REPORT

Ministry of Transportation
and Infrastructure

Henson Creek Culvert Replacement:
Environmental Assessment

March 2018
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1 Introduction

1.1 BACKGROUND

The Ministry of Transportation and Infrastructure (MoTI) retained Associated Engineering (AE) to provide contract administration, limited structural engineering, and environmental consulting services for the Henson Creek culvert replacement on Pacific Marine Road approximately 25 km northeast of Port Renfrew, BC (the Project) (Figure 1-1). Associated Environmental Consultants Inc. (Associated) completed an environmental assessment to support regulatory permitting requirements for the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNR). The environmental assessment focused on Project effects on fish and fish habitat, wildlife and wildlife habitat, and species at risk (valued components).

This report outlines the proposed works, characterizes the existing environmental conditions in the Study area, assesses the environmental effects, and recommends mitigation measures for construction.

1.2 PROPOSED WORKS

The Project includes the replacement of the existing log crib culvert with a cast-in-place concrete box culvert. The proposed works for the culvert replacement include:

- Constructing a temporary detour outside of the existing road surface but within the length of the new culvert (i.e., no alteration of the natural stream channel outside of the right-of-way);
- Constructing a temporary diversion (e.g., pipe, flume);
- Installing a cofferdam upstream of the culvert inlet using sandbags, aqua dam, or similar appropriate method to divert flows (or for bypass pumping);
- Removing a minor amount of riparian vegetation using hand tools to facilitate construction;
- Removing existing log crib culvert (23 m length, 3.9 m width);
- Constructing cast-in-place concrete box culvert (25 m length, 5.6 m width);
- Installing rip rap slope protection (Class 1000 kg, 1500 mm thickness) using heavy machinery (i.e., excavator equipped with a thumb on the bucket);
- Backfilling the culvert;
- Removing the cofferdam and reinstating the creek flow through the new culvert;
- Decommissioning and backfilling the temporary diversion;
- Reconstructing the road (i.e., asphalt works); and
- Revegetating temporarily disturbed areas.

Specific construction methodology including details for any pipes or conduits used to divert water will be determined by the successful contractor.

Additional details are provided in the attached General Arrangement Drawings by AE (Appendix A).
1.3 PROJECT SCHEDULE

Project works are scheduled to occur from May to September 2018. The majority of instream works (i.e., removing existing log crib culvert, constructing new cast-in-place concrete culvert) is scheduled during the instream works timing window (June 15 to September 15) (Section 6.1.3). However, construction of the temporary detour, construction of the temporary diversion, and removal of minor riparian vegetation are anticipated to take place from mid-May to mid-June.
FIGURE 1-1: PROJECT LOCATION

PROJECT NO.: 2018-2243.100.004
DATE: March 2018
DRAWN BY: BdJ

Ministry of Transportation and Infrastructure
Henson Creek Culvert Replacement
2 Regulatory Summary

The Project is under the jurisdiction of several provincial environmental regulations (Appendix B). Regulatory permitting requirements for the Project are limited to a Notification for works in or about a stream to FLNR and fish collection permit applications to FLNR and Fisheries and Oceans Canada (DFO).

A summary of environmental authorization requirements is provided in Table 2-1.

<table>
<thead>
<tr>
<th>Permit</th>
<th>Regulatory Authority</th>
<th>Approximate Turnaround Time</th>
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| Water Sustainability Act Notification | FLNR                 | 45 days                    | • Notification form  
• Detailed project description  
• Environmental assessment report  
• Letter of undertaking             |
| Fish Collection Permit                | FLNR / DFO           | 15 – 30 days; should be obtained pre-construction | • Fish collection permit application forms                     |

Note: Review timelines by the applicable agency are from date of submission and are based on experience. Timelines are affected by regulatory agency workload.

Additional details regarding environmental legislation applicable to the Project and required regulatory reviews or approvals are provided in Appendix B.
3 Methods

The environmental assessment consisted of the following tasks:

- Documenting existing environmental conditions by conducting the following:
  - A desktop review of available information resources;
  - A field assessment of the Study area;
- Identifying potential environmental effects of the Project; and
- Developing mitigation measures to avoid or minimize identified adverse effects.

For the purpose of this assessment, the Study area is the area within 50 m upstream and downstream from Pacific Marine Road including the riparian area within 30 m of top-of-bank.

