Associated Environmental

REPORT

BC Ministry of Transportation and Infrastructure

Highway 28 Cervus Creek Bridge Replacement Environmental Assessment

JANUARY 2023

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1 INTRODUCTION

1.1 Background

The BC Ministry of Transportation and Infrastructure (MOTI) is planning to replace the Cervus Creek bridge, along Highway 28, located approximately 23 km northeast of Gold River, Vancouver Island, BC (the Project) (Appendix A, Figure A1). Associated Engineering B.C. Ltd. (AE) is completing the design and construction services for the Project.

As a part of the design process, Associated Environmental Consultants Inc. (Associated) completed an environmental assessment (EA) to determine effects of the Project on the environment, develop mitigation measures, and provide information to support environmental permit applications and regulatory approvals. This report represents the findings of the EA and provides strategies to avoid, minimize, or mitigate the identified environmental effects.

1.2 Project Description

The proposed Project works will consist of the following:

- Replacement of existing Cervus Creek bridge with a new two-lane clear span bridge along the existing alignment and demolition of the existing bridge.
- Upgrade of existing riprap armouring on the banks of Cervus Creek, above and below the high-water mark, near and beneath the bridge.
- Upgrade of approach grading and paving works extending to approximately 275 m west and 250 m east of the existing bridge.
- Connection with existing access to Lady Falls Picnic Area located approximately 50 m east of the bridge.
- Construction and demolition of a temporary clear span detour bridge on the south side of the existing bridge and the associated approach work.

1.2.1 Construction Approach and Schedule

To maintain traffic access through the Project Area, the bridge will be built in several stages. The first stage will comprise construction of a temporary detour bridge and approaches, parallel and south of the existing bridge. Traffic will be shifted to the detour bridge during the next stage, while the existing bridge is demolished, bank works and riprap completed, and the new bridge and associated roadworks constructed. Once the new bridge and associated roadworks are complete, traffic will be shifted to the new bridge, the detour bridge will be removed, and all remaining roadworks and site restoration will be completed. The Project is anticipated to go to tender and construction in March 2023.

1.3 Objective and Scope

The overall objective of the EA is to identify Project effects and develop mitigation measures to avoid or minimize those effects associated with the construction and operation of the Project. The goals of the EA are to:

- Characterize existing environmental conditions and land use;
- Identify environmental effects of the Project;
- Provide guidance on measures to avoid or minimize environmental effects during construction and operation;
- Determine if there are any residual effects that require additional mitigation measures, including habitat offsetting and replacement; and

- Outline the regulatory framework and permit requirements for the Project.

The scope of the EA for the Project includes the following valued components (VCs):

- Fish and fish habitat;
- Vegetation and ecosystems;
- Wildlife and wildlife habitat; and
- Species at risk (SAR).

This EA is based on the 90% engineering detailed design drawings.

2 REGULATORY FRAMEWORK

To reduce industry's environmental impacts, federal and provincial governments have created acts and regulations that mandate compliance with standards they have set. Under these regulations, proponents are required to notify the agencies of their planned works and secure environmental permits, if necessary. The permitting process allows for the agencies to review the proposed works, assess the potential impacts, implement standards and conditions to reduce potential impacts, set offsetting targets (if required), and control the timing of the works to avoid environmentally-sensitive periods.

2.1 Federal Legislation

2.1.1 Fisheries Act

The *Fisheries Act* (RSC 1985, c. F-14) is designed to protect fish and fish habitat. The *Act* was recently revised and provisions in the new *Fisheries Act* came into force on August 21, 2019, including, among other things, the protection of fish and fish habitat with respect to works, undertakings or activities that may result in the death of fish or the harmful alteration, disruption or destruction of fish habitat (HADD), including in ecologically significant areas. Fisheries and Oceans Canada (DFO) is the federal regulatory authority responsible for the *Fisheries Act*.

Works are in compliance with the fish and fish habitat protection provisions of the *Fisheries Act* if mitigation can be implemented that avoid causing the death of fish, and a HADD as part of conducting the work. Outcomes to be achieved include:

- Prevent the death of fish;
- Maintain riparian vegetation;
- Carry out works, undertakings and activities on land;
- Maintain fish passage;
- Ensure proper sediment control; and
- Prevent entry of deleterious substances in water.

DFO has included a list of bridge works or activities where impacts to fish and fish habitat can be avoided if appropriate protection measures are implemented and includes:

- Clear span bridges;
- Bridge maintenance; and

- Decking repairs for docks, piers, wharves and bridges.

A Request for Project Review is submitted to DFO for works in or around water that are not included in DFO's list of activities above, do not have a specific code of practice, or cannot implement the required protection measures. The result of the Request for Project Review is either a letter of advice indicating that no formal approval is required, or a letter indicating that a *Fisheries Act* Authorization is required. If a project requires a *Fisheries Act* Authorization, regulated timelines will begin at the time an Application for Authorization is submitted. Regulated timelines give DFO 60 days to determine completeness of the application, and a further 90 days to issue the Authorization once the information is deemed complete. These time limits cease to apply when DFO is required to undertake Indigenous consultation.

Minimal works below the high-water mark of Cervus Creek are anticipated for the Project and include removal of the existing bridge abutments, and replacement and extension of riprap along either bank of the creek at the bridge crossing to the toe of slope within the channel. Since these works are not included in the list of activities above or do not have a specific code of practice, a Request for Review will be submitted to DFO under the *Fisheries Act* as this is a project near water with potential for impacts to fish and fish habitat. For the Review, a fisheries protection biologist will inspect the Project plans, identify the potential risks to fish and fish habitat, assess if the Project will impact an aquatic species at risk, and determine if the Project has the potential to result in the death of fish or a HADD. Based on the scope of works proposed and the mitigation measures recommended, an Authorization under the *Fisheries Act* is not anticipated.

2.1.2 Migratory Birds Convention Act

The *Migratory Birds Convention Act* (SC 1994, c. 22) protects various species of migratory game birds, migratory insectivorous birds, and migratory non-game birds, including herons, and is administered by Environment and Climate Change Canada (ECCC). The *Act* provides protection for migratory breeding birds and their nests by requiring that works be conducted in a manner that prevents destruction of and/or disturbance to bird nests. Recent amendments to the *Migratory Birds Regulations* (2022) have enhanced nest protections for species on Schedule 1 of the regulations.

No specific review or approval is required under the *Act*; however, mitigation measures (e.g., work outside of breeding periods) should be implemented as part of construction of the Project. If a nest of a species listed on Schedule 1 of the regulations is detected in the Project footprint, designated wait times for the declaration of an abandoned nest will come into effect.

2.1.3 Species at Risk Act

The *Species at Risk Act* (SARA) (SC 2002, c. 29) provides legal protection to at-risk wildlife (including fish) and their habitats. At-risk wildlife and plants protected under SARA are listed in Schedule 1 of SARA. The purposes of SARA are to prevent Canadian indigenous species, subspecies, and distinct populations from becoming extirpated or extinct, and to encourage the management of other species to prevent these groups/populations from becoming at risk. SARA applies on federal land and typically does not apply to other areas, except for aquatic (i.e., fish) species and migratory birds also listed in the federal *Migratory Birds Convention Act*. The *Act* is administered by ECCC.

The Project is not located on federal land, and while SARA listed species have been documented within the Study Area, they are not anticipated to interact with the Project footprint. No specific review or approval is required under the *Act*.

2.2 Provincial Legislation

2.2.1 Water Sustainability Act

The *Water Sustainability Act* (WSA) (SBC 2014, c. 15) is the principle law for managing the diversion and use of water resources in the province. The main goals of the *Act* are the regulation of water use through groundwater and surface water licencing and the protection of stream health and aquatic environments through the regulation of changes in and about a stream and the releases of deleterious substances.

The Project falls under the jurisdiction of the WSA as clear span bridge replacement is an authorized change in and about a stream that requires the submission of a Notification to the BC Ministry of Forests (MoF). In addition, the Project includes the removal of the existing bridge abutments and riprap works along either bank at the bridge crossing. The riprap work includes regrading and replacement of existing riprap under the existing bridge structure, which is required for erosion protection under the new clear span bridge to be constructed. Temporary placement of additional riprap may be required at the detour bridge abutments. Replacement of existing riprap is also an authorized change under the WSA that requires submission of a Notification to MoF. Authorized changes are typically low risk activities that have minimal impact on the environment and third parties and therefore, qualify for expedited review. Works associated with authorized changes must meet the requirements of the *Water Sustainability Regulation* (B.C. Reg. 36/2016) and comply with any conditions set out by a habitat officer in response to the application. Works in or about a stream that are not included in the list of authorized works and do not meet these requirements will require submission of an Application for Change Approval to MoF.

2.2.2 Wildlife and Wildlife Amendment Act

The *Wildlife Act* (RSBC 1996, c. 488) protects wildlife in BC from human-related harm and disturbance and is administered by the BC Ministry of Forests (MoF). 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. The *Act* protects (a) a bird or its egg, (b) the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl, or (c) the nest of a bird not referred to in paragraph (b) when the nest is occupied by a bird or its egg.

No specific review or approval is required under the *Act*; however, mitigation measures (e.g., working within the reduced risk timing windows) should be implemented as part of construction of the Project.

A fish collection permit will be required under the *Act* to salvage and relocate fish from work areas, as required. In addition, if any threatened or endangered wildlife species described in Section 4.7 are identified in the Project footprint during construction, an additional permit under the *Act* will be required for salvage and relocation to prevent contravention of the *Act*.

2.3 Regulatory Summary

A summary of the environmental permit submission requirements is provided in Table 2-1.

Table 2-1
Environmental Permit Submission Requirements

Permit	Regulatory Authority	Approximate Timeline	Submission Requirements
Fisheries Act Project Review and Authorization	DFO	3 months (must be submitted a minimum 60 days in advance of proposed start date) 3 – 6 additional months	- Request for Review Application; - Project description and detailed design drawings; - EA report - Authorization Application including offsetting and monitoring plan (if required, after review of Request for Review Application)
Water Sustainability Act Notification and Change Approval Application	MoF	45 days 6 – 18 months	- Notification form; - Project description and detailed design drawings; - EA report; - Letter of agency - Change Approval application form, and mitigation plan (if required, after review of the Notification)
Fish Collection Permit	MoF/DFO	2 months	- Fish collection application form submissions to MoF and DFO
General Wildlife Permit	MoF	3 months	- General wildlife permit application form submission to MoF (if required based on final Project footprint); - Project description and detailed design drawings; - EA report

3 METHODOLOGY

For this assessment, the Project Area is defined as the permanent Project footprint plus additional temporary work areas or rights-of-way (ROW) (e.g. laydown areas). The Project footprint is established based on the 90% engineering detailed design drawings. The Study Area is defined as the Project Area plus a 30 m buffer (Appendix A, Figure A1).

