



REPORT

MOTI Highway 7 Upgrade, Mission, BC
Overview Environmental Assessment

Submitted to:

BC Ministry of Transportation and Infrastructure

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Study Limitations

WSP Canada Inc. (WSP) has prepared this report for the exclusive use of the BC Ministry of Transportation and Infrastructure (MOTI), its assignees and representatives, and is intended to serve as an Overview Environmental Assessment (OEA) for MOTI's proposed Highway 7, Glasgow Avenue, and Horne Street improvements in Mission, British Columbia (Project). This report is limited to an overview level reconnaissance-based assessment of the potential effects of the proposed Project on aquatic and terrestrial habitats, fish and wildlife. This report is not intended to identify or evaluate potential effects outside of the proposed Study Area.

The inferences concerning the conditions of the Study Area are based on information obtained from a limited review of available literature, and a field reconnaissance conducted by WSP staff on 26 October 2022. In developing this OEA, WSP has relied in good faith on information provided by the MOTI Project design team and several third-party information sources, such as government reports and databases. We accept no responsibility for any deficiency or inaccuracy contained in this report as a result of our reliance on the aforementioned information.

The findings and conclusions documented in this Report have been prepared for specific application to this Project and have been developed in a manner consistent with the level of care normally exercised by environmental professionals currently practicing under similar conditions in the jurisdiction. WSP makes no other warranty, expressed or implied.

Any use that a third party makes of this Report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any suffered, by any third party as a result of decisions made or actions based on this Report.

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1.0 INTRODUCTION

WSP Canada. (WSP) was retained by the BC Ministry of Transportation and Infrastructure (MOTI) for environmental services related to planning for road improvements along two separate intersections located in Mission, BC (the Project) to improve access for large trucks. Specifically, WSP carried out an overview level reconnaissance-based assessment of the potential environmental effects of the proposed Project.

The following Overview Environmental Assessment (OEA) provides details of the proposed Project and associated construction activities, identifies adjacent environmentally sensitive areas, features and wildlife potentially affected by the Project, and outlines strategies for avoiding and/or mitigating adverse effects to be followed by the Contractor retained by MOTI to complete the Project.

1.1 Project Description

Road improvements are currently proposed to improve access for large trucks at the Glasgow Avenue / Highway 7 and Glasgow Avenue / Horne Street intersections in Mission, BC (Figure 1). Road improvements consist of the following:

Glasgow Avenue / Highway 7 Intersection (i.e., northern site)

- Addition of a double yellow line on Highway 7, east of Glasgow Avenue
- Widen the eastbound lane of Highway 7, east of Glasgow Avenue
- Addition of 460 mm wide concrete low barrier (CLB) tied-in to existing CLB on the eastbound lane of Highway 7, east of Glasgow Avenue
- Addition of a 1.3 m paved shoulder and 0.3 m gravel shoulder adjacent to the eastbound lane of Highway 7, east of Glasgow Avenue
- Extract hydro poles on the south side of Highway 7, east of Glasgow Avenue

Glasgow Avenue / Horne Street (i.e., southern site)

- Removal of eastbound channelized right turn from Glasgow Avenue
- Realignment of the southeast curb of the intersection at Glasgow Avenue and Horne Street to accommodate large vehicle turning movements
- Relocate northbound stop bar backwards on Horne Street

The physical boundaries of these two intersections, within which the above described improvements are proposed, is referred to herein as the Project Area or Project footprint. Proposed road improvements are illustrated in Figure 2 and Figure 3.

Figure 1: Project Location

Figure 2: Proposed Road Improvements – Highway 7 and Glasgow Avenue (Northern Site)

Figure 3: Proposed Road Improvements – Glasgow Avenue and Horne Street (Southern Site)

1.2 Project Schedule

The following is understood with respect to the proposed timing of Project works:

- Functional and detailed Project designs will be developed between late fall 2022 to March 2023.
- Construction is expected to occur in 2024 and is dependent on the ability to procure project funding.

2.0 RELEVANT ENVIRONMENTAL LEGISLATION AND APPROVALS

A summary of environmental federal and provincial statutes, guidelines and approval requirements that are applicable to the Project is provided in Table 1.

Table 1: Federal, Provincial, and Municipal Legislation Applicable to the Project

Applicable Legislation	Government Agency	Permits, Approvals, and Authorizations	Applicability	Description / Relevance to Project
Federal				
<i>Fisheries Act</i> Section 34.4[1], 35[1], 36[3], 38[5]	Fisheries and Oceans Canada (DFO) – The Fish and Fish Habitat Protection Program	The new <i>Fisheries Act</i> came into effect on 28 August 2019 (Government of Canada 1985). Prohibits harmful alteration, disruption or destruction of fish habitat (HADD), and protects against the death of fish, other than by fishing. Prohibits the deposit of a deleterious substance of any type in water frequented by fish or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water. Includes a duty to notify and take corrective action in the event of a deposit of a deleterious substance into fish habitat.	Applicable	Although no fish or fish habitat was identified within the Project Area it is important for the Contractor to understand the worksite is located in close proximity to Mandale Slough, and that DFO's standards and best practices for works and measures to protect fish and fish habitat, including erosion and sediment control and deposition into streams will apply. Additionally, the Fraser River is located within the Study Area (Section 3.1) and is potentially connected to the Project Area through open storm drains, requiring best practices for works and measures to protect fish and fish habitat, including erosion and sediment control. No permits will be required under the <i>Fisheries Act</i> .
		Request for Authorization	Not applicable	
<i>Species At Risk Act</i> (SARA) - Schedule 1 Sections 32 (1), 33, 58(1), and 73	Environment and Climate Change Canada (ECCC) – Canadian Wildlife Service (CWS) or DFO	SARA prohibits harm to individuals and damage to residences or critical habitat for species listed as endangered, threatened or extirpated under SARA Schedule 1 on federal property. Permit under Section 73 of SARA (Government of Canada 2002)	Potentially applicable	Project locations are not on federal lands or within streams with designated critical habitat for aquatic species. On non-federal lands, a SARA Section 73 permit would only be required if a bird species listed under SARA or the <i>Migratory Bird Convention Act</i> (MBCA) has critical habitat parcels designated within project disturbance footprint or there is the potential to affect the nest of an MBCA and SARA-listed bird species. Alternatively, a SARA Section 73 permit would apply if the listed species is an aquatic species. Due diligence requires assessment and measures to protect species at risk and their habitat. Species at risk with potential to occur within the Study Area are identified in Section 4.3.2.1.

Applicable Legislation	Government Agency	Permits, Approvals, and Authorizations	Applicability	Description / Relevance to Project
<i>Migratory Birds Convention Act</i> 1994 (MBCA) and <i>Migratory Birds Regulation</i> 2022 (MBR) Sections 5.1[1]	ECCC - CWS	Damage or Danger Migratory Bird Permit Disturbance or destruction of migratory birds, their nests or eggs is prohibited (Government of Canada 1994). Prohibits the deposit of a substance that is harmful to migratory birds.	Potentially applicable	Permit only required if MBCA listed bird species nest is removed while actively in use. Tree clearing to be conducted outside of the breeding bird window avoids this. Due diligence measures to reduce the risk of contravention of the MBCA include conducting pre-clearing nest surveys if vegetation removal, ground-disturbing activities or activities affecting bird nests on structures will occur during the breeding bird window and enacting no-disturbance buffers around active nests. A site reconnaissance survey was conducted to evaluate the potential for MBCA-listed bird species to nest in the surrounding area. Sections 4.0 details the results of this survey. Note that this permit application does not cover bird species that are also listed under SARA, in which case additional SARA Section 73 permits may be required.
<i>Transportation of Dangerous Goods Act, 1992</i>	Transport Canada	Regulates the transport of dangerous goods in Canada, whether by rail, road, air, or water, and establishes safety standards and documentation to be complied with such that all containers, packages, and means of transport are clearly marked with prescribed safety marks. The Act also establishes requirements regarding emergency response assistance plans.	Applicable	There may be dangerous goods that need to be transported as part of the proposed Project works. Hazardous materials associated with the Project will be transported in accordance with this Act.
Provincial				
<i>Wildlife Act, 1996</i> Sections 34, 75	BC Ministry of Environment and Climate Change Strategy (MENV)	Protects wildlife and wildlife habitat. Section 34 prohibits possessing, taking or destroying: (i) A bird or its egg. (ii) The nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl. (iii) The nest of a bird not mentioned in (ii), when the nest is occupied by a bird or its egg unless authorized under permit.	Potentially applicable	A permit under the <i>Wildlife Act</i> is unlikely to be required; however, due diligence requires implementation of best management practices to protect wildlife and their residences. Many bird nests have recommended buffer zones to prevent disturbance during the nesting period. A site reconnaissance survey conducted on 26 October 2022 evaluated the potential for bird

Applicable Legislation	Government Agency	Permits, Approvals, and Authorizations	Applicability	Description / Relevance to Project
		<p>Section 75 describes the requirement to report accidental killing of wildlife:</p> <p>(1) A person who kills or wounds wildlife, other than prescribed wildlife, either by accident or for the protection of life or property, must promptly report to an officer.</p> <p>(a) The killing or wounding.</p> <p>(b) The location of the wildlife.</p> <p>(2) A person who fails to report as required under subsection (1) commits an offence.</p> <p>(Government of BC 1996a).</p>		species to nest in the surrounding area. Pre-works surveys by the Contractor's Environmental Monitor will still be required to check for active bird nests in the immediate work area prior to initiation of work.
<i>Environmental Management Act, 2003</i> (Spill Reporting Regulation)	MENV	Regulates the discharge or emission of effluent, waste or contaminants and requires spill reporting for certain substances. Prohibits causing pollution (Government of BC 2003).	Potentially applicable	No permits or approvals are required; however, there is a requirement to report spills. Spill Reporting Regulation applies to spills of a listed substance, other than natural gas, if the spill enters, or is likely to enter, a body of water, or the quantity of the substance spilled is or is likely to be equal to or greater than the listed quantity for the listed substance.
<i>Environmental Management Act, 2003</i> (Contaminated Sites Regulation)	MENV	Regulates contaminated sites including the relocation of contaminated soil (Government of BC 2003).	Potentially applicable	A Contaminated Sites Relocation Agreement may be required for the relocation of soils for offsite disposal.
<i>Environmental Management Act, 2003</i> (Hazardous Waste Regulation)	MENV	Hazardous wastes are wastes that could harm human health or the environment if not properly handled and disposed of. The Hazardous Waste Regulation includes the identification, handling, transport, disposal and treatment of hazardous wastes (Government of BC 2003).	Potentially applicable	All reasonable efforts should be made to reduce, reuse and/or recycle to reduce the amount of material being disposed of. All wastes should be disposed of in compliance with applicable legislation such as the BC Environmental Management Act (Government of BC 2003). See Section 6.8 for more details.

Applicable Legislation	Government Agency	Permits, Approvals, and Authorizations	Applicability	Description / Relevance to Project
<i>Transportation of Dangerous Goods Act</i>	Ministry of Transportation and Infrastructure (MOTI)	Regulates the transport of all dangerous goods in British Columbia on provincial highways and ferry routes. The Act establishes safety standards and documentation to be complied with such that all containers, packages, and means of transport are clearly marked with prescribed safety marks (Government of Canada 1992).	Applicable	There may be dangerous goods that need to be transported as part of the pumping test program. General provisions – no authorization issued. Any hazardous materials associated with the Project will require be transported with a manifest.
Municipal				
Good Neighbour Bylaw 5524-2015	City of Mission	This bylaw outlines the regulatory requirements associated with the generation of noise from works involving construction, erection, reconstruction, alteration, repair or demolition of any building, structure or thing; or excavation or fill of land in any manner; or loading, excavating, transporting or removal of soil from land within the City of Mission.	Applicable	Project work should be undertaken during daylight hours and in compliance with the City of Mission Good Neighbour Bylaw (5524-2015; City of Mission 2015a). This includes working only between the hours of 07:00 to 20:00 hours from Monday to Saturday, and 09:00 to 17:00 on Sunday and statutory holidays to reduce disturbance to local residents.
Soil Deposit Bylaw 5506-2015	City of Mission	This bylaw regulates the deposit of soil or other material within the District of Mission (City of Mission 2015b). Key prohibitions include that no person shall: (a) cause or permit the deposit of soil on land without a valid permit; (b) cause or permit the deposit of soil on land contrary to the terms or conditions of a permit, unless authorized by the Engineer (i.e., Director of Engineering and Public Works for the District of Mission) in writing; (c) cause or permit the deposit of other material on land unless done in compliance with the <i>Environmental Management Act</i> ;	Potentially applicable	Project work may require offsite disposal of soil. A soil disposal permit will be required the Contractor decides to dispose / deposit soil on any lands within the District of Mission.
Soil Removal Bylaw 3088-1997	District of Mission	This bylaw (City of Mission 1997) regulates the removal of soil within the District of Mission. No person shall remove or cause to be removed any soil from any parcel of land, unless he or she is the holder of a valid and subsisting permit for such removal, provided that no permit shall be required for: (ii) the removal of soil required for or incidental to the construction, installation or maintenance of utility works within a dedicated road or road statutory right-of-way;	Potentially applicable	It is not known at this time whether the proposed Project works would involve the removal of soil. Moreover, if it is determined that soil removal will be required, it is unclear whether the City of Mission would require this permit, or if the works described herein would classify as utility works. Should it be determined that soil removal is required, then the Contractor should enquire with the City of Mission whether a soil removal permit is required.

3.0 OVERVIEW ENVIRONMENTAL ASSESSMENT METHODS

3.1 Study Area

Construction activities associated with the Project are proposed for two separate road intersection within Mission, BC. These two areas are collectively referred to herein as the Project Area or Project footprint. A Study Area was also defined to capture a broader area and ecological context for the purpose of this OEA. The Study Area is defined as the Project footprint (a.k.a Project Area) plus a 1 km radial buffer applied using the Glasgow Avenue / Horne Street intersection as the center point (Figure 1).

3.2 Desktop Review

Information and data used in this OEA was collected through a review of publicly available databases and search engines, including local, regional, and federal government reports, websites, and databases. The information review focused on the following resources:

- Province of BC Habitat Wizard (Government of BC 2022a)
- Province of BC iMap BC (Government of BC 2022b)
- Invasive Alien Plant Program (IAPP; Government of BC 2022c)
- BC Ministry of Environment Species and Ecosystem Explorer (BC CDC 2022)
- Federal Species at Risk Act Public Registry (Government of Canada 2022)
- Wildlife Tree Stewardship (WiTS 2018)
- Great Blue Heron Nesting Atlas (GBHMT 2018)
- City of Mission WebMap (City of Mission 2022)

3.2.1 Species at Risk

Species at risk information in BC is available from both provincial and federal sources. Provincially, data on known species at risk occurrences (referred to as element occurrences) are available through the BC Conservation Data Centre (CDC). The BC CDC data summarizes both sensitive element occurrence records and non-sensitive element occurrence records for species at risk sightings. Sensitive element occurrence records (i.e., masked records) are species at risk sightings that have no information provided on the species recorded in the public database and masks the precise locations of the species at risk sighting in order to protect the species or for proprietary reasons. For example, known snake hibernacula are preferentially kept hidden from the public to protect these sensitive habitat features. Additional information can be requested from the BC CDC for masked occurrence records if required for a project and by signing a confidentiality agreement. Non-sensitive occurrence records are still species at risk sightings but are for species that have less sensitivity from public harm (e.g., amphibian sightings).

The BC CDC assigns a provincial rank or listing of red, blue, or yellow to a species based on its status within BC. Species on the provincial Red List are considered endangered or threatened in BC. Species on the Blue List are considered vulnerable (Special Concern) in BC. Species on the Yellow List are apparently secure and not at risk of extinction (BC CDC 2022). The BC CDC also assigns these rankings to plant communities.

Federal species ranking is conducted by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), established under Section 14 of the *Species at Risk Act* (SARA). Schedule 1 of SARA provides the official list of species at risk. Under the COSEWIC system, species are ranked as Extinct, Extirpated, Endangered, Threatened, Special Concern, Data Deficient, or Not at Risk. A definition of each federal and provincial conservation status for species at risk that appears in this report is provided in Table 2.

