

Polk-A-Dot Creek Culvert Replacement and Channel Realignment Fish Habitat Assessment and Effects Analysis



PRESENTED TO
Public Works and Government Services Canada

MARCH 12, 2018
ISSUED FOR USE
FILE: TRN.VHWY03038-01

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LIMITATIONS OF REPORT

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1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by Public Works and Government Services Canada (PWGSC) to conduct a review of existing information with respect to fish and fish habitat of Polk-A-Dot Creek located at km 277.4 of the Alaska Highway, BC (the Project). The information reviewed has been used to assess the existing known habitat present at the Alaska Highway crossing location, and to provide an analysis of the potential effects of the culvert replacement and channel realignment proposed. The Polk-A-Dot Creek culvert replacement and channel realignment is part of a greater PWGSC improvement project that includes paving and highway upgrades between km 229 and 451.5 of the Alaska Highway (the Highway), between Fort St. John and Fort Nelson, BC. Polk-A-Dot Creek is located 205 km north of Fort St. John and approximately 177 km south of Fort Nelson (Figure 1).

2.0 PROJECT DESCRIPTION

This Project is being completed as part of an overall capital plan with the goal of reducing risk, preserving assets and improving safety that is necessary to maintain the condition, safety, reliability of the Alaska Highway. Under current traffic volumes, the existing road surface fails frequently, resulting in increased safety concerns, maintenance costs, travel times, and life cycle costs. Many locations along this section of highway have been identified as needing geometric upgrades due to inadequate shoulder width, cross-fall slopes (when the road is higher in the middle preventing ponding water on the driving surface), and has inadequate and inconsistent super-elevation (when the road is elevated on one side) in curves. Current traffic volumes and a high proportion of heavy commercial trucks has resulted in the Highway requiring more frequent and extensive repairs and resurfacing to sustain an acceptable level of service and safety to the travelling public.

Therefore, the overall scope is to complete necessary improvements in the operation and safety of the Highway through surface replacement and upgrades to roadway geometrics. The replacement of the Polk-A-Dot Creek culvert is one component of the larger highway improvement scope and is the focus of this report.

The ultimate design chosen and discussed in this report for the replacement and realignment of the Polk-A-Dot Creek culvert included various iterations on alignment shape and habitat improvements that built on engineering and environmental best practices and requirements.

2.1 Background

During previous Highway infrastructure assessments conducted by Tetra Tech, the existing culvert through which Polk-A-Dot Creek flows was found to be undersized, structurally failing and misaligned with the Highway, all of which poses risks to both the Highway infrastructure and to driver safety. The culvert itself was found to be corroded and was collapsing, causing settlement of the highway.

In its current alignment, the Polk-A-Dot Creek culvert does not meet transportation guidelines for clear zone requirements on the upstream end of the culvert (southbound lane shoulder) in that the inlet is too close to the edge of the Highway (Photo 1 and 2). This is, in part, due to it being misaligned with the highway and poses a risk to the infrastructure and to the safety of drivers.

Polk-A-Dot Creek is a fish-bearing watercourse with historic known occurrences of Arctic Grayling (*Thymallus arcticus*), a species within the Salmonid family. Suitable spawning and rearing habitat has been identified downstream of the Highway (Ministry of Environment (MOE) 2018b, 2018c).

2.2 Purpose

The Highway is being improved and/or upgraded over approximately 222 km between km 229 and 451.5 north of Fort St. John to maintain its condition, safety, reliability. The culvert crossing of Polk-A-Dot Creek at km 277.4 is being replaced and the channel immediately upstream and downstream of the Highway is being realigned as part of the improvements. The Polk-A-Dot culvert replacement and channel realignment is being completed to:

- Increase capacity of the crossing to British Columbia Ministry of Transportation and Infrastructure's (BC MOTI) criteria for sizing (1:200 year storm event) and climate change considerations;
- Better align the culvert and highway to meet clear zone requirements;
- Reduce risk to the highway embankments and improve safety of drivers; and
- Re-establish fish passage across the highway to habitat upstream as the existing culvert is considered to be a barrier to fish migration.

The desktop fish and fish habitat assessment of Polk-A-Dot Creek at the km 277.4 culvert crossing will be used by PWGSC to:

- Understand the probable environmental effects that culvert and channel construction will have;
- Complete necessary environmental permitting in preparation of the culvert replacement; and
- Understand the probable environmental mitigation required during construction.

This report and supporting culvert design details will then be used to form a Section 11 *Water Sustainability Act* application submission to Ministry of Forest, Lands and Natural Resource Operations (FLNRO) for the culvert replacement. Culvert replacement works and their effects are typically well understood and standard best practices for instream works can mitigate these effects when employed properly.

A general Environmental Management Plan (EMP) has been incorporated into this report to guide the successful Contractor's preparation of an Environmental Protection Plan (EPP) that details the mitigation measures that will be specifically implemented during construction. The EMP is included as Appendix B, including an example of an Environment Incident Report (EIR) Form (Appendix C) and is intended to meet the guidance of the Habitat Officer's Terms and Conditions for instream works in Appendix D (FLNRO 2016). Design drawings of the culvert replacement and channel realignment are included in Appendix E.

3.0 FISH AND FISH HABITAT ASSESSMENT

Existing fish and fish habitat conditions have been evaluated from available information collected from government databases, local FLNRO staff, and photos and data from previous engineering studies at the site. A field assessment by a Qualified Environmental Professional (QEP) was not conducted as a part of this assessment.

3.1 Methods

3.1.1 Desktop Study

Tetra Tech collected and reviewed information from public and online government databases, previous documents and reports provided by PWGSC, and liaison with resource specialists with the Fort St. John FLNRO office. These

included the MOE's Fisheries Information Summary System (FISS) and iMap data, the British Columbia (BC) Conservation Data Centre's (CDC's) Species and Ecosystem Explorer, and the Federal Species at Risk registry as well as other relevant government and consultant reports found online. Available and applicable background project information such as site photographs by others were also reviewed.

These sources were used to understand the sensitivities of environmental resources and evaluate potential effects the Project may have on them.

A site visit was not conducted as part of this assessment because the conditions of the culvert and the historical presence of Arctic Grayling were known and understood. The assessment was based on the information gathered regarding fish presence and habitat availability at the site.

3.2 Results

Polk-A-Dot Creek (Watershed Code: 212-998700-48600-55600) is a second order stream, 2.36 km in length, and is tributary to the Buckinghorse River (Watershed Code: 212-998700-48600), which ultimately flows into and is part of the Fort Nelson River watershed (Watershed Code: 212). Polk-A-Dot Creek is located within the moist cool unit of Boreal White and Black Spruce biogeoclimatic Zone (BWBSmk) (Figure 2). The BWBS zone covers approximately 16 million hectares of British Columbia and is part a circumpolar boreal zone (DeLong et al. 2011). Two main ecosystem types make up the BWBS, the upland forests of the Alberta Plateau (east) and mountainous regions of the west, and the extensive poorly drained muskeg of the northeastern lowlands (DeLong 2011). The moist, cool unit of the BWBS generally occurs at an elevation of 300-1100 m and dryer sites are dominated by aspen and white spruce (*Picea glauca*) forests, while poorly drained wetter areas are dominated by black spruce (*P. mariana*) forests (DeLong 2011). Other forest species include tamarack (*Larix laricina*), lodgepole pine (*Pinus contorta*), paper birch (*Betula papyrifera*), willow species (*Salix* spp.) and, balsam poplar (*Populus balsamifera*). While these species are present adjacent to the Project location, the culvert location is within the maintained corridor of the Highway, and only grasses and small shrubs are present in proximity to the construction zone, with forest cover present outside the right of way both up and downstream of the Highway (Photos 3 to 8). Vegetation species observed from photographs of the culvert location include white spruce, lodgepole pine, tamarack, balsam poplar in the background, and willow, various grasses, clover and possibly rose (*Rosa* spp.) or red-osier dogwood (*Cornus stolonifera*).

The confluence of Polk-A-Dot Creek with the Buckinghorse River is approximately 530 m downstream of the Highway, and historical accounts of upstream fish migration barriers have not been reported except at the culvert outlet. Prior to the existing culvert being installed, the Polk-A-Dot Creek crossing of the Highway consisted of a double culvert, with both outlets being perched well above the stream channel bottom (NFA 1981). This migration barrier is likely to have contributed to the most recent observations of Arctic Grayling in Polk-A-Dot Creek occurring up to the culvert outlet on the east side of the Highway but no records from upstream of the Highway (MOE 2018c; Province of BC 2018; Figure 2).

Species historically known to exist within Polk-A-Dot Creek include only the Arctic Grayling. This species, as well as having rearing and spawning potential downstream of the Highway culvert has been observed within Polk-A-Dot Creek during surveys in the early 1980's and again in 1998 (Northern Fishery Analysts Ltd. 1981; DFO 1998; MOE 2018a, 2018b, 2018c). The following describes the information obtained on life history strategies of the Arctic Grayling.

Arctic Grayling (*Thymallus arcticus*) Life History Summary

Arctic Grayling is a member of the salmonid subfamily *Thymallinae*, and is a game fish of clear, cold streams known for their spectacular dorsal fins and colouration. The Arctic Grayling is yellow-listed in British Columbia, indicating that it is apparently secure and not at risk, and is not designated on Schedule 1 of the *Species At Risk Act* (SARA) nor is it ranked by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (BC CDC 2018; Ministry of Environment and Climate Change 2018). Arctic Grayling display one of three life histories: they can be highly migratory (adfluvial) migrating between lakes and streams, or spend much of their lives in streams (riverine) or lakes (lacustrine) (McPhail 2007). The Arctic Grayling recorded within Polk-A-Dot Creek possess a riverine life history, migrating into Polk-A-Dot Creek from the Buckinghorse River. The confluence of Polk-A-Dot Creek with the Buckinghorse River is approximately 530 m downstream of the Highway crossing.

Grayling are Spring spawners, migrating just after ice-out as temperatures rise above 4°C, usually early to late May in northern BC (McPhail 2007). Spawning occurs over substrates that are made up of coarse gravel (2 to 4 cm) and cobbles, within streams that possess modest velocities of 0.5 to 1.0 m/s and in shallow (10 to 40 cm) glides or runs of cold, clear rivers (McPhail 2007). Spawning adults will move from large rivers to smaller tributaries that have gravel or cobble bottomed channels, and migrate back to larger rivers to their summer feeding areas (Scott and Crossman 1973). While they typically avoid higher turbidity, they will inhabit milky glacial streams (Scott and Crossman 1973). Discussion with Fort St. John based FLNRO fisheries biology staff confirmed that while literature suggests optimal habitat for Arctic Grayling is in clear, cold streams, the generally warmer and more turbid streams of northeastern BC between Fort St. John and Fort Nelson also support seasonal rearing potential for Arctic Grayling (Elsner Pers. Comm. 2018).



Upon emergence, fry will inhabit the shallow, calm water of stream backwaters, side channels and shallow shorelines and side pools and initially fry will school together until approximately 3 weeks when agonistic behaviour starts to establish dominance hierarchies through to 6 weeks' post-emergence (McPhail 2007). Juvenile grayling grow rapidly through their first summer and will out-migrate into overwintering habitats of lakes and large rivers in the late summer or fall (Stewart et al. 2007). Juveniles often make annual migrations between feeding areas in small tributaries and overwintering habitats, preferring silt, sand and gravel substrates with cover provided by large rocks and to a lesser extent overhanging vegetation, cutbanks, loose gravel or instream vegetation (EBA, A Tetra Tech Company 2013).

Grayling are primarily a riverine species in British Columbia and will remain in rivers following spawning, and while habitat selection can be variable, they often use habitats that consist of cobble and gravel substrates, depths between 1.0 and 1.5 m, and water velocities of 0.6 to 1.1 m/s (McPhail 2007, EBA A Tetra Tech Company 2013). The sustained¹, prolonged² and burst³ swimming speeds of migrating adult Arctic Grayling have also been studied and are known to be 0.8 m/s, 2.1 m/s and 4.3 m/s respectively (Chillibeck 1993).

The channel downstream of the Highway has been observed to have failing slopes over many years. Polk-A-Dot Creek's banks are composed of fine, easily erodible glaciolacustrine silts and clays, which are the cause of the naturally elevated turbidity of numerous streams in the region (NFA 1981). NFA identified that Polk-A-Dot Creek required bank stabilization to prevent degradation of downstream fish habitat (1981), while Fisheries and Oceans

¹ Sustained = swimming speed can be maintained indefinitely (Chillibeck 1993)

² Prolonged = swimming speed can be maintained up to 200 minutes (Chillibeck 1993)

³ Burst = swimming speed can be maintained for up to 165 seconds (Chillibeck 1993)

Canada (DFO) noted again in 1998 that downstream banks were slumping and recommended maintenance to reduce the slope of the banks to 3:1, spread (native) seed and install willow planting (1998). Recent observations by Tetra Tech while conducting a survey of PWGSC infrastructure, included continued bank slumping downstream of the Highway (Photos 4 to 8). Because data from pre-Highway conditions does not exist, it is unknown how the Highway crossing has affected the rate and magnitude of slope failures and the natural process of fine material erosion. A combination of engineering and planting solutions have been proposed to limit slope failures and increase native riparian plant growth, including willow stakes, into the lower portion of the rip-rapped bank.

For these reasons, the final design for the Polk-A-Dot Creek culvert replacement and channel realignment has taken into consideration both highway engineering safety requirements and standards, as well as habitat stability, function and passage upstream within the context of the generally altered environment of a Highway right-of-way.

3.3 Design and Construction Considerations

Instream works, particularly within watercourses that provide habitat to fish and aquatic species, can adversely affect the aquatic habitat if the infrastructure is poorly designed or constructed. Examples of potential adverse environmental effects from the Project include:

- Construction scheduling, which must consider timing of least risk to the environment and fish species present;
- Construction and machinery activities, which may result in sediment releases due to erosion resulting from ground disturbance and/or vegetation removal, or may result in spill of a deleterious substance;
- Changes to flow patterns during or following construction, which may cause habitat alterations, scour and associated sedimentation, and velocity barriers; and
- Instream construction activities and vegetation clearing, which will result in losses of existing instream (aquatic) and riparian habitat.

The following design considerations are presented in Appendix E (Design Drawings).

3.3.1 Culvert and Channel Design Considerations

The Polk-A-Dot Creek culvert replacement and channel realignment design has incorporated current highway engineering and safety standards and requirements, as well as simple channel restoration efforts drawn from standard environmental best practices that are employed when working within a fish-bearing stream. The design has incorporated a channel realignment that increases the overall channel length and includes a gentle meander and habitat restoration and enhancements to achieve potential for gains to fish and aquatic and riparian habitat.

During high flow events, the culvert replacement design has incorporated fish friendly passage solutions based on the hydraulic analysis results. The culvert exit velocities expected within Polk-A-Dot Creek are 2.09 m/s for 1:2 year event; 3.12 m/s for a 1:25 year event; 3.54 m/s for a 1:100 year event (MOTI design standard level); and 3.73 m/s for a 1:200 year event. As described above, the maximum burst swimming speed of adult Arctic Grayling is between 2.1 and 4.3 m/s, and therefore it is likely that the installation of appropriately sized bed material and the presence of fish baffles will allow grayling to migrate through the replacement culvert even during high freshet flows. During the low flow periods of late summer and into the fall, very little flow has been observed within Polk-A-Dot Creek. By late September the water within Polk-A-Dot creek has been observed to already be somewhat frozen, so it is anticipated that any remaining flow or water within the channel will freeze solid during the winter. Therefore, the culvert replacement will not result in a change in conditions relative to current ability for fish to migrate through the culvert at low flow.

The channel realignment south of the existing location will allow for:

- Construction of the trench for the new culvert in compliance with WorksafeBC requirements by allowing for more area to properly slope the trench;
- Effective and efficient staging of the work to ensure single lane alternating traffic flow is maintained; and
- The added benefit of improved constructability while reducing risk to the receiving environment in that the existing channel, flows and habitat will remain largely unaffected by channel construction and culvert removal tasks.

Engineering Considerations:

The primary reason for replacement and realignment of the Polk-A-Dot Creek culvert is to protect the highway infrastructure. This will ultimately result in reduced risk to the highway embankments and improving safety of drivers through:

- Increasing the culvert capacity to BC MOTI criteria for sizing and climate change considerations; and
- Better aligning the culvert and highway to meet clear zone requirements.