The EA consists of the following tasks:

- Documenting existing environmental conditions in the Study Area by:
  - Reviewing available information sources;
  - Conducting field assessments of aquatic and terrestrial components;
- Identifying effects on identified VCs within the Study Area; and
- Developing a mitigation strategy to avoid or minimize potential adverse environmental effects during construction and operation.

3.1 Existing Environmental Conditions

3.1.1 Information Review

The following available information sources were reviewed to characterize environmental resources and identify potential environmental effects within the Study Area:

- Aerial photos and maps;
- Fisheries Inventory Data Query (FIDQ) (ENV 2022a)
- BC Ministry of Environment and Climate Change Strategy (ENV) Habitat Wizard database (ENV 2022b);
- BC Conservation Data Centre's Ecosystem Explorer database (CDC 2022a);
- iMapBC online application (CDC 2022b); and
- Province of British Columbia's Invasive Alien Plant Program (MoF 2022).

3.1.2 Field Assessment

An initial field assessment was conducted by Associated's biologists on October 1, 2020 to characterize existing habitat conditions in the Study Area and identify key features, potential sensitive habitats, and/or areas of concern within or adjacent to the Project Area.

The aquatic field assessment consisted of visual observations of watercourses and other drainage features (i.e., ditches and creeks) 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 Resource Information Standards Committee (RISC) Fish and Fish Habitat Inventory Standards and Procedures (BC Fisheries Information Services Branch 2001) and Fish Habitat Assessment Procedures (Johnston and Slaney 1996). Photographs were taken of representative habitat and anthropogenic features (e.g., culverts) within the Study Area. Selected photographs are provided in Appendix B.

The terrestrial field assessment focused on visual observations of vegetation within the Study Area, including the identification and mapping of invasive species. Photographs were taken of representative habitat and notable wildlife features and sign. Selected photographs are provided in Appendix B.

A detailed inspection of the bridge superstructure and a nocturnal survey for potential roost sites were conducted on June 15, 2021 to determine if and how bats are using the Cervus Creek bridge (Associated 2021). The bridge was thoroughly inspected using a strong flashlight to search for evidence of bat use using four primary indicators comprising bat presence, auditory clues, guano, and / or staining. A nocturnal survey was also completed, starting approximately one hour before dusk until midnight to watch for any bats exiting a potential day roost in the bridge superstructure.

A subsequent field survey was conducted on June 30, 2022 targeting species at risk and sensitive habitats identified during the initial environmental constraints assessment (Associated 2020).

3.2 Environmental Effects Assessment

Based on the information review and field assessments, Associated reviewed the VCs within the Study Area that could be affected by the Project. Environmental effects are considered as any temporary or permanent changes to an

existing environmental condition, caused by the Project during the construction and/or operational phase. Where there is no interaction between the VC and the Project, no environmental effect is assessed.

3.2.1 Assessment Criteria

The key criteria used for characterization of environmental effects include Magnitude, Geographic Extent, and Duration, as described in the provincial Effects Assessment Policy (BC EAO 2020). A description of these criteria is as follows:

- Magnitude – qualitative assessment of the scale of the effect relative to the baseline/existing condition.
- Geographic Extent – the area over which the effect would occur.
- Duration – the period over which the effect would occur.

Magnitude was assessed based on a variety of factors, including the quality and prevalence of the habitats anticipated to be impacted by the Project, potential habitat use by aquatic and terrestrial species, and the likelihood of impacting SAR.

Geographic Extent was assessed based on area calculations of Project activities expected to result in impacts on aquatic habitats and vegetation ecosystems within the Study Area.

Duration was assessed in the context of the Project construction and the length of time to restore habitats back to a pre-Project existing condition. Project-related environmental effects were characterized as either temporary or permanent. Terrestrial effects where existing functions and features are not regained through revegetation within 12 weeks post-clearing are considered permanent effects.

Table 3-1 describes the significance levels used for each criterion when evaluating the potential project and residual effects in the following sections.

Table 3-1
Significance Criteria for Assessing Environmental Effects

Criteria	Description of Significance Levels
Magnitude	**Negligible** - no measurable negative effect. **Low** - small amount of negative effect. **Medium** - moderate negative effect. **High** - large amount of negative effect.
Geographic Extent	**Local** – effect is restricted to Project Area **Regional** – effect is measured beyond Project Area (e.g. population-level effects).
Duration	**Temporary** – effect restricted to the construction phase, including a sufficient period to allow re-vegetation to occur. **Permanent** – effect continues through the life of the Project infrastructure.

3.2.2 Mitigation Strategy

Mitigation measures are intended to avoid, minimize, or offset adverse environmental effects. Mitigation measures recommended for the Project are based on guidelines and best management practices (BMPs) provided in the following sources:

- Land Development Guidelines for the Protection of Aquatic Habitat (DFO 1993);
- Standards and Best Management Practices for Instream Works (WLAP 2004);
- Requirements and Best Management Practices for Making Changes in and About a Stream in British Columbia (Gov of BC 2022)
- Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia (MOE 2014);
- Measures to Protect Fish and Fish Habitat (DFO 2019);
- Guidelines for Reduced Risk Instream Work Windows (MOE 2017);
- British Columbia Approved Water Quality Guidelines (ENV 2020); and
- Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2003).

3.2.3 Residual Impacts

Adverse environmental effects that are expected to remain after all reasonable mitigation measures have been implemented are the residual effects of the Project, and may require restoration, offsetting and / or compensation.

4 EXISTING CONDITIONS

The Project is situated in the Strathcona Regional District (SRD), within Electoral Area D, which extends from Jubilee Parkway to the Oyster River and east into Strathcona Provincial Park.

4.1 Climate

The Project Area is located in the Coastal Western Hemlock (CWH) very wet maritime biogeoclimatic variant (CWHvm1) (Meidinger and Pojar 1991). The CWH biogeoclimatic zone is characterized by a mild wet climate with complex and highly productive ecosystems. Average annual temperature for this subzone is 7.8°C and average annual precipitation is approximately of 2,976 mm (Meidinger and Pojar 1991).

4.2 Fish and Fish Habitat

4.2.1 Cervus Creek

Cervus Creek is a tributary of Elk River, flowing north approximately 150 m from the Cervus Creek Study Area before entering Elk River. The watercourse has historically supported a variety of fish species, including rainbow trout (*Oncorhynchus mykiss*) and Dolly Varden (*Salvelinus malma*) (ENV 2022a). Based on its connectivity to Elk River, the watercourse may also support cutthroat trout (*O. clarkii*), and sculpin (*Cottus spp.*) (ENV 2022a).

The section of Cervus Creek within the Study Area is primarily glide habitat (i.e., non-turbulent, fast-flowing water). The section has a relatively low channel gradient (<1%) with boulders as the dominant substrate type, and a subdominant mix of gravel and cobbles. The bankfull width varies from approximately 14 m underneath the existing bridge to approximately 10 and 19 m at the upstream and downstream extents of the Study Area, respectively. During the field assessment in October 2020, the average water depth ranged between approximately 0.75 and 0.80 m, and the wetted width ranged between approximately 10 and 19 m.

Cover within the Study Area is comprised of boulders and some overhanging vegetation, potentially providing suitable rearing and overwintering habitat for salmonid species. Isolated pockets of gravel suitable for resident trout and char

spawning are also present. Riparian habitat consists primarily of young, coniferous forest with moderate canopy cover, with some deciduous forest on the west bank downstream of the bridge crossing. The east bank shows signs of erosion ~20 m upstream of the existing bridge, adjacent to the Lady Falls Picnic Area parking lot.

A braided side channel running west-east, parallel to the north side of the highway within Elk River's floodplain, appears to flow into Cervus Creek at the downstream end of the Study Area during high flows. The side channel and scour pool located at its confluence with Cervus Creek likely provide refuge and potentially additional rearing and overwintering habitat for salmonid species during high flows. A map showing fish habitat within the Study Area is provided in Appendix A – Figure A2. Representative photos of fish habitat within the Cervus Creek Study Area are provided in Appendix B.

4.2.2 Drainage Ditches

Roadside drainage ditches are located on the sides of the highway, and there is a drainage channel crossing under Highway 28 approximately 300 m east of the Cervus Creek bridge crossing. These drainage ditches function to convey surface water drainage during rain events. The ditches have no defined channel, sustained flows, or evidence of bed scour or deposition, and therefore are of negligible fish habitat value.

4.3 Vegetation and Ecosystems

Based on the results of the field assessment, six general ecosystems are present within the Study Areas:

- Upper slope coniferous forest;
- Lower slope coniferous forest;
- Deciduous forest;
- Floodplain moss; and
- Grasses and forbs.

Table 4-1 identifies the proportions of terrestrial ecosystems within the Study Area.

Table 4-1
Proportion of Terrestrial Ecosystems within the Study Area

Habitat Type	Total Coverage in Study Area (m^2)
Upper Slope Coniferous Forest	13,340 (21%)
Lower Slope Coniferous Forest	23,936 (38%)
Deciduous Forest	11,155 (18%)
Floodplain Moss	315 (1%)
Grasses and Forbs	4,435 (7%)
Developed / Built-up	9,667 (15%)
TOTAL	62,848 (100%)

Upper slope coniferous forests include moderately dry, lower nutrient, rapidly drained sites. These forests comprise seral species (i.e. second-growth forests) with mainly Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), and western hemlock (*Tsuga heterophylla*) in the overstorey. The shrub layer is dominated by sword fern (*Polystichum munitum*) and red huckleberry (*Vaccinium parvifolium*). Ground cover comprises vanilla-leaf (*Achlys triphylla*), step moss (*Hylocomium splendens*), and flat moss (*Buckiella undulata*).

Lower slope coniferous forests include moist, nutrient rich sites. These are also seral species with mainly western redcedar (*Thuja plicata*), western hemlock, with some Douglas-fir and grand fir in the overstorey. Shrub layers consist of salmonberry (*Rubus spectabilis*), salal (*Gaultheria shallon*), Oregon grape (*Mahonia aquifolium*), oval-leaved blueberry (*Vaccinium ovalifolium*), lady fern (*Athyrium filix-femina*), sword fern, thimbleberry (*Rubus parviflorus*), red huckleberry, and trailing blackberry (*Rubus ursinus*). Ground cover includes vanilla-leaf, starflower (*Trientalis latifolia*), kinnikinnick (*Arctostaphylos uva-ursi*), palmtree moss (*Hypnodendron comosum*), and step moss.