3.1 Existing Environmental Conditions

3.1.1 Desktop Review

The following resources were compiled and reviewed to characterize environmental conditions and identify potential environmental effects in the Study area:

- GoogleEarth© online imagery;
- Fisheries Information Summary System database (MOE 2018a);
- BC Ministry of Environment Habitat Wizard database (MOE 2018b);
- BC Conservation Data Centre Species and Ecosystems Explorer (CDC 2018a);
- BC Conservation Data Centre iMap element occurrence reports (CDC 2018b); and
- EcoCat: The Ecological Reports Catalogue (MOE 2018c).

3.1.2 Field Assessment

A field assessment was conducted by Chris Hegele, B.I.T., of Associated on March 9, 2018 to verify and supplement the findings of the desktop review, characterize existing aquatic and riparian habitat conditions (e.g., stream substrate, morphology, cover, and riparian vegetation), and identify sensitive environmental features (i.e., aquatic habitats, wildlife, and habitats associated with rare or endangered species) within and adjacent to the Study area with particular focus on the proposed instream works.

The aquatic field assessment consisted of visual observations (including underwater video) of Henson Creek and adjacent riparian areas within the Study area and included documentation of biophysical attributes (e.g., channel dimensions and morphology, substrate type, and instream habitat quality). Methods for the assessment were adapted from the Resource Inventory Committee (RIC) Fish and Fish Habitat Inventory: Standards and Procedures (RIC 2001) and Fish Habitat Assessment Procedures (Johnston and Slaney 1996).

In addition, a fish passage assessment was completed for the existing log crib culvert following the Field Assessment for Determining Fish Passage Status of Closed Bottom Structures (MOE 2011).
No species-specific inventories, avian call-back, fish, water, soil, or sediment sampling were conducted.

Representative photographs were taken of habitat and anthropogenic features (e.g., log crib culvert) in the Study area.

### 3.2 ENVIRONMENTAL EFFECTS ASSESSEMENT

Based on the desktop review and field assessment, the environmental assessment focused on the environmental features in the Study area that could be affected by the Project, identified as valued components. An environmental effect is considered to be any change that the design, construction, and operation of the Project may have on existing environmental conditions. Potential environmental effects from the Project were categorized as either permanent changes from the footprint of proposed works, temporary changes or effects during site preparation and construction, or effects during normal operation of the culvert.

Aquatic effects were classified as instream when below the high-water mark and as riparian when above but within 30 m of the high-water mark.

### 3.3 MITIGATION MEASURES

General mitigation measures were developed to avoid, minimize, and mitigate effects of the Project on the valued components in the Study area. Mitigation measures recommended for the Project are based on the following guidelines and standards:

- Land Development Guidelines for the Protection of Aquatic Habitat (DFO 1993);
- Standards and Best Practices for Instream Works (WLAP 2004);
- Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia (MOE 2014);
- Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2018);
- Water Quality Guidelines for British Columbia (MOE 2017); and
4 Existing Environmental Conditions

4.1 FISH AND FISH HABITAT

Henson Creek is a small (approximately 3 km long) tributary of Harris Creek. Henson Creek flows south in the Study area and into Harris Creek approximately 100 m downstream.

Upstream of the culvert inlet, Henson Creek is a low gradient (approximately 3%) stream with a mixed riffle-pool and cascade-pool morphology characterized by undercut banks (Photos 1-2). Downstream of the culvert outlet within the Study area, Henson Creek is a steep gradient (approximately 20%) step-pool with primarily cobble substrate (Photos 3-4). Within the Study area, average top-of-bank width is 9.6 m and average channel width is 8.9 m. During the field assessment, average wetted width was 4.6 m and average wetted depth was 0.23 m. The stream provides potential overwintering and summer rearing habitat for salmonids in plunge and scour pools, and glides, but limited suitable substrate and spawning habitat is present.