Construction will include:

- Installing the replacement culvert and new channel approximately 15 m south of the existing culvert;
- Creation of a downstream channel approximately 53 m long and an upstream channel approximately 10 m long. Channels will each include a 2.0 m wide bed and 2:1 side-slopes comprised of 550 mm thick 50 kg class rip-rap placed over geotextile;
- Channel banks at 2:1 slope will consist of 50 kg class rip-rap (550 mm) for 1.2 m (approximately 2.5 m horizontal) with “lower riparian planting regime” vegetation installed, with 2:1 side-slopes above 1.2 m being vegetated with “upper riparian planting regime (per Appendix C and Table 1 below);”
- Installation of a 35 m long X 2,200 mm diameter corrugated steel pipe (CSP) culvert with fish baffles at 1.7 m intervals, at a 3% slope to replace the existing 39 m long X 2000 mm diameter CSP culvert with non-functional baffles;
- Embedding the new culvert with natural bed material present into the culvert (Photo 9);
- Backfill existing channels upstream and downstream of the former channel and removal of the existing culvert; and
- Installing 50 kg rip rap into former upstream channel (and beyond) to create highway shoulder swale to channelize highway runoff and protect the highway embankment.

Engineering drawings of the channel design are attached in Appendix E for reference.

The work will be carried out during low flow conditions of the summer of 2018. The channel realignment may begin outside of the fish window for streams in northeastern BC known to contain Arctic Grayling (from July 15 through March 31 of each year (FLNRO 2016)) as it will not occur “instream.” Once the channel is created, planting restoration has occurred and the banks are stable, the upstream and downstream connections of the new channel and existing channel will occur, and will be completed within the Instream work window between July 15 and March 31.

Work should not occur until receipt of the Section 11 *Water Sustainability Act* Change Approval Permit which is forthcoming. The Change Approval application will be submitted with this document appended.

Habitat Considerations:

While the primary reason for the replacement and realignment Project was for engineering purposes, in doing so, PWGSC has been able to improve the habitat and fish passage. Arctic Grayling have been observed and habitat for spawning and rearing has been reported; therefore, it was important that the design of the channel realignment and culvert installation be completed in such a way that minimizes impacts and improves fish migration potential. Replacement of the culvert as per the design has the potential to increase Arctic Grayling’s ability to migrate beyond the Highway to upstream habitats.

The habitat considerations that have been included in the culvert replacement and channel realignment design includes:

- Increasing the total channel length and includes a gentle meander;
- Modifying the overall culvert slope (at 3%) along its entire length by installing fish baffles embedded with gravels and cobbles to reduce slope and allow rest areas to develop suitable for passage of fish even during design flow events;
- Restoring the riparian habitat impacted through construction of the new channel, as well as minimizing bank sloughing with willow staking into the rip-rap, seeding with native grass and installing shrubs along channel banks; and
- Stabilizing the realigned channel with rip-rap covered with cobbles and gravels to limit bank failures within the constructed channel section.

Tetra Tech has prepared a Riparian Vegetation Prescription based on the following guidelines for native planting: Peace-Liard Re-Vegetation Manual (NEIPC 2010) and Native Plant Propagation – Hardwood Cuttings (WSU Cooperative Extension 2018). Two planting regimes are recommended: lower and upper riparian. The lower riparian planting regime includes using seed for native grasses and sedges and live stakes for willow. The upper riparian planting regime includes using seed for native grasses and forbs, and live stakes and root cuttings for shrubs. The species selected for the Riparian Vegetation Prescription are known to be found in the White and Black Spruce biogeoclimatic zone and can be sourced either from the surrounding area or native seed suppliers.

Table 1. Proposed Riparian Vegetation Planting List

Common Name	Species	Planting Regime ⁴	Planting Method	Spacing/Volume
Tufted hairgrass	<i>Deschampia cespitosa</i>	Upper & Lower riparian	Seed	30 kg/ha
American vetch	<i>Vicia americana</i>	Upper riparian	Seed	30 kg/ha
Hair ticklegrass	<i>Agrostis scabra</i>	Upper & Lower riparian	Seed	30 kg/ha
Common yarrow	<i>Achillea millefolium</i>	Upper riparian	Seed	30 kg/ha
Willow	<i>Salix spp.</i>	Upper & Lower riparian	Live stakes	1 stem/m
Kinnikinnick	<i>Arctostaphylos uva-ursi</i>	Upper riparian	Live stakes	1 stem/m
Red-osier dogwood	<i>Cornus stolonifera</i>	Upper riparian	Live stakes	1 stem/m
Common snowberry	<i>Symphoricarpos albus</i>	Upper riparian	Root cuttings	As available
Rose	<i>Rosa spp.</i>	Upper riparian	Root cuttings	As available
Twiberry	<i>Lonicera involucrata</i>	Upper riparian	Root cuttings	As available
Slough grass	<i>Beckmannia syzigachne</i>	Lower riparian	Seed	30 kg/ha
Bebb’s sedge	<i>Carex bebbii</i>	Lower riparian	Seed	30 kg/ha

⁴ Refer to Appendix E: Polk-A-Dot Creek Typical Section Drawing No. C353 for location

Before applying seed, stakes, or cuttings to the site, the seed bed needs to be prepared. The seed bed should have rough and loose granular soil on the surface and a firm, not compacted, subsoil. The subsoil should be moist. If a duff layer is present in the pre-disturbance conditions, it should be salvaged with the mineral topsoil and mixed together. The duff and mineral topsoil can be applied as the loose granular topsoil. Weed species need to be removed from the topsoil as best as possible before using it as a seed bed. Avoid using topsoil that has abundant weed species because it will be very difficult to remove all the weeds (NEIPC 2010).

Seeding should be done as soon as possible after disturbance to minimize the time for erosion and soil degradation to occur. Seeding can be done during the construction period at the time of culvert installation in late summer (i.e., late July or August). If seeding is done in the late summer, seeds need to be germinated and up 5 cm or more before killing frost happens. Winter seeding can be done on top of snow. Recommended seed application methods include hand seeding or using a personal cyclone seeder. Seeds can be purchased from a certified seed dealer that can provide weed free seed mixes.

Live stakes should be sourced from native shrubs in the surrounding area. Live stakes are prepared by taking live cuttings from shrubs. Cuttings should be taken from locations within 150 m elevation of the site, and of similar aspect. Cuttings should be taken with a sharp knife or good quality shears from un-split ends near the middle or bottom of the parent plant. Try to select cuttings that are straight, as they root better than crooked cuttings. Once cuttings are cut they should be put into water until they are planted. Cuttings should be at least 15 to 20 cm in length, have a diameter of at least 1 to 2 cm, and have at least two healthy buds. Cuttings should be planted deep into the soil, with as little stem above ground as possible. Ideally, only the top healthy bud should be above ground and at least one healthy bud should be below ground. The bottom of the cuttings can be treated with rooting hormone, which is found at most garden centers (do not apply to willows [WSU Cooperative Extension 2018]). Cuttings should be planted in the autumn immediately after leaves have changed colour or in the spring immediately after the first snowmelt (NEIPC 2010).

Root cuttings can be taken from shrubs that are uprooted during construction. Root cutting should be taken from young roots about pencil thickness and be cut into 5 to 8 cm lengths. Root cuttings should be planted 5 to 8 cm deep into the topsoil, with the end cut nearest the stem placed at the top. Root cuttings can be treated with the same rooting hormone used on the live stakes.

Photographic and percent cover monitoring of the site every three to five years is recommended (NEIPC 2010). Photographs of the site should be taken at multiple vantage points at the same locations every monitoring session with a reference point (i.e., tall tree, surveying rod) in the photograph. Monitoring ends when the vegetation community is sufficiently established, as determined by a Qualified Professional.

Because the Project is occurring entirely within the Highway right of way, prescribing large shrubs and trees is not appropriate from a safety (i.e., sight lines) stand point. In addition, annual maintenance and clearing occurs within the right of way, and limits the growth of any vegetation. The species selected above are those that are native to the area, can be maintained within the right of way, and provide additional slope stability and erosion control without compromising maintenance activities.

3.3.2 Instream Construction Guidance and Mitigation Best Practices

As construction will be in-stream (below the high water mark) and within fish habitat, there is potential for negative effects including the direct loss of fish habitat and harm to fish resulting from the use of machinery, site access, clearing of riparian cover, and the placement and location of laydown areas. Each has the potential to cause erosion and sedimentation and contamination from accidental spills. Because the Project entails a culvert replacement and a channel realignment, consideration to the appropriate scheduling or phasing of the Project can limit the risk to aquatic habitat and is recommended to be undertaken in the following sequence:

- Construct new channel and install new culvert;
- Make channel connections during fish window for least risk;
- Allow flow to enter through new channel and culvert; and
- Remove existing culvert (with no flow and no risk).

An EMP has been developed to provide guidance to avoid or minimize negative construction related effects to the receiving environment and avoid harm to fish (Appendix B). The EMP provides guidance and best practices for conducting instream works for inclusion into the Tender Specifications such that the successful Contractor understands them and is prepared to carry out construction in such a way as to limit or eliminate adverse effects to the receiving environment. It is also meant for the successful Contractor to use as a guide for the preparation of an EPP which will identify and address potential adverse environmental effects through mitigation including, but may not be limited to, water quality, riparian vegetation, sedimentation, air quality, wildlife, soil management, invasive weed management, spill response, etc. as it specifically relates to the construction methods, work plans, equipment and personnel on site. The EMP will be incorporated into the tender documents to ensure that the successful contractor is fully aware of environmental requirements of the Project. The contractor will then prepare an EPP that specifically details how they plan to avoid or mitigate impacts to environmental resources, including fish salvage and relocation, spill and emergency response procedures, etc. described in the EMP.

The EPP must meet all regulatory terms and conditions of the forthcoming WSA Section 11 Change Approval criteria and the Northeast BC Region Terms and Conditions (Appendix D; FLNRO 2016). To achieve this, the EPP shall consider and incorporate measures to avoid causing harm to fish and fish habitat, specifically:

- Project Planning: Timing and Contaminant and Spill Management;
- Erosion and Sediment Control;
- Bank Re-vegetation and Stabilization;
- Fish and Wildlife Protections; and
- Operation of Machinery.

The EPP should be made available for PWGSC and the Ministry of Environment Habitat Officer, if requested, for review and acceptance *prior to* construction getting underway.

4.0 EFFECTS ANALYSIS

Following the background review of aquatic environmental resources and the culvert replacement and realignment design, potential environmental resources that could be affected were identified for this Project. The potential environmental resources were assessed to determine if they are present at or near the Site and if they are subject to stakeholder or regulatory concern. Due to the sensitive nature of the aquatic habitat of Polk-A-Dot Creek, mitigation measures must be implemented during construction so to avoid adverse effects primarily to fish and water quality, but also to the surrounding terrestrial environment.

A summary of potential construction related environmental effects and associated mitigation measures is provided in Table 2 below:

Table 2: Potential Effects and Mitigation Matrix

Potential Effect	Avoidance	Mitigation	Monitoring	Relevant EMP Section (Appendix B)
Fish and Fish Habitat				
Water quality degradation.	Isolate work area; construct new channel, including vegetative bank restoration prior to completing connections with existing channel.	Proper installation of ESC structures (i.e., silt fences). Proper use, fueling and maintenance of machinery and equipment. Prompt Emergency/Spill Response. Prompt re-vegetation of banks.	Frequent field water quality monitoring at pre-determined stations or as required by weather conditions.	<ul style="list-style-type: none"> ▪ Water Quality ▪ Erosion and Sediment Control. ▪ Emergency Response Plan. ▪ Spill Response Plan. ▪ Machinery and Equipment.
Disturbance or harm to fish.	Instream works to be completed in the dry (isolated from flowing water). Remain within construction zone.	Proper installation and removal of appropriate watercourse isolation structures. Use of erosion control methods during construction (i.e., silt fences).	Frequent field monitoring or as required by weather conditions.	<ul style="list-style-type: none"> ▪ Biological Resources. ▪ Erosion and Sediment Control.
Changes to aquatic habitat features/availability.	Remain within construction zone.	Implementation of revegetation plan in the riparian zone of new channel. Use of erosion control methods during construction (i.e., silt fences).	Frequent field monitoring. Post construction monitoring of plant survivorship.	<ul style="list-style-type: none"> ▪ Biological Resources. ▪ Erosion and Sediment Control.
Vegetation and Invasive Species Management				
Loss of established vegetation.	Limit vegetation removal.	Identify vegetation for retention and clearing. Clearly mark/protect vegetation for retention as required. Equipment to remain within limits of construction zone at all times.	Frequent monitoring will include observation of clearing limits, and note any accidental or unauthorized impacts.	<ul style="list-style-type: none"> ▪ Biological Resources.
Risk of non-native or invasive plant spread.	Ensure all equipment used on site is cleaned and not contaminated with invasive plant species.	Invasive plant species identified on site should be properly removed and disposed of.	Monitor construction zone for invasive plant species.	<ul style="list-style-type: none"> ▪ Site Access, Mobilization and Laydown Areas. ▪ Biological Resources.
Erosion / Sedimentation				
Localized erosion of excavated banks.	Avoid construction during periods of poor weather and phase work appropriately.	Prompt re-vegetation of banks.	During/following heavy or prolonged rainfall. Frequent monitoring.	<ul style="list-style-type: none"> ▪ Erosion and Sediment Control.
Release of sediment laden waters to stream.	Keep work areas isolated from flow through appropriate construction phasing: Construct new	Proper installation of ESC structures (i.e., silt fences).	Field water quality sampling prior to, during, and following construction.	

Potential Effect	Avoidance	Mitigation	Monitoring	Relevant EMP Section (Appendix B)
	channel in its entirety prior to making connections with existing channel in fish window. Complete all existing channel backfilling and culvert removal once all flow has been established through new channel.		Frequent monitoring.	
Soil compaction.	Limit machinery access as much as possible.	Remain within work zones.	Frequent monitoring of construction zone.	
Spills and Emergency Response				
Accidental release of deleterious substances (i.e., fuel, lubricants, etc.).	If feasible, service equipment with environmentally friendly hydraulic fluid such as vegetable-based oils.	Clean machinery and maintain in good working condition. Spill kits accessible on equipment. No equipment servicing or refueling within 30 m of Polk-A-Dot Creek	Routine monitoring for spills and leaks. Frequent monitoring of equipment and vehicles. Frequent monitoring by the EM.	<ul style="list-style-type: none"> Spill Response Plan.
Waste Management and Disposal				
Litter left behind in construction zone.	Regular housekeeping will be maintained at the site.	Litter, garbage, and organic debris shall be transported offsite and disposed of appropriately.	Frequent monitoring of site for general cleanliness and daily upkeep.	<ul style="list-style-type: none"> Waste Management.
Recyclables not appropriately disposed.	Recyclables will be separated from regular garbage and recycled.	Personal recyclables will be transported offsite and disposed of appropriately.		
Human-wildlife encounters.	Garbage receptacles, if required, will have bear-proof lids to prevent wildlife attraction.	All waste products will be routinely transported from site to an appropriate waste disposal facility.		
Air Quality				
Airborne dust during dry periods.	Minimize excessive machinery movements over loose or exposed soils during periods when winds are able transport and disperse soils and other sediments, and limit the amount of exposed soils as much as possible.	Use non-chemical dust suppressants (water).	Frequent environmental monitoring will assess and guide application of dust suppression.	<ul style="list-style-type: none"> Air Quality.

Potential Effect	Avoidance	Mitigation	Monitoring	Relevant EMP Section (Appendix B)
Exhaust emissions.	Equipment mobilized to site shall be in good working order.	Removal or replacement of vehicles or equipment producing excessive exhaust. Minimize idling of vehicles and equipment.	Frequent monitoring of vehicles and equipment on site.	

Adverse effects to Polk-A-Dot Creek are not anticipated provided the Contractor prepares and completes the construction according to an EPP that specifically describes how the Polk-A-Dot Creek culvert replacement and channel realignment construction will:

1. achieve the protective measures provided in the attached EMP (Appendix B),
2. meet conditions that will be included in the forthcoming WSA Section 11 Change Approval, and
3. satisfy the criteria of the Northeast BC Region Terms and Conditions (Appendix D; FLNRO 2016).