Deciduous forest occurs along the watercourses in areas of flooding in the Study Area, comprising red alder (*Alnus rubra*), Douglas maple (*Acer glabrum*), twinberry honeysuckle (*Lonicera involucrata*), Pacific ninebark (*Physocarpus capitatus*), with some black cottonwood (*Populus trichocarpa*). The understory is dominated by salmonberry and sparse amounts of other species found in coniferous forests. Ground cover comprises step moss and flat moss.

Floodplain moss areas occur on frequently flooded sites with shallow, undeveloped soils. These areas are largely covered with flat moss with small amounts of tree species from surrounding forests.

Grasses and herbaceous species mainly occur along roadsides and highly disturbed areas. These areas comprise roadside grasses, common plantain (*Plantago major*), wild strawberry (*Fragaria* sp.), trailing blackberry (*Rubus ursinus*), kinnikinnick, pearly everlasting (*Anaphalis margaritacea*) as well as small tree and shrub species from the surrounding forest.

No plant species at risk or ecosystems of regional concern have been documented in the Study Area.

A map showing terrestrial habitat within the Study Area is provided in Appendix A, Figure A2.

4.3.1 Invasive Species and Noxious Weeds

Invasive species were encountered along roadsides and in highly disturbed areas including Scotch broom (*Cytisus scoparius*), St. John's wort (*Hypericum perforatum*), common tansy (*Tanacetum vulgare*), and Canada thistle (*Cirsium arvense*). Oxeye daisy (*Leucanthemum vulgare*) and spotted knapweed (*Centaurea stoebe*) have also been documented along the Highway 28 corridor in the Study Area (MOF 2022).

4.4 Wildlife and Wildlife Habitat

The Study Area comprises a complex of aquatic habitat and forest, and likely supports a diversity of invertebrates, amphibians, small mammals, large mammals, and birds including raptors. The lowland wet forest and side-channels provide suitable amphibian breeding habitat.

Strathcona Regional Park, which encompasses the Study Area, is known to support black-tailed deer (*Odocoileus hemionus*), Roosevelt elk (*Cervus canadensis roosevelti*), gray wolves (*Canis lupus*) and cougars (*Puma concolor*). Resident birds include the chestnut-backed chickadee (*Poecile rufescens*), red-breasted nuthatch (*Sitta canadensis*), Pacific wren (*Troglodytes pacificus*) and kinglet, as well as the gray jay (*Perisoreus canadensis*), Steller's jay (*Cyanocitta stelleri*) and

band-tailed pigeon (*Patagioenas fasciata*). The park also supports numerous blue grouse (*Dendragapus sp.*), ruffed grouse (*Bonasa umbellus*) and a limited number of unique Vancouver Island white-tailed ptarmigan (*Lagopus leucurus saxatilis*).

Mammals likely use the diversity of habitats available in the Study Area to carry out their varied life requisites including foraging in the forests, using the trees and shrubs as shelter habitat, and the watercourses and drainage features as movement corridors. Evidence of use by deer, elk and bear was observed in the Study Area during the field assessments. The presence of snags, high humidity, insect availability, and water sources, provides suitable summer roosting and foraging habitat for many bat species.

The existing bridge superstructure may provide nesting and roosting opportunities for wildlife, including bats and songbirds. Although no nests were observed on the superstructure, there were cavities that have potential to be used by cavity nesters. While primarily suitable for bats as night-roosts, bridges can also make suitable maternity roosts where they offer "protected roost crevices and spaces, are situated where they get warmed by the sun, are constructed from materials that retain heat, and are close to water" (MOE 2016). Concrete bridges are used more frequently by bats than wooden bridges, possibly related to the presence of sticky, oily, and pungent creosote coating used on most wooden bridges (Associated 2021). Some white-wash and staining was observed under the Cervus Creek bridge deck and on bridge footings during the field assessment conducted in October 2020, possibly indicating roosting by birds or bats. A detailed inspection conducted in June 2021 found no evidence of day roosting by bats in the bridge superstructure. Nocturnal surveys confirmed that while bats were observed foraging in the area, they do not appear to use the bridge for roosting of any kind, including night roosting.

The forested areas provide nesting opportunities for passerines with snags and cavities observed throughout the Study Area. The open floodplain areas provide some foraging opportunities for various raptors. During the field assessments, forested areas were observed to be used by grouse, ravens and songbirds. Small-sized stick nests, small songbird nests, and potential cavities were observed in trees throughout the Study Area and vicinity; however, no raptors or raptor nests were observed.

4.5 Species at Risk

Based on a search of the BC Conservation Data Centre (CDC 2022a) online database and refined according to species known ranges and habitat available in the Study Area, 18 wildlife species at risk have the potential to occur in the Study Area and to be affected by Project activities (Appendix C). Mapped critical habitat and marked known occurrences for species at risk are shown in Appendix A, Figure A2. A discussion of species groups with higher potential to be affected by the Project is provided below.

4.5.1 Mammals

There is a historical record reported approximately 10 km north of site for Vancouver Island Marmot (*Marmota vancouverensis*) (CDC 2022a). This species' burrows are found at high elevations, but it travels through low elevation sites between colonies. Recovery efforts have expanded the species range, however known colonies are situated near the Study Area, at Nanaimo Lakes and Strathcona Park, with possible breeding further north at Schoen Lake.

There are several bat species with the potential to occur in the Study Area, including the provincially blue-listed Townsend's Big-eared Bat and Hoary Bat, as well as the federally endangered Little Brown Myotis. In the summer in BC, Townsend's Big- eared Bat will roost in cliffs and mines, but shows an affinity for roosting in buildings, and also

uses very large hollow trees for night-roosting (MOE 2016), which are lacking in the Study Area. Hoary Bats are known to use dead/dying and live trees for summer roosting, as well as bridges although the latter has not been confirmed in BC (MOE 2016). Little Brown Myotis is known to roost in a wide variety of habitats during the summer, including dead/dying trees, as well as under bridges, primarily for night-roosting (BC Bats 2020; MOE 2016). A detailed assessment conducted in June 2021 concluded that bats are not using the Cervus Creek bridge superstructure for either day or night roosting. However, both the Hoary Bat and Californian Myotis were observed foraging around the bridge and likely use nearby trees for roosting.

The nearest CDC record for Western Water Shrew (*Sorex palustris brooksi*) is approximately 22 km east of the Study Area. However, very little is known about this species except that it presumably occurs along watercourses and that it is an insectivore. Therefore, there is potential habitat for this species in the Cervus Creek Study Area.

4.5.2 Amphibians

The CDC has records for Northern red-legged frog (*Rana aurora*) along Filburg Creek/Elk River, approximately 2.5 km east of the Study Area. Based on habitat features and connectivity, red-legged frogs are anticipated to occur in the Cervus Creek Study Area, especially in lowland wet forest areas, and were confirmed in the small side-channel northwest of the Study Area (Figure A2). Western toad (*Anaxyrus boreas*) has been recorded along Wolf Creek (a tributary of Elk River), north of the Study Area, and based on habitat connectivity with Cervus Creek, has the potential to occur in the Study Area. Within their range, Western toad often occur in the same areas / types of habitat as red-legged frog, and the forests would be suitable overwintering habitats.

4.5.3 Birds

There is mapped critical habitat for Marbled Murrelet (*Brachyramphus marmoratus*) within 100 m of the Cervus Creek Study Area. Critical habitat is defined in SARA as “the habitat that is necessary for the survival or recovery of a listed wildlife species” (Parks Canada Agency 2017). Marbled Murrelet nests in old growth trees and sometimes cliffs which were not observed within the Study Area.

The Study Area falls within Northern Goshawk (*Accipiter gentilis*) critical foraging habitat and is situated within 100 m of critical breeding habitat (Figure A2). There are goshawk nest records approximately 700 m southeast of the Study Area, however, active nesting has not been detected since 1999 (CDC 2022b). The field assessment in June 2022 confirmed that the habitat changes in the vicinity of these historical nest locations transitioning to a steeper slope with large diameter trees and a more open, tiered mixed forest canopy, which is more suitable for goshawk nesting than the dense undersized coniferous trees along the highway corridor in the Study Area, however, no goshawk nests were detected.

Western Screech-owls (*Megascops kennicottii kennicottii*) have been detected approximately 6 km west of the Cervus Creek Study Area as recent as 2017 (CDC 2022a). Suitable nesting trees for this species (i.e., larger snags and large deciduous trees) were uncommon in the Study Area. Other raptors with the potential to occur within the forested habitat in the Study Area include Rough-legged Hawk (*Buteo lagopus*), Peregrine Falcon (*Falco peregrinus*), and Northern Pygmy-owl (*Glaucidium californicum*); however, there is limited habitat for these species in the Study Area. No raptor nests or suitable cavities were observed in the Study Area.

5 ENVIRONMENTAL EFFECTS

Works to be completed as part of the Project include land-based and in-water activities that are anticipated to result in some permanent and temporary adverse environmental effects.

5.1 Construction Phase

5.1.1 Fish and Fish Habitat

The removal of the existing Cervus Creek bridge and installation of a new clear span bridge and related roadworks will result in permanent and temporary effects on instream habitat in the river and adjacent riparian areas. Construction activities will include use of heavy machinery for clearing, grubbing, excavating, placement of fill and riprap, building structures (e.g., piles, abutments, bridge superstructure), grading and paving. Environmental effects were classified as instream/aquatic when effects were within the channel and below the high-water mark, and considered as riparian when above the high-water mark up to 30 m from the watercourse.

Environmental effects on fish and fish habitat associated with Project footprint include:

- Permanent and temporary loss of riparian habitat due to clearing, grubbing, fill placement, riprap placement, and structures;
- Temporary loss of instream habitat due to stream bed disturbance and isolation of a portion of the stream channel (i.e. works along the toe of slope below high-water mark for riprap installation).

Potential environmental effects of the Project's construction footprint are summarized in the Table 5-1.

Table 5-1
Extent and Duration of Potential Instream Effects of Project Construction Footprint[1]

Project Activities	Habitat Type	Temporary Loss (m^2)	Permanent Loss (m^2)
Clearing, grubbing, fill placement, and structures	Instream	0	0
	Riparian	542	241
Bank excavation and riprap placement	Instream	244	0
	Riparian	0	286

[1]Based on engineering 90% detailed design drawings.