Table 2: Provincial and Federal Conservation Status Definitions

Agency	Status	Definition
COSEWIC and SARA (Federal)	Endangered (E)	A species facing imminent extirpation (no longer exists in Canada) or extinction (no longer exists).
	Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
	Special Concern (SC)	A species that is particularly sensitive to human activities or natural events, but is not endangered or threatened.
	Not at Risk (NAR)	A species that has been evaluated and found to be not at risk.
	Data Deficient (DD)	A species for which there is insufficient scientific information to support status designation.
BC CDC (Provincial)	Red	Any indigenous species, subspecies, or plant community that is extirpated, endangered, or threatened in BC.
	Blue	Any indigenous species, subspecies, or community considered to be of special concern in BC. Blue-listed elements are at risk, but are not extirpated, endangered, or threatened.
	Yellow	Any indigenous species, subspecies, or ecological community considered to be secure in BC.
	Exotic, Accidental	Species that are exotic (non-native) or accidental are not assigned a status rank and are not placed on the red, blue or yellow lists.

Source: BC CDC 2022.

A search for publicly available element occurrences within the Study Area was conducted using data from the BC CDC, iMapBC and Habitat Wizard (BC CDC 2022, Government of BC 2022a, Government of BC 2022b). For the scope of this OEA report, due to the highly disturbed and anthropogenic nature of the Project footprint, a likelihood of occurrence was not assigned to other species at risk lacking publicly available element occurrence records.

Additional consideration was made by the Qualified Professionals (QPs) responsible for this OEA in determining additional species at risk with the potential to occur within the Study Area and with the potential to be affected by Project activities.

3.2.2 Invasive Species

Invasives are species that are not native to BC or are outside their natural distribution within the province and pose significant threats to native fauna, plants, and ecological communities. Characteristics of invasive species include rapid spread, competitive advantages, and the ability to outcompete other species. Invasive species have negative impacts on the environment, people, and economy (MENV 2022a). Management actions for invasive species are determined at provincial and regional scales.

The BC *Weed Control Act* (WCA; Government of BC 1996b) requires land occupants to control noxious weeds defined as plant species listed in the BC Weed Control Regulation (Government of BC 2011). Noxious weeds are defined under Schedule A of the BC Weed Control Regulation and are applicable across the province.

The BC *Wildlife Act* – Controlled Alien Species Regulation (Government of BC 1996a) controls the possession, breeding, shipping and releasing of alien animals (i.e., that are not native to BC) that pose a risk to the health or safety of people or the environment. Under Sections 6.4 and 6.5 of the *Wildlife Act*, the Ministry of Environment has authority to designate species as controlled alien species and to regulate these species.

The Invasive Species Council of BC (ISCBC) is a non-profit society and registered charity that aims to prevent the spread of invasive species through education and responsible practices. They follow the same rank system as the BC *Weed Control Act* and Weed Control Regulation for invasive plants.

The BC Inter-Ministry Invasive Species Working Group (IMISWG) provides policy and coordinates provincial initiatives for invasive species programs in BC. IMISWG identifies and ranks provincial priority invasive species - which includes 89 plants species and 92 wildlife species - into five categories based on a risk assessment framework (BC IMISWG 2021):

- Prevent - a high risk species not yet established in BC.
- Provincial early detection and rapid response (EDRR) - a high risk species that is new to BC. The primary goal is eradication of the species.
- Provincial containment - a high risk species with limited distribution in BC. The goal is to prevent the spread of the species.
- Regional containment/control - a high risk species and well established or medium risk with potential to spread. The primary goal is to contain infested areas and control any occurrences of this species outside of these areas.
- Management – a widespread species that may be of concern under certain circumstances (e.g., on conservation land). The primary goal is to reduce the impact of this species, where resources are available.

At the regional scale, the Fraser Valley Invasive Species Society (FVISS) has developed a priority rating system from highest priority to lower priority: prevent, eradicate, contain, and control for 120 invasive plants occurring in the region (FVISS 2022).

For the purpose of this report, an invasive plant includes species regulated under the BC *Weed Control Act* and Weed Control Regulations (Government of BC 1996b, 2011), Inter-Ministry Invasive Species Working Group (IMISWG) provincial priority species (BC IMISWG 2021), priority species rated by FVISS (FVISS 2022), or species tracked by the Invasive Alien Plant Program (IAPP; MENV 2022b). IAPP is a tracking program for invasive plants and treatment programs within the province of BC.

3.3 Field Reconnaissance

A field reconnaissance survey was conducted on 26 October 2022 by a suitably trained and experienced environmental professional under supervision of a Registered Professional Biologist. The objectives of the site reconnaissance survey were to verify and supplement information gathered during the desktop review and to search for terrestrial and aquatic resources within the Study Area that could potentially be affected by Project activities. Summary photos from the reconnaissance survey are provided in Appendix A.

4.0 RESULTS AND DISCUSSION

4.1 General Description

The Project footprint within the Highway 7 / Glasgow Avenue intersection (northern site) extends eastward from the intersection, along Highway 7 and towards Catherwood Street by approximately 180 m (Figure 2). A mixture of commercial and residential properties is located on the north side of Highway 7. Vegetation north of Highway 7 consists largely of ornamental species, landscaped lawns, with few mature trees. The south side of Highway 7 is less developed, likely due to the presence of a steep bank between Highway 7 and North Railway Avenue. South of Highway 7A, a stand of mature trees was present on both sides of the Glasgow Avenue intersection. Approximately 50 m east of the intersection, the stand of mature trees transitioned into disturbed roadside grassy habitat with high a high abundance of invasive plant species.

Approximately 200 m to the southwest of the Highway 7 / Glasgow Avenue intersection, across the Glasgow Avenue Bridge, a separate component of the Project footprint remains confined to the Glasgow Avenue / Horne Street intersection (southern site; Figure 3). Vegetation within this intersection is heavily disturbed and consists largely of small ornamental tree and shrubs.

Representative photographs of both intersections are provided in Appendix A.

4.2 Ecological Context

British Columbia has been classified into biogeoclimatic zones based on vegetation, geological and climatic conditions, and uses local climate and landform conditions to reflect the distribution and presence of specific plant and animal communities and ecosystems (BC Forest Service 2007). The Study Area is situated within the dry maritime subzone of the Coastal Western Hemlock Biogeoclimatic Zone (CWHdm). The CWHdm occurs at low elevations (less than 650 m) on the mainland of BC and immediately adjacent islands. The elevation and geography of the subzone results in warm, relatively dry summers and moist, mild winters with little snow. Vegetation is characterized by Douglas-fir (*Pseudotsuga menziesii*), Western red cedar (*Thuja plicata*) and Western hemlock (*Tsuga heterophylla*), as well as salal (*Gaultheria shallon*), red huckleberry (*Vaccinium parvifolium*), and numerous mosses (e.g., Oregon beaked moss [*Kindbergia oregana*], Lanky moss [*Rhytidiadelphus loreus*], and step moss [*Hylocomium splendens*]; Green and Klinka 1994).

4.3 Terrestrial Habitat

4.3.1 Vegetation

Given the timing of the site reconnaissance survey and nature of the works (which will be primarily occurring within disturbed roadway shoulders), a detailed vegetation survey was not warranted or conducted. The vegetation species observed during the site reconnaissance are listed in Table 3. Most of the area in both the northern and southern sites has been previously disturbed and is consistently maintained (i.e., mowed, ornamental plantings) adjacent to the highway. The northern site is more densely vegetated than the southern site and contains more native vegetation while vegetation within the southern site consists largely of ornamental plantings.

At the northern site (Highway 7 / Glasgow Avenue intersection), vegetation is more densely populated than the southern site and is dominated by shrubs and young trees, which form a thick vegetated area on the southern side of Highway 7. On the southeast corner of this intersection, young trees include Douglas-fir (*Pseudotsuga menziesii*), black cottonwood (*Populus trichocarpa*), mountain ash (*Sorbus scopulina*), and red maple (*Acer rubrum* var. *rubrum*). The low lying vegetations contains native hardhack (*Spiraea douglasii*) and dull Oregon grape (*Mahonia nervosa*), and patches of invasive Himalayan blackberry (*Rubus armeniacus*), English holly (*Ilex aquifolium*) and English ivy (*Hedera helix*). The southwestern corner of this intersection had a similar vegetation species composition, although this vegetated area was smaller as it was restricted by a residential building to the west along Highway 7. Additional vegetation on the southwestern side of the intersection included a single Garry oak (*Quercus garryana*), red alder (*Alnus rubra*), a bigleaf maple (*A. macrophyllum*), and bracken ferns (*Pteridium* spp.).

At the southern site (Glasgow Avenue / Horne Street intersection), the landscape is largely disturbed, and vegetation consists mostly of ornamental plantings and with little to no natural vegetation. Vegetation on the northern corner of the intersection, adjacent to the Mission Station Grill, consists of predominantly of several ornamental shrubs including young cedar hedges / arborvitae (*Thuja* spp.), winged euonymus (*Euonymus alatus*), and a fig tree (*Ficus* sp.).

To the east of the intersection, along the northern shoulder of Horne Street, vegetation was limited to small clusters of plantings of individual sweet gum trees (*Liquidambar* spp.) and low-lying ornamental vegetation (e.g., common lavender [*Lavandula angustifolia*]). The diameter at breast height (DBH) of the trees was measured and ranged between 15 to 30 cm. Approximately 160 m south of the intersection, a large grassy area (roughly 300 m x 50 m) was documented along the south side of Horne Street. A list of plant species observed during the reconnaissance survey conducted on 26 October 2022 is provided in Table 3.

Table 3: Plant Species Observed during the 26 October 2022 Reconnaissance Survey

Common Name	Scientific Name	Group
Bigleaf Maple	<i>Acer macrophyllum</i>	Tree
Red Maple	<i>Acer rubrum</i> var. <i>rubrum</i>	Tree
Red Alder	<i>Alnus rubra</i>	Tree
Fig	<i>Ficus</i> spp.	Tree
Sweet Gum	<i>Liquidambar</i> spp.	Tree
Black Cottonwood	<i>Populus trichocarpa</i>	Tree
Douglas Fir	<i>Pseudotsuga menziesii</i>	Tree
Garry Oak	<i>Quercus garryana</i>	Tree
Mountain Ash	<i>Sorbus scopulina</i>	Tree
Winged Euonymus	<i>Euonymus alatus</i>	Shrub
Common/English Holly	<i>Ilex aquifolium</i>	Shrub
Juniper	<i>Juniperus</i> spp.	Shrub
Dull Oregon Grape	<i>Mahonia nervosa</i>	Shrub
Bracken Fern	<i>Pteridium</i> spp.	Shrub
Hardhack (Rose Spirea)	<i>Spiraea douglasii</i>	Shrub

Common Name	Scientific Name	Group
Cedar Hedge / arborvitae	<i>Thuja</i> spp.	Shrub
Thistle	<i>Cirsium</i> spp.	Herb
Common Lavender	<i>Lavandula angustifolia</i>	Herb
Dock	<i>Rumex</i> spp.	Herb
Nightshade	<i>Solanum</i> spp.	Herb
Common Tansy	<i>Tanacetum vulgare</i>	Herb
Field Bindweed	<i>Convolvulus arvensis</i>	Vine
English Ivy	<i>Hedera helix</i>	Vine
Himalayan Blackberry	<i>Rubus armeniacus</i>	Vine

4.3.1.1 Invasive Plant Species

A query of the provincial Invasive Alien Plant Program (IAPP) data found multiple instances of Japanese knotweed (*Reynoutria japonica*) within 200 m of the Project Area to the north and west of the Highway 7 / Glasgow Avenue intersection from 2014 to 2015 and Himalayan blackberry (*Rubus armeniacus*) and policeman's helmet / Himalayan balsam (*Impatiens glandulifera*) were recorded 250 m northwest of the northern site in 2010. Scotch broom (*Cytisus scoparius*), recorded in 2008, and Japanese knotweed, recorded in 2014, were observed approximately 200 m southwest of the Glasgow-Horne intersection (Government of BC 2022b, 2022c). Invasive plant species with IAPP records within the Study Area along with their status under the provincial *Weed Control Act* and Fraser Valley Invasive Species Society (FVISS) priority ranking are listed in Table 4. Additional query searches for invasive vegetation within the Study Area is presented in Appendix B – Table 1. During the field reconnaissance, dense patches of invasive plant species, particularly Himalayan blackberry and English ivy, were observed throughout the Project Area.

Table 4: Invasive Plant Species Reported within the Study Area (Government of BC 2022b, 2022c)

IAPP Code	Common Name	Scientific	Status	
			BC <i>Weed Control Act</i>	FVISS Priority Ranking
BD	Butterfly bush	<i>Buddleja davidii</i>	N/A	Contain
BT	Bull thistle	<i>Cirsium vulgare</i>	N/A	N/A
BU	Burdock species	<i>Arctium minus</i>	N/A	Control
CP	Common periwinkle	<i>Vinca minor</i>	N/A	Control
CT	Canada thistle	<i>Cirsium arvense</i>	Provincial	Control
EI	English ivy	<i>Hedera helix</i>	N/A	Control
HI	Himalayan blackberry	<i>Rubus armeniacus</i>	N/A	Control
HO	English holly	<i>Ilex aquifolium</i>	N/A	Control
IM	Policeman's helmet / Himalayan balsam	<i>Impatiens glandulifera</i>	N/A	Control
JK	Japanese knotweed	<i>Fallopia japonica</i>	Provincial	Contain
MU	Mullein	<i>Verbascum thapsus</i>	N/A	N/A

IAPP Code	Common Name	Scientific	Status	
			BC Weed Control Act	FVISS Priority Ranking
PA	Polar hawkweed	<i>Hieracium atratum</i>	N/A	N/A
QA	Queen Anne's lace / wild carrot	<i>Daucus carota</i>	N/A	N/A
SB	Scotch broom	<i>Cytisus scoparius</i>	N/A	Contain
SL	Daphne / spurge laurel	<i>Daphne laureola</i>	N/A	Contain
TC	Common tansy	<i>Tanacetum vulgare</i>	N/A	Control
TR	Tansy ragwort	<i>Senecio jacobaea</i>	Provincial	Contain
YA	Yellow archangel (lamium)	<i>Lamium galeobdolon</i>	N/A	Control

4.3.1.2 Plant Species at Risk

Based on CDC records, there are no observation records for ecological communities or plant species at risk within the Study Area (Government of BC 2022b) and none were observed during the 26 October 2022 reconnaissance survey. The full query results for the Mission municipality from the BC CDC records for plant and ecological communities at risk are presented in Appendix B – Table 2 and Table 3.

4.3.2 Wildlife

Wildlife habitat within the Project footprint is generally of poor quality given that this area is highly developed with commercial and residential properties and due to the high amount of existing vehicle traffic that may contribute to increased vehicle-wildlife interactions and elevated noise levels. However, some species of birds and mammals may nest or roost in the trees located adjacent to both intersections as well as on the underside of the Glasgow Avenue Bridge that connects the two intersections.

Bird species use a variety of habitat types depending on life requisites such as nesting sites and food sources. A variety of passerines (songbirds) may forage on seeds and fruit produced by trees and shrubs within the Project Area. Forest and shrub habitat located directly adjacent to the Project Area are expected to provide nesting habitat for a variety of birds including passerines, owls, and woodpeckers. Additionally, the 300 m x 50 m grassy area located approximately 150m to the southeast of the Glasgow-Horne intersection may provide a foraging habitat for owls. A proposed critical habitat polygon for the western population of barn owl (*Tyto alba*) was found during the desktop review for the Study Area (Government of BC 2022b), approximately 70 m west of the Project Area.

A search of the *Wildlife Tree Stewardship (WiTS) Atlas* (WiTS 2018) and the *Great Blue Heron Nesting Atlas* (GBHMT 2018) did not return any bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*) or great blue heron (*Ardea herodias fannini*) nests within or immediately adjacent to the Study Area. Four provincially yellow-listed bird species were observed during the field reconnaissance, including bald eagle (*Haliaeetus leucocephalus*), glaucous-winged gull (*Larus glaucescens*), song sparrow (*Melospiza melodia*) and American Crow (*Corvus brachyrhynchos*), as well as one blue-listed species (great blue heron; Table 5).