Photo 1. Upstream view of Henson Creek from the culvert inlet
Photo 2. Downstream view of the culvert inlet

Photo 3. Upstream view of Henson Creek from downstream of the culvert
Two fish passage barriers were identified in the Study area. The existing log crib culvert has a minimum outlet drop of 1.2 m (Photo 5) and is not embedded. Based on the Field Assessment for Determining Fish Passage Status of Closed Bottom Structures, the aforementioned criteria classify the existing log crib culvert as a barrier to fish passage (MOE 2011). In addition, there is a natural barrier to upstream fish passage located approximately 50 m downstream from the culvert outlet (i.e., minimum 1.8 m falls) (Photo 4) upstream of the confluence with Harris Creek. No fish were observed during the field assessment, or after reviewing underwater video footage taken in pools immediately upstream and downstream of the culvert. There is a single documented occurrence from 1995 of Coho salmon (*Oncorhynchus kisutch*) approximately 70 m upstream from the culvert inlet in Henson Creek; however, there is no specific information (e.g., life stage, habitat) associated with the occurrence (MOE 2018a, 2018b). As such, the documented occurrence of Coho is suspect given the presence of fish passage barriers. Nevertheless, this does not preclude the potential for resident fish upstream of the culvert although the lack of spawning gravel within the Study area suggests even lower availability of gravel further upstream, in effect, limiting spawning opportunities for resident fish.

Documented fish species in Harris Creek downstream include Coho salmon and steelhead/rainbow trout (*O. mykiss*) (MOE 2018a, 2018b).

The mixed forest riparian area within the Study area consists primarily of an overstorey of red alder (*Alnus rubra*), western redcedar (*Thuja plicata*), and western hemlock (*Tsuga heterophylla*) and an understorey primarily of salmonberry (*Rubus spectabilis*), sword fern (*Polystichum munitum*), and salal (*Gaultheria spectabilis*).
shallon), consistent with typical vegetation in the Coastal Western Hemlock, Submontane Moist Maritime biogeoclimatic variant (CWHmm1) (MFLNRO 2016).

Photo 5. Upstream view of the 1.2 m (minimum) culvert outlet drop.

4.2 WILDLIFE AND WILDLIFE HABITAT

The second-growth riparian area provides habitat for a variety of amphibians, small and large mammals, songbirds, raptors and owls. Wildlife typically found in the CWHmm1 include, among others, black-tailed deer (Odocoileus hemionus) black bear (Ursus americanus), Douglas squirrel (Tamiasciurus douglasii), deer mouse (Peromyscus spp.), red-tailed hawk (Buteo jamaicensis), northern saw-whet owl (Aegolius acadicus), Townsend’s warbler (Setophaga townsendi), northwestern salamander (Ambystoma gracile), and marbled murrelet (Brachyramphus marmoratus) (Pojar et al. 1991). No wildlife or wildlife signs (i.e., tracks, nests) were observed during the field assessment.

4.3 SPECIES AT RISK

The BC Conservation Data Centre (CDC) maintains records of known occurrences of rare and endangered vertebrates, invertebrates, plants, and ecological communities in BC. These records are individual, verified occurrences of wildlife species and native plant communities that the CDC has mapped. Based on the CDC records, two rare and endangered species occurrences have been detected within a 5 km radius of the Study area and include the northern red-legged frog (Rana aurora) and marbled murrelet (CDC 2018b). A map of known occurrences is provided in Appendix C.
The northern red-legged frog and marbled murrelet are both provincially Blue-listed species. The northern red-legged frog requires shallow slow-moving water to breed such as littoral zones of lakes, temporary and permanent pools and wetlands, and bogs and fens in close proximity to forest (CDC 2018b). The marbled murrelet is highly dependent on the availability of old-growth coniferous forest for nesting. Habitat within the Study area does not provide any of these conditions, and therefore, neither of these species is anticipated to occur within or in the general vicinity of the Study area.

1 Any species or ecosystem that is of special concern.
5 Environmental Effects

5.1 PROJECT DESIGN FOOTPRINT

Project works will occur in a previously disturbed site (i.e., existing log crib culvert) in Henson Creek. A minor permanent loss (21.3 m²) of aquatic habitat will be incurred as a result of shifting and extending the new culvert further north (3.8 m length and 5.6 m width) within the MoTI right-of-way. The new culvert will have similar culvert inlet and outlet invert elevations as the existing culvert and therefore will not alter the movement of any potential resident fish species in Henson Creek. A minor amount of rip rap placement will also be required to protect the new structure (i.e., cast-in-place concrete box culvert) and the stream channel against erosion.

A minor amount of roadside riparian vegetation removal will be required to facilitate construction. There will be no significant permanent disturbance to terrestrial habitats or wildlife in the Project footprint.

5.2 SITE PREPARATION AND CONSTRUCTION

Construction activities include work site isolation, dewatering/bypass pumping or construction of a temporary diversion, construction of a temporary detour, placement of rip rap, removal of minor vegetation, cast-in-place concrete works, backfilling, and asphalt repair works.