Permanent riparian habitat loss comprises approximately 316 m^2 of disturbed grass (60%), 34 m^2 upper slope coniferous forest (7%), 92 m^2 lower slope coniferous forest (17%) and 86 m^2 deciduous forest (16%). Of the 542 m^2 of riparian habitat temporarily lost during construction, approximately 34% consists of disturbed grass (184 m^2), 31% is deciduous forest (170 m^2), 19% is upper coniferous forest (101 m^2) and 16% lower coniferous forest (87 m^2).

To install the new riprap along either bank of Cervus Creek, the existing riprap will be removed, and bank grading and shaping will be required. These works will include some instream works (i.e., below the high-water mark) along the banks and channel margins down to toe of slope. The fish habitats affected include the channel margins of primarily existing riprap glide habitats adjacent to other previously disturbed slopes of highway ROW, or under the bridge, and therefore the magnitude of these effects is considered low. For work within and adjacent to existing riprap areas, the potential adverse effects will be temporary during construction for the replacement with new riprap. The temporary instream areas impacted comprise approximately 244 m^2 of existing and new riprap proposed for below the HWM. Instream impact areas are shown in Figures 5-1, 5-2, 5-3 and Appendix A, Figure A3.

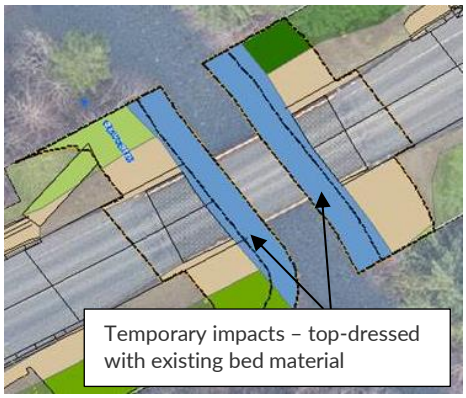
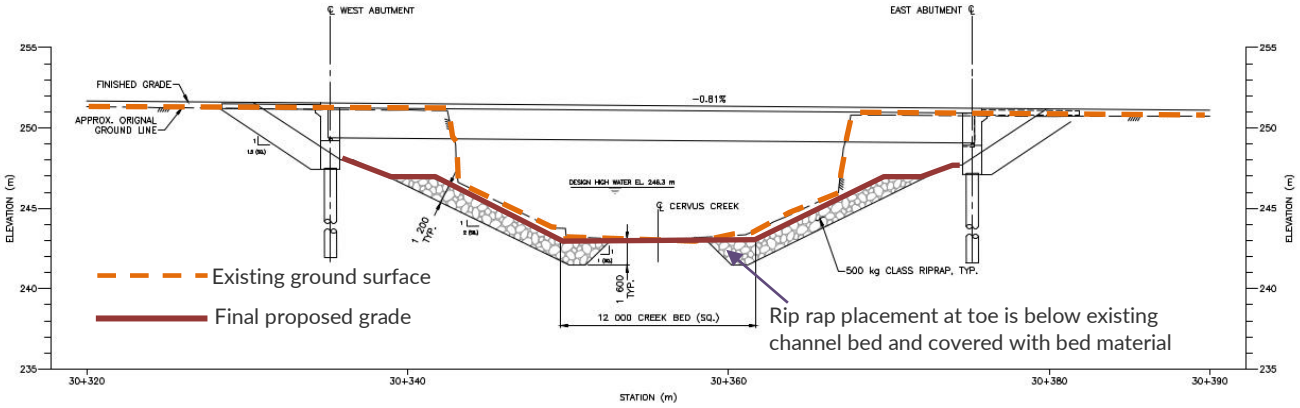


Figure 5-1
Temporary Instream Footprint Impacts of Construction



PROFILE VIEW – L300A1

Figure 5-2
Riprap Placement Below High-water.

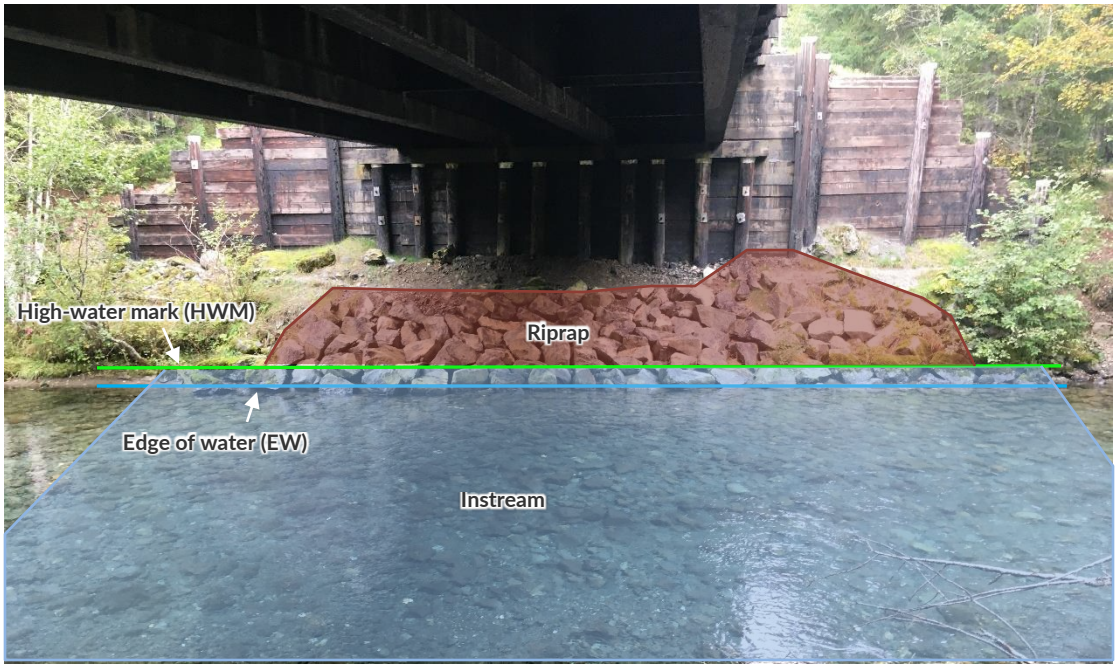


Figure 5-3
West Bank of Cervus Creek Showing Existing Riprap and Instream Areas Under the Bridge, with Approximate High-water Mark (HWM) and Edge of Water (EW)

The channel will be excavated at the toe of the rip rap banks, and rip rap will be placed below the existing channel bed. To avoid resulting in a permanent alteration and habitat impact, construction will include removal and stockpiling of existing riverbed and bank material and top-dressing the newly installed riprap with the stockpiled bed material. The existing channel width will be maintained (Figure 5-2).

In addition to habitat loss associated with the Project footprints, construction activities have the potential to adversely affect fish and fish habitat in the Study Area including:

- Potential water quality degradation due to erosion and sediment transport to Cervus Creek from earthworks and ground disturbance (i.e., grubbing, grading, excavation, placement of riprap and other materials); and
- Potential water quality degradation due to accidental discharge of deleterious substances from on-site spills or leaks.

Potential effects associated with construction activities are temporary or managed through mitigation measures. In addition, the construction works are being completed within the existing disturbed habitats of the ROW and beneath the existing bridge. Potential impacts to fish and fish habitat associated with erosion and sedimentation, and spills or leaks are expected to be mitigated through the application of standard erosion and sediment control (ESC) measures, spill and emergency response planning and measures, and best management practices, and the overall magnitude of this effect on fish and fish habitat is considered negligible.

5.1.2 Vegetation and Ecosystems

The removal of the existing Cervus Creek bridge and installation of a new clear span bridge and related roadworks will result in permanent and temporary effects on vegetation and ecosystems in the Study Area. The proposed alignment includes widening of the existing ROW comprising road surfaces, disturbed areas, with some clearing of forested ecosystems within the Project footprint. Construction activities will include use of heavy machinery for clearing, grubbing, excavating, placement of fill and riprap, building structures (e.g., piles, abutments, bridge superstructure), grading and paving. Environmental effects on vegetation and ecosystems associated with the Project footprint include:

- Permanent loss of upper and lower slope coniferous forest, deciduous forest, and disturbed areas due to clearing, grubbing, and fill placement associated with road upgrades; and
- Temporary loss of upper and lower slope coniferous forest, deciduous forest and grassy disturbed areas associated with laydown areas and machine work zones.

Environmental effects of the Project's construction footprint on vegetation and ecosystems in the Study Area (including riparian habitat) are summarized in the Table 5-2.

Table 5-2
Extent and Duration of Potential Effects of Project Construction Footprint[1] on Vegetation and Ecosystems

Habitat Type	Temporary Loss (m^2)	Permanent Loss (m^2)
Upper slope coniferous forest	46	104
Lower slope coniferous forest	347	453
Deciduous forest	249	138
Grasses/forbs (disturbed areas)	121	607

[1]Based on engineering 90% detailed design drawings

Approximately 695 m^2 of forest habitat, comprising upper slope coniferous (104 m^2), lower slope coniferous (453 m^2) and deciduous (138 m^2) forest types will be permanently lost due to the installation of the new bridge and associated road upgrades. An additional 607 m^2 of previously disturbed grassy areas (e.g., roadsides) will also be permanently lost. A total of 642 m^2 of forest habitat and 121 m^2 of grassy roadside areas are anticipated to be temporarily lost due to clearing and grubbing and the road detour. Most of the lower slope and deciduous forest cleared to accommodate the temporary detour bridge will be restored following construction, however, it will take time to return to its pre-development state, and for this reason, the magnitude of this effect is anticipated to be moderate. Existing disturbed areas (e.g., grassy areas) are anticipated to be restored immediately following construction.

In addition to habitat loss associated with the Project footprints, construction activities have the potential to adversely affect vegetation and ecosystems in the Study Area including:

- Potential degradation due to erosion from earthworks and ground disturbance (i.e., grubbing, grading, excavation); and
- Potential water quality degradation in deciduous forest habitat due to accidental discharge of deleterious substances from on-site spills or leaks.

Potential impacts associated with erosion and sedimentation are expected to be mitigated through the application of standard erosion and sediment control (ESC) measures and best management practices, and the overall magnitude of this effect on vegetation and ecosystems is considered negligible.

5.1.3 Wildlife and Wildlife Habitat

The potential effects on wildlife during site preparation and installation of the clear span bridge and associated road upgrades are primarily related to the clearing and grubbing of vegetation. Environmental effects on wildlife and wildlife habitat associated with the Project footprints include:

- Permanent and temporary loss of wildlife habitat associated with clearing of upper and lower slope coniferous and deciduous forest types;
- Potential wildlife mortality associated with vegetation clearing, including destruction of active bird nests, or encounters with project equipment and machinery;
- Temporary sensory disturbance of wildlife including nesting birds (e.g., noise or light) associated with construction activity;
- Temporary habitat degradation associated with erosion and sedimentation of wetlands and watercourses from earthworks and ground disturbance; and
- Temporary water quality degradation in deciduous forest habitat and side-channels due to accidental discharge of deleterious substances from on-site spills or leaks.

