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To:	**ISL Engineering and Land Services**	Date:	**January 31, 2024**
Attention:	**Amanda Pellam, P.Eng.**	Project No.:	**33580**
Cc:	**Steve Clark, P. Eng.; Octaviano Salgado Perez, P.Eng., PMP; Alana Getty Somers, P.Eng.; Cory Clark, P.Eng., David Neufeld, R.P.Bio, B.Sc.**		
Reference:	**Highway 7 and 11 Upgrades –Environmental Assessment**		
From:	**Larissa Darc, M.Sc., B.I.T**		

1.0 Introduction

ISL Engineering and Land Services (ISL) was retained by the Ministry of Transportation and Infrastructure (MoTI) for engineering design, environmental assessment, and environmental impact assessment for upgrades at the Highways 7 and 11 intersection in Mission, BC (**Figure 1**).

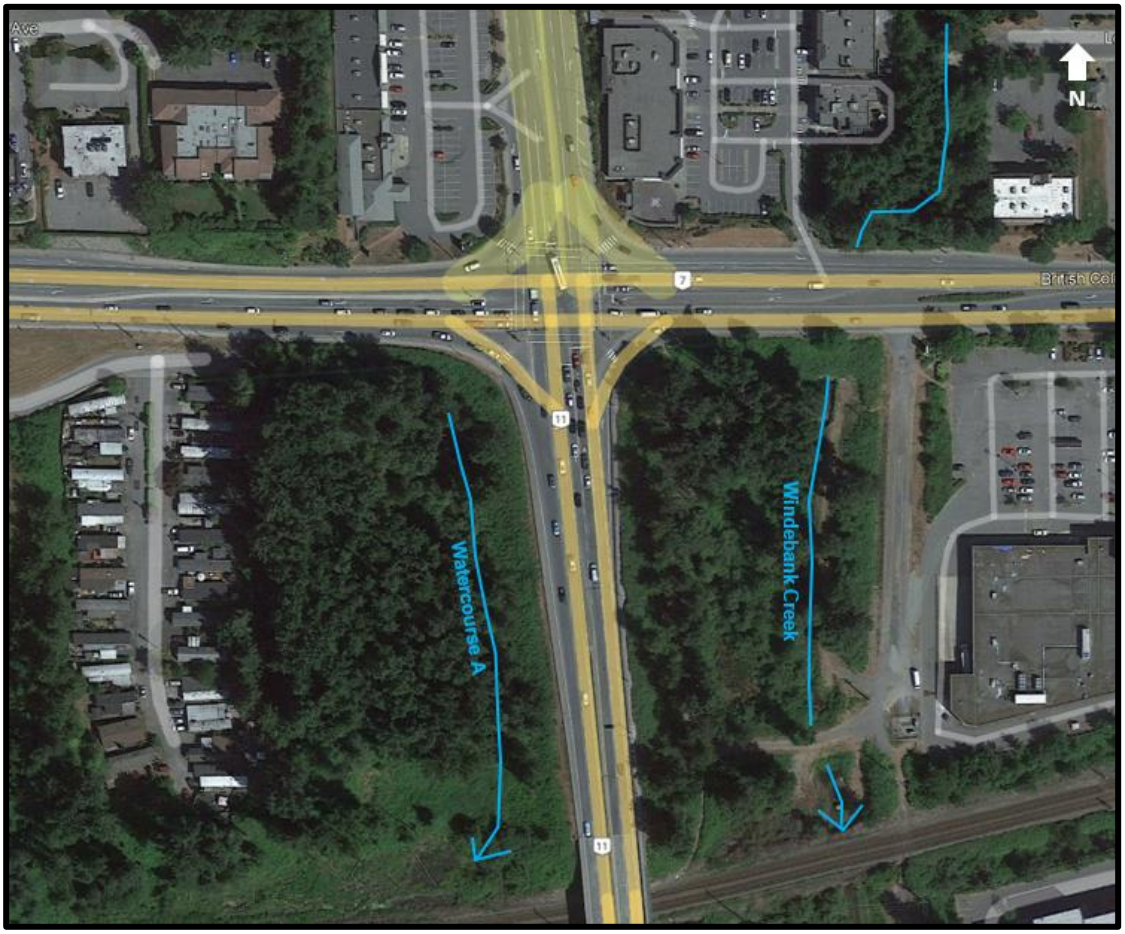

Figure 1. Imagery of the project location showing Highways 7 and 11 in proximity to watercourses.