Potential environmental effects associated with site preparation and construction works include:

- Direct or indirect mortalities of fish potentially present in Henson Creek during or as a result of instream construction works (e.g., site isolation and dewatering, placement of rip rap);
- Direct or indirect mortalities of small mammals, birds, and/or invertebrates during or as a result of construction works (e.g., vegetation removal, excavation, placement of fill);
- Temporary loss of access and disturbance to instream and riparian habitats during work area isolation;
- Impacts on downstream fish populations caused by erosion and sedimentation into Henson Creek and Harris Creek during earthworks (i.e., excavation, backfilling, grading) resulting in potential infilling of downstream spawning gravel and degrading water quality (e.g., increasing turbidity);
- Impacts on water quality and aquatic life (e.g., invertebrates, fish) in Henson Creek and Harris Creek caused by accidental on-site spills of deleterious substances (e.g., fuel, concrete);
- Sensory disturbance and habitat avoidance/abandonment (e.g., bird nests) caused by construction noise; and
- Minor temporary loss of riparian habitat due to roadside vegetation removal.

The impacted areas (i.e., existing culvert, minor rip rap slope protection) will be minimal; therefore, the impacts will be low and will not affect the overall function of the surrounding environment.
5.3 OPERATION

The operation phase of the Project is not anticipated to have any adverse effects on Henson Creek or Harris Creek that did not exist during pre-construction (e.g., quality of surface water runoff, fish passage). The culvert replacement will eliminate the potential collapse of the existing structure, which would have caused sedimentation of fish habitat downstream.
6 Mitigation Measures

Environmental protective measures and mitigation strategies will be implemented during the proposed works to avoid or minimize potential impacts. The Project-specific mitigation measures for terrestrial and aquatic resources are described in the following subsections.

6.1 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

Prior to construction, the contractor will retain an Appropriately Qualified Professional (AQP) with experience in culvert replacements and cast-in-place concrete works to develop a Construction Environmental Management Plan (CEMP), the implementation of which by the contractor, will avoid, minimize, and mitigate the potential effects of the site preparation and construction phases (Section 5.2). The CEMP will include an Erosion and Sediment Control Plan, Waste Management Plan, Emergency Spill Response Plan, and, at minimum, include the following mitigation measures.

6.1.1 Environmental Monitoring

The AQP will conduct monitoring on a weekly basis (at minimum) during regular on-site works and on a daily basis during environmentally sensitive works (e.g., instream works, construction of temporary diversion, cast-in-place concrete pouring) or immediately following significant rainfall (i.e., 25 mm or more within a 24-hr period). The AQP will provide MoTI with weekly environmental monitoring reports that include photo documentation as well as recommendations. These recommendations will be conveyed to the contractor during site inspections.

6.1.2 Erosion and Sediment Control

The following erosion and sediment control (ESC) measures will minimize the potential for sediment-laden water from entering Henson Creek and Harrison Creek:

- Ensure that no material is stockpiled; immediately remove waste off site for proper disposal.
- Install ESC measures (e.g., silt fencing) along top-of-bank prior to construction activities.
- Halt construction activities during periods of heavy rainfall.
- Prior to instream works, isolate the instream work area using an appropriate coffer dam (e.g., sandbags or aqua dam).
- Ensure that rip rap used to armour the slopes at the culvert inlet and outlet is clean and free of sediment.
- Install rip rap using an excavator equipped with a thumb on the bucket.
6.1.3 Fisheries and Aquatic Habitat Protection

The following mitigation measures will mitigate the effects of construction works on fish and aquatic life and avoid contravention of the provincial *Wildlife Act* and the federal *Species at Risk Act* and *Fisheries Act* during site preparation and construction:

- Schedule removal and installation (including cast-in-place concrete works) and rip rap placement between least-risk to fish window (**June 15 to September 15**).\(^2\)
- Secure fish collection permits under the provincial *Wildlife Act* and federal *Fisheries Act*.
- Isolate work sites and complete fish salvages following the Standards and Best Practice for Instream Works (WLAP 2004).
- Avoid unnecessary works below high-water mark to the extent possible.
- Implement ESC measures as outlined in Section 6.1.2.
- Monitor turbidity and pH upstream and downstream of the Study area to ensure changes are within water quality guidelines (MOE 2017 and CCME 2018).