The loss of wildlife habitat associated with installation of the new bridge structure and widening / upgrade of the road comprises an area likely influenced by existing and ongoing disturbance associated with the highway. While restoration of the forest habitats to their pre-development state will take some time, the overall magnitude of the loss of wildlife habitat within the Study Area is expected to be low due to the availability of similar habitat, further away from the highway.

The risk of wildlife mortality during construction activities is expected to be mitigated through standard best management practices including isolating the site, working within species-specific timing windows where applicable, and conducting pre-construction salvages as required. Due to the implementation of measures to avoid wildlife mortality, the magnitude of this effect is anticipated to be negligible.

Temporary sensory disturbance of wildlife, including breeding birds, associated with the operation of equipment and machinery within the Study Area can be avoided and / or mitigated through the application of standard best management practices including pre-construction surveys and restricting specific works (e.g., vegetation clearing) to windows of least risk for species and species groups of concerns. Wildlife utilizing habitat within the Study Area is likely habituated to a certain level of disturbance associated with operation of the highway, and with the application of appropriate mitigation, the magnitude of this effect is anticipated to be low.

Habitat degradation is expected to be avoided through the application of standards ESC measures and best management practices and the overall magnitude of this effect is anticipated to be negligible.

5.1.4 Species at Risk

Construction and installation of the new Cervus Creek Bridge has the potential to affect species at risk confirmed in the Study Area and /or identified as potentially occurring. As with the anticipated effects on wildlife and wildlife habitat, environmental effects on species at risk associated with the Project footprint include:

- Permanent and temporary loss of habitat through the removal of the existing bridge superstructure, which has the potential to support bird roosting and nesting, and through clearing of upper and lower slope coniferous and deciduous forest types;

- Potential mortality of species at risk associated with vegetation clearing, including destruction of active bird nests, and instream works including encounters with project equipment and machinery;
- Temporary sensory disturbance of roosting bats and roosting/nesting raptors;
- Temporary habitat fragmentation associated with instream works which has the potential to impede wildlife movement (e.g., Western water shrew) up and down Cervus Creek; and
- Temporary habitat degradation due to potential sedimentation from erosion or accidental discharge of deleterious substances from on-site spills or leaks into Cervus Creek, side-channels and wetted areas within the forested areas either side of the highway.

Hoary Bat has been confirmed foraging in the Study Area, and there is potential for Townsend's Big-eared Bat and Little Brown Myotis to also occur; the loss of potential roosting habitat due to removal of suitable trees (e.g., snags with sloughing bark) has the potential to adversely affect these species. Scheduling vegetation clearing outside of the period of bat use (e.g., summer) will mitigate effects on these species associated with mortality and sensory disturbance, and if mitigation is implemented, overall magnitude of these effects is anticipated to be negligible.

Several raptors were identified as having the potential to occur within the Study Area, with critical habitat encompassing or adjacent to the existing bridge, however, no raptor nests, nor habitat/trees suitable for supporting nesting by Marbled Murrelet, Northern Goshawk nor Western Screech-owl were observed within the Study Area. Effects on these species at risk associated with habitat loss, sensory disturbance or mortality are anticipated to be low.

If found in the Study Area, Western water shrew is likely associated with the Cervus Creek, the braided side channels, small forest wetlands and upland forest habitat. Northern red-legged frog has been confirmed in the east-west side-channel, north of the highway (outside of the construction footprint), and likely uses wetted areas throughout the deciduous and coniferous forest types in the Study Area. Instream works within Cervus Creek and associated isolation for the removal of the existing bridge and installation of the new clear span bridge has the potential to impede wildlife movements especially for species that cannot easily divert around construction works (i.e., crossing the highway). This is a temporary effect, which will be reversed once instream works are complete, and other suitable habitat exists outside the Project footprint, making the overall magnitude of this effect low to moderate. Pre-construction surveys may further mitigate this effect if instream works are required in known species at risk habitats (e.g., side channel).

Habitat degradation due to sedimentation and potential spills is expected to be avoided through the application of standards ESC measures and best management practices and the overall magnitude of this effect is anticipated to be negligible.

5.2 Operations Phase

Effects associated with the operations phase are not anticipated as the Project comprises bridge and road upgrades to an existing highway and watercourse crossing with no change to the long-term operation.

6 MITIGATION

6.1 Construction

6.1.1 Construction Environmental Management Plan

Prior to construction, the contractor will retain an independent Qualified Environmental Professional (QEP) to develop a Construction Environmental Management Plan (CEMP), to be implemented during the construction phase. The CEMP will include a detailed Water Management Plan, Fish and Aquatic Habitat Protection, a Vegetation Management Plan, Wildlife and Wildlife Habitat Protection, an Erosion and Sediment Control Plan, a Waste Management Plan (including sediment and soil management), an Emergency Spill Response Plan, an Environmental Monitoring Plan, and, at a minimum, include the mitigation measures prescribed below.

6.1.2 Environmental Monitoring

Environmental monitoring will be conducted by an independent QEP. Monitoring will be conducted on a daily basis during environmentally sensitive works (e.g., instream works, vegetation removal, concrete pours within 30 m of a watercourse, during inclement weather) and on a minimum bi-weekly basis during non-critical works. A pre-construction meeting will be held with the contractor, design engineer, and QEP to review the CEMP and discuss environmentally sensitive areas, construction mitigation measures, communication protocols, and permit conditions. The QEP will provide the contractor and MOTI with weekly or bi-weekly (or as requested by the Ministry) environmental monitoring reports that include photo documentation of construction activities, implemented mitigation measures, and any environmental issues observed, recommended corrective actions and timelines for resolution. These recommendations will also be conveyed to the contractor during site inspections.

6.1.3 Erosion and Sediment Control

A detailed Erosion and Sediment Control (ESC) Plan will be developed by a QEP prior to construction and will be documented within the CEMP (Section 6.1.1). The ESC Plan will specify site-specific details (with sketches) of the following measures to minimize the potential for soil erosion and to prevent sediment-laden water from entering Cervus Creek or its tributaries:

- Minimize the amount of shrub and ground vegetation clearing in the proposed work area to minimize exposed soil.
- Complete clearing and ground disturbance immediately prior to construction activities to decrease the duration of soil exposure.
- Install ESC measures (e.g. silt fencing, straw wattles and catch basin liners) prior to construction activities. Silt fence and/or straw wattles should be properly installed at the top-of-bank of Cervus Creek, the side-channel and any other watercourses or drainage features in the Project Area. If catch basins are present on the bridge surface or adjacent areas, these should be lined with approved catch basin liners. ESC measures should be routinely inspected and maintained throughout the construction period.
- Halt construction activities whenever sediment is observed to be moving into a watercourse.
- Locate any stockpiled soil material at least 30 m from the top of bank of any watercourse; cover with polyethylene sheeting or similar material and install silt fencing, as needed, between each stockpile and adjacent watercourses.
- Revegetate graded and disturbed soils with a suitable erosion control mix of seed emphasizing native species and apply mulch or other stabilizers on slopes to minimize erosion until vegetation establishes.

6.1.4 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 results in an increase in pH. The following mitigation measures will minimize the potential for the introduction of deleterious material (i.e., uncured concrete) into Cervus Creek and its tributaries:

- Use pre-cast concrete structures wherever feasible.
- Isolate and contain concrete and pouring using an impermeable material (e.g., polyethylene sheeting).
- Erect an acceptable debris containment system (e.g., tarp) prior to any paving.
- Cover recently poured concrete with the impermeable material until concrete is fully cured.
- Wash off all tools, pumps, pipes, hoses and trucks used for finishing, placing or transporting fresh cement off site to prevent the wash water from entering Cervus Creek. The wash water will be contained and disposed of upland in an environmentally acceptable manner.
- Ensure that a CO^2 tank and regulator, hose, and gas diffuser are readily available on site during concrete pours and curing, and ensure crews are trained in their use.
- Monitor water in contact with concrete for acceptable pH levels. If the pH levels are outside the allowable limits (6.5 - 8.0 pH), the contact water must be contained and neutralized (naturally over time or with the introduction of CO2) prior to release to the environment or removed and disposed of off site.
- Monitor pH in Cervus Creek and / or the side-channel when adjacent to concrete works. The QEP (or an environmental monitor under the direction of the QEP) will collect and analyze water samples from upstream of the construction area (control) and as close as possible downstream of concrete works (impact). Implement emergency measures (introduction of CO2) if pH levels are outside the allowable limits (6.5 - 8.0 pH).

6.1.5 Spill Prevention and Emergency Response

A comprehensive Spill Prevention and Emergency Response Plan will be developed prior to construction and included in the CEMP. The Plan will specify the following mitigation measures to prevent the introduction of deleterious substances into terrestrial or aquatic habitats adjacent to the Project:

- Inspect construction equipment and machinery daily to ensure it is in good working order and free of leaks.
- Refuel and service equipment a minimum of 15 m from any watercourse.
- Store all fuel and/or hazardous materials in trucks or containment areas that are at least 30 m from any watercourse.
- Equip portable equipment and stand-alone fuel canisters with secondary containment capable of holding 110% of the potential spill volume.
- Keep emergency spill kits on site and train crews in their proper application.
- Keep emergency contact information on site with all project personnel and government agency phone numbers to be contacted in the event of a spill.

