



Biophysical Habitat Assessment

Fraser Surrey Canola Oil Transload Facility



January 6, 2023

Prepared for:

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BIOPHYSICAL HABITAT ASSESSMENT

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Abbreviations

µPa	micropascal
°C	celsius
µs/cm	specific conductivity
BC	British Columbia
CCME	Canadian Council of the Ministers of the Environment
CEMP	Construction Environmental Management Plan
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSMOS	City of Surrey Mapping Online System
CWH	Coastal Western Hemlock
CWHxm	Coastal Western Hemlock very dry maritime
dB	decibel
DFO	Fisheries and Oceans Canada
DO	dissolved oxygen
DU	designated units
FREMP	Fraser River Estuary Management Program
IAPP	Invasive Alien Plant Program
kHz	Kilohertz
km	kilometre
m	metre
m ²	square metres
mg/L	milligrams per liter
mm	millimetres
MMPA	<i>Marine Mammals Protection Act</i>



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NOAA	National Oceanic and Atmospheric Administration
NTU	nephelometric turbidity units
PoE	pathways of effects
ppt	parts per trillion
PSU	Practical Salinity Unit
PTS	Permanent threshold shift
QEP	qualified environmental professional
SARA	<i>Species at Risk Act</i>
SPL	sound pressure levels
TS	Target Strength
TSS	total suspended solids
VFPA	Vancouver Fraser Port Authority
WSC	Watershed code



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DP World Fraser Surrey Canola Oil Transload Facility Project Overview
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1.0 DP WORLD FRASER SURREY CANOLA OIL TRANSLOAD FACILITY PROJECT OVERVIEW

DP World Canada Inc. (DP World) is proposing to develop a canola oil transload facility (the Project) at DP World's Fraser Surrey Terminal (Figure 1) located at 11060 Elevator Road, Surrey, British Columbia (the site). The Project includes redevelopment of new marine infrastructure to support vessel mooring and loading at the existing Berth 10, and the development of canola storage facilities and supporting transfer infrastructure on a parcel of land within the DP World Fraser Surrey terminal area. The terminal and Berth 10 Project site are fully located on federal lands and waters under lease by the Vancouver Fraser Port Authority (VFPA).

The Project is subject to application review under VFPA's Project Environmental Review (PER No 22-017) process intended to satisfy Section 82 of the *Impact Assessment Act* for projects on federal lands.

This report presents the results from a desktop environmental review and biophysical and habitat field surveys within the boundary.