6.1.3.1 Concrete Works

Cement, concrete, grouts, and other cement or lime-containing materials are highly toxic to fish due to their basic or alkaline nature. As such, the introduction of these materials into a watercourse can increase the pH of the water. The following mitigation measures will avoid the potential for the introduction of deleterious material (i.e., uncured concrete) into Henson Creek and Harris Creek:

- Ensure that a CO\(_2\) tank with regulator, hose, and gas diffuser are readily available on site during concrete pours, and ensure crews are trained in their use.
- Isolate and contain concrete pouring using polyethylene (poly) sheeting.
- Cover recently poured concrete with poly sheets until concrete is fully cured.
- Wash concrete trucks off site or ensure contact water is properly treated and meets water quality guidelines (MOE 2017 and CCME 2018) prior to discharging to any watercourse.
- Frequently monitor pH in Henson Creek during all concrete pours. The AQP will collect and analyze water samples from upstream of the proposed work, within the Study area, and downstream of the Study area. Implement emergency measures (i.e., introduction of CO\(_2\)) if downstream pH has changed more than 1.0 pH unit.

6.1.4 Vegetation and Wildlife

The following mitigation measures will minimize the effects of site preparation and construction works on riparian vegetation:

- Use hand tools (e.g., chainsaw) to selectively cut trees, if tree removal is required.
- Prior to tree clearing, flag any trees requiring removal to avoid unnecessary clearing of vegetation.
- Prohibit heavy machinery from operating within the vegetated riparian area; access the work sites from the existing road surface.

\(^2\) General fisheries timing window for all species for instream work on Vancouver Island (MFLNRO 2011).
Ministry of Transportation and Infrastructure

- Delineate the work area using a physical barrier (e.g., snow fencing) to limit ground disturbance and machinery access to the Project footprint.
- Revegetate disturbed areas with an appropriate native seed mix and supplement with native plantings (Section 6.1.7).

The following mitigation measures will minimize the effects of site preparation and construction works on wildlife:
- Limit vegetation removal to only the area required as part of the Project design.
- Avoid the removal of natural woody debris, rocks/boulders, or other materials from the banks and instream areas of Henson Creek. If removal of said material is required to facilitate access to the work site, set it aside and return it to the original location once construction activities are completed.
- Avoid the bird nesting season (March 25 – August 10) (Migratory Birds Convention Act, 1994). If working outside of the window is not possible and vegetation removal is required, conduct pre-removal surveys to identify and avoid any potential active nesting in an area, to be completed by the AQP.
- Avoid daily sensitive times for wildlife whenever possible (i.e., dawn or dusk).
- Implement standard best management practices for ESC and spill prevention and emergency response to prevent release of deleterious substances into the aquatic and terrestrial habitats.
- Implement standard best management construction practices to minimize construction noise.

6.1.5 Spill Management

The following mitigation measures will avoid the introduction of deleterious substances into Henson Creek and Harris Creek and minimize the effects in the event of a spill:
- Prohibit equipment or machinery from operating below the high-water mark at any time (i.e., operate equipment and machinery from or above the top of bank).
- Regularly inspect construction equipment and machinery to ensure it is in good working order and free of leaks.
- Refuel and service equipment and machinery and at least 30 m from Henson Creek.
- Store all fuel and/or hazardous materials in trucks that are at least 30 m from Henson Creek.
- Keep emergency spill kits on site and train construction crews in proper application.
- Keep emergency contact information on site, which will include all project personnel and government agency phone numbers to be contacted in the event of a spill.

6.1.6 Waste Management

The following mitigation measures will mitigate the effects of construction waste on the Study area:
- Salvage, re-use, or recycle waste materials where possible.
- Remove waste that cannot be salvaged, re-used, or recycled to a licensed landfill for disposal.
- Prohibit dumping or burning of garbage.
- Regularly remove lunch bags, food scraps, and other domestic waste.
- Place garbage collection containers in appropriate locations to facilitate collection of smaller waste generated on site.
• Routinely inspect entire worksite for loose garbage.
• Secure garbage containers with lids so that wildlife is not attracted to the site.
• Install portable toilet facilities on site and empty as required by an approved contractor.