Table 5: Bird Species Observed during the 26 October 2022 Reconnaissance Survey

Common Name	Scientific Name	BC List	COSEWIC	SARA
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Yellow	Not Assessed	-
European Starling	<i>Sturnus vulgaris</i>	Exotic	-	-
Glaucous-winged Gull	<i>Larus glaucescens</i>	Yellow	-	-
Great Blue Heron, <i>fannini</i> subspecies	<i>Ardea herodias fannini</i>	Blue	Special Concern	Schedule 1 Special Concern
Song Sparrow	<i>Melospiza melodia</i>	Yellow	-	-
Rock Dove	<i>Columba livia</i>	Exotic	-	-
American Crow	<i>Corvus brachyrhynchos</i>	Yellow	-	-

Note: See Table 2 for provincial and federal conservation status definitions.

Source: Bird Studies Canada 2012; Government of BC 2022a

Bird species that nest on or under anthropogenic structures like bridges include barn swallow (*Hirundo rustica*) and cliff swallow (*Petrochelidon pyrrhonota*). One inactive barn swallow cup nest was observed during the site reconnaissance survey under the Glasgow Avenue Bridge. Bats are also known to roost on the underside of bridge structures. No signs of bats (e.g., feces or urine) were observed along the underside of bridge during the field reconnaissance survey.

There exists a potential for other wildlife species at risk to occur within the Study Area. The long-toed salamander (*Ambystoma macrodactylum*; BC yellow-listed; Government of BC 2022b) has been recorded in the CDC database approximately 690 m west of the Glasgow Avenue / Horne Street intersection. Given that the last observation was in 1977, no stagnant or slow-moving water was noted within the Project Area, and the upland habitat with trees is quite fragmented, neither the long-toed salamander or other amphibian species are anticipated to be present within the in the forested area adjacent to the Project Area.

The Study Area is also expected to support a variety of other mammal species typically associated with urban areas. Small mammals, such as rodents, and mobile and opportunistic species such as deer and carnivores (e.g., coyote [*Canis latrans*]) could use the riparian habitat of Mandale Slough for foraging, shelter, and movement corridors. Evidence of lagomorphs and/or rodents were observed during the field reconnaissance adjacent to the bridge in the form of lagomorph fecal matter and rodent pesticides.

4.3.2.1 Wildlife Species at Risk

During the field reconnaissance, a barn swallow (*Hirundo rustica*; COSEWIC Special Concern; SARA Schedule 1 Threatened) cup nest was observed on the underside of the Glasgow Avenue Bridge. No barn swallows were observed, however late October is not the ideal time to survey for swallows in BC.

Based on CDC records, there are observations and proposed critical habitat for barn owl (*Tyto alba*, BC blue-listed; COSEWIC Threatened; SARA Schedule 1 Threatened) adjacent to the Study Area. Barn owls forage in a variety of open habitats, including fields, grasslands, meadows, areas around human habitation such as fence-lines and roadsides. Barn owls nest in a variety of natural and human created cavities including barns, nest boxes, platforms within open buildings, attics, and platforms underneath bridges (BC CDC 2022). Grassy areas within the Study Area may provide limited foraging habitat for barn owls. Buildings near the Project footprint and the Glasgow Avenue Bridge may provide limited nesting habitat for barn owls.

Other nearby critical habitat include habitat for the Oregon forest snail (*Allogona townsendiana*; BC red-listed; COSEWIC Endangered; SARA Schedule 1 Endangered); this habitat is located 1.4 km to the east of the Project Area and most recent publicly available element occurrences of Oregon forest snail were from 2017. Oregon forest snail typically occupy mixed-wood and deciduous forests and mating has been tied to close proximity to coarse woody debris and presence of stinging nettle, *Urtica dioica* (COSEWIC, 2002, Steensma et al., 2009). As such, despite the presence of mature deciduous trees adjacent to the Highway 7 / Glasgow intersection, the lack of stinging nettle suggests unlikely habitation of the forested area adjacent to the Project Area by the Oregon forest snails.

Dun skipper (*Euphyes vestris*; BC blue-listed; COSEWIC Threatened; SARA Schedule 1 Threatened) habitat was also noted for the Study Area during the desktop review; however, the area was masked in the CDC database so the exact location record is unknown. The dun skipper record was last updated on 2012 and the last official observation in the database was recorded in 1919 (BC CDC 2022). Dun skippers are found in habitats containing ditches and as no ditches were observed within or immediately adjacent to the Project footprint, it is unlikely that the species will be impacted by the Project works.

Bat species, including little brown myotis (*Myotis lucifugus*; BC blue-listed; COSEWIC Endangered; SARA Schedule 1 Endangered) are known to roost in anthropogenic structures like bridges and barns (ECCC 2018) and are known to create maternity roosts in these structures. Little brown myotis roost in crevices and cavities in trees, caves, and structures like buildings, which remain warmer than ambient temperature at night (Barclay 1982; Kalcounis and Hecker 1996). Little brown myotis may potentially use the Glasgow Avenue Bridge for roosting. There are presently no provincially reported mapped occurrences of little brown myotis are present within 5 km of the Project footprint. However, that may be more an indication of the lack of reported survey effort than actual absence.

Additionally, a Pacific great blue heron (*Ardea Herodias fannini*; BC blue-listed; COSEWIC Special Concern; SARA Schedule 1 Special Concern) was observed perched on a pile within the Fraser River south in the Study Area near Jack Poole Harbourside Park. The Project footprint does not contain suitable wetland, stream, pond, shore, or riparian habitat for foraging for great blue herons. The mature trees adjacent to the Project footprint at the northern site may provide suitable nesting habitat for great blue herons. No heron nests or other stick nests were observed during the field reconnaissance survey.

Table 6: Wildlife Species at Risk Observed or with Element Occurrences within the Study Area

Scientific Name	Common Name	BC List	COSEWIC	SARA
Barn Owl	<i>Tyto alba</i>	Blue	Threatened	1-Threatened
Barn Swallow	<i>Hirundo rustica</i>	Yellow	Special Concern	1-Threatened
Great blue heron, <i>fannini</i> subspecies	<i>Ardea herodias fannini</i>	Blue	Special Concern	1-Special Concern
Dun Skipper	<i>Euphyes vestris</i>	Blue	Threatened	1-Threatened
Oregon forest snail	<i>Allogona townsendiana</i>	Red	Endangered	1-Endangered

Note: See Table 2 for provincial and federal conservation status definitions.

Source: BC CDC 2022; Government of BC 2022b

A full list of wildlife species at risk identified during the desktop review to occur within the Mission municipal boundaries is presented in Appendix B – Table 4.

4.4 Aquatic Habitat

There are three watercourses present within the Study Area: Mandale Slough (a.k.a., Mandale Creek/Lane Creek, WSC: 100-053200), Brook Creek (WSC: 100-053200-83000), and the Fraser River (WSC: 100)(Government of BC. 2022b).

4.4.1 Mandale Slough and Brook Creek

Mandale Slough is a tributary of the Fraser River within the Study Area. It is a year-round salmon-bearing system and is reported to contain Chinook (*Oncorhynchus tshawytscha*), Coho (*O. kisutch*), Chum (*O. keta*), and Sockeye salmon (*O. nerka*), as well as Rainbow Trout (*O. mykiss*), Cutthroat Trout (*O. clarkii*), and Coastal Cutthroat Trout (*O. clarkii*; Government of BC 2022a). Other fish species that have been recently reported to occur in this system, not specifically in the Study Area, include Black Catfish (*Ameiurus melas*), Brassy Minnow (*Hybognathus hankinsoni*), Carp (*Cyprinus carpio*), Largescale Sucker (*Catostomus macrocheilus*), Northern Pikeminnow (*Ptychocheilus oregonensis*), Peamouth Chub (*Mylocheilus caurinus*), Prickly Sculpin (*Cottus asper*), Pumpkinseed (*Lepomis gibbosus*), Redside Shiner (*Richardsonius balteatus*), Slimey Sculpin (*C. cognatus*), and Threespine Stickleback (*Gasterosteus aculeatus*; Government of BC 2022a).

Brook Creek drains into Mandale Slough just south of 7th Avenue and is also located in the Study Area. While there are substantially fewer records for Brook Creek, rainbow trout were reported to be present during an observation in 1999 (Government of BC 2022a)

During the site reconnaissance survey, Mandale Slough and Brook Creek were determined to be at least 300 m and 500 m away from the Project footprint, respectively, and largely upslope of the Project works. As such, neither watercourse is anticipated to be impacted by proposed Project works.

4.4.2 Fraser River

The Project footprint is located approximately 350 m from the shoreline of the Fraser River (WSC: 100). The Fraser River is a major river in British Columbia and supports some of the world's largest runs of Pacific salmon. Salmonids with known presences in this river and with potential to occur within the Study Area include Chinook, Pink, Coho, Chum and Sockeye Salmon, as well as Dolly Varden char (*Salvelinus malma*), Bull Trout (*S. confluentus*), Rainbow / Steelhead Trout (*O. mykiss*), Cutthroat Trout, and Coastal Cutthroat Trout, and Mountain Whitefish (*Prosopium williamsoni*). Other culturally important fish species that have the potential to occur in the section of the Fraser River adjacent to Mission, BC include Green Sturgeon (*Acipenser medirostris*), White Sturgeon (*A. transmontanus* pop. 4), and Eulachon (*Thaleichthys pacificus* pop. 2; Government of BC 2022a).

Given their nature and location relative to the Fraser River, proposed Project works are not anticipated to adversely impact aquatic life or habitat within the Fraser River. However, open storm drains were observed within the proposed Project footprint and, if left unmitigated, may have the potential to direct turbid or contaminated water into the Fraser River during construction.

4.4.3 Fish Species at Risk

The provincial database reports six species observations within waterbodies/watercourses in the Study Area (Government of BC 2022a; Appendix B – Table 5). Of these, two species have been given provincial Red- or Blue-listed designations: Coastal Cutthroat Trout (provincially blue-listed) and White Sturgeon – Lower Fraser River Population (*Acipenser transmontanus* pop. 4; provincially red-listed). Additionally, White Sturgeon have been designated as Threatened by COSEWIC (Table 7).

Table 7: Observed Fish Species at Risk within the Study Area

Scientific Name	Common Name	BC List	COSEWIC	SARA
<i>Acipenser transmontanus</i> pop. 4	White Sturgeon (Lower Fraser River Population)	Red	Threatened	-
<i>Oncorhynchus clarkii</i>	Cutthroat Trout, <i>clarkii</i> subspecies	Blue	-	-

Note: See Table 2 for provincial and federal conservation status definitions.

Source: BC CDC 2022; Government of BC 2022b

5.0 PROJECT – ENVIRONMENT EFFECTS

The Project is currently in the design phase and detailed information on construction footprint, schedule, and methodology is not currently available. Potential environmental effects have been identified based on the current understanding of the Project scope and the surrounding existing environment.

5.1 Terrestrial (Riparian) Habitat

Proposed highway upgrades are anticipated to result in the removal/disturbance of vegetation, which may result in effects to wildlife within the Study Area. Habitat loss has the highest potential of occurring on the southern side of Highway 7, particularly between Glasgow Avenue and Catherwood Street where Project activities would involve widening of the eastbound lane and addition of a 1.3 m paved shoulder and 0.3 m gravel shoulder. The proposed activities would involve extensive earthworks and have the potential to impact approximately 180 m (i.e., linear, not area) of roadside habitat. The majority of the lands requiring modification have been previously altered during previous infrastructure updates and maintenance.

Other impacts to vegetation and terrestrial habitat may occur through the accidental introduction and/or proliferation of invasive, non-native plant species and the coating of leaves by dust and other airborne debris during Project construction.

5.2 Wildlife

Potential effects on wildlife from the proposed Project works could include:

- Accidental harm/mortality of wildlife, including wildlife species at risk (e.g., birds nesting within trees and shrubs impacted by Project works).
- Disruption to wildlife, including wildlife species at risk, due to adjacent construction activities (e.g., birds and bats nesting and roosting on the underside the nearby bridge).
- Temporary and permanent alteration of wildlife habitat, including loss of vegetation.

- Destruction (purposeful and accidental) of wildlife habitat (e.g., trees and shrubs where birds can nest).
- Attraction of wildlife to the work area due to garbage and / or food waste (e.g., bears).

5.3 Fish and Aquatic Habitat

The proposed highway improvements within the Study Area are not expected to directly affect fish and aquatic habitat as no watercourses or waterbodies are located in close proximity to the Project footprint. However, open storm drains were observed within the Project Area that may have outfalls in Mandale Slough and/or the Fraser River. Based on results of the site reconnaissance, and consulting the DFO Pathways of Effects diagrams (DFO 2018), potential effects on fish and aquatic habitat of Mandale Slough and Fraser River from construction activities may include:

- **Increase in sediment concentrations** - may occur due to storage of material, settlement of airborne dust from construction, and use/parking of equipment near open storm drains. If left unmitigated, these mechanisms have the potential to introduce sediment into the fish bearing watercourses which can reduce the quality and availability of fish habitat as well as have direct effects on fish by damaging gills.
- **Increase in contaminant concentrations** - may occur from the accidental release of cement, concrete wash water, oil, grease, fuel, or other pollutants from construction equipment, which can reduce the quality and availability of fish habitat if accumulated in water or sediment. Contaminants can also have direct effects on fish causing lethal or sublethal effects (e.g., physical deformities, adversely affect reproductive success or growth) or accumulate in their food sources.

These potential effects on wildlife, fish, and aquatic and riparian habitat can be avoided through the implementation of best management practices (BMPs) and mitigation measures as outlined below.

6.0 RECOMMENDED ENVIRONMENTAL MITIGATION MEASURES

Potential effects of the proposed Project on environmental resources can be avoided, mitigated, or managed through implementation of recommended measures described in the sections below, which have been developed from the following Best Management Practices (BMP) guidelines, industry standards and other documents:

- DFO's Measures to Protect Fish and Fish Habitat (DFO 2019)
- Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al. 1993)
- A User's Guide for Changes In and About a Stream in British Columbia (Government of BC 2022d)
- Requirements and Best Management Practices for Making Changes In and About A Stream in British Columbia (Government of 2022e)
- BC Summary of Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture (Ministry of Environment and Climate Change Strategy [MENV] 2019)
- Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Developments in British Columbia (MENV 2014)

- Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia: A companion document to Develop with Care (MENV 2013)
- Environmental Best Practices for Highway Maintenance Activities (MOTI 2018)
- 2020 Standard Specifications for Highway Construction (Section 165 Protection of the Environment; MOTI 2020)
- Erosion and Sediment Control Manual (MOTI 2022)

The mitigation measures outlined below are general recommendations. A detailed Construction Environmental Management Plan (CEMP) should be developed by the Contractor's Qualified Professional and be provided to the MOTI Project team for review. The CEMP should describe the specific commitments that the Contractor should adhere to, with respect to environmental protection, throughout the duration of the Project work, as required by *Standard Specifications for Highway Construction*; SS 165.02.02 and any permits or approvals issued for the Project (MOTI 2020). The CEMP should include the following components, at a minimum: an Erosion and Sediment Control Plan (see Section 6.1), Vegetation Protection Plan (see Section 6.2), Wildlife Protection Plan (see Section 6.3), and a Spill Protection and Emergency Response Plan (see Section 6.9).

6.1 Erosion and Sediment Control

Any earthworks associated with the proposed Project have the potential to generate sources of soil or other materials that can be mobilized and introduced into Mandale Slough or the Fraser River.

The following erosion and sediment control guidelines have been developed based on Section 36(3) of the *Fisheries Act* (Government of Canada, 1985), which requires that “*no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water*”. These measures are recommended for implementation during Project works.

- Erosion and sediment control provisions implemented will be in accordance with measures provided in *Land Development Guidelines for the Protection of Aquatic Habitat* (Chilibeck et al. 1993), *Erosion and Sediment Control Manual* (MOTI 2022), and applicable BMPs.
- Any necessary ground-disturbing works should be timed to avoid periods of heavy rainfall to as to reduce the potential for introduction of soils or sediment-laden water into nearby aquatic habitat.
- As required, based on the degree of ground disturbance to be required, sediment (silt) fences, catch basin protection, straw bales or wattles and/or other measures should be installed as appropriate to reduce potential for soils or sediment-laden water to enter into nearby aquatic habitat. If used, silt fences should follow the ground contour and should be properly keyed-in (see Figure 3.3 in Chilibeck et al. 1993).
- Erosion and sediment control requirements should be evaluated throughout construction of the Project and identified issues should be addressed as they arise.
- Erosion and sediment control measures should be inspected periodically, and frequently during rain events, and should be continually maintained, as required.
- Erosion and sediment control measures, such as silt fences, filter fabric, or catch basin protectors should be removed from the Project Area for appropriate re-use or disposal when no longer needed.