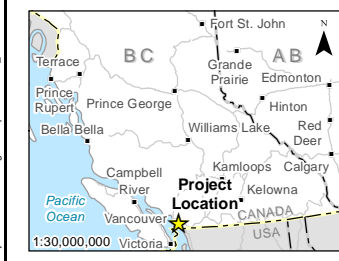
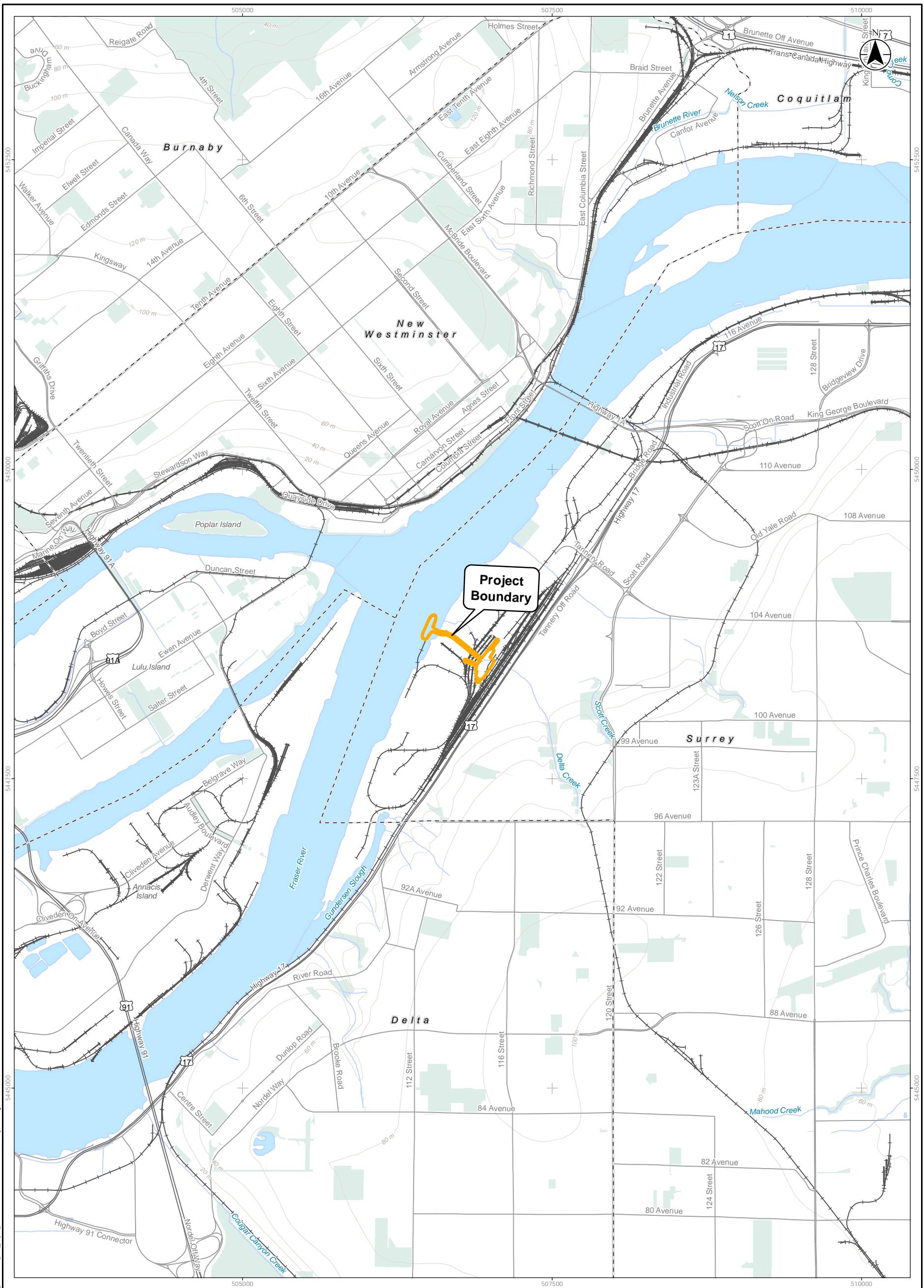
1.1 PROJECT LOCATION

The DP World Fraser Surrey Terminal and Berth 10 Project site are adjacent to and in Annieville Channel of the Fraser River, situated south of Shoal Point and north of Gundersen Slough (Figure 1). Berth 10 is located behind on the eastern upstream end of the terminal within the area protected by existing breakwater within the Annieville Channel of the river. The channel is bound to the northwest by Annacis Island. The Project site is approximately 33.1 km from Sand Heads Navigation marker within the Strait of Georgia.

1.2 PROJECT DATES

The preliminary construction schedule anticipates project permitting in 2022 and marine construction works starting in early 2023 over a 6-month period of construction.





- Highway
- Road
- Railway
- Topographic Contour
- Watercourse
- Waterbody
- Local Greenspace
- Municipal Boundary
- Project Boundary



Stantec DP WORLD
Canada

Project Location: Surrey, BC
NTS 50K Grid: 092G02

Project Number: 12322054
Prepared by KWONG on 20220520
Requested by BBOOTH on 20220520
Checked by LTRUPELL on 20220930

Client/Project/Report:
DP World (Canada)
Fraser Surrey Canola Oil Transload Facility
Habitat Assessment

Figure No. **1** Revision No. **2**

Title
Site Location

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BIOPHYSICAL HABITAT ASSESSMENT

Project Description
January 6, 2023

2.0 PROJECT DESCRIPTION

The Canola Oil Transload Facility and Berth 10 Project include:

- Construction of a concrete access trestle to the loading arm platform at Berth 10
- Selective tree removal, as required to provide safe clearance along the first 30 m of the access trestle from terminal lands into the Fraser River
- Excavation of an abutment area within the existing operating terminal paved area and fence line
- Construction of a canola loading platform at Berth 10
- Construction of a canola oil storage tank and rail offload area within the terminal adjacent to the realigned Timberland Road South, including:
 - Two rail spurs and offloading station
 - Three carbon steel canola oil tanks
 - Containment area including liners, precast walls, and fire water loop
 - Control building and parking
 - Below grade canola oil lines from storage tanks to Berth 10 loading platform

The Project will not require any change to the existing Fraser River routine maintenance dredging program behind the existing breakwater at Fraser Surrey Terminal.