6.1.7 Site Restoration

Following completion of construction, temporarily disturbed sites should be revegetated using an appropriate native seed mix. Any vegetation removed for the construction of a temporary detour will be replaced with native trees. The contractor’s CEMP will include a restoration plan incorporating BC MOE’s Riparian Restoration Guidelines (Appendix D) including but not limited to, the following criteria:

• All riparian plantings should be based on 1 tree or shrub per 1 square metre density.
• Trees shall be of standard and quality, true to name and type, and representative of their species variety.
• The botanical name should be used when ordering stock to ensure that the desired native species is being purchased. Each specimen should be tagged with the botanical name and the tag should be left attached after planting.
• Trees and shrubs shall be planted in the fall (September - October) or spring (March - April) to provide greatest chance of surviving. Regular watering may be required until the plants are established. Additional advice on proper planting procedures should be obtained from the nursery supplying the stock.
• Coniferous trees should comprise no less than 10% or more than 25% of the tree stock planted.
• Tree stock should be a minimum of 1.2 m (4 ft) in height when purchased and planted 1.5 to 2.0 m apart.
• Planting on a given area being enhanced must be successful to an 80% take. If there is more than 20% mortality over one year, replanting is required.
• A minimum of 50% of trees and shrubs planted should be fruit-bearing species.

In addition, the restoration plan should provide a monitoring plan to ensure planting success.
References


Appendix A - General Arrangement Drawings
Appendix B - Regulatory Framework

The Project is under the jurisdiction of several federal and provincial environmental regulations. A summary of key environmental legislation and regulatory authorizations applicable to the Project is provided below.

**FEDERAL LEGISLATION**

*Fisheries Act*

The *Fisheries Act* is designed to protect fish and fish habitat. According to the Act, “No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery.” Fisheries and Oceans Canada (DFO) is the regulatory authority responsible for administering the Act.

The Act applies to the Project because Henson Creek is potentially a fish-bearing stream. A request for review is required for any proposed activities that have the potential to result in serious harm to fish. Based on the Project’s proposed in-water activities, serious harm to fish can be avoided by implementing best management practices. As such, a Request for Review is not required to be submitted to DFO. However, a fish collection permit will be required to salvage fish prior to any instream works in Henson Creek.

*Migratory Birds Convention Act, 2014*

The *Migratory Birds Convention Act, 2014* protects various species of migratory game birds, migratory insectivorous birds, and migratory non-game birds, including herons. The Act provides protection for breeding birds and their nests by requiring that works be conducted in a manner that prevents disturbance to bird nests. The Act is administered by Environment Canada.

No specific review or approval is required under the Act; however, mitigation measures (e.g., work outside of breeding windows) should be implemented as part of construction of the Project to prevent violation of the Act. The breeding window applicable to the Study area is from March 25 to August 10. If working outside of the window is not possible and vegetation clearing is required, a qualified environmental professional should conduct pre-clearing surveys to identify and avoid any potential active nesting in an area.

**PROVINCIAL LEGISLATION**

*Water Sustainability Act*

The *Water Sustainability Act* (formerly the *Water Act*) is provincial legislation administered by the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRO) that protects the quality of water, fish and wildlife habitat, and the rights of licensed water users in BC. Under section 11 of the Act, any activities that result in changes in or about a stream require submission of Notification or
applications for Change Approval. The submission requirements depend on the nature of the proposed works.

The Project includes a culvert replacement and temporary diversion, thus a Notification submission under the Water Sustainability Act will be required.

Wildlife Act and Wildlife Amendment Act
The Wildlife Act protects wildlife in BC from human-related harm and disturbance and is administered by the MFLNRO. The Act provides protection for birds and their nests by prohibiting the destruction or disturbance of birds, their eggs, and active nests and all other wildlife including amphibians and fish. Subsection 34(b) provides year-round protection to raptor nests, whether active or not.

The Wildlife Act and Wildlife Amendment Act largely pertain to the site preparation and construction phases of the Project. The major wildlife activity window is between April 1 and October 1, when most taxa are breeding, nesting, foraging, and fledging (GoBC 2004). Any development that will “molest, injure or destroy” a nest site as defined by the Wildlife Act will require a protective buffer to reduce disturbance of the nest.

If any threatened or endangered species described in Section 4.3 are identified during any phase of design or construction, a permit under the Wildlife Act will be required for salvage and relocation to prevent contravention of this Act.
Appendix C - CDC Occurrence Map
CAUTION: Maps obtained using this site are not designed to assist in navigation. These maps may be generalized and may not reflect current conditions. Uncharted hazards may exist. DO NOT USE THESE MAPS FOR NAVIGATIONAL PURPOSES.