ISL undertook an environmental assessment at the site to evaluate potential effects of the proposed intersection improvements and inform project design. The following memorandum outlines the results of the reconnaissance

and implications for project design. It is ISL's understanding that the intersection upgrades will not require fillslope extension and will utilize the existing road footprint, however there are drainage improvements that are required. Drainage improvements will include repair and replacement of existing outfall leads and installation of four additional outfalls. These outfall repairs/construction may require disturbance of riparian areas associated with Watercourse A and Windebank Creek.

2.0 Regulatory Context

An overview of environmental legislation pertinent to stream riparian areas and fish habitat, that may be applicable to the project are outlined in the following sections.

2.1 Water Sustainability Act

The province regulates water resources in BC, including 'changes in and about a stream' through the *Water Sustainability Act* (WSA), and associated Regulations. Section 11 of the WSA prohibits making changes in and about a stream (CIAS) unless the changes are made with a license, Change Approval, or are an Authorized Change. The *Water Sustainability Regulation* (WSR) allows for Authorized Changes to proceed in and about streams with submission of a Notice at least 45 days prior to the CIAS. The construction or maintenance of stormwater outfalls are an Authorized Change under the WSR.

2.2 Fisheries Act

Activities that affect fish habitat are federally regulated through the *Fisheries Act*. Fish habitat is any water frequented by fish and any other areas which fish depend on (directly or indirectly) to carry out their life processes. The key tool that Fisheries and Oceans Canada (DFO) uses to manage risks is the Fish and Fish Habitat Protection and Pollution Prevention provisions within the Act, which prohibit:

- The death of fish
- Activities which result in the harmful alteration, disruption, or destruction (HADD) of fish or fish habitat
- Deposition of deleterious substances of any type in water frequented by fish

This includes non-fish bearing watercourses that are significant sources of food, nutrients, and baseflows to downstream fish habitat, and vegetation within riparian zones. Instream or riparian projects which have a scope, scale and intensity that may cause HADD can be submitted to DFO as a Request for Review (RfR).

3.0 Methods

Desktop assessment was undertaken prior to field investigation. Sources of desktop information included provincial databases (iMapBC, Habitat Wizard, BC Conservation Data Centre), the City of Mission GIS (Mission WebMap), the Species at Risk Public registry, and reports from previous assessments (ISL, 2016).

The field investigation was undertaken by Larissa Darc, M.Sc., B.I.T of ISL on November 2 and 3rd, 2023. Weather during the assessment was light rain, with an ambient air temperature of 11°C and no wind. The investigation included watercourse assessment of Watercourse A and Windebank Creek using standard 1:20,000 RISC methods. Riparian habitat was categorized according to the Field Manual for Describing Terrestrial Ecosystems, 2nd Edition.

4.0 Results

The results of the desktop and field investigation are outlined in the following sections.

4.1 Windebank Creek

Windebank Creek has a bankfull width of 3 m, and originates from headwaters north of Highway 7, flows directly south under Highway 7 and discharges into the Fraser River, after passing through a flood box, approximately 800 m southwest of the project location. Windebank Creek is located approximately 70 m east of Highway 11 and is classified as Class A (red-coded), indicating the stream has year-round presence of fish (Mission WebMap, 2023). The following native species are present in Windebank Creek: coho salmon (*Oncorhynchus kisutch*), coastal cutthroat trout (*Oncorhynchus clarkii clarkii*), northern pikeminnow (*Ptychocheilus oregonensis*), threespine stickleback (*Gasterosteus aculeatus*), and rainbow trout (*Oncorhynchus mykiss*) (Habitat Wizard, 2023).

4.2 Watercourse A

Watercourse A flows south and parallel to the west side of Highway 11. Watercourse A is classified as a Class B (yellow-coded) watercourse, indicating it is non-fish bearing, but provides significant food and nutrients to downstream fish habitat (Mission WebMap, 2023). ISL's observations noted no barriers to fish passage and as such portions of Watercourse A may be fish accessible under certain discharge conditions.