- The Contractor(s) should ensure that all machinery used within the Project Area should arrive free of excess external soil, mud, and debris prior to working at the site.
- The Contractor(s) should be responsible for the maintenance and any necessary changes to the erosion and sediment control measures and should confirm they are working effectively and comply with the CEMP. All materials for effective erosion and sediment control should be supplied by the Contractor(s).
- The EM should have authority to immediately suspend work, all activities that are resulting, or which could imminently result, in the release of sediment or other deleterious substances to waterbodies or environmental receptors in the vicinity of the Study Area.
- The Contractor(s) should immediately take remedial steps to control and contain the release of sediment or other potentially deleterious substance from entering a watercourse and be responsible for making necessary modifications to its erosion and sediment control measures to ensure compliance with environmental requirements and permit conditions.
- Any excess waste material should be hauled off-site to an approved disposal site.

6.2 Vegetation Protection

The following vegetation protection measures are recommended for application throughout the Project Area:

- Native vegetation, particularly trees, should be retained where possible. Disturbance of retained vegetation should be minimized by physically delineating equipment and machinery operational limits and temporary access area with snow fencing or another visible barrier during works. Vegetation outside the work area should not be disturbed.
- Spread of invasive and noxious plants should be controlled or avoided, as described in Section 6.2.1.
- Disturbed areas should be re-vegetated as quickly as possible after completion of the Project. Seeding should be timed to allow for establishment to occur before the end of the growing season. If there is insufficient time remaining in the growing season for seeds to germinate, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring. Use mulches and other organic stabilizers to reduce potential for erosion until vegetation is established on sensitive soils. Disturbed areas within the Project Area where bare soils are exposed should be hand seeded or hydroseeded with an appropriate local grass seed mix.
- Work should be conducted in accordance with relevant provincial Natural Resource Best Management Practices (Government of BC 2022e). These practices should be reviewed by the Contractor prior to work in the Project Area.

6.2.1 Invasive Plant Management

For the purpose of this report, an invasive plant includes species regulated under the BC *Weed Control Act* and *Weed Control Regulations* (Government of BC 1996b, 2011), Inter-Ministry Invasive Species Working Group (IMISWG) provincial priority species (BC IMISWG 2021), priority species rated by FVISS (FVISS 2022), or species tracked by the Invasive Alien Plant Program (IAPP; MENV 2022b). The following measures are recommended to mitigate the spread of invasive and non-native plant species should be implemented as determined appropriate by the QP / Environmental Monitor (EM):

- Machinery and equipment should be checked before it arrives on-site to make sure it is clean (i.e., free of mud and plants) to avoid potential for introduction of invasive plant species.
- Clothing and vehicle/equipment should be inspected for plant parts or propagules if working in an area known to contain invasive plants.
- Plant seeds or propagules should be removed from clothes and/or equipment and contain washing fluids (i.e., water or mud) on-site at designated cleaning stations.
- Disturbed soils should be re-vegetated with a locally appropriate seed mix.
- Where required, only clean soil or other fill material free of non-native plants or seeds should be used.
- Staff and Contractor(s) should be instructed to identify invasive plants that have the potential to establish at the site.
- The amount of soil disturbance should be minimized to only those areas required for Project access.
- Invasive plant material should be treated and/or properly disposed of to prevent further invasion of naturally vegetated areas. Material containing invasive plants should not be stored or piled at or near the Project Area and should be disposed of at an acceptable disposal facility located off-site, using best management practices.

6.3 Wildlife Protection

The following wildlife protection strategies are recommended for application at the Project Area:

- The amount of new disturbance and vegetation clearing or limbing, particularly clearing of trees and shrubs, should be minimized where possible.
- The standard avoidance mechanism in environmental assessment is to have any vegetation clearing activities or high noise generating activities occur within the appropriate “least risk periods” outlined in *Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia* (MENV 2014). This avoidance mechanism is the first priority for reducing the potential for contravention of Section 34 of the *BC Wildlife Act*, and the *Canada Migratory Birds Convention Act* for the protection of migratory birds and their nests. “Least risk windows” are provided in Table 4 below. Project works that cannot be scheduled within the least risk window can still be conducted; however, there is the need for additional survey effort, mitigation measures, and/or other avoidance measures to be undertaken as described herein.
- For works involving the entire or partial (e.g., limbing) removal of vegetation (i.e., trees or shrubs) that cannot avoid the least risk timing window for birds, pre-works nest surveys should be conducted no more than 7-days prior to the initiation of works in keeping with the Ministry bird nest sweep protocol. If any stick nests or other raptor nests are identified prior to or during Project works, appropriate setbacks should be established in accordance with *Develop with Care: Environmental Guidelines for Urban and Rural Land Developments in British Columbia* (MENV 2013), and a nest management plan should be developed if construction activities occur in the setbacks buffer. Osprey, eagle, heron and peregrine falcon nests are protected year-round under the *BC Wildlife Act*, whether occupied or not.

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- Due to the presence of a proposed critical habitat polygon for the western population of barn owl in the Study Area, as well as the potential for occurrence of bats, barn owls, and barn swallows under the Glasgow Avenue Bridge, the following surveys should occur within 7-days prior to initiation of construction:
 - Inspect the underside of the bridge/overpass for bats, barn owls, and barn swallows, or their corresponding nests or roosts.
 - Inspect trees within and adjacent to the construction footprint for barn owl stick nests.

If a nest or roost is discovered, additional mitigation measures should be recommended, including but not limited to setback buffers, additional surveys, and monitoring. Specific recommendations and mitigations should be determined with input from a QP.

- Potential effects on aquatic and terrestrial wildlife due to the potential introduction of contaminants during Project construction activities should be mitigated through implementation of the erosion and sediment control measures (See Section 6.1) and a spill prevention and emergency response plan (See Section 6.9).
- Sightings of potential problem wildlife should be reported to a QP who should use the information to adapt work activities as appropriate to minimize interaction with workers and wildlife. An onsite EM should periodically monitor wildlife presence and occupation within the Project Area over the duration of the Project.
- Garbage, refuse, and construction materials that could attract wildlife should be stored in appropriate containment or removed it from the Project Area daily.
- Work should be conducted in accordance with Provincial Best Management Practices. These practices should be reviewed by the Contractor prior to work in the Project Area (Government of BC 2022e).

Table 8: Summary of Least Risk Windows for Wildlife including SAR¹ Relevant to the Project

Month:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Birds												
Passerines		28							1			
Barn Swallow (bridge nesting)				25					21			
Great Blue Heron	15								15			
Bald Eagle												31
Barn Owl (potential bridge nesting)			15						15			
Other raptors		28								1		
General breeding and fledging period		28							1			
Mammals												
Bats (bridge maternity roosting)			31							1		

Footnotes:

¹Numbers indicate days of the month in which the window applies. Green cells denote least-risk periods.

6.4 Fish and Aquatic Habitat Protection

While the proposed highway improvements are not anticipated to directly affect fish and aquatic habitat as no watercourses or waterbodies are present in close proximity to the Project Area, the following measures have been identified to mitigate the potential for the Project to indirectly impact fish and aquatic habitat through the introduction of contaminated or sediment-laden water into Mandale Slough or the Fraser River.

- Work should be undertaken and completed in such a manner as to avoid or reduce the potential for release of silt, sediment or sediment-laden water, or any other deleterious substances into Mandale Slough and the Fraser River.
- Machinery and equipment should be clean and in good operating condition (washed, free of leaks, excess oil and grease) before arriving at the Project Area.
- Spill kits should be present and stocked according to the type and amount of material potentially requiring cleanup in the event of a release. The kits should be placed in areas that are easily accessible and near higher risk Project activities. On-site staff should be trained on the use of items in the spill containment kits.
- Weather forecasts should be checked frequently and communicated to the Contractor(s) crew. Earth works should be limited during poor weather conditions to the extent possible to minimize the risk of surface flows of sediment-laden water into Mandale Slough and the Fraser River.
- Excavated material and debris should be removed from the site or placed in a stable area and protected from erosion. Stockpiled materials (e.g., soil or road base) should be located away from aquatic habitat and securely covered with plastic sheeting when not actively being used.
- Material which is moved off-site should be disposed of in such a manner as to prevent its entry into Mandale Slough or the Fraser River.

6.5 Water Quality Management

The Contractor should provide their own water source for construction use and to create and implement a wastewater management plan that will maintain water quality in the nearby Mandale Slough and the Fraser River. This plan should outline immediate action to be taken to correct any deficiency in water quality, as observed by the on-site EM. In addition, The Contractor should maintain site conditions to protect the environment not only during active construction on the Site, but also during periods when the Contractor has suspended its construction activity for any reason.

During construction activities, the EM should visually observe for pooling turbid water, sediment-laden surface flows, and hydrocarbon sheens. Suspect water should be contained on site in a settling pond or other form of containment for testing or treatment. This water should not be allowed to leave site, through catch basins or otherwise, until it can be confirmed by a QP/EM that it will not adversely impact water quality of Mandale Slough or the Fraser River. Where necessary, monitoring of water quality should be conducted in accordance with the minimum requirements specified in Table 9.

Table 9: BC Summary of Water Quality Guidelines for Freshwater Aquatic Life ¹

Parameter	Maximum Allowable
Turbidity	<ul style="list-style-type: none"> ▪ Change from background of 8 NTU at any one time for a duration of 24 hours in all waters during clear flows or in clear waters ▪ Change from background of 2 NTU at any one time for a duration of 30 days in all water during clear flows or in clear waters ▪ Change from background of 5 NTU at any time when background is 8 to 50 NTU during high flows or in turbid waters ▪ Change from background of 10% when background is >50 NTU at any time during high flows or in turbid waters
Suspended Solids	<ul style="list-style-type: none"> ▪ Change from background of 25 mg/L at any one time for a duration of 24 hours in all waters during clear flows or in clear waters ▪ Change from background of 5 mg/L at any one time for a duration of 30 days in all waters during clear flows or in clear waters ▪ Change from background of 10 mg/L at any time when background is 25 to 100 mg/L during high flows or in turbid waters ▪ Change from background of 10% when background is >100 mg/L at any time during high flows or in turbid waters
pH ²	<ul style="list-style-type: none"> ▪ Restricted changes in pH where background levels are less than 6.5. No statistically significant decrease in pH from background levels are permitted ▪ Unrestricted change in pH within the range of 6.5 to 9.0 ▪ Restricted changes in pH where background levels are greater than 9.0. No statistically significant increase in pH from background levels are permitted

¹ Source: MENV 2019, Tables 30, 44; NTU - nephelometric turbidity units

² Statistical significance is determined as outlined in Table 30 footnotes (MENV 2019)

6.6 Air Quality and Dust Control

Air quality, idle reduction and dust control management should be implemented in accordance with Subsections 165.02.02, 165.16.02 and 165.16.03 of the MOTI's *Standard Specifications for Highway Construction* (MOTI 2020). The emissions management options and management triggers outlined in Table 10 below should be considered, and the Contractor's CEMP should include procedures outlining how drivers and equipment operators will be engaged in idle reduction practices. Vehicles and equipment should be operated and maintained according to manufacturer's guidelines and monitored regularly for potential air quality and emission concerns. If required, access routes should be watered to reduce dust generation.

Table 10: Air Quality Emissions Management Options and Triggers

Source Description	Options for Emissions Management	Triggers for Management
Construction Vehicles	<p>Avoid engine idling. In colder weather, where possible, use electrical engine heaters rather than idling to prevent engine freeze.</p> <p>Maintain construction fleet vehicles according to manufacturers' guidelines.</p>	<p>Periodic maintenance of construction vehicles. In addition, excessive or consistently black exhaust is a signal that an engine is not operating optimally. If black exhaust is noted, the EM shall be notified immediately.</p>
Vehicle Traffic Fugitive Dust	<p>On dry days consider watering unpaved access roads that are in frequent use.</p> <p>Where possible, fit 'upswept' exhausts(a) to construction vehicle fleet.</p> <p>Implementation of a speed limit to slow vehicles and therefore reduce fugitive dust emissions.</p> <p>Cover vehicle loads that are fine grained, especially on windy days.</p> <p>Where access roads join public roads, there is the potential for material to be tracked onto the paved road. If a considerable volume of material is tracked onto a public road, consideration should be given to cleaning the paved road surface by sweeping or using a wet vacuum sweep.</p>	<p>Visual cues would be the primary trigger for mitigative action to be taken with respect to vehicle traffic fugitive dust emissions.</p> <p>If the weather forecast indicates dry weather and strong winds are likely, this is also a trigger for preventative dust management action to be taken.</p>
Heavy Equipment Activities	<p>Move as little material as possible. While placing material, this translates to keeping drop heights as low as possible.</p> <p>Wet material before handling if possible.</p> <p>Sweep or water roads as necessary for dust control and maintaining public road cleanliness.</p> <p>Implementing a speed limit to slow vehicles and reduce noise generation near residences.</p>	<p>If construction activities are occurring within 300 m of residences and:</p> <ul style="list-style-type: none"> ▪ If visible dust is being generated by activities such as bulldozing, excavation, backfilling; and/or ▪ If the weather forecast indicates dry conditions and strong winds are likely. <p>Visual cues would be the primary trigger for mitigative action to be taken with respect to vehicle traffic fugitive dust emissions.</p> <p>If the weather forecast indicates dry weather and strong winds are likely, this is also a trigger for preventative dust management action to be taken.</p>

6.7 Noise Control

Potential effects on terrestrial resources (i.e., wildlife) and local communities resulting from noise associated with the Project can be mitigated by implementing the following strategies:

- The Contractor(s) should act reasonably to reduce noise through the use of "Best Available Control Technology" noise control on construction equipment as well as noise level regulations or guidelines established by the WorkSafe BC and other regulatory agencies and jurisdictions having authority for noise levels.
- Project work should be undertaken during daylight hours and in compliance with the City of Mission Good Neighbour Bylaw (5524-2015; City of Mission 2015a). This includes working only between the hours of 07:00 to 20:00 hours from Monday to Saturday, and 09:00 to 17:00 on Sunday and statutory holidays to reduce disturbance to local residents.

6.8 Material Storage Handling and Waste Management

Cleanup of the site should be an ongoing process. Contractor(s) should, at all times, keep the work site free from accumulations of waste materials or rubbish caused by employees or by works. All garbage and recycling containment should be animal proof. Upon completion of work activities, the Contractor(s) should remove and properly dispose of all temporary structures, rubbish, and waste materials resulting from the operation.

The following mitigation measures should be implemented on-site by the Contractor(s), as required:

- All reasonable efforts should be made to reduce, reuse and/or recycle to reduce the amount of material being disposed of. All wastes should be disposed of in compliance with applicable legislation such as the *BC Environmental Management Act* (Government of BC 2003).
- Hazardous waste registration, storage, permit and transportation requirements should be met, if applicable, and waste materials should be removed from the Project Area as soon as possible in accordance with applicable standards and regulations.
- If activities involve the handling, storage, and removal of hazardous wastes, the following records should be maintained: (1) Inventories of types and quantities of Hazardous Wastes generated, stored, or removed; (2) Manifests identifying Hazardous Waste haulers and disposal destinations; and (3) Disposal certification documents.
- Contractor(s) should be responsible for maintaining Safety Data Sheets (SDS) for all products used on the Project.
- If suspected contaminated materials are found during the works, they should be managed in accordance with the *BC Environmental Management Act* (Government of BC 2003) and Regulations.

The following mitigation measures should be implemented specifically for concrete materials in accordance with MOTI's *Standard Specifications for Highway Construction* Subsections 165.14.04, 165.02.03 (f)(vi) and 145.27.02 (MOTI 2020):

- The release of waste concrete, concrete slurry or water that has come into contact with uncured concrete should not be permitted in the Project area.
- The Contractor should manage high-pH or turbid water and concrete slurry generated during removal or installation of concrete structures and prevents entry of such material into Environmentally Sensitive Areas (i.e., Mandale Slough and Fraser River) in accordance with applicable laws, regulatory requirements, Ministry requirements and best practices.

The following mitigation measures should be implemented specifically for use of hydrocarbon-based materials:

- Plastic containers used to carry petroleum products should be designed for that purpose and should not be more than five years old.
- Containers should be fitted with a proper fitting cap or lid.
- All containers containing hydrocarbon products should be labelled and transported according to the Transportation of Dangerous Goods Regulations.
- Containers under 23 L (5 gallons) should be stored and transported in the equipment box of a vehicle that can contain the total quantity of the fuel in the container in the event that it leaks or spills.
- Containers greater than 23 L (5 gallons), including 205 L (45 gallon) drums, should be transported upright and secured to prevent shifting and toppling.