Construction of the loading arm berthing platform, access trestle, and connection trestle to the existing Berth 10 have been designed to minimize the in-water and over-water construction activities. Construction materials will include hollow pipe style coated or painted steel piles, temporary falsework, form work, precast concrete, rebar, ready mix concrete, granular fill, riprap, steel pipe and berth accessories. Marine construction equipment will include barges, cranes, pile driving equipment, concrete pump trucks air compressors and welding equipment. The abutment construction will be completed using an excavator and a roller to connect the trestle with the landside of the terminal.

The general construction sequence will include:

1. Tree removal within the planned trestle alignment from the terminal to Berth 10
2. Site preparation and removal of one existing steel dolphin pile
3. Installation of approximately 36 new steel piles to support the access trestle and loading arm platform
4. Installation of concrete pile caps
5. Installation of precast concrete panels, girders above highwater
6. Installation of concrete cast in place deck topping slab and concrete approach slab above the high-water mark to construct the surface of loading arm platform and access trestle
7. Installation of the new catwalk connection above highwater to the loading platform
8. Installation of fender panels, bollards, and berth accessories above highwater
9. Installation of the canola loading arm, loading and recycle lines, sump tank and pressure recovery vessel



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Regulatory Context
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3.0 REGULATORY CONTEXT

The terminal and Berth 10 Project site are located on federal lands and waters under lease by the Vancouver Fraser Port Authority (VFPA). The following federal regulations have been considered as they relate to the assessment of biophysical resources at the site.

3.1 IMPACT ASSESSMENT ACT AND CANADA MARINE ACT

Through the project and environmental review (PER) process, the VFPA fulfills federal responsibilities under the *Canada Marine Act* and the *Impact Assessment Act* (Section 82), to consider potential effects of project development on federal lands and waters and neighboring communities. The VFPA will not allow projects to proceed if they are likely to result in significant adverse effects. The habitat assessment report provides the description of the environment and an assessment of the potential effects of the Project to inform the review under PER 22-017.

3.2 FISHERIES ACT

Canadian fisheries resources, including the protection of fish and fish habitats are regulated by the *Fisheries Act*. Fisheries and Oceans Canada (DFO) is the Federal agency responsible for the administration of the *Fisheries Act*, which includes provisions to protect fish and fish habitats in Canadian waters. Subsection 34.4(1) prohibits the killing of fish and subsection 35(1) prohibits the harmful alteration, disruption, or destruction (HADD) of fish habitat unless it is authorized by the minister under paragraph 35(2)(b) of the Act.

3.3 SPECIES AT RISK ACT

The *Species at Risk Act* (SARA) is the primary federal legislation intended to protect animal and plant species at risk in Canada. The primary purposes of the SARA are to prevent the extinction or extirpation of species in Canada and to outline actions deemed necessary for species recovery. SARA is administered by DFO and Environment and Climate Change Canada.

Species are listed under the SARA as either Special Concern, Threatened, Endangered, or Extirpated. For species listed as Threatened, Endangered, or Extirpated, SARA requires the Government of Canada to develop recovery strategies, which identify areas of critical habitat.

Under Sections 32 and 33 of the SARA it is an offence to kill, harm, harass, capture, or take an individual of a listed species. Additionally, under Section 58, the SARA prohibits the destruction of any part of the critical habitat of listed aquatic species.

3.4 FEDERAL POLICY ON WETLAND CONSERVATION

The Government of Canada adopted the Federal Policy on Wetland Conservation (the Policy) in 1991 as a commitment to promoting wetland conservation within all federal decisions and responsibilities.