Watercourse A is unconfined in its headwaters and appears to be sourced by a spring located near the southwest corner of the intersection (see Figure 3). There is also a tributary to Watercourse A in the form of a stormwater outfall from under Highway 7 (ISL, 2016). The channel becomes more confined 35 m downstream from the spring. Watercourse A has an average bankfull width of 1.2 m and a substrate of 100% mineral fines, which had a sandy texture (**Figure 2**).

Figure 2. Representative instream conditions at Watercourse A. Photograph facing upstream (north).

4.3 Terrestrial Condition

Four polygons were delineated across the project site, based on canopy type and age (**Figure 3**).

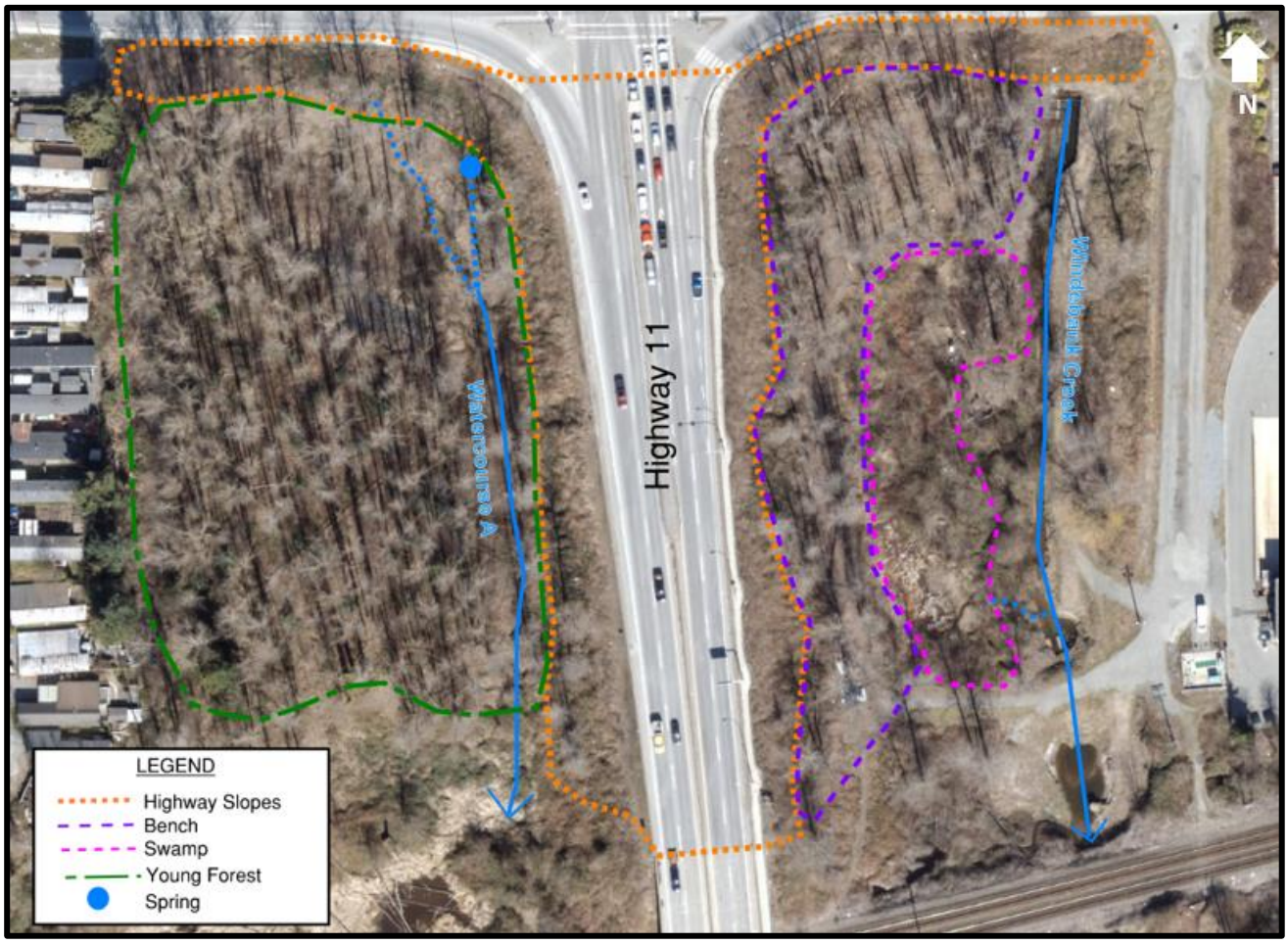

Figure 3. Polygons and drainages within the project location (imagery source: Mission WebMap, 2023).