Following construction, the culvert replacement and channel realignment will provide an overall net benefit to fish habitat because:

- The new culvert will be shorter in length than the existing culvert, reducing the linear footprint, and length migrating fish are forced to navigate;
- The channel realignment upstream and downstream of the Highway will be less prone to erosion and frequent slope failures;
- The new channel will incorporate riparian enhancements relative to current conditions; and,
- The new culvert installed using current BMPs to allow for fish passage replaces the existing culvert which acts as a barrier to upstream fish migration, thereby allowing for Grayling to gain access to potential spawning habitat that they have historically been cut off from.

5.0 CLOSURE

We trust this document meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.



Prepared by:
Cameron Kulak, B.Sc., R.P.Bio.
Aquatic Biologist
Direct Line: 778.945.5760
Cameron.Kulak@tetrattech.com



Reviewed by:
Nigel Cavanagh, M.Sc., R.P.Bio.
Senior Aquatic Biologist
Direct Line: 250.756.2256
Nigel.Cavanagh@tetrattech.com

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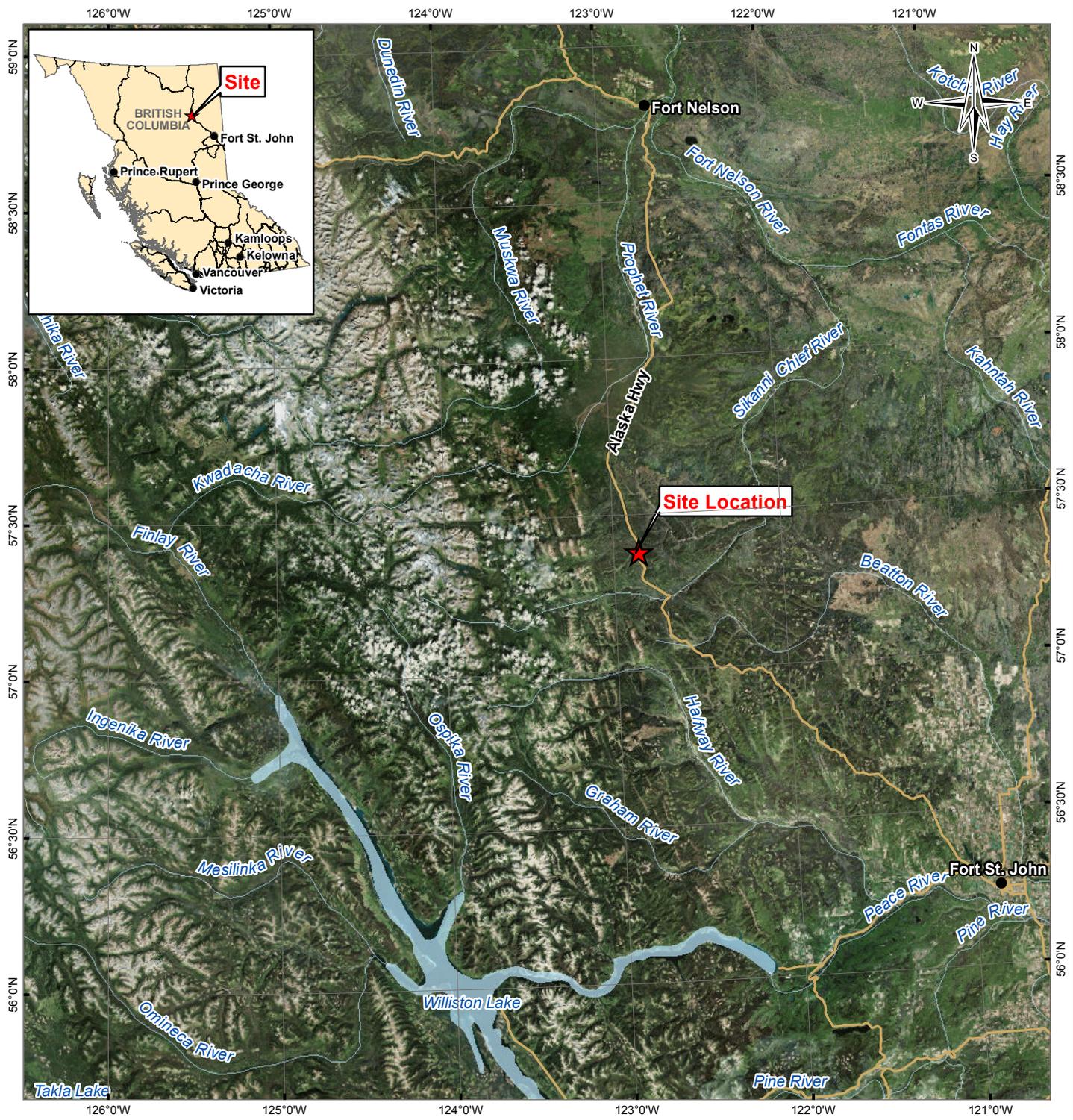
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FIGURES

- Figure 1 Site Location
- Figure 2 Fish Presence

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LEGEND

-  Site Location
-  City
-  Major Road
-  Watercourse
-  Waterbody

NOTES
 Base data source:
 Imagery from ESRI; DigitalGlobe
 CanVec 1:1M (2017)

STATUS
 ISSUED FOR USE

**POLK-A-DOT CREEK
 CULVERT REPLACEMENT**

Site Location

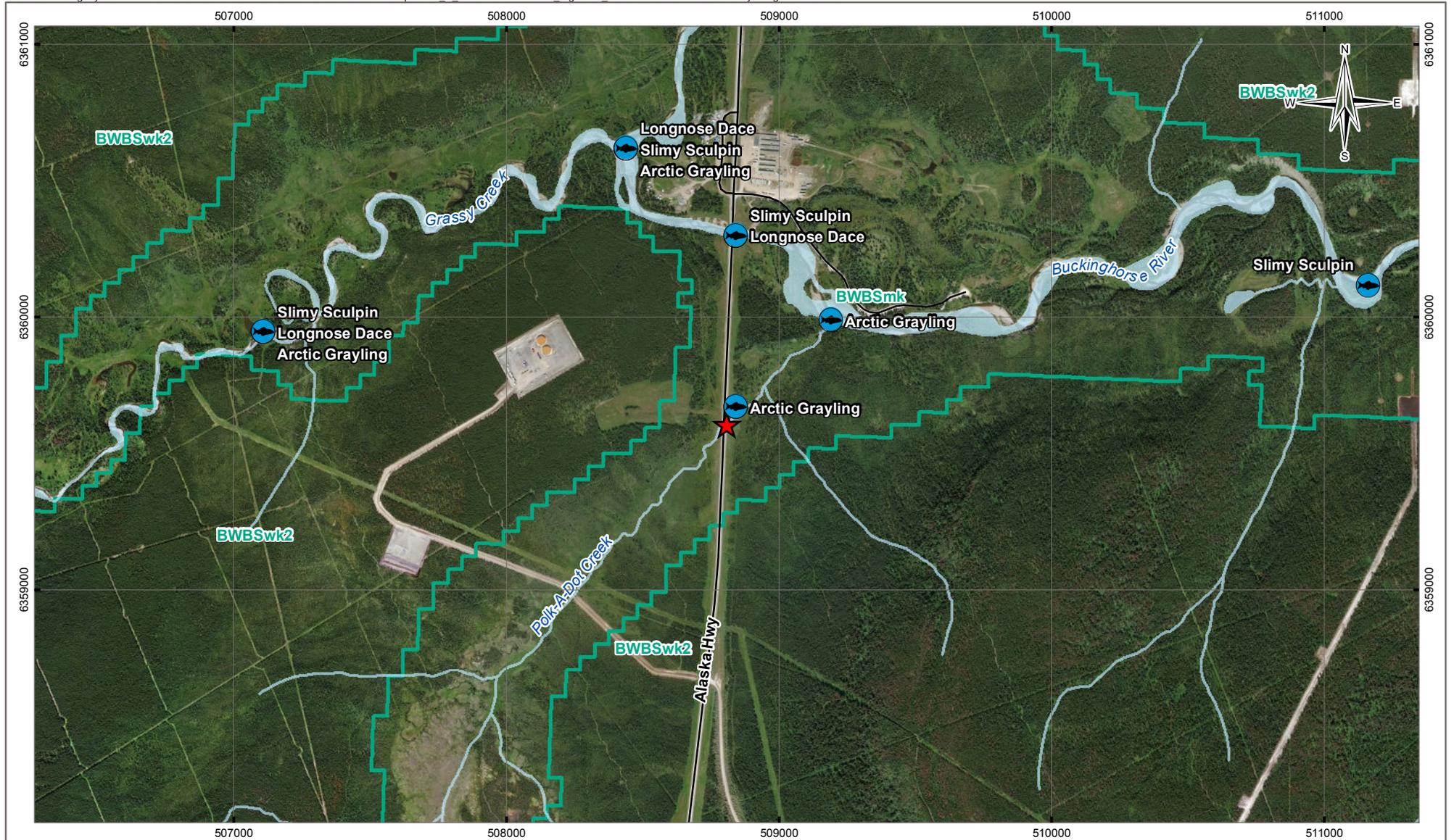
PROJECTION BC Albers		DATUM NAD83	
Scale: 1:2,000,000			
			
FILE NO. VHWY03038-01_Figure01_SiteLocation.mxd			
OFFICE T-VANC	DWN MEZ	CKD SL	APVD CK
DATE March 2, 2018	PROJECT NO. TRN.VHWY03038-01		

CLIENT

 Public Works and Government Services Canada

 **TETRA TECH**

Figure 1



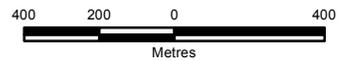
LEGEND

- Site Location
- FISS Observation Point
- Biogeoclimatic Zone
- Road
- Watercourse
- Waterbody

NOTES
 Base data source:
 Imagery from ESRI; DigitalGlobe (2014)
 CanVec 1:50K (2017)
 FISS data accessed 10/2017
 BGC - v10

STATUS
 ISSUED FOR USE

Scale: 1:20,000



PROJECTION
 UTM Zone 10

DATUM
 NAD83

FILE NO.
 VHWHY03038-01_Figure02_Fish.mxd

CLIENT
 Public Works and Government Services Canada



**POLK-A-DOT CREEK
 CULVERT REPLACEMENT**

Fish Presence

OFFICE TL-VANC	DWN MEZ	CKD SL	APVD CK	REV 0
DATE March 2, 2018	PROJECT NO. TRN.VHWHY03038-01			

Figure 2

PHOTOGRAPHS

Photos 1 to 9



Photo 1: Polk-A-Dot Creek culvert inlet adjacent to the southbound lane of the Highway. Inlet currently does not provide the required clear zone requirements.



Photo 2: View upstream towards Polk-A-Dot Creek inlet. Highway shoulder directly above inlet.



Photo 3: View upstream of Polk-A-Dot Creek from culvert inlet. Riparian habitat generally low grasses and shrubs, with typical BWBS forest in background and outside of Highway right of way.



Photo 4: View downstream of Polk-A-Dot Creek habitat from Highway shoulder. Riparian area consists of low shrubs and grasses with typical BWBS forest in the background outside of Highway right of way.



Photo 5: Polk-A-Dot Creek culvert outlet. New outlet will occur approximately 15 m south of this location.



Photo 6: View downstream of Polk-A-Dot Creek channel showing right bank failures and slumping within right of way.



Photo 7: View downstream of Polk-A-Dot Creek channel showing left bank failures and slumping within right of way.



Photo 8: View downstream of Polk-A-Dot Creek channel showing left bank failures and slumping.

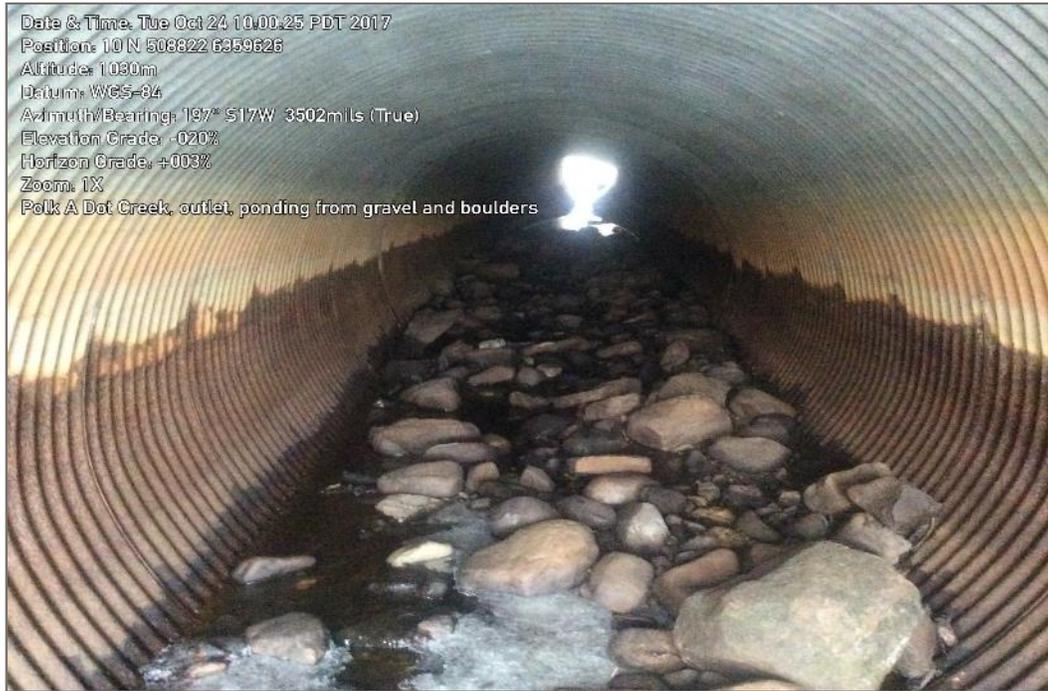


Photo 9: View inside Polk-A-Dot Creek culvert from outlet. Culvert embedded with cobble and gravels amongst the baffles (several broken). Inlet of culvert no longer embedded. Replacement culvert will include natural stream bed materials similar to this.

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Professional Document is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Professional Document.

Where TETRA TECH has expressly authorized the use of the Professional Document by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these Limitations on Use of this Document as well as any limitations on liability contained in the Contract with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these Limitations on Use of this Document and the Contract prior to making any use of the Professional Document. Any use made of the Professional Document by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Professional Document and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH's professional work product and shall remain the copyright property of TETRA TECH.

The Professional Document is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Document, if required, may be obtained upon request.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner

consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by persons other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

APPENDIX B

POLK-A-DOT CREEK EMP FOR CULVERT REPLACEMENT AND CHANNEL REALIGNMENT

INTRODUCTION

This EMP is based on the known environmental conditions at Polk-A-Dot Creek and the nature of the proposed Project. It makes recommendations to mitigate Project related effects to the receiving environment during construction. The EMP is designed as a guidance document that provides general mitigation measures and best management practices (BMPs) to protect the receiving environment. It is typically the responsibility of the successful Project contractor to develop activity specific mitigation measures in an EPP. That is, the EMP identifies the features that must be protected during the Project and provides recommendations for how to protect them in terms of “industry standards” while the contractor’s EPP will detail exactly how the recommendations will be implemented. For example, an EMP may recommend that refuelling occur more than 30 m from a watercourse and the EPP will identify exactly where the refuelling will occur for the project, while meeting that recommendation.

Based on an understanding that the Project entails the replacement of the Polk-A-Dot Creek culvert and channel realignment within a fish-bearing watercourse, this EMP will identify mitigation measures designed to:

- Avoid or minimize sedimentation from construction activities;
- Prevent the introduction of deleterious substances that potentially result from heavy machinery use;
- Maintain flow downstream of the works during construction;
- Permit the free passage of fish during construction (except during up and downstream connections); and
- Restore riparian habitat following construction.

Project Schedule

As per Section 2.0 of the Polk-A-Dot Creek Culvert Replacement & Channel Realignment Fish Habitat Assessment and Impact Analysis report, the overall scope of the Project is to complete necessary improvements in the operation and safety of the Alaska Highway through surface replacement and upgrades to roadway geometrics. The replacement of the Polk-A-Dot Creek culvert is one component of the larger highway improvement scope. The work is ongoing, with the Polk-A-Dot Creek Project scheduled for replacement during the low flow period of 2018.