6.9 Spill Prevention and Emergency Response

To reduce the potential for a spill or release of cement, concrete wash water, hydrocarbons or other hazardous materials, spill prevention mitigation should be implemented during all concrete works, refuelling of equipment or machinery, and during the storage and handling of hazardous materials. The following is a list of spill prevention and response measures, including general measures, refuelling areas, spill response, spill clean-up, and spill reporting procedures. This list is not exhaustive and should be adapted as necessitated by the changing site conditions.

- A release of a deleterious substance that enters or is likely to enter the aquatic environment must be reported to the BC Environmental Emergency Program (1-800-663-3456). Immediately report all spills of deleterious substances, no matter how small, to the EM and to the Contractor's Site Supervisor.
- All equipment (excavators and trucks) and machinery (pumps) should be in good operating condition and free of leaks or excess oil and grease. If necessary, power-wash equipment prior to entering the site.
- Spills occurring on dry land should be contained, scraped and stored for disposal upon project completion. Contaminated material should be stored on polyurethane tarps and covered to prevent mobilization and should be disposed of in accordance with the regulations outlined in the *BC Environmental Management Act* (2003) and *Spill Reporting Regulation* (Government of BC 2017).
- A designated refuelling and maintenance area should be established at the site. Personnel should not leave equipment unattended during refuelling to prevent the overfilling of the equipment.
- Any stationary equipment such as pumps or generators should have their own containment, and mobile equipment parked for more than 24 hours should have drip trays placed beneath the equipment.
- No bulk storage of fuel, oils, or other flammable and combustible products should occur on-site.
- A spill containment kit should be readily accessible on-site in the event of an accidental release of a deleterious substance to the environment. All construction personnel should be sufficiently trained in the location and use of spill prevention equipment.

7.0 CONCLUSION

WSP prepared the enclosed OEA for the proposed highway improvement works in Mission, BC. Environmental regulatory context and avoidance and mitigation measures have been provided for the protection of wildlife, fish, and terrestrial and aquatic resources.

This OEA is intended to provide MOTI, its assignees and representatives with necessary information on mitigation measures to avoid and reduce potential environmental effects of the Project. Once a Contractor has been selected to complete these works, the enclosed mitigation measures should be incorporated into the Contractor's CEMP. With implementation of these measures, residual adverse effects of the Project on environmental resources are expected to be negligible.

8.0 CLOSURE

We trust the information contained in this report is sufficient for your present needs. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

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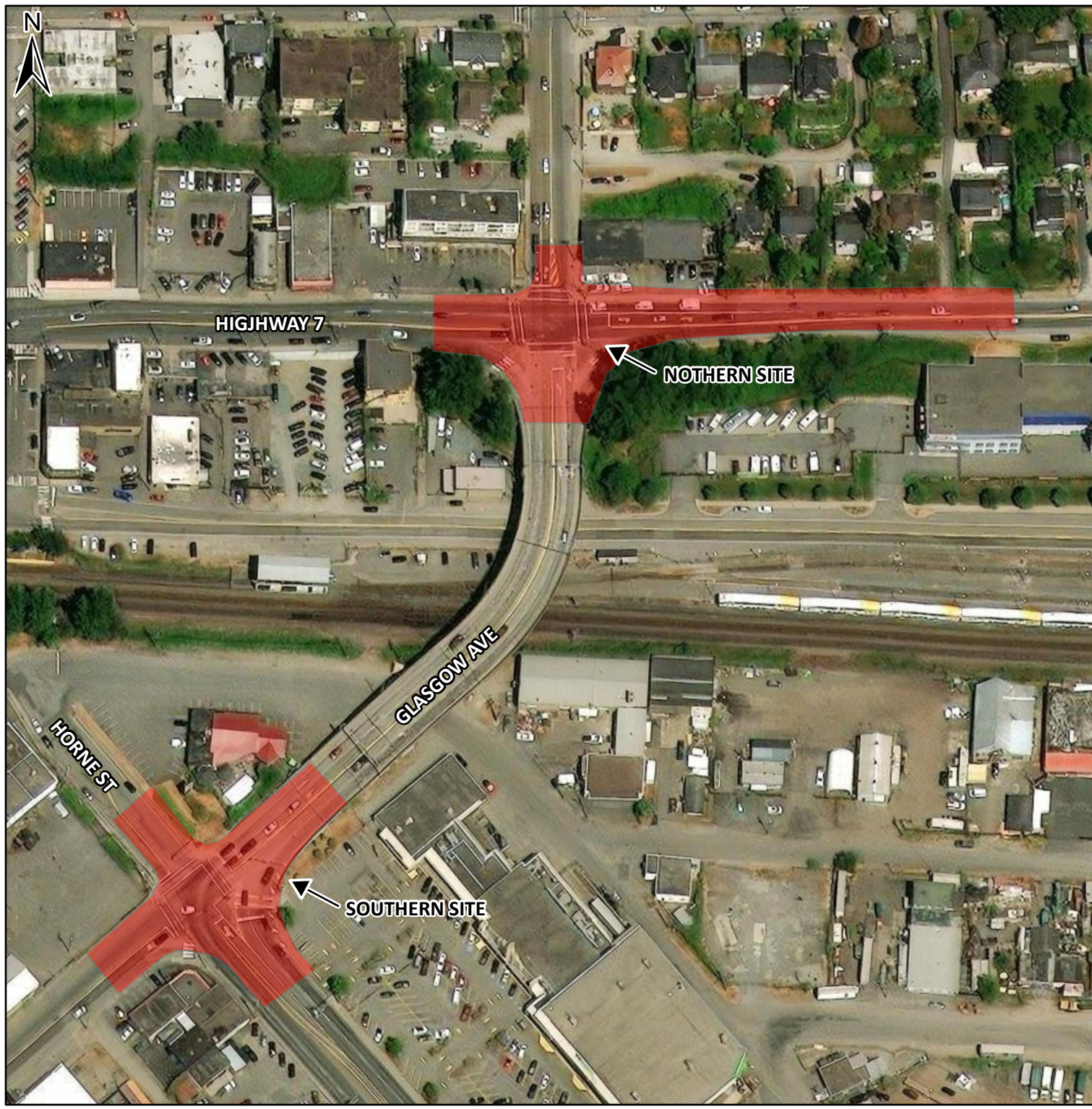
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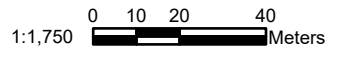
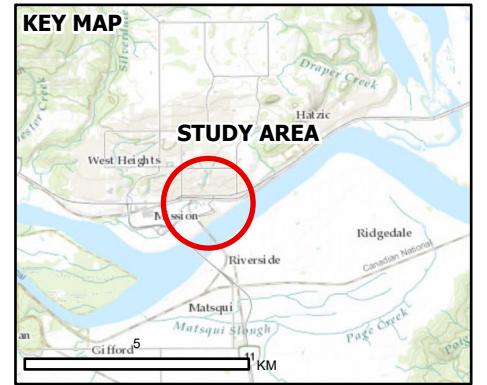
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LEGEND

- PROJECT AREA / PROJECT FOOTPRINT
- STUDY AREA



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SPATIAL REFERENCE: NAD 1983 UTM ZONE 10N

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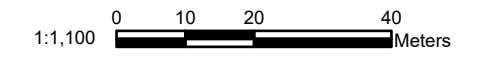
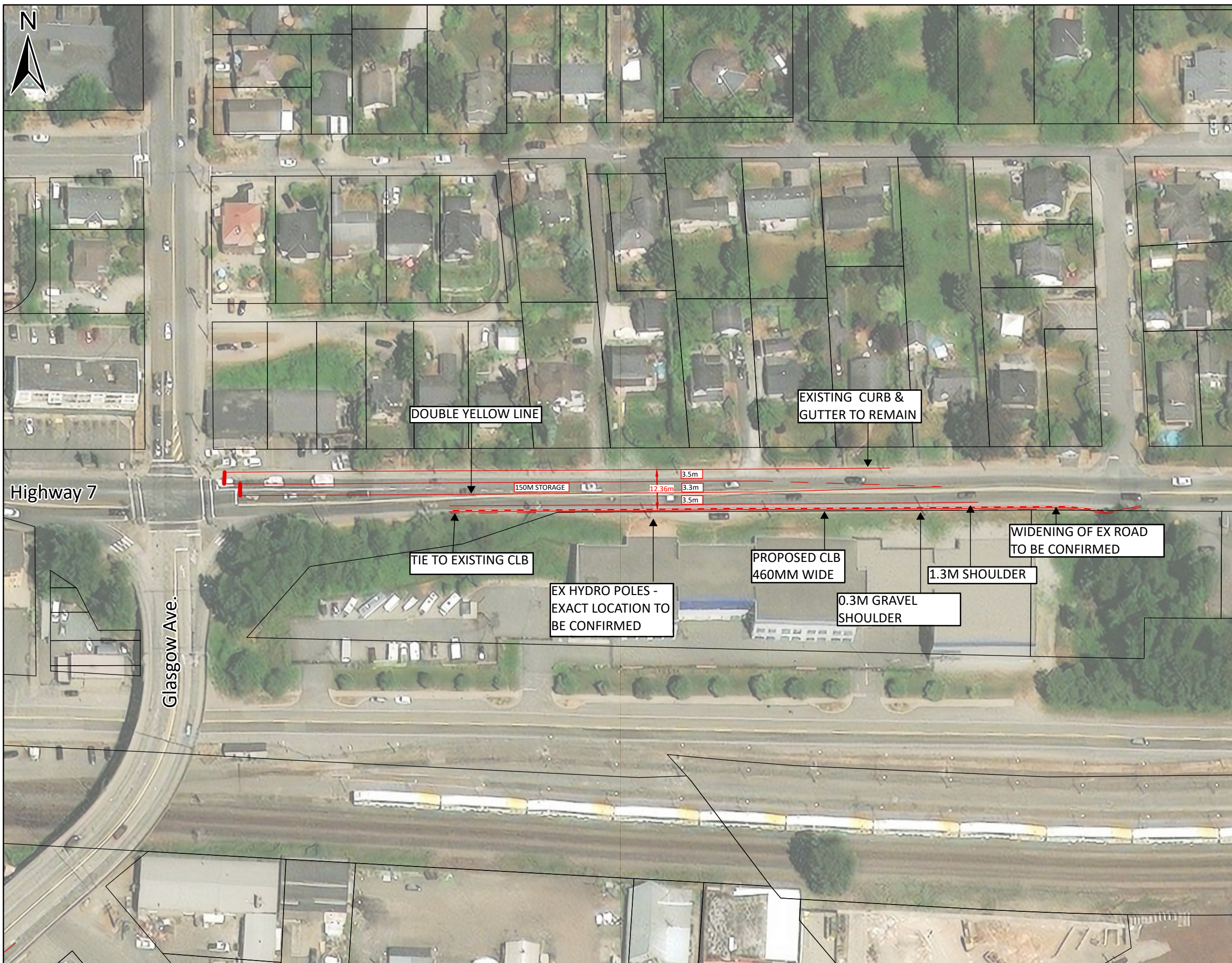
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	REVIEWED NO
	APPROVED SR



- LEGEND
- PROJECT DESIGN ELEMENTS
 - PARCEL



REFERENCES
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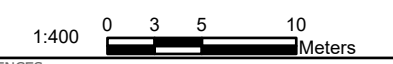
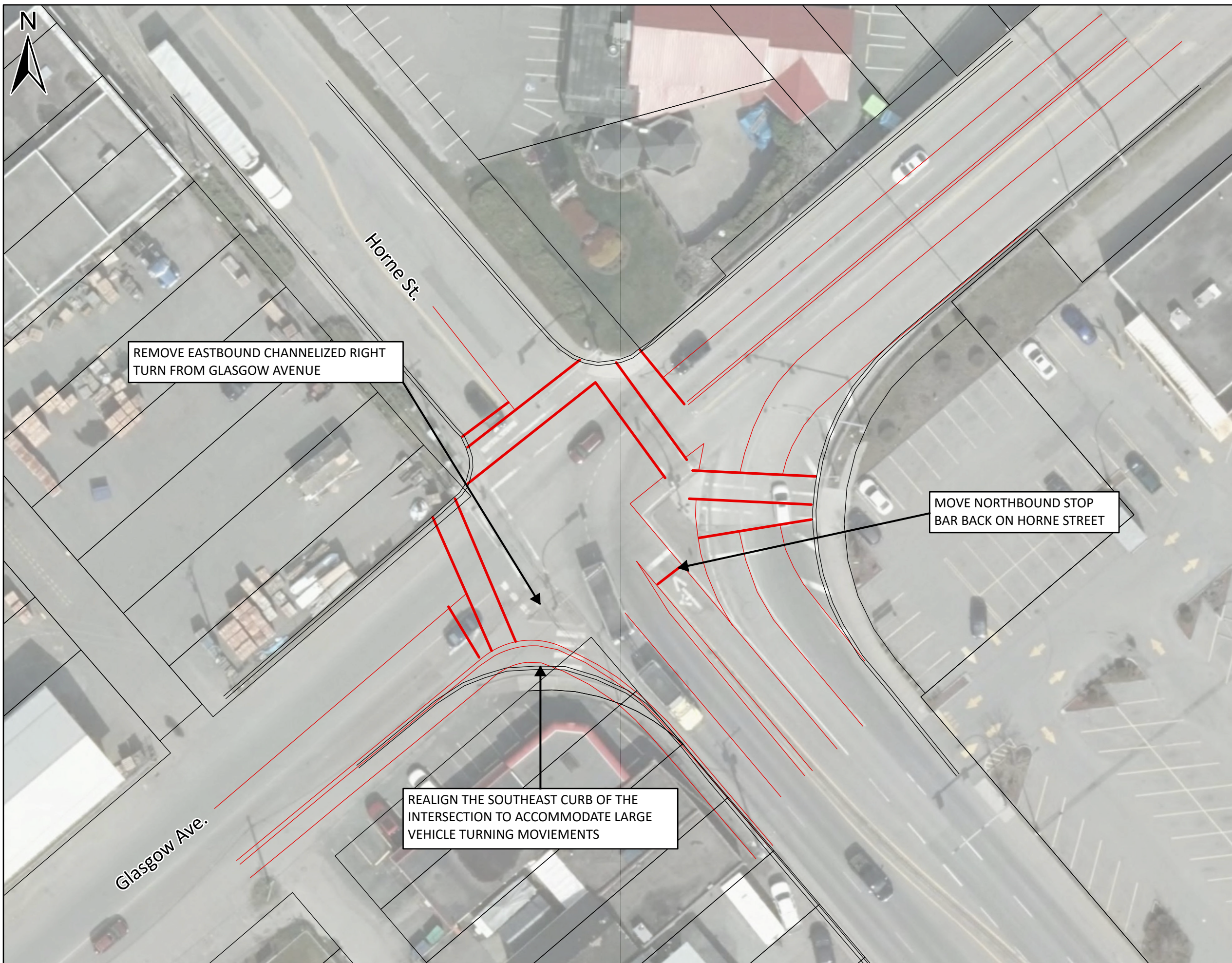
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- LEGEND
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SPATIAL REFERENCE: NAD 1983 UTM ZONE 10N

CLIENT
 BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE

PROJECT
 HIGHWAY 7 UPGRADE

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	REVIEWED	NO
	APPROVED	SR

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APPENDIX A

Site Photographs



Photo 1: Northern site (Glasgow Avenue and Highway 7), facing the northeast corner of the intersection.



Photo 2: Northern site (Glasgow Avenue and Highway 7), facing the southeast corner of the intersection.



Photo 3: WSP Golder staff recording vegetation on the southeast corner of the Highway 7 / Glasgow Avenue intersection (northern site).



Photo 4: Typical roadside vegetation along the eastbound lane of Highway 7, east of the Highway 7 / Glasgow Avenue intersection (northern site), including Himalayan blackberry (*Rubus armeniacus*), dull Oregon grape (*Mahonia nervosa*), and various shrubs and small trees.