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Datum: NAD83
Projection: NAD_1983_BC_Environment_Abers

Key Map of British Columbia
Appendix D - MOE Riparian Restoration Guidelines
Riparian Restoration Guidelines

Riparian Restoration Plans should be prepared and supervised by an appropriately qualified professional. The riparian restoration plan should be sufficiently detailed to allow for monitoring for conformity to the plan as well as plant survival rates.

Planting Guidelines:

A list of recommended tree and shrub species is provided on page 2.

\[d = \text{dry}, m = \text{moist}, w = \text{wet}\]

- denotes fruit-bearing species

- All riparian plantings should be based on 1 tree or shrub per 1 square metre density.
- All tree/shrub species should be of guaranteed nursery stock.
- The botanical name should be used when ordering stock to ensure that the desired native species is being purchased. Each specimen should be tagged with the botanical name and the tag should be left attached after planting.
- Stock planted during the fall (Sept. - Oct.) and spring (March - April) has the greatest likelihood of surviving. Regular watering may be required until the plants are established. Additional advice on proper planting procedures should be obtained from the nursery supplying the stock.
- Coniferous trees should comprise not less than 10% nor more than 25% of the tree stock planted.
- Tree stock should be a minimum of 1.2 m (4 ft) in height when purchased and planted 1.5 to 2 m apart.
- Planting on a given area being enhanced must be successful to an 80% take. If more than 20% die over one year, replanting is required.
- A minimum of 50% of trees and shrubs planted should be fruit-bearing species.

Structural Guidelines

Wherever a development site will result in land clearing activities, the opportunity exists to salvage and translocate structural materials (i.e. downed wood, stumps, mossy rocks, vascular plants, non vascular plants) into the remaining environmentally sensitive areas. These key forest floor features provide a diversity of habitats for both invertebrates and vertebrate species.

- Salvaged large woody debris and stumps from the development site should be placed in previously damaged riparian areas to provide structural habitat features for small wildlife and amphibians.
- Mossy rocks and herbs can be salvaged from the development site to help ‘seed’ the restored area with native groundcover species.
- Large projects are well suited to the creation or translocation of wildlife trees within the area undergoing restoration/enhancement.
## Recommended Native Plant Species for Riparian Fish and Wildlife Habitat

### Deciduous Trees

<table>
<thead>
<tr>
<th>Botanical Name</th>
<th>Common Name</th>
<th>Mature Height (m)</th>
<th>Best Growth Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acer circinatum</em></td>
<td>vine maple</td>
<td>to 7</td>
<td>m-w</td>
</tr>
<tr>
<td><em>Acer glabrum var. douglasii</em></td>
<td>Douglas maple</td>
<td>to 10</td>
<td>d-m</td>
</tr>
<tr>
<td><em>Acer macrophyllum</em></td>
<td>broadleaf maple</td>
<td>to 35</td>
<td>d-m</td>
</tr>
<tr>
<td><em>Alnus rubra</em></td>
<td>red alder</td>
<td>to 25</td>
<td>m</td>
</tr>
<tr>
<td><em>Betula papyrifera var. commutata</em></td>
<td>western white birch</td>
<td>to 30</td>
<td>m-w</td>
</tr>
<tr>
<td>♦ <em>Crataegus douglasii</em></td>
<td>black hawthorn</td>
<td>to 10</td>
<td>m</td>
</tr>
<tr>
<td>♦ <em>Populus balsamifera or P. trichocarpa</em></td>
<td>black cottonwood</td>
<td>to 50</td>
<td>m-w</td>
</tr>
<tr>
<td>♦ <em>Prunus emarginata</em></td>
<td>bitter cherry</td>
<td>2-15</td>
<td>m</td>
</tr>
<tr>
<td><em>Rhamnus purshiana</em></td>
<td>cascara</td>
<td>to 10</td>
<td>d-w</td>
</tr>
<tr>
<td><em>Salix lucida ssp. lasiandra</em></td>
<td>Pacific willow</td>
<td>to 12</td>
<td>w</td>
</tr>
</tbody>
</table>