Due to sensitivities of Polk-A-Dot Creek, a stream known to provide habitat for Arctic Grayling, all instream works must be carried out during the least risk window for watercourses that provide habitat to spring spawners, i.e., Arctic Grayling, which is from July 15 through March 31 of each year (FLNRO 2016). All instream works must occur in isolation of flowing water during the least risk timing window. In doing so, the proposed Project is not anticipated to result in serious harm to fish or a net loss of fish habitat, provided that construction is completed according to environmental specifications identified through the Tendering process. This includes the preparation of an EPP, prepared to meet the mitigation measures set out in this EMP, and all regulatory criteria (of the *Water Sustainability Act* (WSA) Section 11 Change Approval, once granted).

CONTACTS AND RESPONSIBILITIES

Key Project Personnel

The effective environmental management of this Project requires a coordinated effort from all individuals involved. The following sections outline the responsibilities of key personnel involved with the Project.

The Project contact list for the works proposed in this EMP should be completed as soon as the information is known and made available to all parties. At the time this EMP was completed, PWGSC was in the process of preparing tender documents for bidding. The successful contractor shall provide details to complete and update this list as part of the EPP.

Table 1: Project Contact List

Name	Role	Phone Number	Email
TBD	Contractor Site Superintendent	TBD	TBD
TBD	Contractor's Qualified Environmental Professional Environmental Monitor	TBD	TBD
TBD	PWGSC Representative	TBD	TBD
TBD	Tetra Tech Canada Project Manager	TBD	TBD

Environmental Monitor Responsibilities

On-site monitoring is a key component of ensuring that the mitigation measures recommended in the EMP (and ultimately the EPP) are implemented properly (appropriate location and correct installation) and function as intended. A qualified environmental professional (QEP) should be retained as the environmental monitor (EM) to provide guidance on implementing the recommended measures and, if necessary, to develop additional mitigation measures if the need arises.

An appropriate schedule should be established between the EM, PWGSC and all involved regulatory agencies (FLNRO – Fort St. John). An EM shall be available during key monitoring stages described below. It is expected that the monitoring schedule will establish expected frequency and duration of EM visits during instream works, during any accidents or malfunctions that affect the work or creek and following any significant rainfall events⁵.

It is equally important to take corrective action prior to inclement weather events rather than to react during or after the event. Monitoring should be conducted with greater frequency during periods of inclement weather (i.e., heavy precipitation, strong winds) and during critical stages of the Project. Key monitoring stages may include, but are not necessarily limited to:

- During start-up of the Project and installation of erosion and sediment control measures;
- Periodically during channel realignment, new culvert installation and existing culvert removal;

⁵ A rainfall event is considered significant when 25 mm or greater falls within a 24 hour period, or when 10 mm or greater falls within a one hour period.

- Full-time during new and existing channel connections when isolation and pumping of flows around the work site will be necessary (i.e., during all in-stream work);
- During fish salvage operations that take place when stream isolation and pumping is necessary for the connections to be completed, two EM on site will make the fish salvage more effective and efficient periodically during channel restorative seeding and planting; and
- During completion of the Project and decommissioning/removal of mitigation measures.

The primary responsibility of the EM is to confirm that the environmental protection objectives of PWGSC are met and that the requirements of this EMP and EPP are enacted. The responsibilities of the EM include the following:

- The EM will monitor compliance with the EPP.
- The EM will communicate the requirements of the EPP to the contractors and their respective employees during pre-job and tailboard meetings.
- The EM will be on site as per the schedule established between parties prior to Project start. The EM will remain on-call during non-critical work periods to respond to emerging environmental issues or emergencies.
- The EM will review the contractors work procedures to assess functionality and compliance with the EPP and applicable regulations, standards and BMPs.
- The EM has the authority to modify and/or halt any construction activity at any time if deemed necessary for the protection of the environment.
- The EM will advise Project members if Project activities have caused or are likely to cause an environmental incident and make recommendations for corrective action.
- The EM will liaise directly with Project members and provide technical advice to resolve situations that may impact the environment as they arise.
- The EM will monitor that all works within Polk-A-Dot Creek are effectively isolated from downstream habitat.
- The EM will conduct routine field water quality data collection (turbidity, pH, temperature, conductivity) using portable water quality meters prior to (baseline) and during construction activity within watercourses. Results will be compared to the British Columbia Approved Water Quality Guidelines for Aquatic Life. If a Guideline is exceeded, the EM will direct the contractor to undertake corrective measures.
- The EM will maintain complete records of activities related to the implementation of the EPP. This should include any readings or measurements taken, photographs and incident reports.
- The EM will complete and submit a monitoring report to PWGSC and will report any unanticipated adverse effects to the environment within 24 hours of occurrence. Such reports should include the nature of the effect, its cause, mitigation and/or remediation implemented, and whether a work stoppage was ordered, as well photographs, analyses, and measurements, if applicable.

Contractor Responsibilities

The successful contractor will review Tender Specifications for environmental compliance, the Section 11 WSA Change Approval and this EMP with their staff and subcontractors and prepare an EPP prior to undertaking any work.

- Contractors will comply with all laws, orders, rules, regulations, and codes of any provincial or federal environmental agency or like authority, which are applicable to the Project.
- Contractors will cooperate with the EM appointed for the work. They must comply with written or verbal instructions with respect to execution of the proposed work in compliance with the mitigation measures outlined in the Tender Specifications, and EPP, which are at a minimum, consistent with the regulatory agencies having jurisdiction over the area of the Project.
- Contractors must complete their work in such a fashion that all watercourses, including any ditches and swales, where works are to occur, are effectively isolated from downstream habitat. The Contractor will coordinate with the EM prior to and during the installation of the isolation measures in order that the EM can arrange for the concurrent salvage of fish within the isolated reach of the creek.
- Contractors are responsible for following and enforcing the BMPs and mitigation measures outlined in the EPP.
- Contractors will correct deficiencies and any non-compliance upon direction from the EM whether written or verbal. Corrections should be made as soon as reasonably possible, ideally within 24 hours of directions.
- Contractors will arrange provision of appropriate on-site waste containers, if required.
- Contractors are responsible for the restoration of all disturbed areas resulting from any of the works they undertake. The contractor is responsible for reinstatement of the Site after construction, to the satisfaction of the Project Manager and the EM.

RELEVANT ENVIRONMENTAL LEGISLATION

Several federal and provincial legislative Acts and Regulations are applicable to the environmental management and protection activities that will be carried out during the Project. These include but are not limited to the following:

Table 2: Relevant Environmental Legislation

Federal	Provincial
<i>Fisheries Act</i>	<i>Water Sustainability Act</i>
<i>Species at Risk Act</i>	<i>Fish Protection Act</i>
<i>Migratory Birds Convention Act</i>	<i>Wildlife Act</i>
<i>Transport of Dangerous Goods Act</i>	<i>Weed Control Act</i>
	<i>Environmental Management Act</i>
	<i>Heritage Conservation Act</i>

Review and Permitting Requirements

At the time this EMP was prepared, all permits/approvals for the Project were in the process of being secured from the applicable regulatory agencies. A Section 11 *Water Sustainability Act* Change Approval has been submitted for

the proposed works. The Project will, therefore, be subject to the terms and conditions of the Section 11 Change Approval.

Provincial

Water Sustainability Act

The BC *Water Sustainability Act* is the main provincial statute regulating water resources in British Columbia. Under the *Act*, it is an offence to divert or use water, or alter a stream, without formal Change Approval from the Province. Section 11 of the *Water Sustainability Act* ensures that water quality, riparian habitat, and the rights of licensed water users are not compromised. Under Section 11, any changes in and about a stream must also meet with DFO approval under the federal *Fisheries Act*.

Section 11 of the *Water Sustainability Act* requires that a “changes in and about a stream” can only be done following acquisition of a Change Approval for changes that are of a complex nature. The placement of rip rap into the new stream channel of Polk-A-Dot Creek, along with the realignment of the channel constitute complex changes in a stream, and as such, a Change Approval will be required from FLNRO. An application for a Section 11 Change Approval was submitted to FLNRO in February 2018. While review timelines are uncertain, a decision is expected no later than mid to late July 2018.

Fish Protection Act

The BC *Fish Protection Act* is part of the provincial Fisheries Strategy. The *Act* focuses on ensuring sufficient water for fish, protecting and restoring fish habitat, improving riparian protection and enhancement, and strengthening local government powers in environmental planning.

While there are no direct fines and penalties under the *Act*, non-compliance with the *Act* and associated regulations risks an offence under the *Waste Management Act*, the *Water Sustainability Act*, the *Wildlife Act*, or other legislation.

Wildlife Act

The BC *Wildlife Act* protects most vertebrate animals from direct harm or harassment except as allowed by regulation (e.g., hunting or trapping). Legal designation provides additional protection for selected red- and blue-listed species and their residences.

Section 34 of the *Wildlife Act* protects the nests of all species of birds when birds or eggs are present in the nest.

Limited vegetation is present within the Project area due to the maintained highway right of way. Similarly, no large trees suitable for nesting of raptor species are present within the location where grubbing, stripping, and vegetation removal is to occur. Nesting potential is limited to small passerine birds along the limited riparian zone of Polk-A-Dot Creek. Searching for potential passerine nests can be completed by the onsite EM during Project start-up. The least risk window for bird species in the Northeast Region is August 20 to April 25 of the following year for most species in the Northeast Region during which vegetation clearing may occur. Clearing outside of these periods requires a nest survey to be completed.

Weed Control Act

The BC *Weed Control Act* consists of legislation that states private landowners, private companies, utility companies, regional districts and municipalities, and provincial government agencies or anyone in physical possession of land, except federal lands, have a responsibility to manage weeds in the province (Invasive Species Council of BC, 2007). Therefore, the *Weed Control Act* does not apply to the lands occupied by the Alaska Highway.

Nonetheless, land stewardship principles and practices advocate that PWGSC should implement weed and invasive species best practices during construction and operation of the Alaska Highway given federal involvement in multi-jurisdictional strategies and planning sessions (ISCBC 2007).

Therefore, this information is provided to educate and address the potential for the spread of invasive species from federal lands to provincial lands adjacent to it. The BC *Weed Control Act* currently designates 39 plant species as noxious weeds within all regions of the province (Table 3). A further eleven are classified as noxious within the boundaries of Peace River Regional District (Table 4). These species are non-native plants that create problems for agriculture and/or natural habitats.

The following 39 species are regulated throughout all of British Columbia:

Table 3: Regulated Plant Species in BC

Common Name	Scientific Name	Common Name	Scientific Name
Annual Sow Thistle	<i>Sonchus oleraceus</i>	Bohemian Knotweed	<i>Fallopia x bohemica</i>
Bur Chevril	<i>Anthriscus caulcalis</i>	Canada Thistle	<i>Cirsium arvense</i>
Common Crupina	<i>Crupina vulgaris</i>	Common Reed	<i>Phragmites australis</i> subs. <i>australis</i>
Common Toadflax	<i>Linaria vulgaris</i>	Dalmatian Toadflax	<i>Linaria dalmatica</i>
Dense-flowered Cordgrass	<i>Spartina densiflora</i>	Diffuse Knapweed	<i>Centaurea diffusa</i>
Dodder	<i>Cuscuta spp.</i>	English Cordgrass	<i>Spartina anglica</i>
Flowering Rush	<i>Butomus umbellatus</i>	Garlic Mustard	<i>Allaria petiolata</i>
Giant Hogweed	<i>Heracleum mantegazzianum</i>	Giant Knotweed	<i>Fallopia sachalinensis</i>
Giant Mannagrass/Reed Sweetgrass	<i>Glyceria maxima</i>	Gorse	<i>Ulex europaeus</i>
Himalayan Knotweed	<i>Polygonum polystachyum</i>	Hound's-tongue	<i>Cynoglossum officinale</i>
Japanese Knotweed	<i>Fallopia japonica</i>	Jointed Goatsgrass	<i>Aegilops cylindrical</i>
Leafy Spurge	<i>Euphorbia esula</i>	Milk Thistle	<i>Silybum marianum</i>
North Africa Grass	<i>Ventenata dubia</i>	Perennial Sow Thistle	<i>Sonchus arvensis</i>
Purple Loosestrife	<i>Lythrum salicaria</i>	Purple Nutsedge	<i>Cyperus rotundus</i>
Rush Skeletonweed	<i>Chondrilla juncea</i>	Saltmeadow Cordgrass	<i>Spartina patens</i>
Scentless Chamomile	<i>Matricaria maritima</i>	Smooth Cordgrass	<i>Spartina alterniflora</i>
Spotted Knapweed	<i>Centaurea maculosa</i>	Tansy Ragwort	<i>Senecio jacobea</i>
Velvetleaf	<i>Abutilon theophrasti</i>	Wild Oats	<i>Avena fatua</i>
Yellow Flag Iris	<i>Iris pseudacorus</i>	Yellow Nutsedge	<i>Cyperus esculentus</i>
Yellow Starthistle	<i>Centaurea solstitialis</i>		

The following eleven species are regulated throughout the Peace River Regional District:

Table 4: Regulated Plant Species in Peace River Regional District

Common Name	Scientific Name	Common Name	Scientific Name
Burdock	<i>Arctium spp.</i>	Cleavers	<i>Galium aparine</i>
Green Foxtail	<i>Setaria viridis</i>	Kochia	<i>Kochia scoparia</i>
Night-flowering Catchfly	<i>Silene noctiflora</i>	Oxeye Daisy	<i>Chrysanthemum leucanthemum</i>
Quackgrass	<i>Agropyron rapens</i>	Russian Thistle	<i>Salsola kali</i>
Tartary Buckwheat	<i>Fagopyrum tataricum</i>	White Cockle	<i>Lychnis alba</i>
Wild Mustard	<i>Sinapsis arvensis</i>		

Therefore, Contractors should ensure that any invasive species that are identified are controlled and not allowed to spread. Information related to the control and management of invasive species can be found on the Invasive Plant Council of BC’s website (<http://www.invasiveplantcouncilbc.ca/>).

Environmental Management Act

The BC *Environmental Management Act* (EMA) governs solid waste and manages introduction of waste into the environment by providing an authorization framework and environmental management tools to protect human health and environmental quality.

Under the Waste Discharge Regulations of the EMA, certain industries, trades, businesses and operations require authorization to discharge waste into the environment. However, even if an industry, trade, business or operation does not require an authorization, waste discharge must not cause pollution [EMA, Section 6 (4)].

The Spill Reporting Regulations of the EMA establishes a protocol for reporting the unauthorized release of substances into the environment as well as a schedule detailing reportable amounts for certain substances. A **Spill Response Plan**, including reportable quantities for spills, is provided below.

The Hazardous Waste Regulations of the EMA ensures that the generators, carriers and receivers of hazardous waste handle, store, transport, treat and dispose of hazardous waste in a safe manner. Hazardous wastes must be disposed of properly to ensure human health and environmental protection.

Heritage Conservation Act

The BC *Heritage Conservation Act* confers automatic protection upon archaeological and historic heritage sites that meet the definitions within section 13(2) of the Act. These include:

- All sites pre-dating AD1846;
- All sites of unknown age or origin which may pre-date AD1846;
- All burial places and rock art sites of historical or archaeological value; and
- All vessels or aircraft wrecked for two or more years.

All areas within the boundaries of a heritage site are protected under the *Act*, including areas without archaeological deposits or other kinds of heritage remains (e.g., land without archaeological deposits between several culturally modified trees at one site, or between several storage pits at one site).

Known Heritage Resources have not been investigated at or adjacent to the Polk-A-Dot Creek Project. It is recommended that a Chance Find Procedure (CFP) be developed in advance of construction, in the event that

cultural artifacts or anthropogenic deposits (e.g., remains of hearths, dwellings, storage pits) are uncovered during construction.

There is always a limited possibility for unknown archaeological sites to exist. Archaeological sites (both recorded and unrecorded) are protected under the *Heritage Conservation Act* and must not be altered or damaged without a site alteration permit from the Archaeology Branch. If an archaeological site is encountered during development, activities must be halted and the Archaeology Branch contacted at **250-953-3334** for direction.