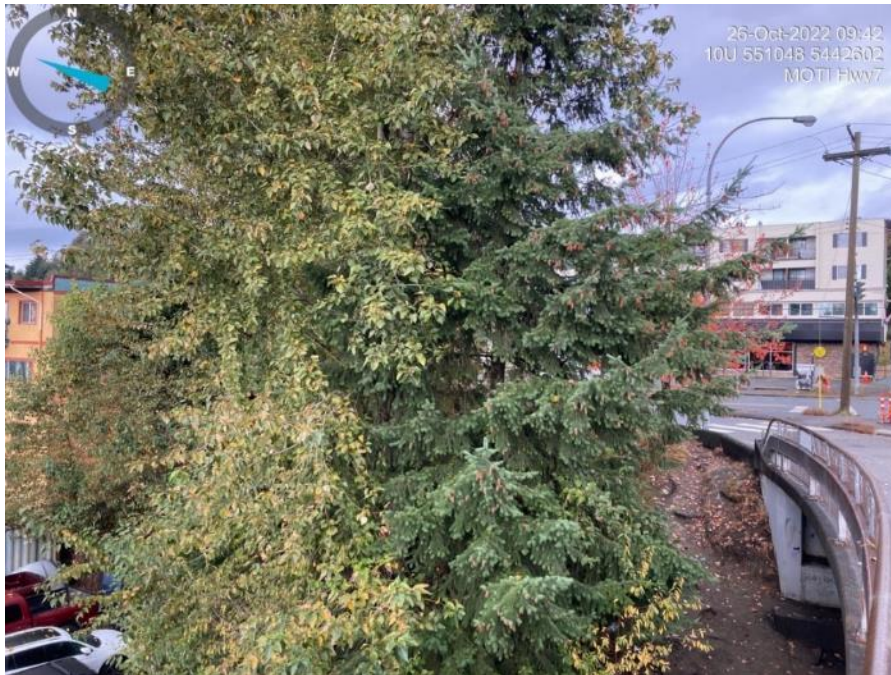


Photo 5: Establish Douglas-fir (*Pseudotsuga menziesii*) and red alder (*Alnus rubra*) trees on the southwestern corner of the Highway 7 / Glasgow Ave intersection (northern site).



Photo 6: Red maple (*Acer rubrum var. rubrum*), Himalayan blackberry, Douglas-fir, and red alder on the southwestern corner of the Highway 7 / Glasgow Ave intersection (northern site).



Photo 7: Southwestern corner of the Highway 7 / Glasgow Avenue intersection (northern site), looking south over the bridge.



Photo 8: Glasgow Avenue Bridge connecting the northern and southern sites. Roadside vegetation consisting of grasses and ornamental shrubs.



Photo 9: Potential bird and bat nesting/roosting habitat beneath the Glasgow Avenue Bridge.



Photo 10: Barn swallow (*Hirundo rustica*) cup nest observed the Glasgow Avenue Bridge.



Photo 11: Lagomorph pellets observed near the Glasgow Avenue Bridge.



Photo 12: Southern site (Glasgow Avenue and Horne St.), facing the western corner of the intersection.



Photo 13: Winged euonymus shrubs (*Euonymus alatus*), sweet gum tree (*Liquidambar* spp.), and other ornamental plantings on the north side Horne St., east of the intersection.



Photo 14: Open storm drain at the southern site on the eastern corner of the intersection.



Photo 15: Grassy area with potential barn owl (*Tyto alba*) hunting habitat to the south of the Glasgow / Horne intersection (southern site).

APPENDIX B

Desktop Review Results

Table B.1 - Invasive Plant Species within Study Area

Jurisdiction	Map Label	UTM Zone	UTM Easting	UTM Northing	ObjectID	Created Date	Site ID	Elevation (m)	BGC Label
Municipality owned land	JK SB	10	550412	5443132	306884	2014-08-11	297985		CWH dm
Ministry of Transportation and Infrastructure	SB	10	550637	5442185	254202	2008-07-05	249075		CWH dm
Ministry of Transportation and Infrastructure	SB	10	550804	5442219	254211	2008-07-10	249084		CWH dm
Municipality owned land	JK	10	550588	5442243	306879	2014-08-11	297980		CWH dm
Ministry of Transportation and Infrastructure	SB	10	550989	5442234	251144	2007-09-14	246017		CWH dm
Municipality owned land	JK	10	550840	5442268	306878	2014-08-11	297979		CWH dm
Municipality owned land	JK	10	551236	5442264	306872	2014-08-11	297973		CWH dm
Ministry of Transportation and Infrastructure	SB	10	550760	5442398	254220	2008-07-11	249093		CWH dm
Private Land	JK	10	550980	5442629	316109	2015-09-16	307137		CWH dm
Municipality owned land	JK	10	551092	5442671	307872	2014-09-06	298973		CWH dm
Ministry of Transportation and Infrastructure	JK	10	551529	5442657	307871	2014-09-06	298972		CWH dm
Municipality owned land	JK	10	551361	5442729	307873	2014-09-06	298974		CWH dm
Private Land	JK	10	551663	5442791	316110	2015-09-16	307138		CWH dm
Municipality owned land	JK	10	550873	5442857	306880	2014-08-11	297981		CWH dm
Municipality owned land	JK	10	551832	5443105	307874	2014-09-06	298975		CWH dm
Municipality owned land	JK	10	551641	5443328	307875	2014-09-06	298976		CWH dm
Municipality owned land	JK	10	551453	5443489	307877	2014-09-06	298978		CWH dm
Ministry of Transportation and Infrastructure	SB	10	550236	5442011	254210	2008-07-09	249083		CWH dm
Ministry of Transportation and Infrastructure	SB	10	550305	5442051	254209	2008-07-09	249082		CWH dm
Municipality owned land	JK	10	550164	5442065	244228	2007-08-27	239103	1	CWH dm
Municipality owned land	SB	10	550201	5442082	254213	2008-07-10	249086		CWH dm
Ministry of Transportation and Infrastructure	SB	10	550477	5442100	254205	2008-07-06	249078		CWH dm
Municipality owned land	SB	10	550536	5442178	251156	2007-08-17	246029		CWH dm
Ministry of Transportation and Infrastructure	SB	10	550629	5442159	254199	2008-07-05	249072		CWH dm
Ministry of Transportation and Infrastructure	SB	10	550637	5442119	254197	2008-07-05	249070		CWH dm
Ministry of Transportation and Infrastructure	SB	10	550670	5442140	254203	2008-07-05	249076		CWH dm
Ministry of Transportation and Infrastructure	SB	10	550715	5442155	254207	2008-07-08	249080		CWH dm
Municipality owned land	JK	10	550837	5442130	306877	2014-08-11	297978		CWH dm
Private Land	JK	10	550837	5442130	316108	2015-09-16	307136		CWH dm
Municipality owned land	EI HI HO IM	10	550975	5443119	276824	2010-02-17	268170	53	CWH dm
Municipality owned land	EI HI HO IM	10	550899	5443131	276827	2010-02-17	268173	61	CWH dm
Municipality owned land	EI HI HO YA	10	551038	5443140	276829	2010-02-17	268175		CWH dm
Municipality owned land	HI HO PA	10	550848	5443212	282928	2010-09-09	274208		CWH dm
Municipality owned land	EI HI IM SB	10	550864	5443245	282289	2010-09-10	273569	73	CWH dm
Municipality owned land	EI HI HO IM YA	10	550756	5443333	282288	2010-09-09	273568	77	CWH dm
Municipality owned land	EI HI JK	10	550646	5443401	282291	2010-09-10	273571		CWH dm
Regional District owned land	HI MU	10	551454	5441661	276198	2010-01-27	267544		CWH dm
Regional District owned land	BT CT TC TR	10	551859	5441974	282432	2010-09-07	273712		CWH dm
Municipality owned land	BD HI HO YA	10	551476	5442879	277043	2010-02-17	268323	56	CWH dm
Municipality owned land	HI	10	551875	5443095	276348	2010-03-01	267694	50	CWH dm

Table B.1 - Invasive Plant Species within Study Area

Jurisdiction	Map Label	UTM Zone	UTM Easting	UTM Northing	ObjectID	Created Date	Site ID	Elevation (m)	BGC Label
Municipality owned land	HI HO	10	551870	5443170	276345	2010-03-01	267691	67	CWH dm
Regional District owned land	CP HI SL	10	551154	5441434	276209	2010-01-27	267555		CWH dm
Municipality owned land	JK	10	550183	5442075	270602	2009-12-24	262019		CWH dm
Municipality owned land	HI	10	551034	5442066	277044	2010-02-17	268324	11	CWH dm
Municipality owned land	SB	10	550573	5442096	270609	2009-12-24	262026		CWH dm
Ministry of Transportation and Infrastructure	SB	10	550925	5442178	270091	2009-12-12	261508	22	CWH dm
Ministry of Transportation and Infrastructure	TR	10	550585	5442209	254955	2008-09-04	249828		CWH dm
Municipality owned land	HI IM	10	550845	5442739	282299	2010-09-09	273579		CWH dm
Municipality owned land	EI HI HO JK	10	550805	5442799	282936	2010-09-09	274216		CWH dm
Municipality owned land	EI HO IM JK	10	550846	5442816	262889	2009-07-08	255660		CWH dm
Municipality owned land	BU JK	10	550846	5442816	262890	2009-07-13	255661		CWH dm
Municipality owned land	EI HI IM JK	10	550840	5442832	282921	2010-09-09	274201	24	CWH dm
Municipality owned land	EI HO IM JK	10	550883	5442904	262891	2009-07-15	255662		CWH dm
Municipality owned land	EI HO IM	10	550883	5442904	270589	2009-12-23	262006		CWH dm
Municipality owned land	EI HI IM JK	10	550885	5442928	282922	2010-09-09	274202	24	CWH dm
Municipality owned land	EI HI HO	10	550877	5442980	276826	2010-02-17	268172	24	CWH dm
Municipality owned land	EI HI IM JK	10	550934	5443098	282926	2010-09-09	274206		CWH dm
Municipality owned land	CP EI HI HO IM	10	550934	5443098	276825	2010-02-17	268171	57	CWH dm
Municipality owned land	JK	10	550153	5442879	368076	2021-06-19	359137	48	CWH dm
Municipality owned land	JK	10	550231	5442595	356208	2019-06-24	347258	31	CWH dm
Private Land	JK	10	550380	5442705	346827	2018-08-31	337866		CWH dm
Regional District owned land	QA	10	550420	5441618	363236	2020-07-17	354288		CWH dm
Municipality owned land	TR	10	550503	5442160	350188	2018-08-22	341231	14	CWH dm
Regional District owned land	QA	10	550663	5441759	362833	2020-07-17	353885		CWH dm
Municipality owned land	JK	10	551089	5442155	356218	2019-07-15	347268	13	CWH dm
Municipality owned land	JK	10	551161	5442230	347380	2018-10-19	338423		CWH dm

Note: BD = Butterfly bush; BT = Bull thistle; BU = Burdock species; CP = Common periwinkle; CT = Canada thistle; EI = English ivy; HI = Himalayan blackberry; HO = English holly; IM = Policeman's helmet / himalayan balsam; JK = Japanese knotweed; MU = Mullein; PA = Polar hawkweed; QA = Queen Anne's lace / wild carrot; SB = Scotch broom; SL = Daphne / spurge laurel; TC = Common tansy; TR = Tansy ragwort; YA = Yellow archangel (lamium)

Source: Government of BC 2022c

Table B.2 - BC Conservation Data Centre Queried Plant Species at Risk in Mission, BC

Scientific Name	English Name	Biogeoclimatic Units	Provincial	BC List	Global	COSEWIC	SARA
<i>Acorus americanus</i>	American sweet-flag	CWHdm; ICHdw; ICHxw; IDFmw; SBSdk; SBSdw; SBSmh; SBSwk	S3 (2019)	Blue	G5 (2015)		
<i>Actaea elata</i> var. <i>elata</i>	tall bugbane	CWHdm; CWHms; CWHvm; MHmm	S1S2 (2019)	Red	G4T4 (2015)	E	1-E (2003)
<i>Artemisia douglasiana</i>	Douglas' sagewort		SU (2019)	Unknown	G5 (1988)		
<i>Bartramia aprica</i>	rigid apple moss	CDF; CWH	S2 (2015)	Red	GU (2006)	E	1-E (2003)
<i>Berula incisa</i>	cut-leaved water-parsnip	BGxh; CWHdm; IDFxh; PPxh	S3? (2019)	Blue	G4G5 (1984)		
<i>Bidens amplissima</i>	Vancouver Island beggarticks	CDFmm; CWHdm; CWHms; CWHxm	S3 (2019)	Blue	G3 (2016)	SC	1-SC (2003)
<i>Brotherella roellii</i>	Roell's brotherella	CWH	S1S2 (2011)	Red	G3 (2004)	E	1-E (2018)
<i>Callitriche heterophylla</i> var. <i>heterophylla</i>	two-edged water-starwort		SU (2020)	Unknown	G5T5 (2016)		
<i>Cephalanthera austiniiae</i>	phantom orchid	CDFmm; CWHdm; CWHxm	S2 (2019)	Red	G4 (1990)	E	1-T (2003)
<i>Claytonia washingtoniana</i>	Washington springbeauty	CDFmm; CWHdm; CWHxm; IDFfw	S3 (2022)	Blue	G2G4 (2001)		
<i>Corispermum hookeri</i> var. <i>pseudodeclatum</i>	British Columbia bugseed		SU (2020)	Unknown	G4G5T2T3 (2016)		
<i>Entosthodon fascicularis</i>	banded cord-moss	CDF; CWH; ICHdm; ICHdw	S2S3 (2015)	Blue	G4G5 (2001)	SC	1-SC (2006)
<i>Eutrochium maculatum</i> var. <i>bruneri</i>	Joe-pye weed		SU (2019)	Unknown	G5T5 (2015)		
<i>Fabronia pusilla</i>	silver hair moss	CWHdm	SH (2015)	Red	G4G5 (2005)	E	1-E (2005)
<i>Festuca rubra</i> ssp. <i>mediana</i>	dwarf red fescue		S5? (2020)	Yellow	G5TNR		
<i>Fissidens pauperculus</i>	poor pocket moss	CWH	S1 (2015)	Red	G3? (2012)	E	1-E (2003)
<i>Lupinus rivularis</i>	streambank lupine	CDFmm; CWHdm; CWHxm	S1 (2019)	Red	G2G4 (2016)	E	1-E (2005)
<i>Veronica catenata</i>	pink water speedwell	CWHdm; ESSFmw; IDFdm	S3 (2019)	Blue	G5 (1984)		

Source: Government of BC 2022a

Table B.3 - BC Conservation Data Centre Queried Ecosystem Communities at Risk in Mission, BC