4.3.1 Highway Slopes

Slopes with a 40-60% gradient slope are present immediately west and east of Highway 11. These areas have been historically cleared of trees, but trees which have become re-established are near the toe of slope. The canopy cover on the slope was < 5%. All trees were < 30 years of age. Tree species present included black cottonwood (*Populus trichocarpa),* willows (*Salix* spp) and red alder (*Alnus rubra*). The shrub layer on the slopes consisted solely of non-native Himalayan blackberry (100% cover). No herbaceous layer was observed. Invasive plant species and weeds were observed upslope adjacent to the highway road edge and included: Canada goldenrod (*Solidago canadensis*), scotch broom (*Cytisus scoparius*), yarrow (*Achillea millefolium*), reed canary grass (*Phalaris arundinacea*), and Himalayan blackberry (*Rubus armeniacus*) (**Figure 4**).

Figure 4. Invasive plant species present upslope adjacent to the highway. Photograph facing south.

4.3.2 Bench

Approximately 27 m downslope from Highway 11, there is a 6 m wide bench. The canopy cover on the bench was 10%. The forest canopy was dominated by black cottonwood trees, with subdominant components of willow, red alder, and bigleaf maple (*Acer macrophyllum*). The flat areas of the bench had no shrub vegetation (**Figure 5**), however sloping areas were covered with 100% Himalayan blackberry. Herbaceous species consisted solely of horsetails (*Equisetum* spp.). Sandy material was observed as the main soil type on the bench.

The bench had multiple areas of human encampment, with trash and other objects throughout the riparian zone. Multiple trees have been vandalized by people, with damage including hacked off bark, metal objects stuck into trees, axe marks, and spray paint. A hydrogeological monitoring well was also observed in this area.

Figure 5. Representative conditions of the slope east of Highway 11 and the bench. Photograph facing north.

4.3.3 Swamp

Immediately below the bench (approximately 35 m from Highway 11) we observed a low-lying area with pooling water and shrub vegetation consistent with a swamp, consisting of cattails (*Typha latifolia*), hardhack (*Spiraea douglasii*), and willows (**Figure 6**). Water pooling in this area was orange-brown in colour with iron precipitate buildup and a top layer of organic sheen, that we attribute to the breakdown of organic compounds within the swamp. This swamp was observed to discharge to the east into Windebank Creek.

Figure 6. View of the area of pooling water present downslope from the bench.

4.3.4 Young Forest

Watercourse A is located within the Young Forest at the base of the slope, approximately 26 m from the edge of the highway median. The tree canopy surrounding Watercourse A was denser at the base of the slope (20% canopy cover) and was dominated by black cottonwood, with a subdominant component of willow and trace amounts of red alder. The shrub layer was more diverse and began at the base of Highway Slope 2. Tall shrubs consisted of salmonberry (*Rubus spectabilis*, 30%), red elderberry (*Sambucus racemose*; 5%), and Indian plum (*Oemleria cerasiformis*; 5%) (**Figure 7**). The short shrub layer was also dominated by salmonberry (50%), but had elements of willow (5%), Indian plum (5%), elderberry (5%), hardhack (5%), and Nootka rose (*Rosa nutkana;* 5%). Herbaceous species present consisted of horsetails, bracken fern (*Pteridium aquilinum*), swordfern (*Polystichum munitum*), and grasses.

Figure 7. Representative conditions of the shrub layer in the Young Forest polygon. Photograph facing south.