Federal

Fisheries Act

The *Fisheries Act* is the main federal legislation providing protection for fish, fish habitat, and water quality and is administered federally by DFO and Environment Canada (EC). With the 2012 revisions made to the *Fisheries Act*, the proponent is responsible for determining whether their Project requires DFO review. Section 35 of the Act prohibits *serious harm to fish* that are part of commercial, recreational, or Aboriginal fisheries, or to fish that support such fisheries, unless Authorized by DFO. Serious harm is defined as the death of fish or any permanent alteration to, or destruction of, fish habitat.

Fish habitat is defined as spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes. The definition also indicates that not only the watercourse itself but also the vegetated stream side or riparian areas which provide nutrients and shade to the stream are considered fish habitat.

DFO advises proponents to retain qualified professionals to assess their projects to determine if serious harm to fish is likely to occur and if so, to advise on suitable measures to avoid or mitigate these effects. Where serious harm to fish is not anticipated, or can be mitigated, an Authorization under Section 35 from DFO is not required. Where serious harm is anticipated, an authorization must be issued by DFO, normally accompanied by an agreement regarding implementation of habitat creation or enhancement work to offset harm to fish. Where there is uncertainty concerning the potential for serious harm to fish, proponents can submit a Request for Review to DFO, which will then determine the likelihood of serious harm to fish and offer suggestions regarding mitigation or the need for an Authorization.

Based on Tetra Tech's understanding of the *Fisheries Act*, the proposed Project activities and the habitat of Polk-A-Dot Creek at the Alaska Highway crossing, it is unlikely that the Project will cause serious harm to fish if the BMPs presented in this EMP are implemented. Following construction, the culvert replacement and channel realignment will provide an overall net benefit to fish habitat because:

- The new culvert will be shorter in length than the existing culvert, reducing the linear footprint, and length migrating fish are forced to navigate;
- The channel realignment upstream and downstream of the Highway will be less prone to erosion and frequent slope failures;
- The new channel will incorporate riparian enhancements relative to current conditions; and,
- The new culvert installed using current BMPs to allow for fish passage replaces the existing culvert which acts as a barrier to upstream fish migration, thereby allowing for Grayling to gain access to potential spawning habitat that they have historically been cut off from.

Therefore, a Request for Review has not been submitted for this Project.

Species at Risk Act

The *Species at Risk Act* (SARA) prohibits the killing, harming, harassing, capturing or taking of species at risk, or destruction of their critical habitats. Species are designated ‘at risk’ by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), an independent body of experts that assesses species according to a broad range of scientific data. The federal Cabinet then decides whether those species should receive legal protection under the SARA.

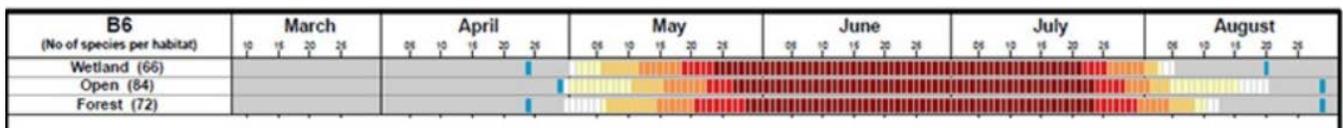
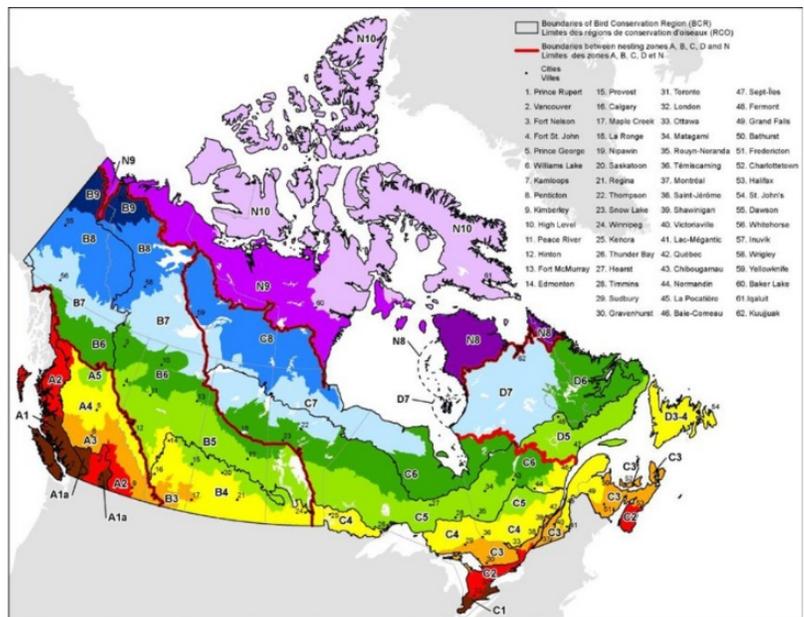
Should a SARA-listed species or any other rare species be identified prior to or during the Project, the Canadian Wildlife Service (CWS) and the MOE should be notified immediately for direction on appropriate action as measures employed would vary greatly with the species encountered, its sensitivity to the Project, and its proximity to the works.

The search for SARA listed species resulted in the known occurrence of the Northern Mountain population of Caribou (*Rangifer tarandus* pop. 15; Shape ID 74264: BC CDC 2014). This species is a SARA Schedule 1 species and designated as Endangered by COSEWIC. No other SARA listed species are known to occur at or near the Project based on the desktop assessment of Polk-A-Dot Creek and surrounding area.

Migratory Birds Convention Act

This *Migratory Birds Convention Act* restricts the disturbance or destruction of migratory birds and their nests, eggs, and shelters, except in accordance with a permit. The *Act* (1994) prohibits the taking or killing of migratory bird nests and eggs, and the deposition of harmful substances in areas frequented by migratory birds. Vegetation removal that will affect trees used by all birds and other wildlife should be avoided while they are breeding, nesting, roosting or rearing young.

Provincial restrictions require that vegetation removal/clearing be conducted outside of the bird nesting season, which is considered April 25 to August 20 for most species in the Northeast Region (ECCC 2017).



No trees are present immediately at or adjacent to the Polk-A-Dot culvert; however, portions of Polk-A-Dot Creek’s riparian area, consisting of low shrubs, will be cleared. A nest survey by the onsite EM is recommended prior to clearing.

Transportation of Dangerous Goods Act

The transportation of dangerous goods is regulated by the BC *Transport of Dangerous Goods Act* and Transport of Dangerous Goods (TDG) Regulation. The transportation of dangerous goods is also regulated federally by the Transportation of Dangerous Goods Program and Regulations, administered by Transport Canada. The provincial TDG program is limited to transportation via roads. Nine categories of substances are regulated within the provincial TDG Regulation: explosives, gases, flammable and combustible liquids, flammable solids, oxidizing substances, poisonous and infectious substances, radioactive material, corrosive substances and miscellaneous substances.

It is the responsibility of Contractor to ensure that all materials within the TDG Schedule are transported in accordance with TDG Regulations.

Environmental Incident Reporting

Any incidents which result in non-compliance with the *Water Sustainability Act*, and/or Federal *Fisheries Act* must be reported within 12 hours to the MOE, DFO and Emergency Management BC (EMBC) [formerly the Provincial Emergency Program (PEP); if reportable spill quantity]. Examples of environmental incidents include, but are not limited to:

- Discharge of deleterious substances into a watercourse, such as:
 - Spills of oil, fuel or chemicals;
 - Excessive sediment laden water entering a watercourse; and
 - Concrete materials (e.g., wet grout) spills into water.
- Work and/or removal of vegetation in or near waterbodies without regulatory approval (exclusive of sites that satisfy DFO Self-Assessment criteria).

A **Spill Response Plan**, including reportable spill quantities, is provided below.

MITIGATION MEASURES AND BEST MANAGEMENT PRACTICES

The BMPs provide prescriptive instructions for managing Project activities in accordance with environmental approval conditions, and to limit the duration, frequency and intensity of environmental effects. Throughout all phases of the Project, the Contractors are expected to comply with all federal, provincial and municipal regulations, permits, authorizations, conditions, and agreements with respect to environmental protection. Additional guidance for project-related environmental management practices and activities will be determined by the terms and conditions of relevant permits, licenses and approvals as they are acquired, such as the *Water Sustainability Act* Change Approval. It should be recognized that the employment of site personnel experienced in implementation of BMPs, particularly at the Site Superintendent level, is integral to the successful implementation of the Project EPP.

General requirements of applicable environmental legislation, regulations, standards, guidelines and BMPs will be adhered to throughout the duration of the Project. Supplementary environmental standards, guidelines and BMPs are also contained in the following documents:

- DFO. 1998. Habitat Conservation and Protection Guidelines.
- DFO. 1992. Land Development Guidelines for the Protection of Aquatic Habitat.

- DFO. 2013. Measures to Avoid Causing Harm to Fish and Fish Habitat.
- MOE. 2016. Habitat Officer's Terms and Conditions for Changes In and About a Stream Specified by MOE Habitat Officers, Northeast Region.
- MOE. 2014. Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia.
- MOE. 2005. A User's Guide to Working In and Around Water: Understanding the Regulation under British Columbia's Water Act. Water Management Branch.
- MOE. 2004. Standards and Best Management Practices for Instream Works.

The Contractors will be familiar with, and will follow the environmental specifications included in this document.

The following sections outline general BMPs and mitigation measures that should be implemented to minimize potential environmental effects and reduce potential for serious harm to fish.

General Practices / Project Planning

It is the responsibility of the Contractor to acquire and familiarize themselves with the requirements of the guideline documents and of the legislation discussed.

- Ensure all Contractors review this EMP, the EPP and the applicable guidelines prior to starting the Project.
- Ensure Contractors know how to properly install any protection measure and understand BMPs used on the Project. Improperly installed measures / BMPs do not perform their intended functions and will not achieve desired environmental protection outcomes.
- All relevant federal and provincial acts, regulations, guidelines, and codes of good practice will apply to all work and activities associated with the Project.
- Hold a pre-construction meeting that includes the EM and all persons undertaking work on site to ensure a common understanding of the contents of this EMP and the EPP and all BMPs for the Project, safety, responsibilities, reporting, response plans etc.
- Plan and schedule project activities for dry weather whenever possible. Minimize Project works near Polk-A-Dot Creek during periods of heavy or prolonged precipitation. Work should be timed to occur within relevant timing windows (instream) when water is at its lowest levels. Work below the creek high water mark must be isolated from flows.
- Maintain, or have readily available, sufficient supplies of Erosion and Sediment Control (ESC) materials as appropriate on-site such as (but not limited to) rock, gravel, grass seed, silt fencing, staking, polyethylene sheeting, etc.
- Adopt an "adaptive management" management strategy for the Project. Adaptive management evaluates and adjusts management decisions (i.e., mitigation measures) to reflect the actual interactions. Contractors should be prepared to change existing measures and BMPs should they fail or in the event additional measures are warranted. The EM should be notified of any changes to assess that they are adequate and installed properly.

Site Access, Mobilization, and Laydown Areas

- Mobilization should be planned to minimize the number of trips to and from the Site.

- A laydown area for storage of equipment and materials should be established. It should be located on a flat, stable area at least 30 m from top of bank of Polk-A-Dot Creek.
- Ensure all equipment is brought to site clean (power washed) and in good working order free of sediment, oil and grease staining/leaks, weeds/seeds. Equipment servicing with environmentally sensitive hydraulic fluids is recommended.

Biological Resources

The EMP, in its current form, has been prepared in advance of a Contractor being identified, or permits/approvals acquired. Therefore, following selection of the successful Contractor, and acquisition of Section 11 Change Approval, it is recommended that the EPP be prepared to meet all regulatory terms and conditions detailed or referenced within the Change Approval. Additionally, the EPP shall specifically, in relation to the work methods proposed and equipment used during construction, incorporate DFO's measures to avoid causing harm to fish and fish habitat.

The primary sensitive environmental resource is the aquatic habitat of Polk-A-Dot Creek. The connection of the upstream and downstream constructed channel to the existing channel poses the greatest risk for downstream fish habitat. Therefore, it is recommended that construction be phased in such a way that allows the majority of works to occur in isolation of flow, as follows:

- Construct the upstream and downstream sections of the new channel without making connections to the existing channel, including culvert installation. This allows the construction to occur in isolation of flowing water and can occur outside the typical fish window;
- Install riparian plantings and complete seeding of the banks to stabilize the newly constructed channel banks;
- Isolate the work zones around the upstream and downstream locations of the existing channel where new and existing channels will be connected. Once work enters the existing watercourse with flow, works must be carried out within the least risk fish window;
- Conduct a fish salvage of isolated work zones;
- Dewater the work zones so that connection construction occurs in absence of flow through pumping around the work zones;
- Construct the upstream and downstream connections and promptly restore and stabilize any remaining areas of the channel banks left exposed during construction with planting and seeding;
- Remove existing culvert and decommission old channel segments no longer conveying flows.

The construction efforts of making the connections should be done only during fisheries window, i.e., after July 15 and before March 31. When the two connections are made, flow within the existing channel will have to be temporarily pumped around the construction zone. Each connection will have to be isolated from flows, and fish salvaged from the area being dewatered. The decommissioning of the existing channel and culvert should only be completed once flow has been established through the new channel. In phasing construction this way, all instream works can be completed in isolation of flow and with low risk of adverse effects to fish.

Aquatic organisms often require defined environmental parameters to survive and cannot tolerate significant changes to their environment. Aquatic ecosystems are sensitive to changes in water quality parameters such as temperature, total suspended solids (TSS), chemical composition and available oxygen as well as the overall flow regime or creek hydraulics.

Fish and Fish Habitat

Polk-A-Dot Creek is a fish bearing watercourse, within which Arctic Grayling are known to reside. Recommended measures to avoid harm to fish include:

- All works will occur in the dry, isolated from flowing water. Measures may include phasing the work as indicated above to ensure Polk-A-Dot Creek flows are uninterrupted during construction, the water remains clear and free of suspended sediments as it bypasses the construction of the realigned channel, and ensures downstream flows remain unimpeded. The appropriate fish window, within which both connections should be completed is July 15 to March 31 (MOE 2016).
- Water quality will be frequently monitored by the Contractor's EM to ensure TSS/turbidity are maintained at an acceptable level (more detail is provided below).
- By phasing the construction so that all work is completed in isolation of flow until the connections can be made during the fish window, a fish salvage will only be required when making the two connections. Should fish or other aquatic animals be observed by the QEP, steps should be taken to trap/salvage and relocate fish to an appropriate habitat well outside of the work area. Permits under the *Wildlife Act* must be obtained from MFLNRO to permit the salvage and relocation of fish, should they be encountered within the work area.
- Pumping will temporarily be required to effectively connect the newly created and existing channels. All water intakes must be screened according to DFO's Freshwater Intake End-of-Pipe Fish Screen Guideline to prevent entrainment or impingement⁶ of fish and other aquatic organisms. BMPs related to the design and proper installation of the intake end of pipe fish screens include:
 - Screens should be located away from natural or artificial structures that may attract fish;
 - Orient the screen face in the same direction as the flow;
 - Ensure openings of the guides and seals are less than the opening criteria to make "fish tight";
 - Suspend the screens a minimum of 300 mm above the bottom of the watercourse, or as close to the surface as possible, to prevent entrainment and conveyance of sediment downstream;
 - Ensure the screen is inspected, cleaned and debris is removed on a regular basis; and
 - Ensure pumps are shut down when fish screens are removed for inspection and cleaning.
- No water shall be extracted from Polk-A-Dot Creek for Project use.
- Erosion and Sediment Control measures should be implemented according to the Erosion and Sediment Control section below.
- Construction environmental monitoring by a QEP is required to ensure the work is completed as per the Tender Specifications and the Section 11 Change Approval.
- In the event of any fluid spills or leaks into Polk-A-Dot Creek, the Spill Response Plan shall be enacted and notifications are to begin immediately.

⁶ **Entrainment** occurs when a fish is drawn into a water intake and cannot escape. **Impingement** occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself.

Wildlife Interactions

There is a low potential for wildlife interactions and/or disturbances to occur during the Project due to limited habitat within the highway right of way. Nonetheless, minor amounts of riparian vegetation exist along Polk-A-Dot Creek which present potential for wildlife interactions.