BIOPHYSICAL HABITAT ASSESSMENT

Description of Existing Environment

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Although it is not a regulatory document, the Cabinet-level direction has been to apply this Policy to all federal policies, plans, programs, projects, and activities (Lynch-Stewart et al. 1996). The Canadian Wildlife Service of Environment and Climate Change Canada is responsible for coordinating the implementation of the Policy whenever federal corporations, agents or authorities are making decisions that may affect wetlands. These decisions include actions such as granting permits, constructing facilities, leasing Crown land, or conducting land use planning.

The Policy commits all federal departments to the goal of no net loss of wetland functions where any of the following conditions apply:

- i. On federal lands and waters
- ii. In areas affected by the implementation of federal programs where the continuing loss or degradation of wetlands has reached critical levels
- iii. Where federal activities affect wetlands designated as ecologically or socio-economically important to a region (Government of Canada 1991)

The Canadian Wildlife Service of Environment and Climate Change Canada has provided regional guidance on the application and implementation of the Policy in the context of environmental assessments in British Columbia (ECCC/CWS 2019).

4.0 DESCRIPTION OF EXISTING ENVIRONMENT

The following methods were used to review existing ecological baseline information for the Project site and collect field observations, including information on species at risk and critical habitat within or adjacent to the Project site.

4.1 METHODS

4.1.1 Desktop Assessment

A search of available data sources and mapping was conducted to identify known occurrences of invasive plant species, ecological communities, plant and/or wildlife species at risk, and aquatic resources. The following desktop tools and data sources were utilized:

- Online mapping tools including iMap BC (Government of BC 2022a), HabitatWizard (Government of BC 2022b), City of Surrey Mapping Online System (COSMOS, City of Surrey 2022), and Metro Vancouver Sensitive Ecosystem Inventory Mapping (Metro Vancouver 2022).
- Ecological community and plant species conservation status information from BC Species and Ecosystems Explorer (BC CDC 2022). The search for historical occurrences and potentially occurring species and communities used a 1 km radius around the Project footprint
- Federally listed plant and wildlife species from the Species at Risk Public Registry (Government of Canada 2022).



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Description of Existing Environment

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- The Wildlife Tree Stewardship Atlas (Community Mapping Network 2022) to review for mapped known occurrences of raptor nest trees.
- Wildlife occurrence data and distribution from E-Fauna BC (E-Fauna 2022) and eBird (eBird 2022)
- The Invasive Alien Plant Program (IAPP) database and map display (MOECSS 2022) for records of invasive plant species within 1 km of the study area.
- The Metro Vancouver Invasive Plant Prioritization Rankings (ISCMV 2020) for a list of invasive plants that are priorities in the Metro Vancouver region.
- Habitat mapping from Fraser River Estuary Management Program Atlas (FREMP 2008); and
- Aquatic and terrestrial information from previous reports and studies completed within the same area (e.g., Hemmera 2018a, 2018b).

4.1.2 Aquatic and Riparian Field Assessment

Habitat and species field surveys were conducted on:

- April 12, 2022
- April 18 and 19, 2022
- May 24, 2022
- May 31, 2022
- November 3, 2022

The two-day April 18 – 19, 2022 habitat survey included:

- Mapping of prominent habitat features (i.e., side-channels/back channels, shoreline at high and low tide, culverts etc.) and Fraser River substrates.
- In-situ water quality sampling at varying tidal extents using a YSI ProDSS multi parameter meter to measure temperature (°C), dissolved oxygen (DO; mg/L), specific conductivity ($\mu\text{s}/\text{cm}$), salinity (ppt), pH and turbidity (nephelometric turbidity units - NTU).
- Fish presence sampling using beach seining and dip netting.
- Riparian vegetation observations within the proposed Project footprint.

Beach seining was completed in April within an extending approximately 80 m upstream and 25 m downstream of the proposed loading arm access trestle Project footprint (Figure 2). Two seining techniques were used over four seining events during receding tides. Three seining events (i.e., Seine 1, 2 and 4) were completed with a seine pull perpendicular to shore with one person wading out into the water with a 6 m long seine net and walking approximately 30 m along the shore. The other seining event (i.e., Seine 3) consisted of casting the seine net into the water from the shore and dragging it along the shoreline approximately 20 m before bringing it in. The latter technique was used when wading within the water was deemed unsafe due to turbid water and poor visibility of the river bottom. Dip netting was also completed approximately 20 m downstream of the proposed access trestle within an area leading to a back channel where seining was not possible due to depths (Figure 2).