6.1.6 Aquatic Habitat Protection

Prior to the commencement of construction works adjacent to Cervus Creek, the following mitigation measures will be implemented to maintain downstream water quality and avoid direct disturbance to aquatic habitat within the Project Area:

- Delineate the work area using a physical barrier (e.g., snow fence) to establish 'no-go' zones along the riparian corridor of Cervus Creek and the east-west side channel to avoid unnecessary encroachment of protected riparian buffers.
- Implement appropriate ESC measures.
- Do not allow machinery to enter below the high-water mark at any point during construction. All machinery is to be operated from the top of bank.
- Avoid unnecessary works below the high-water mark, including disturbance to instream or riparian vegetation, large woody debris, and other fish habitat features. Any features removed from the aquatic environment will be replaced upon completion of the works.
- Time instream works to occur when flow is minimal. Adhere to regional reduced risk instream work windows
- (i.e., **August 1 – September 1**) wherever feasible (MOE 2017).
- Isolate instream work areas without impeding flow to downstream portions of the river at any time during construction.
- Conduct fish and amphibian salvages in isolated instream work areas.
- Monitor underwater noise during pile installation activities; install bubble curtains, if necessary, to attenuate potentially harmful underwater noise during pile installation works.
- Install silt curtains upstream and downstream of the Project Area to minimize sediment dispersal off site during ground disturbance activities on the banks of Cervus Creek.
- Install containment netting or shrouding below work areas that are suspended above the creek to prevent release of deleterious substances into aquatic and riparian habitats.
- Monitor turbidity upstream and downstream of the works area to ensure changes are within water quality guidelines.
- Discharge to the environment can only occur if lab analyses can prove that there are no exceedances of provincial or federal water quality guidelines (i.e., British Columbia Approved Water Quality Guidelines for aquatic life, wildlife & agriculture [ENV 2020d], Canadian Water Quality Guidelines for the Protection of Aquatic Life [CCME 1999]) and/or that water quality is the same or better than background conditions (i.e., upstream).
- Discharge groundwater and construction runoff upland in a vegetated area where it will infiltrate and settle.
- Ensure all imported fill materials are clear of contaminants and fully isolated from instream areas.
- Grade disturbed areas to a stable slope after work is completed.

6.1.7 Vegetation Management

The following mitigation measures will be implemented to prevent, minimize or manage effects on vegetation and ecosystems in the Project Area:

- Access the work sites using the existing roads and pathways.
- Delineate the work area using a physical barrier (e.g., snow fence) to establish 'no-go' zones and avoid unnecessary encroachment of adjacent vegetation.
- Delineate areas for clearing of riparian vegetation, particularly trees, and use methods to prevent soil compaction within the riparian zone.
- Restrict fill placement to only those areas where this is required to complete construction activities.
- Revegetate disturbed areas, where necessary, with native plants and/or native seed mixes.

- Ensure gravel, soil and any fill material are not contaminated (i.e., not taken from a site contaminated with noxious plants such as knotweed).
- Minimize soil disturbance during construction activities.
- Identify areas of invasive plants (e.g., Scotch broom) within the Project footprints, remove with root structures and dispose of off site (i.e., to an appropriate location to prevent proliferation of invasive, non-native species in adjacent areas). Alternatively, burning can be used for Scotch broom shoots and leaves. Deep burial should not be used on Scotch broom infested soils, but may be used on soils infested with other invasive species (e.g. thistle, St. John's Wort). Soils near these identified areas will potentially be contaminated (i.e., contain seeds, root material) and should not be used for site reclamation to prevent further spread. Restore these areas quickly to prevent re-establishment.
- Revegetate cleared areas post-construction with native plant species suited to local conditions (e.g., red alder and cottonwood or Douglas-fir and western hemlock) as soon as feasible to assist in preventing the spread of invasive plant species. Replacement of removed trees is required at a >1 to 1 ratio for trees over 30 cm in diameter. If seed mixes are used during revegetation, ensure they do not contain weed or invasive species. If possible, follow riparian restoration guidelines as outlined by the Province of BC (2008).
- Limb or trim trees instead of cutting them down, where feasible.

6.1.8 Wildlife and Wildlife Habitat Protection (including Species at Risk)

The following mitigation measures will be implemented to prevent, minimize or manage potential effects on wildlife:

- Minimize clearing and grubbing activities to those areas required to complete construction activities.
- Utilize areas of disturbance or low value grassed areas where possible for both permanent and temporary staging areas.
- Limit clearing and grubbing to outside the migratory bird nesting window in accordance with Section 6 of the *Migratory Birds Regulations* (C.R.C., c. 1035) and Section 34 of the *Wildlife Act* (R.S.B.C. 1996, c. 488). The nesting period on Vancouver Island is identified as March 12 to August 17 (Government of Canada 2022); however, these dates are only a guideline and each specific site, bird species, and geographical area will have variations that should be considered in accordance with the applicable law. If vegetation clearing or bridge removal during the nesting period is unavoidable, a nest survey must be conducted in advance by an appropriately qualified professional to confirm there will be no disturbance to occupied bird nests and/or eggs.
- Conduct a survey for nests of relevant species listed on Schedule 1 of the *Migratory Bird Regulations* (2022) with the clearing footprint and identify if designated wait times apply to the Project.
- Conduct a raptor nest survey in advance of construction activities. Regardless of the timing of clearing and grubbing, the nests of some bird species, including those listed in Subsection 34(b) of the *Wildlife Act*, are protected year-round and must not be disturbed (e.g. raptors, owls, and herons), whether occupied or not.
- If any active raptor or heron nests are detected within the Study Area, provide sensory disturbance buffers ranging from 100 m to 200 m surrounding the nest site or colony. If removal of an inactive nest related to the above-named species is required to accommodate construction, discuss in advance with MOF and obtain the necessary permit from MOF.
- Limit clearing of trees and snags to outside the bat active season, generally identified as April 1 to October 31 (ENV 2022).

- Whenever possible, schedule construction activities to avoid daily sensitive times for wildlife, such as dawn or dusk.
- Conduct wildlife salvages or sweeps targeting species at risk (e.g., Western toad, Northern red-legged frog, Western water shrew) in suitable habitat (i.e., side-channels, wetlands, forests, vegetated ditches) in advance of construction under valid salvage permits. Amphibian salvages will be required as part of instream works. Note, the review period can be up to 12 weeks for permit approval.
- Minimize the removal of vegetation, snags, natural woody debris, rocks, or other materials from the riparian areas and watercourses within the Project Area.
- If material (excluding introduced invasive vegetation) is removed from a vegetated area, set it aside and return it to the original location once construction activities are completed.
- Implement a waste management system to avoid attracting wildlife.
- Implement standard best management practices for spill prevention and emergency response to prevent release of deleterious substances into aquatic and terrestrial habitats.
- Implement standard best management practices to minimize construction noise.
- Revegetate disturbed areas with native tree and shrub species where possible to re-establish valuable breeding, nesting, and shelter habitat for various wildlife species and prevent the establishment and spread of invasive species, while providing groundcover to minimize erosion.

7 RESIDUAL EFFECTS

7.1 Aquatic Habitat

Potential adverse environmental effects on fish and fish habitat resulting from the Project footprint are limited to 527 m^2 moderate quality (i.e., previously modified and disturbed) riparian habitat. Construction activities will cause a maximum temporary disturbance to 542 m^2 of riparian habitat, and 244 m^2 of instream habitat. Potential adverse effects of habitat loss associated with this Project footprint on fish and fish habitat are assessed as local in extent, and low in magnitude. Potential adverse effects of the construction activities are assessed as local in extent, temporary in duration, and low in magnitude. Application of mitigation measures (Section 6) including specific aquatic resource protection measures (Section 6.1.6) will help to avoid or minimize the potential adverse environmental effects on aquatic resources. With the application of recommended mitigation measures, residual effects on aquatic resources are anticipated to be negligible.

7.2 Vegetation and Ecosystems

Potential adverse environmental effects on vegetation and ecosystems resulting from the Project footprint comprise a total permanent loss of 695 m^2 of forest habitat and 607 m^2 of modified and disturbed grassy habitat, with an additional total temporary disturbance during construction of 763 m^2 of primarily deciduous and lower slope coniferous forest types (78%). Given that vegetation disturbance is limited to along the existing road ROW, which is already subject to disturbance influences (e.g., edge effect), the effects are considered incremental and were assessed as local in extent and low in magnitude. While most of the vegetation disturbance is temporary and will be restored following construction, the return of the habitat to forested ecosystem types will occur over the long-term. Application of mitigation measures (Section 6) including specific vegetation management measures (Section 6.1.7) will help to avoid or minimize the potential adverse environmental effects on vegetation resources. With the application of recommended mitigation measures, residual effects on vegetation resources are anticipated to be low.

7.3 Wildlife and Wildlife Habitat

As the Project footprint contains existing infrastructure, adverse effects on wildlife, including sensory disturbance, and habitat loss and fragmentation, are considered incremental and were assessed as local in extent, temporary in duration, and low in magnitude. Potential adverse environmental effects on wildlife and wildlife habitat are reasonably mitigated by avoiding sensitive habitats (e.g., side-channel) and with the application of appropriate measures selected for species, season and/or activity (Section 6.1.8). Residual effects on wildlife and wildlife habitat are anticipated to be negligible.

7.4 Species at Risk

Where present in the Project Area, there is potential for disturbance of species at risk during construction of the Project footprint. Overall, potential adverse effects on species at risk was assessed as local in extent, temporary in duration and low to moderate in magnitude. Application of mitigation measures (Section 6) including pre-construction surveys specific to species at risk (Section 6.1.8) will help to avoid or minimize the potential adverse environmental effects on this group, and residual effects on species at risk are anticipated to be negligible.

8 SUMMARY

Associated completed the environmental assessment (EA) for the Cervus Creek Bridge Replacement project in August 2022. The scope of the EA focused on the permanent and temporary effects from the construction of the Project on terrestrial and aquatic habitats within the Study Area. Based on the findings of the EA, the Project will result in a permanent loss of 527 m^2 of moderate quality (i.e., previously modified and disturbed) riparian habitat. Construction activities will cause a maximum temporary disturbance to 256 m^2 of riparian habitat and 244 m^2 of instream habitat.

The Project footprint will result in a permanent loss of 695 m^2 of forest habitat, comprising both upper (15%) and lower slope coniferous forest (65%) and deciduous forest (20%), and an additional 607 m^2 of previously disturbed grassy habitat. Construction activities will result in a maximum temporary disturbance to 393 m^2 of upper (12%) and lower slope coniferous forest (88%), 249 m^2 of deciduous forest, and 121 m^2 of previously disturbed grassy habitat. A summary of these footprint habitat effects is provided in Table 8-1.

Table 8-1
Summary of Project Construction Footprint[1] Habitat Effects

Habitat Type	Temporary Loss (m^2)	Permanent Loss (m^2)
Aquatic		
Instream	244	0
Riparian	256	527
TOTAL Aquatic	**500**	**527**
Terrestrial		
Lower slope coniferous forest	347	453
Upper slope coniferous forest	46	104
Deciduous forest	249	138

Habitat Type	Temporary Loss (m^2)	Permanent Loss (m^2)
Grasses/forbs (disturbed areas)	121	607
TOTAL Terrestrial	**763**	**1,302**

[1]Based on engineering 90% detailed design drawings

Temporary effects on wildlife, including species at risk, associated with construction of the Project include sensory disturbance and habitat change and fragmentation, and will be reversed following Project completion. Minimal permanent wildlife habitat loss is anticipated and is considered incremental as losses are confined to the existing road right of way, which is subject to existing disturbance influences.