Scientific Name	English Name	Biogeoclimatic Units	Provincial	BC List	Global
<i>Carex lasiocarpa</i> - <i>Rhynchospora alba</i>	slender sedge - white beak-rush	CDFmm/Wf53; CWHdm/Wf53; CWHmm1/Wf53; CWHmm2/Wf53; CWHxm1/Wf53; CWHxm2/Wf53	S2 (2022)	Red	G2
<i>Carex sitchensis</i> - <i>Oenanthe sarmentosa</i>	Sitka sedge - Pacific water-parsley	CWHdm/Wm50; CWHvh2/Wm50; CWHwm/Wm50; CWHxm1/Wm50	S3 (2004)	Blue	G3
<i>Picea sitchensis</i> / <i>Rubus spectabilis</i> Dry	Sitka spruce / salmonberry Dry	CWHdm/08; CWHds1/08	S1S2 (2010)	Red	G1G2
<i>Populus trichocarpa</i> - <i>Alnus rubra</i> / <i>Rubus spectabilis</i>	black cottonwood - red alder / salmonberry	CDFmm/08; CWHdm/09; CWHds1/09; CWHds2/09; CWHmm1/09; CWHms1/08; CWHms2/08; CWHvm1/10; CWHwm/06; CWHws1/08; CWHws2/08; CWHxm1/09; CWHxm2/09	S3 (2010)	Blue	GNR
<i>Populus trichocarpa</i> / <i>Salix sitchensis</i>	black cottonwood / Sitka willow	CWHdm/10; CWHds/10; CWHmm1/10; CWHms/09; CWHvm1/11; CWHwm/07; CWHws/09; CWHxm1/10; CWHxm2/10	S2S3 (2004)	Blue	GNR
<i>Pseudotsuga menziesii</i> / <i>Polystichum munitum</i>	Douglas-fir / sword fern	CWHdm/04; CWHxm1/04; CWHxm2/04	S2 (2019)	Red	G2G4
<i>Pseudotsuga menziesii</i> - <i>Tsuga heterophylla</i> / <i>Gaultheria shallon</i> Dry Maritime	Douglas-fir - western hemlock / salal Dry Maritime	CWHdm/03; CWHxm1/03; CWHxm2/03	S2 (2019)	Red	G3G4
<i>Rhododendron groenlandicum</i> / <i>Kalmia microphylla</i> / <i>Sphagnum</i> spp.	Labrador-tea / western bog-laurel / peat-mosses	CDFmm/Wb50; CWHdm/Wb50; CWHvm1/Wb50; CWHxm1/Wb50; CWHxm2/Wb50	S3 (2004)	Blue	G4
<i>Thuja plicata</i> / <i>Carex obnupta</i>	western redcedar / slough sedge	CWHdm/15; CWHxm1/15; CWHxm2/15	S2 (2021)	Red	GNR
<i>Thuja plicata</i> / <i>Lonicera involucrata</i>	western redcedar / black twinberry	CWHdm/14; CWHxm1/14; CWHxm2/14	S1 (2019)	Red	GNR
<i>Thuja plicata</i> - <i>Picea sitchensis</i> / <i>Lysichiton americanus</i>	western redcedar - Sitka spruce / skunk cabbage	CDFmm/Ws54; CWHdm/12; CWHdm/Ws54; CWHds1/12; CWHds1/Ws54; CWHds2/12; CWHds2/Ws54; CWHmm1/12; CWHmm1/Ws54; CWHms1/11; CWHms1/Ws54; CWHms2/11; CWHms2/Ws54; CWHvh1/13; CWHvh1/Ws54; CWHvh2/13; CWHvh2/Ws54; CWHvm1/14; CWHvm1/Ws54; CWHvm2/Ws54; CWHwh1/12; CWHwh1/Ws54; CWHwh2/06; CWHwh2/Ws54; CWHws1/11; CWHws1/Ws54; CWHws2/Ws54; CWHxm1/Ws54; CWHxm2/Ws54	S3? (2004)	Blue	G3?
<i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i>	western redcedar / sword fern - skunk cabbage	CDFmm/11; CDFmm/Ws53; CWHdm/Ws53; CWHxm1/12; CWHxm1/Ws53; CWHxm2/12; CWHxm2/Ws53	S3? (2012)	Blue	GNR
<i>Thuja plicata</i> / <i>Polystichum munitum</i> Dry Maritime	western redcedar / sword fern Dry Maritime	CWHdm/05	S2? (2016)	Red	G2G3
<i>Thuja plicata</i> / <i>Rubus spectabilis</i>	western redcedar / salmonberry	CWHdm/13; CWHxm1/13; CWHxm2/13	S1S2 (2019)	Red	GNR
<i>Thuja plicata</i> / <i>Tiarella trifoliata</i> Dry Maritime	western redcedar / three-leaved foamflower Dry Maritime	CWHdm/07	S2S3 (2018)	Blue	G3
<i>Tsuga heterophylla</i> / <i>Buckiella undulata</i>	western hemlock / flat-moss	CWHdm/01	S3 (2016)	Blue	G3G4
<i>Tsuga heterophylla</i> - <i>Thuja plicata</i> / <i>Struthiopteris spicant</i>	western hemlock - western redcedar / deer fern	CWHdm/06; CWHxm1/06; CWHxm2/06	S2 (2013)	Red	G2G3
<i>Typha latifolia</i> Marsh	common cattail Marsh	BGxh1/Wm05; BGxh2/Wm05; BGxw1/Wm05; BWBSmw/Wm05; CDFmm/Wm05; CWHdm/Wm05; CWHxm1/Wm05; CWHxm2/Wm05; IDFdck/Wm05; IDFdck1/Wm05; IDFdck2/Wm05; IDFdck3/Wm05; IDFdck5/Wm05; IDFdm1/Wm05; IDFdm2/Wm05; IDFmw1/Wm05; IDFmw2/Wm05; IDFxc/Wm05; IDFxh1/Wm05; IDFxh2/Wm05; IDFxk/Wm05; PPdh2/Wm05; PPxh1/Wm05; PPxh2/Wm05	S3 (2020)	Blue	G5

Source: Government of BC 2022a

Table B.4 - BC Conservation Data Centre Queried Wildlife Species at Risk in Mission, BC

Scientific Name	English Name	Biogeoclimatic Units	Provincial	BC List	Global	COSEWIC	SARA
Invertebrates							
<i>Allogona townsendiana</i>	Oregon Forestsnail	CDF; CMA; CWH; ESSF; MH	S2 (2015)	Red	G3G4 (2010)	E	1-E (2005)
<i>Argia emma</i>	Emma's Dancer	CWH; IDF	S3S4 (2015)	Blue	G5 (1990)		
<i>Argia vivida</i>	Vivid Dancer	BG; CWH; ICH; IDF; PP	S2S3 (2015)	Blue	G5 (2015)	SC	1-SC (2019)
<i>Callophrys eryphon sheltonensis</i>	Western Pine Elf, <i>sheltonensis</i> subspecies	CDF; CWH	S3 (2013)	Blue	G5TNR		
<i>Callophrys johnsoni</i>	Johnson's Hairstreak	CDF; CMA; CWH	S2? (2020)	Red	G3 (2017)	SC	
<i>Carychium occidentale</i>	Western Thorn	CDF; CWH	S3 (2015)	Blue	G3G4 (2002)		
<i>Cercyonis pegala incana</i>	Common Wood-nymph, <i>incana</i> subspecies	CDF; CWH	S2? (2021)	Red	G5T4T5 (2003)		
<i>Chlosyne hoffmanni</i>	Hoffman's Checkerspot	CMA; CWH; ESSF; MS	S2 (2020)	Red	G4 (2020)		
<i>Cicindela hirticollis</i>	Hairy-necked Tiger Beetle	BAFA; BG; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP; SBPS; SBS	S2S4 (2017)	Blue	G5 (2016)		
<i>Cryptomastix devia</i>	Puget Oregonian	CDF; CWH	SX (2015)	Red	G2 (2017)	XT	1-XT (2005)
<i>Danaus plexippus</i>	Monarch	BG; CDF; CWH; ESSF; ICH; IDF; MS; PP	S1?B (2020)	Red	G4 (2015)	E	1-SC (2003)
<i>Enallagma clausum</i>	Alkali Bluet	BAFA; BG; CDF; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP; SBPS	S3 (2015)	Blue	G5 (2015)		
<i>Epargyreus clarus</i>	Silver-spotted Skipper	CDF; CWH; ESSF; ICH; IDF; MH; MS; PP	S3 (2020)	Blue	G5 (2020)		
<i>Epargyreus clarus californicus</i>	Silver-spotted Skipper, <i>californicus</i> subspecies	CDF; CWH	S1 (2016)	Red	G5TNR		
<i>Erynnis propertius</i>	Propertius Duskywing	CDF; CMA; CWH; MH	S2 (2020)	Red	G5 (2020)		
<i>Erythemis collocata</i>	Western Pondhawk	BG; CDF; CWH; ESSF; PP	S3S4 (2015)	Blue	G5 (2016)		
<i>Euphyes vestris</i>	Dun Skipper	CDF; CMA; CWH; ESSF; IDF; IMA; MH; PP	S2S3 (2020)	Blue	G5 (2020)	T	1-T (2003)
<i>Galba bulimoides</i>	Prairie Fossaria	CDF; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP	S3? (2015)	Blue	G5 (1999)		
<i>Galba dalli</i>	Dusky Fossaria	BG; CDF; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP	S3S4 (2015)	Blue	G5 (1999)		
<i>Galba parva</i>	Pygmy Fossaria	CWH; SBS	S3S5 (2015)	Blue	G5 (2015)		
<i>Gyraulus crista</i>	Star Gyro	BAFA; BG; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP	S3S4 (2015)	Blue	G5 (2017)		
<i>Hesperia colorado oregonia</i>	Western Branded Skipper, <i>oregonia</i> subspecies	CDF; CWH; MH	S2 (2021)	Red	G5T2 (2016)	E	
<i>Nearctula sp. 1</i>	Threaded Vertigo	CDF; CWH	S3 (2015)	Blue	G3G5 (2006)	SC	1-SC (2012)
<i>Octogomphus specularis</i>	Grappletail	CWH	S2 (2015)	Red	G4 (2016)	SC	
<i>Omus audouini</i>	Audouin's Night-stalking Tiger Beetle	CDF; CWH	S1 (2017)	Red	G5 (2008)	T	1-T (2018)
<i>Ophiogomphus occidentis</i>	Sinuus Snaketail	BAFA; BG; CDF; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP; SBPS	S3 (2015)	Blue	G5 (2015)		
<i>Pachydiplax longipennis</i>	Blue Dasher	CWH	S3S4 (2015)	Blue	G5 (2015)		
<i>Papilio indra</i>	Indra Swallowtail	CWH; ESSF; IDF; IMA; MH; MS	S1 (2020)	Red	G5? (2020)		
<i>Parnassius clodius claudianus</i>	Clodius Parnassian, <i>claudianus</i> subspecies	CDF; CMA; CWH; MH	S3S4 (2013)	Blue	G5TNR		
<i>Parnassius clodius pseudogallatinus</i>	Clodius Parnassian, <i>pseudogallatinus</i> subspecies	CMA; CWH; ESSF; IDF; IMA; MH; MS	S3S4 (2013)	Blue	G5TNR		
<i>Physella propinqua</i>	Rocky Mountain Physa	BAFA; CDF; CMA; CWH; ESSF; IDF; IMA; MH; MS; SBPS; SBS	S3S4 (2015)	Blue	G5Q (2015)		
<i>Physella virginea</i>	Sunset Physa	BAFA; BG; CDF; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; SBPS; SBS	S3S5 (2015)	Blue	G5 (2015)		
<i>Planorbula campestris</i>	Meadow Rams-horn	BAFA; BWBS; CDF; CMA; CWH; ESSF; ICH; IMA; MH; SBS	S3S4 (2015)	Blue	G4G5 (2015)		
<i>Speyeria zerene bremnerii</i>	Zerene Fritillary, <i>bremnerii</i> subspecies	CDF; CWH	S2 (2013)	Red	G5T3T4 (1998)		
<i>Sphaerium occidentale</i>	Herrington Fingernailclam	BG; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP; SBPS; SBS	S2S3 (2015)	Blue	G5 (2015)		
<i>Sphaerium patella</i>	Rocky Mountain Fingernailclam	CWH; MH	SH (2015)	Red	G2G3 (2015)		
<i>Sphaerium striatinum</i>	Striated Fingernailclam	BAFA; BG; BWBS; CDF; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP; SBPS; SBS; SWB	S3S4 (2015)	Blue	G5 (2015)		
<i>Stagnicola traski</i>	Widelip Pondsnaill	BG; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP; SBPS; SBS	S3S4 (2015)	Blue	G3G4 (2017)		
Herpetiles							
<i>Actinemys marmorata</i>	Northwestern Pond Turtle	CWH	SX (2018)	Red	G3 (2005)	XT	1-XT (2005)
<i>Anaxyrus boreas</i>	Western Toad	BG; BWBS; CDF; CWH; ESSF; ICH; IDF; PP; SBS; SWB	S4 (2022)	Yellow	G4 (2008)	SC	1-SC (2018)
<i>Ascaphus truei</i>	Coastal Tailed Frog	CWH; ESSF; ICH; IDF; MH; MS	S4 (2022)	Yellow	G4 (2016)	SC	1-SC (2003)
<i>Charina bottae</i>	Northern Rubber Boa	BG; CWH; ICH; IDF; PP	S4 (2018)	Yellow	G5 (2016)	SC	1-SC (2005)
<i>Chrysemys picta</i>	Painted Turtle	BG; CDF; CWH; ICH; IDF; MH; PP; SBS	S3 (2018)	No Status	G5 (2016)	T/SC	1-T/SC (2021)
<i>Chrysemys picta</i> pop. 1	Painted Turtle - Pacific Coast Population	CDF; CWH; MH	S1S2 (2018)	Red	G5T2Q (2007)	T	1-T (2021)
<i>Contia tenuis</i>	Common Sharp-tailed Snake	CDF; CWH	S1S2 (2018)	Red	G5 (2016)	E/T	1-E (2003)
<i>Dicamptodon tenebrosus</i>	Coastal Giant Salamander	CWH	S2S3 (2022)	Blue	G5 (2003)	T	1-T (2003)
<i>Pituophis catenifer</i>	Gophersnake	BG; CDF; CWH; IDF; PP	S3 (2018)	No Status	G5 (2015)	XT/T	1-XT/T (2005)
<i>Pituophis catenifer catenifer</i>	Gophersnake, <i>catenifer</i> subspecies	CDF; CWH	SX (2018)	Red	G5T5 (2016)	XT	1-XT (2005)
<i>Rana aurora</i>	Northern Red-legged Frog	CDF; CWH; MH	S3 (2022)	Blue	G4 (2015)	SC	1-SC (2005)

Table B.4 - BC Conservation Data Centre Queried Wildlife Species at Risk in Mission, BC