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Description of Existing Environment

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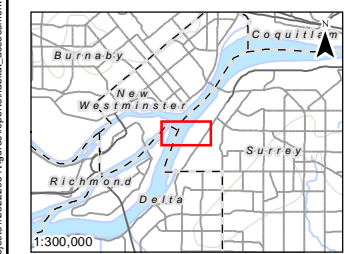
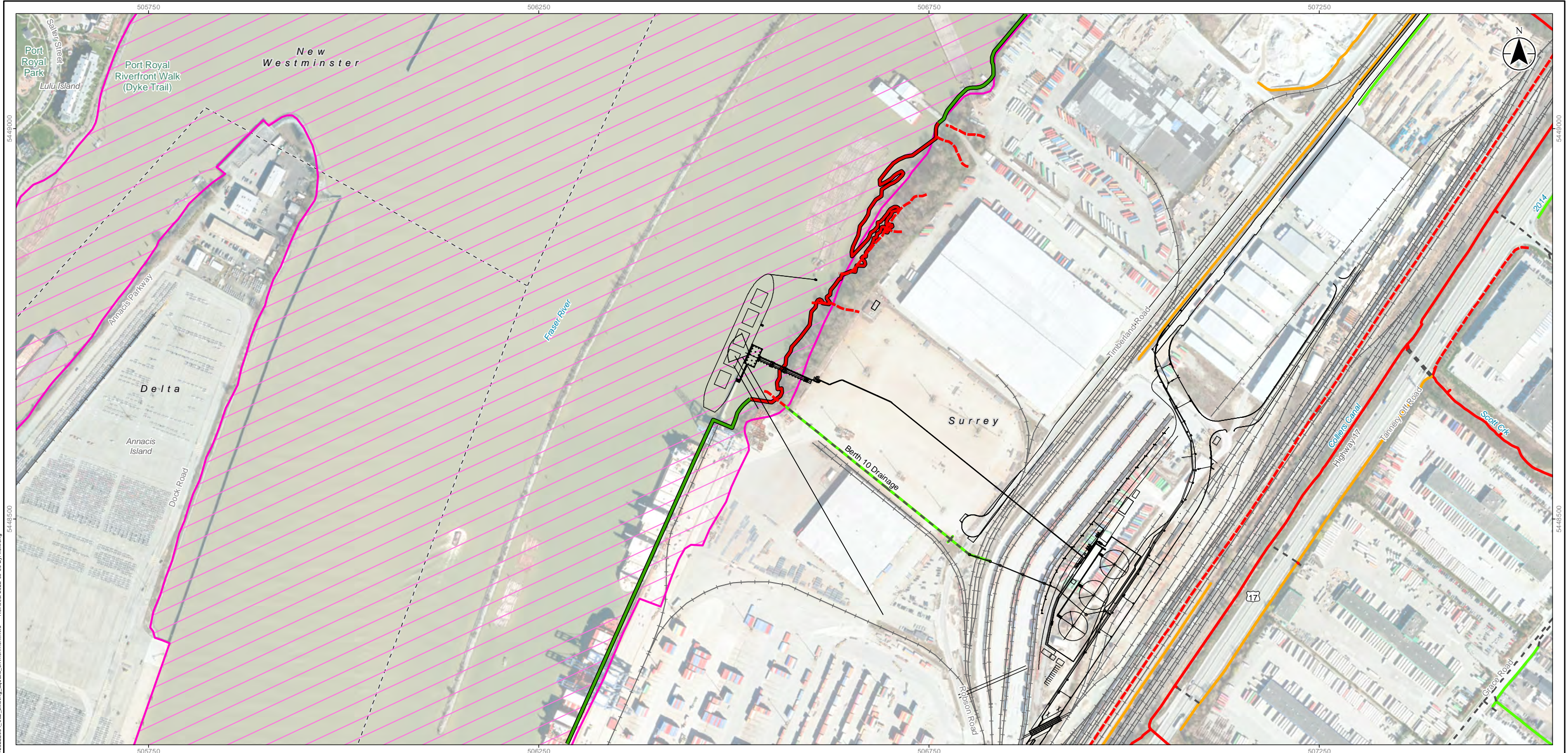
Summaries of the results from the water quality sampling and fish sampling are presented in Section 4.2.4 and Section 4.2.5, respectively.