### Coniferous Trees

<table>
<thead>
<tr>
<th>Botanical Name</th>
<th>Common Name</th>
<th>Mature Height (m)</th>
<th>Best Growth Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Picea sitchensis</em></td>
<td>Sitka spruce</td>
<td>up to 70</td>
<td>m</td>
</tr>
<tr>
<td><em>Pinus monticola</em></td>
<td>western white pine</td>
<td>to 40</td>
<td>m-d</td>
</tr>
<tr>
<td><em>Pseudotsuga menziesii</em></td>
<td>Douglas-fir</td>
<td>to 70</td>
<td>d</td>
</tr>
<tr>
<td><em>Thuja plicata</em></td>
<td>western red cedar</td>
<td>to 60</td>
<td>m-w</td>
</tr>
<tr>
<td><em>Tsuga heterophylla</em></td>
<td>western hemlock</td>
<td>to 60</td>
<td>d-w</td>
</tr>
</tbody>
</table>

### Shrubs

<table>
<thead>
<tr>
<th>Botanical Name</th>
<th>Common Name</th>
<th>Mature Height (m)</th>
<th>Best Growth Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Alnus crispa ssp. sinuata</em></td>
<td>Sitka alder</td>
<td>1-5</td>
<td>m</td>
</tr>
<tr>
<td>♦ <em>Amelanchier alnifolia</em></td>
<td>saskatoon</td>
<td>1-5</td>
<td>d-m</td>
</tr>
<tr>
<td>♦ <em>Cornus sericea or C. stolonifera</em></td>
<td>red-osier dogwood</td>
<td>1-6</td>
<td>m</td>
</tr>
<tr>
<td>♦ <em>Corylus cornuta var. californica</em></td>
<td>beaked hazelnut</td>
<td>1-4</td>
<td>m</td>
</tr>
<tr>
<td>♦ <em>Holodiscus discolor</em></td>
<td>oceanspray</td>
<td>to 4</td>
<td>d-m</td>
</tr>
<tr>
<td>♦ <em>Physocarpus capitatus</em></td>
<td>Pacific ninebark</td>
<td>4</td>
<td>w</td>
</tr>
<tr>
<td>♦ <em>Prunus virginiana</em></td>
<td>choke cherry</td>
<td>1-4</td>
<td>d</td>
</tr>
<tr>
<td>♦ <em>Rosa nutkana</em></td>
<td>Nootka rose</td>
<td>to 3</td>
<td>d-m</td>
</tr>
<tr>
<td>♦ <em>Rosa gymnocarpa</em></td>
<td>baldhip or dwarf rose</td>
<td>1.5</td>
<td>d-m</td>
</tr>
<tr>
<td>♦ <em>Rubus parviflorus</em></td>
<td>thimbleberry</td>
<td>0.5-3</td>
<td>m</td>
</tr>
<tr>
<td>♦ <em>Rubus spectabilis</em></td>
<td>salmonberry</td>
<td>to 4</td>
<td>m-w</td>
</tr>
<tr>
<td>♦ <em>Salix hookeriana</em></td>
<td>Hooker's willow</td>
<td>to 6</td>
<td>w</td>
</tr>
<tr>
<td>♦ <em>Salix lucida ssp. lasiandra</em></td>
<td>Pacific willow</td>
<td>to 12</td>
<td>w</td>
</tr>
<tr>
<td>♦ <em>Salix scouleriana</em></td>
<td>Scouler's willow</td>
<td>2-12</td>
<td>m</td>
</tr>
<tr>
<td>♦ <em>Salix sitchensis</em></td>
<td>Sitka willow</td>
<td>1-8</td>
<td>m-w</td>
</tr>
<tr>
<td>♦ <em>Sambucus caerulea or S. glauca</em></td>
<td>blue elderberry</td>
<td>-</td>
<td>d-m</td>
</tr>
<tr>
<td>♦ <em>Sambucus racemosa var. arborescens</em></td>
<td>red elderberry</td>
<td>to 6</td>
<td>m</td>
</tr>
<tr>
<td>♦ <em>Sorbus sitchensis</em></td>
<td>Sitka mountain ash</td>
<td>1-4</td>
<td>m</td>
</tr>
<tr>
<td>♦ <em>Symphoricarpos albus</em></td>
<td>snowberry</td>
<td>0.5-2</td>
<td>d-m</td>
</tr>
<tr>
<td>♦ <em>Vaccinium parvifolium</em></td>
<td>red huckleberry</td>
<td>to 4</td>
<td>m</td>
</tr>
</tbody>
</table>