4.4 Wildlife and Terrestrial Species at Risk

The project is located in the Coastal Western Hemlock dry maritime (CWHdm) biogeoclimactic subzone. This subzone is characterized by wet, mild climate with complex coniferous forests dominated by Douglas fir, western hemlock, and western redcedar (Meidinger and Pojar, 1991).

No wildlife trees, Bald Eagle (*Haliaeetus leucocephalus*), Great Blue Heron (*Ardea herodias*), or Osprey (*Pandion haliaetus)* nests are mapped within 1 km of the project location (Mission WebMap, 2023).

Polygons for two terrestrial species at Risk overlap the project site (BC CDC, 2023) (**Table 1**).

Table 1. Polygons for terrestrial Species at Risk which overlap the project location.

Species	Polygon Type	Provincial Status	SARA Status
Barn Owl (*Tyto alba*)	Critical Habitat	Blue	1 - Threatened
Dun Skipper (*Euphyes vestris)*	Historical Occurrence	Blue	1 - Threatened

4.4.1 Barn Owl

A Critical Habitat (CH) polygon overlaps the project location. Barn Owl require CH with open areas that support and abundance of small mammal prey and physically protected cavity sites for nesting and roosting. Barn Owl CH

contains three key components: foraging habitats, nesting habitats, and roosting habitats (**Table 2**). The required habitat attributes must be present on the ground for an area to be considered CH.

Table 2. Critical Habitat attributes for Barn Owl (source: ECCC, 2022)

Foraging Critical Habitat Attributes	Nesting and Roosting Critical Habitat Attributes

• Grass fields and/or naturalized meadow habitat
• Foreshore and marshland habitat
• Open fields associated with agriculture (ideally rough pasture, non-intensively managed hayfields)
• Grassy ditches/margins between fields, and along pre-existing roads and railway tracks
• Remnant linear strips (i.e. minimum 3 m wide) or patches of grass and/or green space in semi-urban to urban landscapes
• Availability of small mammal prey
	• Structures with elevated cavities or partially-enclosed spaces that is accessible through an entry hole at least 15 cm in diameter, including but not limited to:
	  • dead and live trees with existing cavities, and
	  • anthropogenic structures that support known nest locations.

No nesting or roosting habitat attributes for Barn Owl were observed at the project location. Trees present adjacent to the highway were young, with no large (> 15 cm) cavities observed. No anthropogenic structures which could support a nest location are visible from the outfall sites.

Some attributes for Barn Owl foraging are present at the project site. A remnant linear strip ranging in width from 2.6 m to 4.3 m is present between the road edge and top-of-bank on the west edge of Highway 11. This area is sparsely vegetated with grasses and invasive weeds. The slope down from the highway is steep and densely vegetated with Himalayan blackberry. On the east side of Highway 11 the linear strip consists of paved asphalt for a pedestrian walkway from the edge of the highway to top-of-slope which would preclude roadside foraging. Flat areas of the bench adjacent to the swamp may provide potential foraging areas.

There are no Orders for protection of Barn Owl CH on non-federal lands.

4.4.2 Dun Skipper

A Historical Element Occurrence polygon for a butterfly, the Dun Skipper, overlaps the project site (BC CDC, 2023). The records indicate that the last observation of Dun Skipper in this location was 1919. There is no mapped CH for Dun Skipper in the project location (iMapBC, 2023).

Dun Skipper can occupy a variety of habitats, including open deciduous woods and areas adjacent to swamps and streams; disturbed sites including roadsides, railway right-of-ways, ditches and powerline right-of-ways; areas with spring floods, natural hot springs or seeps, and wet seasonally flooded stream banks (ECCC, 2017). This species has often been observed utilizing disturbed habitats such as roadside edges, constructed drainages, utility corridors and other habitats wet enough to support sedge communities. However, Dun Skippers require host flowering plants for feeding, resting, and hiding from predators. BC populations may use or require sedges/grasses for overwintering and larval feeding (ECCC, 2017).

The outfall areas are dominated by dense areas of Himalayan blackberry, but the swamp does contain some sedge vegetation.