Two subsequent visits were completed on May 24, and May 31, 2022. On May 24, 2022, side-scan and hydroacoustic surveys were completed at Berth 10. Side scan Sonar and hydroacoustic surveys were used to examine the presence of sturgeon and potential white sturgeon habitat with the Project footprint around Berth 10. Methods for both these surveys are outline below in Section 4.2.4 and 4.2.5.

On May 31, 2022, salinity measurements were taken within the river water column to provide information about the extent of the salt wedge and salinity at Berth 10 throughout a tidal cycle¹. Measurements were taken at a depth of 11.5 m (i.e., 1 m from the bottom of the dredge pocket and river bottom) from the north and south side of the Berth 10 platform, respectively. Measurements were also taken throughout the water column.

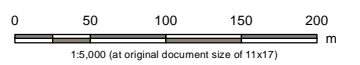
¹ Tidal seawater is moved upstream from the mouth of the Lower Fraser River during flood (incoming) tides (saltwater wedge). When this occurs, the colder and denser seawater flows upstream along the riverbed and lifts the lighter Fraser River freshwater to the surface in the upper water column (Thomson 1981).





- Railway
- - Municipal Boundary
- Project Components
- - Culvert
- Fraser River and Estuary Management Program (FREMP) Colour Coding 2016**
- High Productivity
- Low Productivity
- ▨ Species and Ecosystems at Risk - Publicly Available Occurrence

- Watercourse (Fish Classification)**
- Class A
 - - Class AO
 - Class B
 - Class C



Project Location: Surrey, BC
 NTS 50K Grid: 092G02
 Project Number: 123222054
 Prepared by: KWONG on 20220502
 Requested by: KBUJNOWICZ on 20220502
 Checked by: LTRUDEL on 20220930

Client/Project/Report:
 DP World (Canada)
 Fraser Surrey Canola Oil Transload Facility
 Habitat Assessment

Figure No. **2** Revision No. **2**

Title
Existing Aquatic Environment

Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
 3. Imagery: ESRI World Imagery 2021
 4. Watercourse Classification: City of Surrey COSMOS

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Description of Existing Environment
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4.1.2.1 Hydroacoustics Survey

A May 2022 hydroacoustic survey was used to identify the distribution of subtidal marine fish taxa. Hydroacoustic data were collected using a BioSonics Inc. 120 kilohertz (kHz) DT-X scientific echosounder mounted to the gunwale of an aluminum jet boat and using a BioSonics Inc. Visual Acquisition v6.3.1.10980 software.

The transducer was mounted horizontally within the water column in a stationary location from the dolphin adjacent to the platform for Berth 10. The transducer was also mounted in a downward facing position and the vessel slowly maneuvered between and north of the Berth 10 platform.

Hydroacoustic echograms (visual representations of the acoustic data) were processed using BioSonics Inc. Visual Analyzer v4.3.0.9020 software with a minimum of -60 decibel (dB) threshold applied to limit the inclusion of plankton and other small non-targeted organisms. A 0.5 m buffer was used above the seafloor to reduce the risk of interpreting seafloor features and debris as fish targets.

Vessel wake and propwash, as well as waves, create disturbances within the top of the water column in echograms. To remove this from the data set, the top 2 m of the echograms were excluded from the data analysis. Echo integration (estimates of target density) was processed through in-software algorithms in Visual Analyzer. The analyses results include the estimated fish density per unit area (Fish per Unit Area of 1 m²). Processed echoes must meet a set of criteria (see BioSonics Inc. 2004) during analysis to be accepted as fish targets. These criteria reduce the acceptance of echoes from non-fish targets. The targets included in the *Fish per Unit Area* calculations are interpreted with the understanding that the results may include some falsely identified targets.

4.1.2.2 Side Scan Sonar Survey

The Side Scan Sonar was mounted onto a tripod structure which was launched from an aluminum jet boat and placed on the riverbed adjacent to the platform for Berth 10 and next to the dolphin. A Kongsberg High Resolution Imaging/Profiling Sonar was used to scan a 40 m radius from the sonar while surveying in the Project area.