To manage construction-related effects, a Construction Environmental Management Plan will be developed and implemented by the contractor and will include management plans for water quality, fish and aquatic habitat protection, wildlife and wildlife habitat protection, vegetation, erosion and sediment control, construction waste (including sediment and soil management), air quality, emergency spill response, and environmental monitoring, which are to be implemented during construction.

The mitigation measures proposed in Section 6 are intended to avoid, minimize and/or restore effects of the Project on fish, aquatic habitat, vegetation, wildlife, wildlife habitat, and species at risk. Provided the mitigation measures outlined in this report are implemented, the environmental effects of the Project are anticipated to be low to negligible.

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CERTIFICATION PAGE

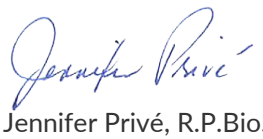
This report presents our findings regarding the BC Ministry of Transportation and Infrastructure Highway 28 Cervus Creek Bridge Replacement Environmental Assessment .

Respectfully submitted,
Associated Environmental Consultants Inc.

Prepared by:

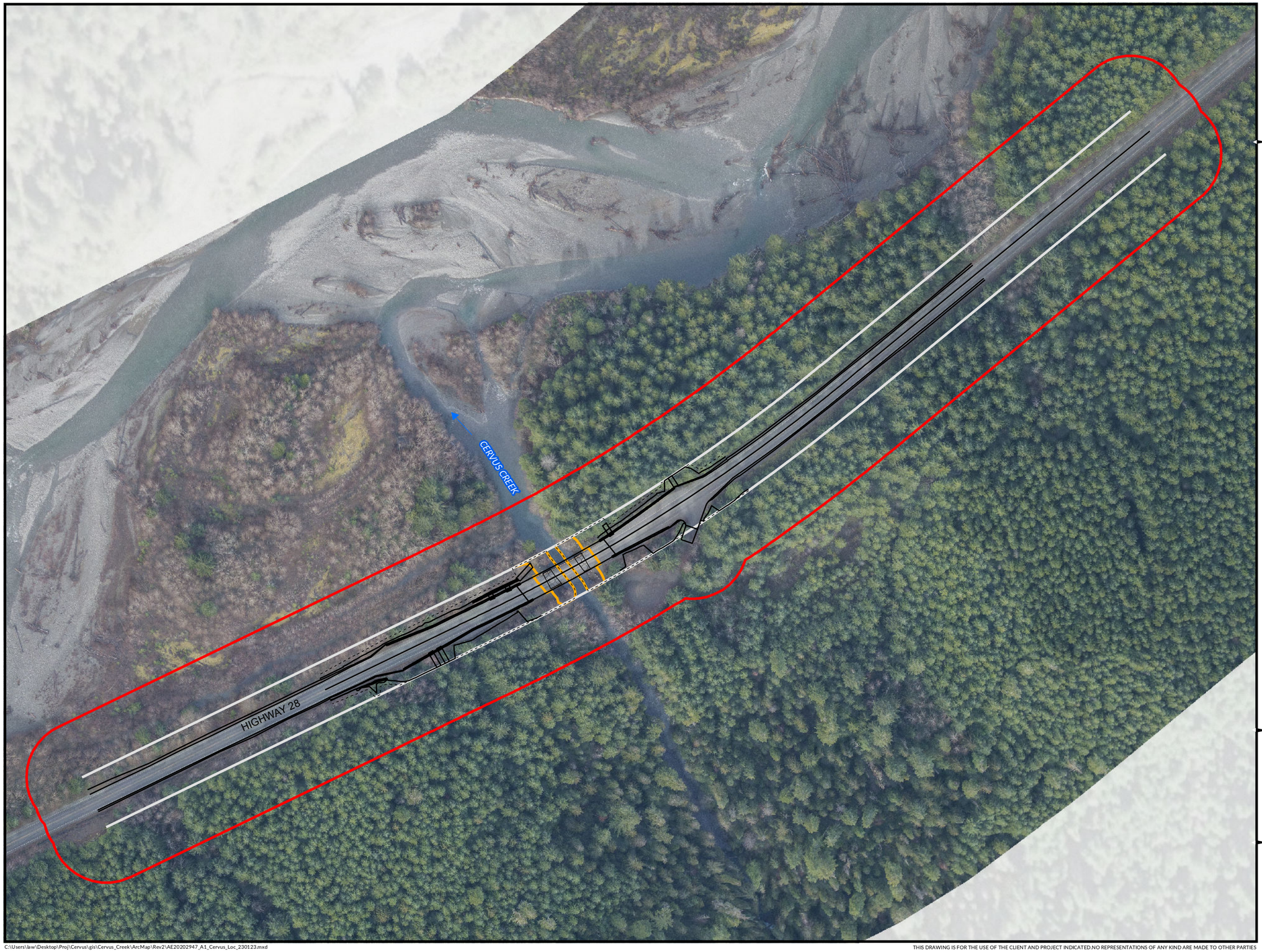
Naomi Sands, R.P.Bio.
Environmental Scientist

Reviewed by:



Jennifer Privé, R.P.Bio.
Manager, Environmental Sciences

APPENDIX A - FIGURES



Associated Environmental

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

Legend

Footprint
- Permanent
- Right-Of-Way Boundary
- Temporary
- Existing Riprap
- Proposed Riprap
- Study Area

0 25 50 75 100 m

FIGURE A-1
Project Location

BC Ministry Of Transportation And Infrastructure Highway 28 Bridge Replacements For Cervus Creek

Environmental Assessment

AE PROJECT No.	2020-2947
DATE	2023 JANUARY
SCALE	1:2,000
COORD. SYSTEM	NAD 1983 UTM Zone 10N
REV	02
DESCRIPTION	ISSUED FOR REPORT
DRAWN BY	WL
CHECKED BY	NS

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Associated Environmental

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

Legend

- Detour Bridge Detail
- Existing Riprap
- Proposed Riprap

N

0 10 20 30 40 50 m

FIGURE A-1B
Project Location (Detour Bridge)

BC Ministry Of Transportation And Infrastructure Highway 28 Bridge Replacements For Cervus Creek

Environmental Assessment

AE PROJECT No.	2020-2947
DATE	2023 JANUARY
SCALE	1:1,000
COORD. SYSTEM	NAD 1983 UTM Zone 10N
REV	02
DESCRIPTION	ISSUED FOR REPORT
DRAWN BY	WL
CHECKED BY	NS

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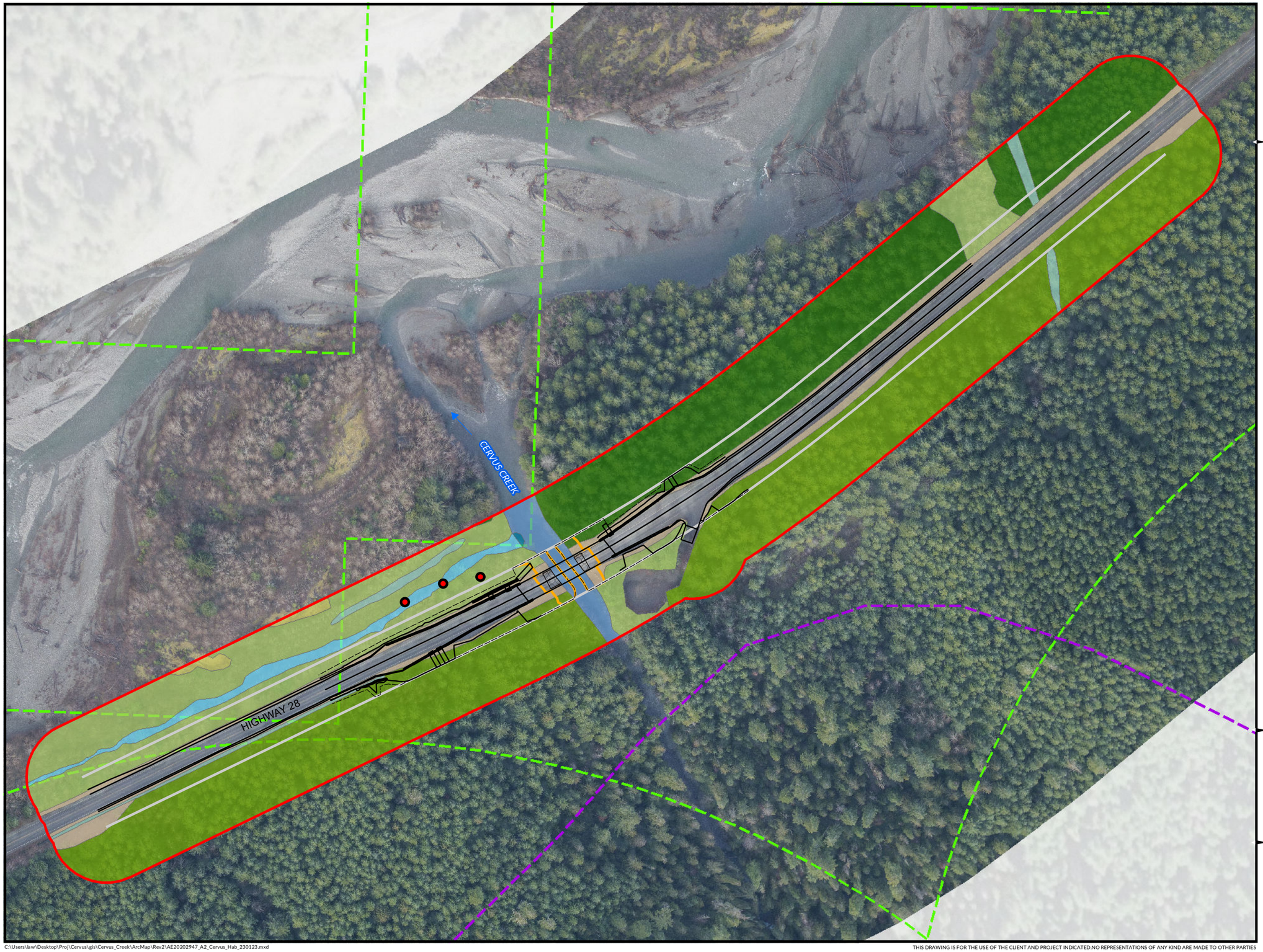

Associated Environmental

BRITISH COLUMBIA
Ministry of Transportation and Infrastructure

Legend

- Red Legged Frog

Footprint
- Permanent
- Right-Of-Way Boundary
- Temporary
- Existing Riprap
- Study Area
- Proposed Riprap