5.0 Project Implications

Alteration of riparian vegetation can impact bank stability and expose soils, change the amount of shading, and change nutrient inputs into streams. These impacts can ultimately affect fish as they cause changes in habitat structure, water temperature, sediment concentrations, food supply, and contaminant concentrations in streams (DFO, 2010). Intact riparian vegetation can provide natural biofiltration of stormwater and road runoff, and streams adjacent to highway and road corridors are especially vulnerable to increases in deleterious substance deposition directly into the stream when that riparian vegetation is altered or removed.

The Hwy 11 and Hwy 7 Intersection outfall construction and upgrades will affect riparian vegetation, as the new and upgraded outfalls have leads that extend downslope from the asphalt running surface to the base of slope.

Both Windebank Creek and Watercourse A and their riparian zones provide fish habitat, and the installation of new stormwater outfalls and replacements will require some riparian disturbance. Stormwater management features will likely extend into the Highway Slopes polygon and Bench polygon. The potential project impacts will likely be to 'low-quality' riparian habitat of Himalayan blackberry berms, but there is potential for transport of stormwater runoff into Watercourse A.

The amount of remaining riparian habitat has been declining throughout the Lower Mainland, and to limit the amount of riparian habitat loss DFO will require habitat mitigation of at least a ratio of 1.2:1 for projects within the Lower Mainland (V. Dragan, pers. comm.). Potential mitigation areas at the project location or throughout the watershed will need to be identified at the project design stage. It is important to note that mitigation areas must be existing "poor" riparian habitat which could be improved, but due to the already limited amount of riparian habitat throughout the Lower Mainland this option may be difficult to achieve. DFO has previously accepted instream enhancements in lieu of riparian enhancement for mitigation. To reduce the amount of regulatory risk/amount of area to offset at the design stage, it is best to limit the stormwater management structure sizes to only what is required in terms of riparian disturbance and limit the number of mature trees to be removed.

Further, DFO and MoTI have concerns regarding deleterious substances from car tires discharging to downslope fish habitat in the project location. Recent studies (Tian et al., 2020; Hiki et al., 2021; Hiki and Yamamoto, 2022; McIntyre et al., 2022; Greer et al., 2023) have shown that a chemical contained in tire preservative, called 6PPD and its byproduct 6PPD-quinone (6PPD-q), leaches into road runoff, is transported to streams, and causes acute mortality to salmon. Emerging literature has evaluated stormwater BMPs to treat this problem (Navickis-Brasch, Maurer, Hoffman-Ballard, Bator, and Diamond; 2022). While there are still limited studies showing effectiveness of different BMPs, these early studies have shown that dispersion, infiltration, or biofiltration options may be effective in treating road runoff containing 6PPD/6PPD-q. Potential design options for filtering 6PPD and 6PPD-q for highway projects in other jurisdictions have included:

- Stormwater to infiltration to ground, in a flat area where the stormwater cannot drain to watercourses.
- Dispersion of stormwater through many stormwater management structures at top-of-slope, allowing stormwater to infiltrate completely on the slope. Geotechnical investigations would be required for this option.
- Installation of a submerged gravel wetland.

The steep slopes and associated regulatory risks at this project site may preclude some of these options.

Design components resulting in CIAS below top-of-bank will require Change Approval or Notice under the WSA. Stormwater outfalls are an Authorized Change which the province will accept within 45 days of submission. While the Notice process for a project of this type is somewhat routine, the province will require some form of mitigation or

restoration for any riparian areas which are disturbed during the project. We expect that habitat mitigation formulated for submission to DFO will also be acceptable to the province.

6.0 Recommendations

- Once stormwater management design has been conceptualized, complete environmental impact assessment of locations and functions.
- Consider implementing a stormwater treatment chain to prevent discharge of deleterious substances to waters frequented by fish.
- Based on footprint effects identify options and approaches for mitigating those effects. Identify potential areas to complete mitigation at the EIA stage at a minimum ratio of 1.2:1.
- Depending on stormwater outfall design, a Request for Review (RfR) should be submitted to DFO to assess if the project has the potential to cause HADD.
- Submit a WSR Notice for any project which will require works below top-of-bank of a stream.

7.0 Closure

We trust that the information contained in this report meets the needs of the project at this time. Please contact the undersigned should you have any questions or comments

Regards,

ISL ENGINEERING AND LAND SERVICES

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Environmental Scientist

8.0 References

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