To minimize potential for negative interactions or impacts with wildlife, the following BMPs are recommended:

- The *Migratory Birds Convention Act* (1994) prohibits the taking or killing of migratory bird nests and eggs, and the deposition of harmful substances in areas frequented by migratory birds. Likewise, the *Wildlife Act* (1996) generally prohibits capturing, possessing, hunting or killing of wildlife without authorization. Clearing must occur outside the regional nesting window of April 25 to August 20 for most species. Should vegetation clearing be required within the nesting window, a nest survey must be completed.
- The *Wildlife Act* also prohibits the possession, taking, injury, molestation or destruction of a bird or its eggs. Minor vegetation removal is proposed for the Project including minor amounts of instream aquatic vegetation and minor-moderate amounts of riparian vegetation on the fringe and along the banks of the Polk-A-Dot Creek; therefore, nests are not likely to be encountered; however, a nest survey must be completed if clearing is to occur within the nesting period.
- The SARA protects rare and sensitive wildlife species. While considered unlikely, should a rare or sensitive species be identified at the Site at any time during the Project, the EM should be notified immediately for further direction. The BMPs to be employed to mitigate the potential effects would vary greatly depending on the identified species, its sensitivity to the project, and its proximity of habitat to the project footprint.
- All food waste and other materials that may attract wildlife are to be removed from the Site daily. Lunches, coolers and food products, including waste food products shall be securely stored away from access by animals. Temporary garbage storage used on-site should be bear-proof containers. Wildlife attractants also pose significant safety risk to travellers on the Alaska Highway.

Vegetation

Minor vegetation removal is proposed for the Project including minor amounts of riparian vegetation along the banks of the Polk-A-Dot Creek. No trees are present in the construction area.

BMPs to mitigate the effects of vegetation clearing include:

- Vegetation removal should be minimized as much as possible particularly along the top of bank of Polk-A-Dot Creek to provide cover and reduce erosion potential within the work area.
- Vegetation removal that will affect low shrubs and aquatic plants used by all birds and other wildlife should be avoided while they are breeding, nesting, roosting or rearing young. Adherence to the nesting windows for clearing activities is required.
- Any vegetation to be removed should be surveyed by the EM, or other QEP, to identify any breeding, nesting, roosting or rearing birds and determine the appropriate BMPs.
- To mitigate effects to vegetation, areas temporarily disturbed by Project related works (including lay-down sites, temporary work sites, and material stock pile sites) should be restored as quickly as possible. This may be accomplished by planting or grass seeding affected areas. A restoration plan for riparian vegetation has been prepared for post-construction restoration of Polk-A-Dot Creek riparian zone.

Erosion and Sediment Control

The following measures are recommended to minimize erosion, reduce sediment mobilization and be used as the basis for sediment, drainage, and water quality management:

- All instream works should occur in the dry, isolated from flowing water using project phasing as previously described.
- Erodible materials should not be used in construction of the isolation structure.
- Erosion and sediment control devices (such as, but not limited to, silt fencing, geotextiles, polyethylene sheeting, straw, mulch, approved grass seed, gravel for check dams, etc.) should be available for use on-site. Project members should be trained in the installation and use of the devices.
- Have adequate ESC measures available for use on-site for containing and stabilizing sediments (and waste materials) above the high water mark (i.e., where the excavator will be operating from) in order to prevent re-entry to Polk-A-Dot Creek. Project members should be trained in the installation, maintenance and use of the measures implemented.
- Minimize the area of soil exposed at any one time by: phasing construction activities; retaining vegetation as much as possible; and, once construction works are completed, stabilize the exposed soils as soon as possible according to the riparian restoration prescription described in Section 3.3.1 of the Polk-A-Dot Creek Culvert Replacement & Channel Realignment Fish Habitat Assessment and Impact Analysis report, and detailed in the design drawings.
- Vegetation outside of the work area should be protected. Surface disturbance should be kept to within the limits of work area and the amount of time surfaces are exposed should be minimized.
- Periods of heavy precipitation are possible during the proposed construction schedule. As much as possible, earthworks should be scheduled to be conducted and completed during dry weather. When significant wet weather is encountered, additional measures may be required to minimize erosion potential.
- Excavation activities should be halted during heavy or prolonged rainfall events. Work may be stopped completely or works may require additional ESC measures be implemented to permit work to continue.
- Soil stockpiling, if necessary, will occur within designated areas which are a reasonable distance (i.e., > 30 m, if possible) from the existing and realigned portions of Polk-A-Dot Creek and the selected location should be approved by the EM. Stockpile volume and area will be minimized where possible and should not be placed on sloped terrain. Protect stockpiles with ESC materials such as silt fence, polyethylene sheeting, and tarps if necessary.
- All ESC measures (i.e., silt fences, etc.) should be routinely inspected during or after intense or prolonged rainfall events, to ensure proper function. After a heavy rain event, it is likely that many of the controls will require repair, clean out, or reinforcement. A quick response to assess and correct damages of the controls is required, especially before subsequent precipitation events. The integrity of the structural components should be verified and the accumulated sediment be measured. As a general rule of thumb, if sediment levels exceed half the volume of the basin or one third the height of a sediment barrier, the sediments should be removed to ensure continued operating effectiveness. Any structural failures should be repaired and any major defective sections replaced upon detection.
- Water quality should be frequently monitored during instream works to ensure turbidity is at an acceptable level. Table 6, below, provides provincial guidelines for water quality; however, the levels directly applicable to the Project should be determined prior to start-up by appropriate regulatory agencies. When turbidity exceeds the established acceptable levels, the EM may direct activities, including additional sediment control measures or halting work.

- Water quality sampling should be completed by the EM at predetermined stations within Polk-A-Dot Creek. Background samples should be taken prior to the start of construction and at regular intervals throughout construction for comparison. The EM should review locations and may sample additional stations if conditions or activities warrant the need for additional stations.
- All ESC structures will be decommissioned once the Project Site has been reclaimed to a level where surface erosion and sedimentation have been stabilized, and potential adverse effects to receiving aquatic systems during peak precipitation events are deemed unlikely by the EM. Non-degradable materials will be removed and disposed of off-site.

Water Quality

The Project involves activities that have potential to contribute sediment to Polk-A-Dot Creek which is known to contain fish. Sediment laden water entering a fish bearing watercourse can be considered an act that causes serious harm to fish and consequently is a contravention of the Federal *Fisheries Act*. Therefore, managing soil and surface runoff is paramount.

According to DFO’s Land Development Guidelines, water is considered sediment laden if it has more than 25 mg/L of TSS above background levels during dry weather or 75 mg/L above background levels during wet weather. It is also recognized that under normal conditions, Polk-A-Dot Creek appears brown in colour indicating elevated suspended solids and turbidity.

TSS is not typically measured in the field as it requires filtering the water sample and weighing the resulting solids. Instead, turbidity is used as a field measurement to describe the level of suspended sediments and can roughly correlate to TSS levels. The MOE Ambient Water Quality Guidelines considers both TSS and turbidity, which is commonly measured in the field. The MOE guidelines consider sediment levels excessive when they exceed levels described in Table 5:

Table 5: Water Quality Guidelines

Water Use	Turbidity	Total Suspended Solids
Aquatic Life (freshwater, marine and estuarine)	Change from background of 8 NTU at any one time in a 24-hour period during low/clear flows (dry weather) ¹	Change from background of 25 mg/L at any one time in a 24-hour period during low/clear flows (dry weather) ¹
	Average change from background of 2 \ NTU over a period of 30 days during low/clear flows (dry weather) ²	Average change from background of 5 mg/L over a period of 30 days during low/clear flows (dry weather) ²
	Change from background of 5 NTU at any one time when background is 8 to 50 NTU during high/turbid flows (wet weather) ¹	Change from background of 10 mg/L at any one time when background is 25 to 100 mg/L during high/turbid flows (wet weather) ¹
	Change from background of >10% at any one time when background is > 50 NTU during high/turbid flows (wet weather) ²	Change from background of >10% at any one time when background is >100 mg/L during high/turbid flows (wet weather) ²

1 Turbidity should not exceed the level expressed in any single measurement.

2 Average turbidity (minimum 5 measurements over 30 days) should not exceed the level expressed.

Details available at: <http://www.env.gov.bc.ca/wat/wq/BCguidelines/turbidity/turbidity.html#tab1>

Establishing a background level of suspended sediment in Polk-A-Dot Creek is necessary to ensure that guidelines are not exceeded. These measurements should be established prior to the start of the Project.

Emergency Response Plan

Potential environmental emergencies may include but are not limited to:

- Reportable fuel spills;
- Sediment laden water leaving the Site;
- Excessive sediment laden water entering Polk-A-Dot Creek;
- Negative wildlife interactions; and
- Observation of previously unidentified sensitive environmental features.

The EM and PWGSC should be notified of all environmental emergencies, either by the Site Superintendent or by construction team members. The EM should assess and record all incidents and determine appropriate action. All significant emergencies should be reported to EMBC (1-800-663-3456).

Emergency Communication

All environmental incidents will be reported to the Environmental Monitor, the Contractor Site Superintendent, and PWGSC as soon as possible, so that appropriate notifications can be made and Project management can ensure that incidents are handled appropriately. For response to spill emergencies, refer to the Spill Response Plan (below), and follow the six steps of spill response. Spills must be promptly cleaned up and reported in accordance with EIR requirements (Appendix C). All personnel on-site have a responsibility to report all environmental concerns or incidents regardless of magnitude. It is the responsibility of the EM to follow-up with the Contractor to ensure that an EIR is filed.

In the case of any environmental concern and or incident, Site crews are responsible for informing their Site Superintendent, who must then report to the EM. Contractors are responsible to ensure that all crew are adequately trained and equipped to deal with potential environmental incidents related to their work. Any concerns about preparedness for environmental incidents will be brought to the attention of the Site Superintendent or the EM during daily meetings.

Any incidents which result in non-compliance with the Provincial *Water Sustainability Act*, and/or Federal *Fisheries Act* must be reported within 12 hours to MFLNRO, DFO and EMBC (if reportable spill quantity).

An environmental incident is one that has caused, or has the potential to cause, one or more of the following:

- Environmental damage.
- Adverse effects on fish, wildlife or other environmental resources.
- Adverse publicity with respect to environment.
- Legal action with respect to violation of statutes or environmental damage.

Examples of Environmental Incidents include, but are not limited to:

- Spills of oil, fuel, hydraulic fluids, PCBs or chemicals;
- Discharge of deleterious substances (sediment, spills, concrete) into fish-bearing water;
- Mass wasting, landslides, erosion, or floods as they affect environmental or water quality;

- High or low flows that affect fish or fish habitat, wildlife or recreation;
- Violation of environmental regulations, permits or approvals;
- Forest fires related to activities; and
- Work and/or removal of vegetation in or near water bodies without regulatory approval.

The Contractor shall complete and or update the Emergency Contacts table as part of the EPP, as necessary.

Table 6: Emergency Responder Contact Numbers

Agency	Phone Number
Emergency Services	911
Local Non-emergency police	911
Local Non-emergency fire	911
Fort St. John Hospital	(250) 262-5200
Emergency Management BC	1-800-663-3456

Spill Response Plan

The Contractor must be familiar with the Spill Response Plan and must ensure that the entire Site crew understands it. Each member of the Site crew should know what constitutes a “significant” spill which needs to be reported. In the case of any environmental concern and/or incident, the Site crew is responsible for informing the Site Superintendent, who must then report to the EM and PWGSC. The Site Superintendent is responsible to ensure that all Site crew members are adequately trained and equipped to deal with potential environmental incidents related to their work. Any concerns regarding preparedness for environmental incidents will be brought to the attention of the Site Superintendent or the EM during daily meetings.

The following measures should be implemented as part of the **Spill Response Plan**:

- The Contractor’s EPP should provide a list of all materials that may be hazardous and of a deleterious nature, and include the WHMIS paperwork.
- A pre-construction meeting should be held to identify all materials of a deleterious nature that could be spilled.
- Hazardous materials and wastes shall be stored in covered containers and in secondary containment.
- Appropriate spill cleanup materials should be readily available and easily accessible. Construction team members should be aware of the specific materials required to clean up various spills.
- If a spill occurs, stop work immediately to respond. Action should be taken to contain the spill and then, if necessary, reported.
- Minimize the potential for spills through proper use, handling, storage and disposal of products.
- Work shall be undertaken and completed in such a manner as to prevent the release of silt, sediment-laden water, fuels or lubricants, or any other deleterious substance.
- All waste fuel, oil, petroleum products, other hydrocarbons and their storage containers must be disposed of off-site at an approved disposal site.

- Contractors shall ensure that all construction machinery is to arrive on site in a clean, washed condition, in good operating condition and is to be maintained free of fluid leaks, excess oil, and grease.
- Hydraulic fluids for machinery used within Polk-A-Dot Creek should be biodegradable in case of accidental loss of fluid.
- Contractors shall ensure vehicles and equipment will not be serviced or refuelled within 30 m of Polk-A-Dot Creek. Tanks, hoses, and connections will be inspected before use. All hose connections will be wrapped and secured with absorbent pads during fuel/oil transfers and remain wrapped, contained, and in an upright orientation during all other times. All hoses, valves, and equipment are to be kept in a containment area whenever possible. Minimize hose length and the number of connections - use dripless connections if possible. Drain hoses when finished.
- Hazardous materials must be labelled and disposed of according to the WHMIS criteria and the TDG Regulations.
- Hydrocarbon and coolant storage, if required on site, shall be within a secondary impermeable containment facility capable of holding 110% of the storage tank contents. This may be achieved through the use of double-walled storage tanks. These containment basins shall be inspected daily for leaks and wear points, kept clean and any measurable rainwater removed and disposed of appropriately. If practical, the containment area should be covered to prevent infilling with rainwater. Where leaks and/or wear points are found, they shall be repaired promptly to restore full containment.
- Contractors shall ensure that small containers (i.e., jerry cans) will be stored in a secure location, protected from weather. These containers must be designed solely for the purpose of storing and pouring fuel and shall not be more than 5 years old. Containers must not leak and must be sealed with a proper fitting cap or lid.
- All work sites must have emergency spill kits (stocked with pads and sorbent booms) available on site. The kits shall be suitable for the quantities and types of material in use and stored at the site. All mobile equipment must contain fully stocked, dedicated spill kits. Contractors must be trained in the proper use of the kits in case of a spill.

Spill Response Procedures:

1. Assess / Ensure Safety
 - Ensure personal/public, electrical, and environmental safety.
 - Ensure that people with proper training and equipment deal with the spill and unnecessary people are kept clear of the area.
 - Wear appropriate Personal Protective Equipment (PPE) and consult Material Safety Data Sheets.
 - Never rush in, always determine the product spilled before taking action.
 - Warn people in the immediate vicinity.
 - Ensure no ignition sources if spill is of a flammable material.
2. Stop the Source (When Possible)
 - If required, and when it is safe to do so, stop the spill at its source. This may simply be righting an overturned container or sealing a hole.
 - Act quickly to reduce the risk of environmental impacts.

- Close valves, shut off pumps or plug holes/leaks, set containers upright.
- Stop the flow of the spill at its source.

3. Secure the Area

- Limit access to the spill area.
- Prevent unauthorized entry onto the site.

4. Contain and Control the Spill

- The spill should be prevented from infiltrating into the ground or entering a watercourse (e.g., Polk-A-Dot Creek).
- If the spill occurs to water, booms should be deployed to prevent its spread.
- Block off and protect drains and culverts.
- Prevent spilled material from entering drainage structures (ditches, culverts, drains).
- Use spill sorbent material to contain spill.
- If necessary, use a dyke or any other method to prevent any discharge off-site.
- Make every effort to minimize contamination.
- Contain as close to the source as possible.

5. Notify / Report Incident to Appropriate Authority

All environmental spills or incidents must be reported to the EM, the Contractor's Superintendent and PWGSC as soon as possible by phone so that appropriate notifications can be made and the incident is handled appropriately. Spills must be promptly cleaned up and subsequently reported. Make a note of what, how, and where the incident happened. An EIR should be prepared as soon as possible following an incident (Appendix C). The target for reporting is within one (1) working day from the time of the incident occurs. All personnel on-site have a responsibility to report all environmental concerns or incidents regardless of magnitude. The Contractor will be responsible for completing and filing the EIR. A sample EIR is included in Appendix C.

External Reporting

For all spills in amounts requiring external notification/reporting or of any substance toxic to aquatic life, the person who had possession, charge or control of a substance immediately before its spill, or the person that discovers a spill, will report the spill to EMBC 24 hour phone line at **1-800-663-3456**. This same person must also immediately report the spill details to the Contractor's Superintendent and EM who will report the spill internally. Minor, non-externally reportable spills should be reported to the Contractor's Superintendent and the Environmental Monitor. All spills should be reported to PWGSC.