Scientific Name	English Name	Biogeoclimatic Units	Provincial	BC List	Global	COSEWIC	SARA
<i>Rana pretiosa</i>	Oregon Spotted Frog	CWH	S1 (2022)	Red	G2 (2013)	E	1-E (2003)
Fish							
<i>Acipenser medirostris</i>	Green Sturgeon	CDF; CWH	S2S3N (2019)	Blue	G2 (2022)	SC	1-SC (2006)
<i>Acipenser transmontanus</i>	White Sturgeon	BG; CDF; CWH; ICH; IDF; MS; PP; SBS	S2 (2018)	No Status	G4 (2002)	E/T	1-E
<i>Acipenser transmontanus</i> pop. 4	White Sturgeon (Lower Fraser River Population)	CDF; CWH; IDF	S1S2 (2018)	Red	G4T2Q (2002)	T	
<i>Cottus aleuticus</i> pop. 1	Coastrange Sculpin, Cultus Population	CWH	S1S2 (2019)	Red	G5T1T2Q (2010)	E	1-T (2003)
<i>Hybognathus hankinsoni</i> - Pacific group	Brassy Minnow - Pacific Group	CDfmm; CWHdm; CWHxm	S2S3 (2019)	Blue	G5TNRQ	SC	
<i>Oncorhynchus clarkii clarkii</i>	Cutthroat Trout, <i>clarkii</i> subspecies	BWBS; CDF; CWH; ICH; SBS	S3S4 (2004)	Blue	G5T4 (1997)		
<i>Rhinichthys cataractae</i> - <i>Chehalis</i> lineage	Nooksack Dace	CWH	S1 (2019)	Red	G3 (1996)	E	1-E (2003)
<i>Salvelinus confluentus</i> pop. 28	Bull Trout - South Coast Population	CDF; CWH; MH	S2S3 (2018)	Blue	G5T3Q (2015)	SC	1-SC (2019)
<i>Spirinchus</i> sp. 1	Pygmy Longfin Smelt	CWH	S2 (2019)	Red	G5T2Q (2019)	DD	
Birds							
<i>Accipiter gentilis laingi</i>	Northern Goshawk, <i>laingi</i> subspecies	CDF; CWH	S2 (2010)	Red	G5T2 (2016)	T	1-T (2003)
<i>Aechmophorus occidentalis</i>	Western Grebe	BG; BWBS; CDF; CWH; ICH; IDF; MS; PP; SBPS; SBS	S1B,S2N (2015)	Red	G5 (2016)	SC	1-SC (2017)
<i>Aeronautes saxatalis</i>	White-throated Swift	BAFA; BG; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP; SBPS; SBS	S3S4B (2022)	Blue	G5 (2016)		
<i>Ammodramus nelsoni</i>	Nelson's Sparrow	BWBS; CWH	S2B (2018)	Red	G5 (2016)	NAR	
<i>Ardea herodias fannini</i>	Great Blue Heron, <i>fannini</i> subspecies	CDF; CWH	S3B,S4N (2022)	Blue	G5T4 (2016)	SC	1-SC (2010)
<i>Asio flammeus</i>	Short-eared Owl	BG; BWBS; CDF; CWH; ICH; IDF; MS; PP; SBPS; SBS; SWB	S3B,S1N (2022)	Blue	G5 (2016)	T	1-SC (2012)
<i>Bartramia longicauda</i>	Upland Sandpiper	BG; BWBS; CDF; CWH; ICH; IDF; SBPS; SBS; SWB	S2B (2022)	Red	G5 (2016)		
<i>Botaurus lentiginosus</i>	American Bittern	BG; BWBS; CDF; CWH; ICH; IDF; MS; PP; SBPS; SBS	S3B,SNRN (2015)	Blue	G5 (2016)		
<i>Brachyramphus marmoratus</i>	Marbled Murrelet	CDF; CWH; MH	S3 (2022)	Blue	G3 (2016)	T	1-T (2003)
<i>Branta bernicla</i>	Brant	BWBS; CDF; CWH; IDF; SBPS	S3M (2015)	Blue	G5 (2016)		
<i>Buteo lagopus</i>	Rough-legged Hawk	BAFA; BG; BWBS; CDF; CWH; ESSF; ICH; IDF; IMA; MS; PP; SBPS; SBS; SWB	S3N (2015)	Blue	G5 (2016)	NAR	
<i>Butorides virescens</i>	Green Heron	BG; CDF; CWH; ICH; IDF; PP; SBS	S3S4B (2015)	Blue	G5 (2016)		
<i>Calcarius pictus</i>	Smith's Longspur	BAFA; BG; BWBS; CDF; CMA; CWH; IDF; MS; PP; SBPS; SWB	S3S5B (2015)	Blue	G4G5 (2016)		
<i>Calidris canutus</i>	Red Knot	CDF; CWH	S3?M (2022)	Blue	G4 (2016)	T	1-T (2010)
<i>Cardellina canadensis</i>	Canada Warbler	BWBS; CDF; CWH	S3B (2022)	Blue	G5 (2016)	SC	1-T (2010)
<i>Catostomus</i> sp. 4	Salish Sucker	CWH	S2 (2019)	Red	G1 (2011)	T	1-T (2005)
<i>Chondestes grammacus</i>	Lark Sparrow	BG; BWBS; CDF; CWH; ICH; IDF; MS; PP; SBPS; SBS	S2S4B (2022)	Blue	G5 (2016)		
<i>Chordeiles minor</i>	Common Nighthawk	BG; BWBS; CDF; CWH; ESSF; ICH; IDF; MH; MS; PP; SBPS; SBS; SWB	S3S5B (2022)	Blue	G5 (2016)	SC	1-T (2010)
<i>Coccythraustes vespertinus</i>	Evening Grosbeak	BG; BWBS; CDF; CWH; ESSF; ICH; IDF; MH; MS; PP; SBPS; SBS; SWB	S5 (2022)	Yellow	G5 (2016)	SC	1-SC (2019)
<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	BG; CDF; CWH; ICH; PP	SXB (2022)	Red	G5 (2016)		
<i>Contopus cooperi</i>	Olive-sided Flycatcher	BWBS; CDF; CWH; ESSF; ICH; IDF; MH; MS; PP; SBPS; SBS; SWB	S4B (2022)	Yellow	G4 (2016)	SC	1-T (2010)
<i>Cypseloides niger</i>	Black Swift	BAFA; BG; CDF; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP; SBPS; SBS; SWB	S2S4B (2022)	Blue	G4 (2016)	E	1-E (2019)
<i>Dolichonyx oryzivorus</i>	Bobolink	BG; BWBS; CDF; CWH; ICH; IDF; PP; SBS	S2?B (2022)	Red	G5 (2016)	SC	1-T (2017)
<i>Eremophila alpestris strigata</i>	Horned Lark, <i>strigata</i> subspecies	CDF; CWH	SXB (2019)	Red	G5T2 (2016)	E	1-E (2005)
<i>Euphagus carolinus</i>	Rusty Blackbird	BG; BWBS; CDF; CWH; ESSF; MS; PP; SBPS; SBS; SWB	S3S4B (2015)	Blue	G4 (2016)	SC	1-SC (2009)
<i>Falco mexicanus</i>	Prairie Falcon	BG; BWBS; CDF; CWH; ESSF; ICH; IDF; MS; PP; SBS	S1 (2018)	Red	G5 (2016)	NAR	
<i>Falco peregrinus</i>	Peregrine Falcon	BG; BWBS; CDF; CWH; ESSF; ICH; IDF; MS; PP; SBPS; SWB	S3 (2015)	No Status	G4 (2016)	SC	1-SC
<i>Falco peregrinus anatum</i>	Peregrine Falcon, <i>anatum</i> subspecies	BG; BWBS; CDF; CWH; IDF; MS; PP; SBS	S2? (2011)	Red	G4T4 (2016)	NAR	1-SC (2012)
<i>Falco peregrinus pealei</i>	Peregrine Falcon, <i>pealei</i> subspecies	CDF; CWH	S3S4 (2019)	Blue	G4T3 (2016)	SC	1-SC (2003)
<i>Falco rusticolus</i>	Gyrfalcon	BAFA; BG; BWBS; CDF; CWH; ICH; IDF; SBPS; SBS; SWB	S3S4B,SNRN (2015)	Blue	G5 (2016)	NAR	
<i>Fulmarus glacialis</i>	Northern Fulmar	CDF; CWH	S1B,S4N (2015)	Red	G5 (2016)		
<i>Hirundo rustica</i>	Barn Swallow	BAFA; BG; BWBS; CDF; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP; SBPS; SBS; SWB	S4B (2022)	Yellow	G5 (2016)	SC	1-T (2017)
<i>Hydroprogne caspia</i>	Caspian Tern	BG; BWBS; CDF; CWH; ICH; IDF; PP; SBS	S3B (2015)	Blue	G5 (2016)	NAR	
<i>Icteria virens</i>	Yellow-breasted Chat	BG; CDF; CWH; ICH; IDF; PP; SBS	S2B (2018)	Red	G5 (2016)	E	1-E (2003)
<i>Larus californicus</i>	California Gull	BG; BWBS; CDF; CWH; ICH; IDF; MS; PP; SBS	S1B,SNRN (2022)	Red	G5 (2016)		
<i>Limnodromus griseus</i>	Short-billed Dowitcher	BG; BWBS; CDF; CWH; ICH; IDF; PP; SWB	S2S3B (2015)	Blue	G5 (2016)		

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Scientific Name	English Name	Biogeoclimatic Units	Provincial	BC List	Global	COSEWIC	SARA
<i>Limosa haemastica</i>	Hudsonian Godwit	BWBS; CDF; CWH; IDF; MS; SWB	S1B (2022)	Red	G4 (2016)	T	
<i>Megascops kennicottii</i>	Western Screech-Owl	BG; CDF; CWH; ICH; IDF; PP	S4 (2015)	No Status	G4G5 (2016)	T	1-T
<i>Megascops kennicottii kennicottii</i>	Western Screech-Owl, <i>kennicottii</i> subspecies	CDF; CWH; MH	S2S3 (2017)	Blue	G4G5T4 (2016)	T	1-T (2005)
<i>Melanerpes lewis</i>	Lewis's Woodpecker	BG; CDF; CWH; ICH; IDF; PP; SBS	S2S3B (2022)	Blue	G4 (2016)	T	1-T (2012)
<i>Melanitta americana</i>	Black Scoter	CDF; CMA; CWH; MH	S3S4N (2015)	Blue	G5 (2016)		
<i>Melanitta perspicillata</i>	Surf Scoter	BG; BWBS; CDF; CWH; ICH; IDF; MS; PP; SBPS; SBS; SWB	S3B,S4N (2015)	Blue	G5 (2016)		
<i>Nannopterum auritum</i>	Double-crested Cormorant	BWBS; CDF; CWH; ICH; IDF; PP; SBPS; SBS	S3S4 (2015)	Blue	G5 (2016)	NAR	
<i>Numenius americanus</i>	Long-billed Curlew	BG; CDF; CWH; ICH; IDF; PP; SBPS; SBS	S4B (2022)	Yellow	G5 (2016)	SC	1-SC (2005)
<i>Nycticorax nycticorax</i>	Black-crowned Night-heron	BG; CDF; CWH; ICH; IDF; PP	S1 (2022)	Red	G5 (2016)		
<i>Oreoscoptes montanus</i>	Sage Thrasher	BG; CDF; CWH; ICH; IDF; PP	S1B (2022)	Red	G4 (2016)	E	1-E (2003)
<i>Patagioenas fasciata</i>	Band-tailed Pigeon	CDF; CWH; ICH; IDF; MS; SBS	S3S4 (2022)	Blue	G4 (2016)	SC	1-SC (2011)
<i>Pekania pennanti</i>	Fisher	BAFA; BWBS; CDF; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP; SBPS; SBS; SWB	S3 (2020)	No Status	G5 (2016)		
<i>Phalaropus lobatus</i>	Red-necked Phalarope	BG; BWBS; CDF; CWH; ICH; IDF; MS; PP; SBPS; SBS; SWB	S3S4B (2015)	Blue	G4G5 (2016)	SC	1-SC (2019)
<i>Pluvialis dominica</i>	American Golden-Plover	BAFA; BG; BWBS; CDF; CWH; ICH; IDF; MS; PP; SBPS; SWB	S3S4B (2015)	Blue	G5 (2016)		
<i>Progne subis</i>	Purple Martin	BWBS; CDF; CWH; ICH	S3S4B (2022)	Blue	G5 (2016)		
<i>Ptychoramphus aleuticus</i>	Cassin's Auklet	CDF; CWH	S2B,S3N (2018)	Red	G4 (2016)	SC	1-SC (2019)
<i>Recurvirostra americana</i>	American Avocet	BG; BWBS; CDF; CWH; ICH; IDF; MS; PP; SBPS	S2S3B (2015)	Blue	G5 (2016)		
<i>Setophaga virens</i>	Black-throated Green Warbler	BWBS; CDF; CWH; ESSF; ICH; SBS	S3B (2015)	Blue	G5 (2016)		
<i>Sterna forsteri</i>	Forster's Tern	BG; BWBS; CDF; CWH; ICH; IDF; PP	S1B (2022)	Red	G5 (2016)	DD	
<i>Strix occidentalis</i>	Spotted Owl	CWH; ESSF; IDF; MH	S1 (2018)	Red	G3G4 (2016)	E	1-E (2003)
<i>Sympetrum vicinum</i>	Autumn Meadowhawk	CDF; CWH	S3S4 (2015)	Blue	G5 (2015)		
<i>Synthliboramphus antiquus</i>	Ancient Murrelet	CDF; CWH	S2S3B,S4N (2022)	Blue	G4 (2016)	SC	1-SC (2006)
<i>Tanypteryx hageni</i>	Black Petaltail	CWH	S3 (2015)	Blue	G4 (2000)		
<i>Thaleichthys pacificus</i>	Eulachon	CWH	S2S3 (2004)	Blue	G5 (2005)	E/T	
<i>Tringa incana</i>	Wandering Tattler	BWBS; CDF; CWH; IDF; SBS; SWB	S3B (2015)	Blue	G4G5 (2016)		
<i>Tyto alba</i>	Barn Owl	BG; BWBS; CDF; CWH; ICH; IDF; PP	S3 (2022)	Blue	G5 (2016)	T	1-T (2018)
<i>Uria aalge</i>	Common Murre	CDF; CWH	S2B,S3S4N (2015)	Red	G5 (2016)		
Mammals							
<i>Aplodontia rufa</i>	Mountain Beaver	CDF; CWH; ESSF; MH; MS	S4 (2015)	Yellow	G5 (2016)	SC	1-SC (2003)
<i>Cervus elaphus roosevelti</i>	Roosevelt Elk	CWH; MH	S3S4 (2017)	Blue	G5T4 (2016)		
<i>Corynorhinus townsendii</i>	Townsend's Big-eared Bat	BG; CDF; CWH; ICH; IDF; PP	S3 (2022)	Blue	G4 (2016)		
<i>Gulo gulo</i>	Wolverine	BAFA; BWBS; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; SBPS; SBS; SWB	S3 (2015)	No Status	G4 (2016)	SC	1-SC (2018)
<i>Gulo gulo luscus</i>	Wolverine, <i>luscus</i> subspecies	BAFA; BWBS; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; SBPS; SBS; SWB	S3 (2010)	Blue	G4T4 (2016)	SC	1-SC (2018)
<i>Lasiurus cinereus</i>	Hoary Bat	BG; BWBS; CDF; CWH; ICH; IDF; MS; PP; SBS	S3S4 (2022)	Blue	G3G4 (2016)		
<i>Lepus americanus washingtonii</i>	Snowshoe Hare, <i>washingtonii</i> subspecies	CDF; CWH	S1 (2011)	Red	G5T3T5 (1996)		
<i>Mustela frenata altifrontalis</i>	Long-tailed weasel, <i>altifrontalis</i> subspecies	CDF; CWH; MH	SH (2011)	Red	G5TNR		
<i>Myodes gapperi occidentalis</i>	Southern Red-backed Vole, <i>occidentalis</i> subspecies	CDF; CWH	S1 (2006)	Red	G5T5 (2016)		
<i>Myotis lucifugus</i>	Little Brown Myotis	BG; BWBS; CDF; CWH; ESSF; ICH; IDF; MH; MS; PP; SBPS; SBS; SWB	S3S4 (2022)	Blue	G3G4 (2021)	E	1-E (2014)
<i>Myotis yumanensis</i>	Yuma Myotis	BG; CDF; CWH; ICH; IDF; MH; PP	S3 (2022)	Blue	G5 (2016)		
<i>Oreamnos americanus</i>	Mountain Goat	BAFA; BG; BWBS; CDF; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; PP; SBPS; SBS; SWB	S3 (2015)	Blue	G5 (2016)		
<i>Sorex bendirii</i>	Pacific Water Shrew	CWH	S2? (2015)	Red	G4 (2016)	E	1-E (2003)
<i>Sorex rohweri</i>	Olympic Shrew	CDF; CWH	S2? (2015)	Red	G4G5 (2007)		
<i>Sorex trowbridgii</i>	Trowbridge's Shrew	CDF; CWH	S3 (2015)	Blue	G5 (2016)		
<i>Scapanus townsendii</i>	Townsend's Mole	CWH	S1 (2015)	Red	G5 (2016)	E	1-E (2005)
<i>Ursus arctos</i>	Grizzly Bear	BAFA; BWBS; CMA; CWH; ESSF; ICH; IDF; IMA; MH; MS; SBPS; SBS; SWB	S3? (2015)	Blue	G4 (2022)	SC	1-SC (2018)

Source: Government of BC 2022a

Appendix B
Table B.5 - Observed Fish Species within the Study Area

Geometry (X)	Geometry (Y)	Waterbody Name	Life Stage	Species Name	OBJECTID	Watershed Code	Activity	Point Type Code	Observation Date	Waterbody ID	Agency Name
-13614165.88	6296870.541	FRASER RIVER	Juvenile	White Sturgeon	743923391	100		Observation	2007-09-26	1	LGL Sidney
-13613701.54	6296427.019	FRASER RIVER	Juvenile	White Sturgeon	743924659	100		Observation	2007-09-04	1	LGL Sidney
-13613387.45	6297056.097	FRASER RIVER	Juvenile	White Sturgeon	743924656	100		Observation	2007-09-03	1	LGL Sidney
-13615667.52	6296856.811	MANDALE SLOUGH		Stickleback (General)	744104571	100-053200	Fish observed at this point or zone	Observation	1999-02-01	1400	
-13615667.52	6296856.811	MANDALE SLOUGH		Coho Salmon	744104262	100-053200	Fish observed at this point or zone	Observation	1999-02-01	1400	
-13614325.08	6296319.585	FRASER RIVER		Sockeye Salmon	744126007	100	Fish observed at this point or zone	Observation	1991-06-01	1	
-13615365.43	6297356.016	MANDALE SLOUGH		Coho Salmon	744067553	100-053200		Observation	1994-01-01	1400	
-13614718.49	6297844.413	MANDALE SLOUGH		Coho Salmon	744073205	100-053200	Fish observed at this point or zone	Observation	1994-01-01	1400	
-13614552.99	6298416.845			Rainbow Trout	744104256	100-053200-83000	Fish observed at this point or zone	Observation	1999-02-01	1405	
-13614432.73	6298548.897	MANDALE SLOUGH	Parr	Coastal Cutthroat Trout	744016920	100-053200		Observation	2015-03-20	1400	Scott Resource Services Inc.
-13614552.99	6298416.845			Rainbow Trout	743877212	100-053200-83000		Summary	1999-02-01	1405	

Source: Government of BC 2022a

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