Instream Habitat
- Drainage
- Glide
- Side-Channel
- Scour Pool

Terrestrial Habitat
- Deciduous Forest
- Grasses/Forbs
- LS Conifer
- Floodplain Moss
- US Conifer

Critical Habitat
- Marbled Murrelet
- Northern Goshawk Laingi Subspecies

N

0 25 50 75 100 m

FIGURE A-2
Habitat Types And Environmental Features

BC Ministry Of Transportation And Infrastructure Highway 28 Bridge Replacements For Cervus Creek

Environmental Assessment

AE PROJECT No.	2020-2947
DATE	2023 JANUARY
SCALE	1:2,000
COORD. SYSTEM	NAD 1983 UTM Zone 10N
REV	02
DESCRIPTION	ISSUED FOR REPORT
DRAWN BY	WL
CHECKED BY	NS

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Permanent habitat loss
Riparian:
34 m2 US Conifer Forest
92 m2 LS Conifer Forest
86 m2 Deciduous Forest
316 m2 Grass/Forbs
Terrestrial:
104 m2 US Conifer Forest
453 m2 LS Conifer Forest
138 m2 Deciduous Forest
607 m2 Grass/Forbs

Temporary habitat loss
Instream:
244 m2 Glide
Riparian:
101 m2 US Conifer Forest
87 m2 LS Conifer Forest
170 m2 Deciduous Forest
184 m2 Grass/Forbs
Terrestrial:
46 m2 US Conifer Forest
347 m2 LS Conifer Forest
249 m2 Deciduous Forest
121 m2 Grass/Forbs

Associated Environmental

BRITISH COLUMBIA
Ministry of Transportation and Infrastructure

Legend

30m Riparian Buffer

Footprint
- Permanent
- Right-Of-Way Boundary
- Temporary
- Existing Riprap
- Proposed Riprap

Permanent Impact
- Deciduous Forest
- Drainage
- Glide
- Grasses/Forbs
- LS Conifer
- US Conifer

Temporary Impact
- Deciduous Forest
- Drainage
- Glide
- Grasses/Forbs
- LS Conifer
- US Conifer

N

0 25 50 75 100 m

FIGURE A-3
Environmental Impacts

BC Ministry Of Transportation And Infrastructure Highway 28 Bridge Replacements For Cervus Creek

Environmental Assessment

AE PROJECT No.	2020-2947
DATE	2023 JANUARY
SCALE	1:2,000
COORD. SYSTEM	NAD 1983 UTM Zone 10N
REV	02
DESCRIPTION	ISSUED FOR REPORT
DRAWN BY	WL
CHECKED BY	NS

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APPENDIX B - PHOTOGRAPHS

Photo 1: Cervus Creek looking north towards the bridge and downstream section of the Study Area.

Photo 2: Cervus Creek looking west towards the west bank underneath the existing bridge.

Photo 3: Cervus Creek looking north along west bank under existing bridge.

Photo 4: Cervus Creek looking south along east bank under existing bridge.

Project Number: 2020-2947	Date: 08/05/2022	**Highway 28 Bridge Replacement for Cervus Creek**	
Prepared For: Associated Engineering; BRITISH COLUMBIA Ministry of Transportation and Infrastructure	Drawn By: NS Data Sources: Field Photos: 10/01/2020; 06/14/2021 06/30/2022	Associated Environmental	Appendix B: Site Photographs

Photo 5: Cervus Creek looking north to Elk River and the downstream section of the Study Area.

Photo 6: Cervus Creek east-west side-channel (looking west), located downstream of bridge crossing.

Photo 7: Scour pool situated near mouth of side-channel along west bank of Cervus Creek, downstream of bridge crossing.

Photo 8: East-west side-channel, looking east towards scour pool near mouth along Cervus Creek.

Project Number: 2020-2947	Date: 08/05/2022	**Highway 28 Bridge Replacement for Cervus Creek**	
Prepared For: Associated Engineering; BRITISH COLUMBIA Ministry of Transportation and Infrastructure	Drawn By: NS Data Sources: Field Photos: 10/01/2020; 06/14/2021 06/30/2022	Associated Environmental	Appendix B: Site Photographs

Photo 9: Floodplain moss ecosystem typical along the Elk River floodplain in Cervus Creek Study Area.

Photo 10: Typical vegetation of deciduous forest near Highway 28 Cervus Creek bridge

Photo 11: Typical vegetation of lower-slope coniferous forest near Highway 28 Cervus Creek bridge

Photo 12: Typical vegetation of upper slope coniferous forest near Highway 28 Cervus Creek bridge

Project Number: 2020-2947	Date: 08/05/2022	**Highway 28 Bridge Replacement for Cervus Creek**	
Prepared For: Associated Engineering; British Columbia Ministry of Transportation and Infrastructure	Drawn By: NS Data Sources: Field Photos: 10/01/2020; 06/14/2021 06/30/2022	Associated Environmental	Appendix B: Site Photographs

Photo 13: Typical vegetation of roadside grasses and forbs

Photo 14: Red-legged Frog observed in east-west side-channel in the Cervus Creek Study Area

Photo 15: Dry culvert conducting surface drainage under Highway 28, approximately 300 m east of the bridge crossing

Photo 16: Evidence of woodpecker feeding and small cavities throughout the Study Area

Project Number: 2020-2947	Date: 08/05/2022	**Highway 28 Bridge Replacement for Cervus Creek**	
Prepared For: Associated Engineering; BRITISH COLUMBIA Ministry of Transportation and Infrastructure	Drawn By: NS Data Sources: Field Photos: 10/01/2020; 06/14/2021 06/30/2022	Associated Environmental	Appendix B: Site Photographs

APPENDIX C - SAR TABLE

Scientific Name	English Name	BC List	SARA Schedule	SARA Status	Likelihood of occurrence * / Rationale
Accipiter gentilis laingi	Northern Goshawk, *laingi* subspecies	Red	1	Threatened	1/ Nearby records (700 m), within critical habitat; limited potential within Project footprint
Anaxyrus boreas	Western Toad	Yellow	1	Special Concern	1/ Record ~10 km east of Study Area, may occur along tributaries or adjacent coniferous forests
Brachyramphus marmoratus	Marbled Murrelet	Blue	1	Threatened	1/ Critical habitat within 100 m; limited potential within Project footprint
Buteo lagopus	Rough-legged Hawk	Blue			2/ Limited habitat in Study Area (no breeding, potential foraging)
Butorides virescens	Green Heron	Blue			3/ Small amount of swamp, and no nesting observed
Callophrys eryphon sheltonensis	Western Pine Elfin, *sheltonensis* subspecies	Blue			3/ Lack of habitat in Study Area (pine stands)
Cercyonis pegala incana	Common Wood-nymph, *incana* subspecies	Red			3/ Nearby record (~3 km), however associated with Garry Oak Ecosystem which is absent here
Cervus elaphus roosevelti	Roosevelt Elk	Blue			1/ Sign noted within project footprint; likely moving through area
Chordeiles minor	Common Nighthawk	Blue	1	Threatened	2/ Few open areas in forested habitat within Study Area
Coccothraustes vespertinus	Evening Grosbeak	Yellow	1	Special Concern	3/ Lack of habitat in Study Area (no spruce)
Coenonympha tullia insulana	Common Ringlet, *insulana* subspecies	Red			3/ Lack of habitat in Study Area (open grasses)
Contopus cooperi	Olive-sided Flycatcher	Yellow	1	Threatened	2/ Some potential in coniferous forest
Corynorhinus townsendii	Townsend's Big-eared Bat	Blue			2/ Some foraging potential; lack of suitable roosting (i.e., very large hollow trees)
Cypseloides niger	Black Swift	Blue	1	Endangered	3/ Potentially forages, but unlikely to nest (no waterfalls or wet cliffs)
Deroceras hesperium	Evening Fieldslug	Red			3/ Potentially extirpated in BC; floodplain forest marginally suitable
Falco peregrinus pealei	Peregrine Falcon, *pealei* subspecies	Blue	1	Special Concern	3/ Lack of habitat in Study Area (cliffs)
Glaucidium gnoma swarthi	Northern Pygmy-owl, *swarthi* subspecies	Blue			2/ Some potential in tree snags; lack of suitable cavities within Study Area
Gulo gulo vancouverensis	Wolverine, *vancouverensis* subspecies	Red	1	Special Concern	3/ Reclusive and possibly extirpated; unlikely to be down near highway
Lagopus leucura saxatilis	White-tailed Ptarmigan, *saxatilis* subspecies	Blue			3/ Lack of habitat in Study Area (Alpine areas)
Lasiurus cinereus	Hoary Bat	Blue			1/ Some potential in trees, snags; documented foraging in Study Area
Marmota vancouverensis	Vancouver Island marmot	Red	1	Endangered	2/ Potentially travels at low elevations, occurrence at Strathcona Lake
Megascops kennicottii kennicottii	Western Screech-Owl, *kennicottii* subspecies	Blue	1	Threatened	2/ Nearby record (~6 km), but limited habitat in Study Area (large deciduous trees >25 cm DBH)
Mustela erminea anguinae	Ermine, *anguinae* subspecies	Blue			2/ Habitat generalist
Myotis lucifugus	Little Brown Myotis	Blue	1	Endangered	2/ Potential roosting in dead/dying trees, foraging habitat
Nearctula sp. 1	Threaded Vertigo	Blue	1	Special Concern	3/ limited habitat in Study Area (big leaf maples), restricted to roadside
Patagioenas fasciata	Band-tailed Pigeon	Blue	1	Special Concern	2/ Some potential in Temperate coniferous forest
Pristiloma johnsoni	Broadwhorl Tightcoil	Blue			2/ Limited habitat in Study Area (leaf litter)

Scientific Name	English Name	BC List	SARA Schedule	SARA Status	Likelihood of occurrence * / Rationale
Rana aurora	Northern Red-legged Frog	Blue	1	Special Concern	1/ Nearby records (~2 km), suitable breeding habitat along tributaries and adjacent coniferous habitat; confirmed in Study Area
Sorex navigator brooksi	Western Water Shrew, *brooksi* subspecies	Blue			1/ Little known; presumably occurs along water courses; habitat checkoffs are guesses.
Speyeria zerene bremnerii	Zerene Fritillary, *bremnerii* subspecies	Red			3/ Lack of habitat in Study Area (no mesic/xeric meadows)
Ursus arctos	Grizzly Bear	Blue	1	Special Concern	3/ Rare & large range - not likely to occur in footprint; key habitat features not in footprint area

* 1- Occurrence record nearby/critical or highly suitable habitat in Study Area
2- Suitable habitat in Study Area but no occurrence records nearby/critical habitat
3- Suitable habitat likely lacking in Study Area