If the incident results in severe environmental impact or involvement of the public, the media, or government representatives, PWGSC must be notified immediately. **PWGSC will then initiate notification. The target for this type of notification is within one hour of the incident or its escalation to severe status. Notification may be made via telephone, fax or email, but preference is for personal contact.**

When reporting a spill, the caller should be prepared to provide the dispatcher the following information, if possible:

- Name and phone number of person reporting the spill;
- Name and phone number of person involved with the spill;
- Location, time, and date of spill;
- Type and quantity of material spilled;
- Cause and effect of the spill;
- Details of action taken or proposed to contain the spill and minimize its effect;
- Duration of occurrence;
- Weather conditions;
- Description of the spill location and surrounding area;
- Names of government agencies on scene, if any;
- Names of other persons or agencies advised or to be advised concerning the spill; and
- Planned follow-up.

Table 7 below lists key contacts in the event of spill:

Table 7: Key Project Emergency Contacts

Contact	Name	Phone #	Contact Details
PWGSC Project Manager	Alex Taheri	604.666.9374	Report all incidents to contact
PWGSC Site Manager	TBD	Office – TBD Cell – TBD	Report all incidents to contact
PWGSC Environmental Manager	Laurie Crawford	250.520.0363	Report all incidents to contact
Contractor Site Superintendent	TBD	TBD	Report all incidents to contact
Environmental Monitor (EM)	TBD	TBD	Report all incidents to contact
Fire, ambulance, police service		911	Emergency Assistance
Emergency Management BC		1.800.663.3456	Report as required
Conservation Officer Service (wildlife issues)		1.877.952.7277	Wildlife issues
DFO (aquatic habitat/fisheries issues, Record and Report 24 hour Hotline)		1.800.465.4336	Aquatic habitat/ fisheries issues

*****ALL SPILLS TO WATER ARE REPORTABLE TO Emergency Management BC AND DFO*****

*****If in doubt as to whether or not to report a spill, err on the side of caution and report the spill*****

Table 8 below outlines specific substances and reportable quantities according to the EMA Spill Reporting Regulation (includes amendments up to BC Reg. 376/2008, December 9, 2008):

Table 8: Reportable Spill Quantities

Item	Substance Spilled	Specific Amount
1	Class 1, Explosives as defined in section 2.9 of the Federal Regulations*	Any quantity that could pose a danger to public safety or 50 kg
2	Class 2.1, Flammable Gases, other than natural gas, as defined in Section 2.14 (a) of the Federal Regulations	10 kg
3	Class 2.2 Non-Flammable and Non-Toxic Gases as defined in Section 2.14 (b) of the Federal Regulations	10 kg
4	Class 2.3, Toxic Gases as defined in Section 2.14 (c) of the Federal Regulations	5 kg
5	Class 3, Flammable Liquids as defined in Section 2.18 of the Federal Regulations	100 L
6	Class 4, Flammable Solids as defined in Section 2.20 of the Federal Regulations	25 kg
7	Class 5.1, Oxidizing Substances as defined in Section 2.24 (a) of the Federal Regulations	50 kg or 50 L
8	Class 5.2, Organic Peroxides as defined in Section 2.24 (b) of the Federal Regulations	1 kg or 1 L
9	Class 6.1, Toxic Substances as defined in Section 2.27 (a) of the Federal Regulations	5 kg or 5 L
10	Class 6.2, Infectious Substances as defined in Section 2.27 (b) of the Federal Regulations	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
11	Class 7, Radioactive Materials as defined in Section 2.37 of the Federal Regulations	Any quantity that could pose a danger to public safety and an emission level greater than the emission level established in Section 20 of the "Packaging and Transport of Nuclear Substances Regulations"
12	Class 8, Corrosives as defined in Section 2.40 of the Federal Regulations	5 kg or 5 L
13	Class 9, Miscellaneous Products, Substances or Organisms as defined in Section 2.43 of the Federal Regulations	25 kg or 25 L
14	Waste containing dioxin as defined in Section 1 of the Hazardous Waste Regulation	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
15	Leachable toxic waste as defined in Section 1 of the Hazardous Waste Regulation	25 kg or 25 L
16	Waste containing polycyclic aromatic hydrocarbons as defined in section 1 of the Hazardous Waste Regulation	5 kg or 5 L
17	Waste asbestos as defined in Section 1 of the Hazardous Waste Regulation	50 kg
18	Waste oil as defined in Section 1 of the Hazardous Waste Regulation	100 L
19	Waste containing a pest control product as defined in Section 1 of the Hazardous Waste Regulation	5 kg or 5 L
20	PCB Wastes as defined in Section 1 of the Hazardous Waste Regulation	25 kg or 25 L
21	Waste containing tetrachloroethylene as defined in Section 1 of the Hazardous Waste Regulation	50 kg or 50 L
22	Biomedical waste as defined in Section 1 of the Hazardous Waste Regulation	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
23	A hazardous waste as defined in Section 1 of the Hazardous Waste Regulation and not covered under items 1 – 22	25 kg or 25 L

Table 8: Reportable Spill Quantities

Item	Substance Spilled	Specific Amount
24	A substance, not covered by items 1 to 23, that can cause pollution	200 kg or 200 L
25	Natural gas	10 kg, if there is a breakage in a pipeline or fitting operated above 100 psi that results in a sudden and uncontrolled release of natural gas

*"Federal Regulations" means the Transportation of Dangerous Goods Regulations made under the Transportation of Dangerous Goods Act (Canada)

6. Clean Up the Spill

- Use appropriate absorbent pads or other materials based on the type of substance spilled. The method of disposing of the waste is dependent on the amount and type of deleterious substance that was spilled.
- Technical assistance is available from the EM on clean-up procedures and residue sampling.
- All equipment and/or material used in clean-up (e.g. used sorbent, oil containment materials, etc.) must be disposed of properly.
- Accidental spills may produce hazardous wastes (e.g. material with > 3% oil) and contaminated soil. All waste disposal must comply with the *Environmental Management Act* and Regulations.
- Contaminated soil must be treated and dealt with as required on a site-specific basis.

Machinery, Equipment and Fuel Management

Refer to Spill Response Plan above for additional details with respect to the proper fueling and maintenance of machinery and equipment

- Equipment and machinery should be in good operating condition, free of leaks, excess oil and grease and invasive or noxious weeds and seeds (power washed if necessary). Equipment should be operated at optimum rated loads and be turned off when not in use to minimize exhaust emissions. Equipment producing excessive exhaust should be repaired or replaced.
- Equipment should be serviced with environmentally friendly hydraulic fluid such a vegetable oil. Machinery used for creating the realigned channel of Polk-A-Dot Creek should use environmentally friendly fluids.
- Machinery should be situated in a way so to minimize track movement.
- Equipment should operate above the high water mark of all watercourses. While working instream, equipment should work from a dry location such as above the bank or from an area that has been isolated.
- Refuelling and maintenance of equipment as well as the storage of any excess fuels, oils, lubricants or other petrochemical products should occur at least 30 m from any watercourse and/or catch basin. Topographic features and slope should be considered, flat surfaces are recommended.
- All spill containment kits should be readily accessible both onsite and on each piece of equipment in the event of a release of a deleterious substance to the environment. All members of the construction team should be trained in the use of spill kit materials and supplies. Any spill of a substance that is toxic, polluting, or deleterious

to aquatic life of reportable quantities must immediately be reported to the EMBC 24-hour phone line at **1-800-663-3456** (see Spill Response Plan above).

Waste Management (Including Hazardous Wastes and Potentially Contaminated Soils)

- The Contractor is expected to abide by the general 'leave no trace' rule. All site personnel are responsible for removing all litter, domestic garbage, recyclables and organic wastes that are brought to site for appropriate offsite disposal. General housekeeping will be monitored on a weekly basis by the EM. Should garbage containers be required on site, they shall be made inaccessible to wildlife, including bear-proof lids.
- The Contractor is expected to adhere to all applicable legislation with respect to the handling, transportation, and/or disposal of all materials related to this Project (waste or otherwise). These regulations may include (but not be limited to) the Hazardous Waste Regulations, Spill Reporting Regulations, Workers Compensation Board Regulations, TDG Regulations, etc.
- Hazardous wastes generated could include waste petroleum products (engine oils, lubricants) from machinery and equipment, spent batteries, solvents and cleaning agents, etc. The Contractor should provide labelled separate container(s) for potentially hazardous waste such as oily rags and hydrocarbon absorbent pads.
- All hydrocarbon products and other hazardous wastes potentially present during project activities should be identified and the associated Workplace Hazardous Materials Information System (WHMIS) and Materials Safety Data Sheets (MSDS) made available to all Project members.
- Any waste considered to be hazardous will be labeled and disposed of according to the WHMIS criteria and the TDG Regulations.
- Non-hazardous construction waste should be collected at designated areas on the site and removed to appropriate facilities on a regular basis.
- Maintain a tidy work area to minimize loose waste from leaving the Site.
- Recycle materials whenever possible.
- Waste materials should not be buried or burned.

If hazardous or contaminated material (including suspect soils) is encountered, stop work immediately and report it to the Contractor's Superintendent and EM who will determine appropriate BMPs. Hazardous materials should only be handled by appropriately trained personnel.

Asphalt Handling and Management

General Asphalt Handling

The following BMPs should be followed for handling asphalt:

- Trucks used for hauling asphalt mixture should 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. The vehicle covers shall be securely fastened. Excess truck box lubricants such as light oil, detergent or lime solutions should not be allowed to contaminate the mix and should be disposed of in an environmentally acceptable manner. Truck box lubricant application should be carried out in designated area.
- Asphalt plant operations must comply with all environmental pollution control regulations applicable in the plant area (i.e., controlled spraying of sealant within 20-metres of any watercourse). The application of the emulsion

will be restricted to the highway surface only. The sprayer boom will be operated as close to the highway surface as possible and not over the edge of the highway, in order to prevent contamination of adjacent vegetation.

- Grade construction conducted close to Polk-A-Dot Creek will employ methods to ensure materials are not pushed, fall and/or are eroded into the water. Generally, work within 30 metres will require monitoring by the EM.
- No grade building shall occur outside of designated areas. Any material inadvertently falling outside the work limits is to be removed promptly in a manner that does not damage vegetation at that location. Materials should be placed at storage sites or on the grade without spillage outside the working limits.
- Pavement marking shall be undertaken pursuant to standard methods for control of paint products, both in transport and handling. The Contractor should present a description of the methods to be employed for transporting and controlling paint and hazardous products, application of paint, cleaning of equipment, containment and disposal of waste paint, cleaning products, etc.

Equipment Cleaning and Good Housekeeping

The following BMPs should be followed for asphalt equipment cleaning and good housekeeping:

- Asphalt should never be disposed of in a body of water or other non-permitted disposal area;
- Park the paver in an area that is **not** near (within 30 m) Polk-A-Dot Creek or any drainage feature that leads to Polk-A-Dot Creek;
- Use as little solvent as possible to lubricate, not clean, the surfaces and moving parts of the paver;
- The solvent should be sprayed on the equipment, not poured;
- Do not pour solvent down the bed of the truck to lubricate the bed;
- The solvent must not form puddles under the equipment;
- When cleaning tools, servicing equipment or doing routine maintenance, use care to avoid spills, leaks and drips of equipment and cleaning fluids. Use absorbent pads during these activities, if needed, and clean up any spills. Proper disposal of the solvent pad as a hazardous waste is required; and
- During construction, tack over-spray should be covered or cleaned up.

Air Quality

To address air quality considerations, the following mitigation measures apply:

- The Contractor shall confirm all equipment brought to site is serviced and maintained and in efficient working order.
- The Contractor's Superintendent and EM will visually inspect all vehicles and equipment. Vehicles or equipment producing excessive exhaust pollution shall be repaired or replaced.
- Dust-generating activities will be minimized as much as possible, especially during windy periods, to minimize airborne dust emissions. Given the habitat sensitivity of Polk-A-Dot Creek, water is considered the only appropriate dust suppressant (e.g., a sprinkler system) and shall be kept on site to be used as needed. Water shall not be withdrawn from Polk-A-Dot Creek for this purpose.
- No burning of oils, rubber, tires and any other material should take place at the Site.

- Stationary emission sources (e.g., portable diesel generators, compressors, etc.) should be used only as necessary and turned off when not in use.
- Equipment and vehicles should be turned off when not in active use so to reduce idling.
- All equipment, vehicles and stationary emission sources should be well-maintained and used at optimal loads to encourage minimal emissions.

Noise & Vibration

Short-term noise generation and vibrations will result from equipment and associated activities during the Project. Noise impacts not only affect humans but also wildlife and fish. Response to noise is a function of many variables including characteristics of the noise and duration, life history characteristics of the species, habitat type, season and current activity of the animal, sex and age, previous exposure and whether other physical stressors are present. While thresholds of tolerance vary by species, even moderate levels of noise can cause damage or stress and intense noise levels (180dB+) can potentially cause death in some species. Table 9 below shows general noise levels according to equipment type that may be used during the Project:

Table 9: Equipment Noise Levels

Equipment	Average dBA	Range dBA
Dozers, Dumpers	96	89-103
Front end loaders	88	85-91
Excavators	87	86-90
Backhoes	86.5	79-89
Scrapers	96	84-102
Mobile Cranes	100	97-102
Compressors	79	62-92
Pavers	101	100-102
Rollers (compactors)	90	79-93
Bar benders	95	94-96
Pneumatic breakers	106	94-111
Hydraulic breakers	95.5	90-100
Graders, trucks, concrete pumps & mixers, generators	<85	-
Concrete batch plant operator	<85	-
Poke vibrators	94.5	87-98
Saws	88.5	78-95
Pile drivers (diesel & pneumatic)	98	82-105
Pile drivers (gravity, board)	82.5	62-91

Source: Eaton, Stewart (February 2000) "Construction Noise" Workers Compensation Board of BC
<https://www2.worksafefbc.com/pdfs/hearing/ConstructionNoise.pdf>

Noise exposure levels should comply with Part 7, Division 1 of the Occupational Health and Safety Regulation. WorkSafeBC has several publications regarding noise in the work place and are available at:

http://www.worksafefbc.com/publications/health_and_safety/by_topic/assets/pdf/basic_noise_calculations.pdf

http://www.worksafefbc.com/publications/health_and_safety/by_topic/assets/pdf/occupational_noise_surveys.pdf

Because the Project will occur along a highway, typical noise concerns are not likely applicable to the Site. However, construction BMPs recommends that all equipment be properly maintained to limit noise emissions.

The following BMPs are recommended to minimize noise:

- All equipment should be properly maintained to limit noise emissions and fitted with functioning exhaust and muffler systems. Machinery covers and equipment panels should be well fitted and remain in place to muffle noise. Bolts and fasteners should be tight to avoid rattling.
- Engines should be turned off when not in use or reduced to idle.

Archaeological Resources and Historical Sites

A Chance Find Procedure (CFP) should be part of the Contractor's EPP and developed in advance of construction, in the event that cultural artifacts or anthropogenic deposits (e.g., remains of hearths, dwellings, storage pits) are uncovered during construction.

If an archaeological site is encountered during construction, activities must be halted and the Contractor must follow the CFP. The Archaeology Branch shall be contacted at 250-953-3334 for direction.

APPENDIX C

ENVIRONMENTAL INCIDENT REPORT FORM

Environmental Incident Report Form

Project Name _____ Project No. _____

Location _____

Date & Time of Spill _____

Person	Name	Number
Reporting Spill		
Involved in Spill		
Spill Cleanup		
Type and quantity of material spilled		
Cause of spill		
Action taken to contain and minimize effects		
Notification to :		
Project Manager <input type="checkbox"/>	Phone/cell: _____	EMBC <input type="checkbox"/> Phone/cell: _____
Site Superintendent <input type="checkbox"/>	Phone/cell: _____	DFO <input type="checkbox"/> Phone/cell: _____
Environmental Monitor <input type="checkbox"/>	Phone/cell: _____	MOE <input type="checkbox"/> Phone/cell: _____

APPENDIX D

FLNRO HABITAT OFFICER'S TERMS AND CONDITIONS



Ministry of
Forests, Lands and
Natural Resource Operations

Terms and Conditions
for *Water Sustainability Act* Changes in and about a Stream
as specified by Ministry of Forests, Lands & Natural Resource Operations
(FLNRO) Habitat Officers, Northeast Region

Upon submission of a signed Authorized Change for works in and about a stream, the proponent has agreed to be compliant with all applicable terms and conditions detailed in this document and ensured that the project meets all requirements and will comply with Section 11 of the *Water Sustainability Act* and Part 3 of the Water Sustainability Regulation.

The proponent must also comply with all applicable provincial and federal legislation, municipal enactments, and applicable Ministry of Environment *Instream Works Best Management Practices* (<http://www.env.gov.bc.ca/wld/instreamworks/index.htm>).

As per Section 38 of the Water Sustainability Regulation a person must not make a change in and about a stream unless that person notifies a habitat officer 45 days prior to the commencement of the change and complies with the applicable terms and conditions provided in this document. The Habitat Officer may specify additional conditions to ensure the protection of habitat. If additional conditions are required you will be contacted within 45 days. If a person is not contacted by a habitat officer within 45 days after the notice is received by a habitat officer, the person may proceed with the authorized change that is the subject of the notice.

An Authorized Change is only applicable for activities described in Section 39 of the Water Sustainability Regulation. If the proposed activity does not meet these requirements or the requirements of these Terms and Conditions, a Section 11 *Water Sustainability Act* Approval application will be required. Applications are available, and must be submitted to FrontCounter BC.

Please note: The *Water Sustainability Act* definition of a “stream” differs from the definition in other provincial statutes and legislation such as the *Forests and Range Practices Act* and the *Oil and Gas Activities Act*.

Important Definitions:

Section 1, Water Sustainability Act:

"stream" means

(a) a natural watercourse, including a natural glacier course, or a natural body of water, whether or not the stream channel of the stream has been modified, or

(b) a natural source of water supply, including, without limitation, a lake, pond, river, creek, spring, ravine, gulch, wetland or glacier, whether or not usually containing water, including ice, but does not include an aquifer

"stream channel" means the bed of the stream and the banks of the stream, both above and below the natural boundary and whether or not the channel has been modified, and includes side channels of the stream

"aquatic ecosystem" means the natural environment of the stream, including

(a) the stream channel, the vegetation in the stream and the water in the stream, and

(b) fish, wildlife and other living organisms insofar as their life processes

(i) are carried out in the stream, and

(ii) depend on the natural environment of the stream

Section 44, Water Sustainability Regulation:

"Timing Windows" in relation to a stream, means a period of the calendar year, specified under Section 44 of the Water Sustainability Regulation by a habitat officer, during which changes in and about the stream can be made without causing a risk of significant harm to fish, wildlife or the aquatic ecosystem of the stream.

Timing windows are one of the measures applied to protect fish from impacts of works or undertakings in and around water during spawning migrations and other critical life history stages. Works in and about watercourses must be undertaken at a time of year when the threat of negative impacts to aquatic organisms is low, in accordance with Terms and Conditions. The timing of instream work(s) also extends to tributaries where there is a risk of depositing sediment into fish-bearing waters. Proponents must ensure that instream works minimize the impacts to all aquatic organisms including fish, wildlife, aquatic invertebrates and species at risk.

Section 44 of the Water Sustainability Regulation gives authority to a Habitat Officer to add specific conditions to ensure the protection of the aquatic ecosystem in addition to the conditions of general application. Under this authority, FLNRO Habitat Officers, Northeast Region, require the following mandatory terms and conditions:

(a) The timing window during which the change may be made;

The timing window during which changes in and about a stream can be made without causing a risk

of significant harm to fish, wildlife or the aquatic ecosystem of a stream must be applied to all activities in fish streams as well as tributaries that have any risk of deleterious effects (eg. depositing sediment into fish streams). Timing windows are designed to protect all fish species known to occur in a stream. One way fish presence can be confirmed is through a fish inventory database¹. If using this database, the lack of fish records for a particular area is not equivalent to fish absence. All streams are assumed to have both spring and fall spawners until proven otherwise.

Resources Information Standards Committee (RISC) provides documents pertaining to aquatic ecosystem assessment standards: <http://www.for.gov.bc.ca/hts/risc/pubs/aquatic/index.htm>

The timing windows for the Northeast Region are as follows:

Fish/Wildlife Presence	Window of Least Risk
Both spring and fall spawners*; or unknown	July 15 – August 15
Fall spawners* (eg bull trout, kokanee)	June 15 – August 15
Spring spawners (eg rainbow trout, walleye)	July 15 – March 31
Anadromous salmon (eg chum)	Please contact Fisheries and Oceans Canada (DFO) for site-specific timing
Beavers	July 15 – September 14

* Includes winter spawning burbot (*Lota lota*).

Notwithstanding the above, if any one of the following conditions is met, the timing window is not applicable:

- If the stream channel is naturally dry (no flow) or frozen to the bottom at the worksite and the instream activity will not adversely impact fish habitat (eg. result in the introduction of sediment into fish habitat).
- If construction of a winter crossing is proposed and such works does not adversely impact the stream channel (including stream banks), fish habitat or fish passage.
- The structure does not encroach below the high water mark, no work is proposed below the high water mark of a fish stream, and measures will be taken to prevent the delivery of sediments or contaminants into fish habitat.
- Work is in a non-fish stream and measures will be taken to prevent the delivery of sediments into downstream fish habitat or the stream is not fish-bearing and discontinuous with no connection to downstream fish habitat.

If your work is proposed outside of the timing window, you must retain a qualified environmental professional (such as an RPBio). The professional will be responsible for providing a written technical rationale that assesses and addresses the risks of the proposed changes in and about a stream, including proposing site specific mitigation (eg. an Erosion Control Plan that identifies contingency measures and emergency procedures related to the proposal) and onsite monitoring of their implementation. This document must be submitted to the Habitat Officer via FrontCounter B.C.

¹ Fisheries Inventory site <http://www.env.gov.bc.ca/fish/>

with reference to your file number (shown on top of this document).

If proceeding outside the timing window in accordance with recommendations by your qualified environmental professional, you must comply with any measures specified by that professional to prevent impacts on the stream channel (including stream bed and banks) or fish, wildlife or the aquatic ecosystem of the stream, as well as any additional Habitat Officer terms and conditions specified in the confirmation of receipt of your original Notice.

(b) The minimum instream flow or the minimum flow of water that must remain in the stream while the change is being made,

- The original rate of water flow in the stream (existing prior to commencing work) must be maintained upstream and downstream of the worksite during all phases of instream activity associated with the work to ensure natural downstream streamflow is maintained at all times. All instream activities must be conducted in the dry and the worksite must be isolated from flowing waters in the stream channel. Downstream reaches are not to be dewatered due to site isolation activities.

(c) The removal of material from the stream or stream channel in connection with the change,

- In fish streams, the permanent removal of stable, naturally occurring material from the stream or stream channel is not permitted.
- The channel width of the stream must not change.
- In non-fish streams, the permanent or temporary removal of stable, naturally occurring material must be minimized and completed only as necessary to make the change in accordance with Part 3 of the Water Sustainability Regulation.
- The removal of material must not lead to stream channel instability or increase the risk of sediment delivery to the watercourse.
- Any spoil materials must be placed in a location which ensures that sediment or debris does not enter the watercourse.

(d) The addition of substance, sediment, debris or material to the stream or stream channel in connection with the change,

- If possible, work must be conducted on, and equipment located and operated from, dry land (no water present) and the worksite must be isolated from flowing water.
- Any equipment used in conducting work must be in good mechanical condition and, when operating in close proximity to the wetted perimeter of a stream, the operator must prevent entry of any substance, sediment, debris or material (eg. hydrocarbons, silt) into the stream so as to prevent harm to fish, wildlife or the aquatic ecosystem of a stream. Note that it is an offence under Section 46 of the *Water Sustainability Act* which prohibits the introduction of foreign matter into a stream. Failure to comply may result in a remediation order.

- During work onsite, erosion and sediment control materials must be available onsite at all times and must be installed if sedimentation is likely to occur into the stream. A contingency plan must be developed outlining the measures to be taken by workers when carrying out any work to control erosion and sediment.
- Within the work area, standing water that contains sediment must be pumped to a vegetated area or settling pond that is sufficiently far from the stream to allow for suspended fine particles to settle or be filtered out, prior to reintroducing stream flow to the work area. The return water must not cause erosion that result in sediment delivery to the stream.
- Any materials, such as riprap or gabion rock, placed within the stream channel must be free of silt, overburden, or other substances deleterious to aquatic life. Rock used as riprap must be angular in shape and suitably sized to resist movement by stream flows. Rock placement should be designed to minimize the potential for failure of riprap bank protection and displacement of riprap to the stream bed.

(e) The salvage or protection of fish or wildlife while the change is being made or after the change has been made,

- When work requires de-watering or isolation of the worksite in the stream, a permit for the salvage of fish and wildlife must be obtained prior to commencing work. All required salvage permits must be obtained from FrontCounter BC:
<http://www.frontcounterbc.gov.bc.ca/guides/fish-wildlife/general-permit/overview/>
- Any salvage must be carried out by a qualified environmental professional (such as an RPBio).
- If an area is de-watered as a result of beaver dam removal or modification and results in the stranding of fish, then these fish must be salvaged and returned to the stream.
- Measures must be taken to ensure that equipment (e.g. screened water pump intakes) does not harm aquatic life. Refer to the Freshwater Intake End-of-Pipe Fish Screen Guideline. Available from: <http://www.dfo-mpo.gc.ca/Library/223669.pdf>
- Proponents are responsible for complying with the BC *Wildlife Act*, and must not disturb wildlife and/or their residences (eg. beaver lodges², eagle, osprey and heron nests) within the project area.

² Beaver may only be removed by the registered trapline holder or contract problem beaver trappers (contact BC Trappers Association, c/o Trappers International (250-561-1602)). A permit issued by the Fish, Wildlife Science and Allocation Section Head is required to remove beaver outside the trapping season.

(f) The protection of natural materials and vegetation that contribute to habitat or stream channel stability, and

- Consider whether removal of object(s) or material from the stream would cause more damage to fish and wildlife populations and habitats than would result if the object(s)/materials are left. If the object is large and is more than one-third buried in the stream substrates, its removal may result in a large amount of sediment being re-suspended, discharged or may result in significant changes to in-channel habitats.
- Trees on the work site or clearing width adjacent to streams must be felled away from the stream to the fullest extent possible. All the tree(s) and all resultant debris must be removed from the channel concurrently with felling.
- Minimize disturbance to natural materials (eg. embedded woody debris) and vegetation that contribute to habitat or stream channel stability.
- The disturbance of stream bank vegetation must not occur or be minimized as much as possible.

Beaver Dam or House Alteration or Removal

Complete beaver dam removal should be avoided and only considered after all other beaver management tools have been exhausted, an emergency situation has arisen or where measures can be taken to ensure no harmful alteration of fish habitat. When planning your project develop designs and select locations to minimize potential impacts to fish and fish habitat. The project must comply with the [Ministry of Environment Instream Works Best Management Practices Beaver Dam Removal Guidelines](#).

As per Section 9(1) of the provincial Wildlife Act, a person commits an offence if the person disturbs, molests or destroys (a) a muskrat house or den, except on diked land, or (b) a beaver house or den or beaver dam.

Applications to modify or remove a beaver dam or house are available from the Permit and Authorization Service Bureau (PASB): <http://www.env.gov.bc.ca/pasb/applications/process/wildlife.html#beaver-dam>

Requests to modify or remove a dam or house outside of the Window of Least Risk (July 15 – September 14) must be accompanied by a detailed rationale.

(g) The restoration of the work site after the change has been made.

- Undertake activities that result in the restoration of natural pre-disturbance site condition that will not contribute deleterious materials into any aquatic habitat at any time of year.
- Any areas that are disturbed during the work (such as exposed soil) must be promptly restored at a minimum to the pre-disturbance condition. Any soil exposed at the worksite must be promptly re-vegetated.
- Following de-watering or isolation of the worksite, stream flow must be returned gradually to the de-watered or isolated area within the stream and not in a single sudden rush so as to

avoid erosion of the stream channel and sediment delivery to the stream.

- Note: Guidance is provided in the [Habitat Enhancement and Restoration Section](#) of the *Best Management Practices Instream Works*.
- The [Peace-Liard Re-Vegetation Manual](#) contains re-vegetation best management practices and recommended seed mixes for the Northeast Region. In addition, the Peace River Regional District Invasive Plant Committee has developed invasive plant best management practices for various industrial sectors. Available here:
<http://prrd.bc.ca/wp-content/uploads/page/invasive-plants/2015IPCPRRD-Strategic-Plan-and-Profile.pdf>

Final Note

It is the responsibility of persons intending to carry out changes in and about a stream, as described under Part 3 of the Water Sustainability Regulation:

- To ensure that all sections of the Notice form are properly completed;
- To comply with federal, provincial and municipal enactments, including but not limited to the *Water Sustainability Act* (and its regulations), *Fisheries Act* (Canada), *Wildlife Act* (BC) or the *Navigation Protection Act* (Canada), as well as local government bylaws and regulations, as may be applicable to proposed changes and related works or activities; and,
- To obtain the written consent of the landowner for proposed changes and related works or activities intended to take place on private land or premises or to use any privately owned works, before proceeding.

Supportive Information and Best Management Practices Documents

Instream works:

<http://www.env.gov.bc.ca/wld/instreamworks/index.htm#>

User's Guide to Working In and Around Water:

http://www.belcarra.ca/reports/User_Guide_To_Working_Around_Water.pdf

Water Licences and Approvals:

<http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/water-licences-approvals>

Working Around Water:

<http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water>

Apply for a Change Approval or Submit Notification of Instream Work:

<http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/water-licences-approvals/apply-for-a-change-approval-or-submit-notification-of-instream-work>

Exemptions from approval or notification:

<http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/exemptions-from-approval-or-notification>

Standards and Best Management Practices for Instream Works:

http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/water-rights/standards_bp_instream_work.pdf

Bank stabilization:

<http://www.env.gov.bc.ca/wld/instreamworks/downloads/BankStabilization.pdf>

Beaver dam management – Constructed ditch factsheet:

http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/agriculture-and-seafood/agricultural-land-and-environment/water/500-series/543110-1_bever_dam_management-drainage_guide_factsheet_no16.pdf

Beaver dam removal:

<http://www.env.gov.bc.ca/wld/instreamworks/downloads/BeaverDamRemoval.pdf>

Bridges:

<http://www.env.gov.bc.ca/wld/instreamworks/downloads/Bridges.pdf>

Channel maintenance:

<http://www.env.gov.bc.ca/wld/instreamworks/downloads/ChannelMaintenance.pdf>

Culverts:

<http://www.env.gov.bc.ca/wld/instreamworks/downloads/Culverts.pdf>

Habitat enhancement and restoration:

<http://www.env.gov.bc.ca/wld/instreamworks/downloads/Habitat.pdf>

Land development guidelines for the protection of aquatic habitat:

<http://www.dfo-mpo.gc.ca/Library/165353.pdf>

Miscellaneous works:

<http://www.env.gov.bc.ca/wld/instreamworks/downloads/MiscellaneousWorks.pdf>

Pipeline crossings:

<http://www.env.gov.bc.ca/wld/instreamworks/downloads/PipelineCrossings.pdf>

Public utility works:

<http://www.env.gov.bc.ca/wld/instreamworks/downloads/PublicUtilityWorks.pdf>

Resources Information Standards Committee (RISC):

<http://www.for.gov.bc.ca/hts/risc/pubs/index.html>

Riprap design and construction guide:

http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/riprap_guide.pdf

Standard project considerations:

<http://www.env.gov.bc.ca/wld/instreamworks/downloads/GeneralBMPs.pdf>

Urban stormwater management:

<http://www.env.gov.bc.ca/wld/instreamworks/downloads/UrbanStormwater.pdf>

Wharf, pier, dock, boathouse and mooring:

<http://www.env.gov.bc.ca/wld/instreamworks/downloads/Docks.pdf>

Please be advised that these documents may contain information which may be the subject of change due to amendments to the federal *Fisheries Act* and/or to related processes by DFO. Current up-to-date information on DFO process and legislation can be found at: <http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>

APPENDIX E

DESIGN DRAWINGS

Note: Design Drawings removed from Appendix E, see Contract Drawings.