4.1.2.3 Fish Habitat Classification

Fish habitat classifications, adapted from City of Surrey's Watercourse Classification Map (2018), have been used to identify fish habitat potential for primarily salmonid species and other fish species. Fish habitat classifications are based on potential (or confirmed) fish presence, the connectivity and permanence of a watercourse, and characteristics of riparian vegetation. The classifications and their colour coding are described as follows:

- Class A (red): Inhabited by salmonids year-round or potentially inhabited year round
- Class A(O) (red dashed): inhabited by salmonids primarily during the over-wintering period or potentially inhabited during the over-wintering period with access enhancement. Other fish species may be present year-round.



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- Class B (yellow): includes non-fish bearing watercourses with permanent (wetted >6 months of the year) and non-permanent flow (wetted <6 months of the year). Also provides valuable food and nutrients to downstream fisheries watercourses, but does not support salmon or regionally significant fish
- Class C (green): typically includes ditches with insignificant food and nutrient input and does not support fish. Usually designed for the conveyance of storm water.

4.1.3 Wildlife Assessment

A wildlife biologist completed a Project site visit on March 3, 2022, and documented the presence of wildlife habitat features (i.e., the nest of a bald eagle, osprey, or great blue heron), migratory bird nesting habitat potential, and amphibian breeding habitat potential. Wildlife and wildlife activity observed during the visit were also recorded.

4.1.4 Vegetation and Wetlands Assessment

A vegetation and wetlands ecologist completed a site visit on November 3, 2022, to determine the spatial extent and classification of ecological communities and wetlands within the field study area. Ecological communities were classified according to the Field Guide for Site Identification and Interpretation for the Vancouver Forest Region (Greene and Klinka, 1994) using methods derived from the Field Manual for Describing Terrestrial Ecosystems (BC MOFR and BC MOE 2010). The conservation status of ecological communities was determined according to the BC Conservation Data Centre (BC CDC 2022). Wetlands were determined and classified according to the Canadian Wetland Classification System (NWWG 1997) and Wetlands of British Columbia (Mackenzie and Moran 2004).

4.2 AQUATIC ENVIRONMENT RESULTS

The following results were compiled from desktop review and field surveys for the existing aquatic environment including instream fish habitat within and surrounding the Project footprint. Photographs from the field assessments are included in Appendix D.

4.2.1 Aquatic Features within the Project Area

4.2.1.1 Fraser River

The Fraser River is the primary fish habitat at Berth 10 (Figure 3). The Fraser River is the longest river in British Columbia, running from its headwaters in the Rocky Mountains down to the Pacific Ocean with a total length of 1,375 km with an area of 225,000 km² and is the largest undammed river along the west coast of North America (CHRS 2022).

The Project is located on the south bank of the Fraser River within the Annieville Channel, where the river separates into the north and south arms. The Project is approximately 15 - 20 km upstream from the mouth of the Fraser River, within the tidally influenced portions of the Lower Fraser River. The extent of tidal influence at Berth 10 is based on river flow. During low river flow, the tidal saltwater wedge extends



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its influence 10–20 km upstream of the mouth of the Fraser River and the tidal influence is constrained closer to the mouth of the Fraser River during periods of high freshwater flow, such as peak freshet (Kostaschuk and Atwood 1990; Hatfield Consultants 2018).

The Fraser River has a high silt content fed by upstream erosion and glacier melt. The silt and sediment are deposited into the lower reaches of the river (CHRS 2022) and within the berths of the Fraser Surrey Terminal. Ambient turbidity in the lower Fraser River often exceeds 20 NTU between March and September (Rempel et al. 2012).

The substrate within the Lower Fraser River is sand-dominated and is referred to as the “sand reach”, extending from Mission to the terminus of the river at the Strait of Georgia (Rempel et al. 2012). Differences in channel morphology and flow along the entire length of the Fraser River provide varying habitats for fish species and life stages.

Berth 10 is located behind a constructed breakwater/training berm and is out of the mainstem thalweg of the Fraser River, but still experiences permanent river flow and tidal influence.

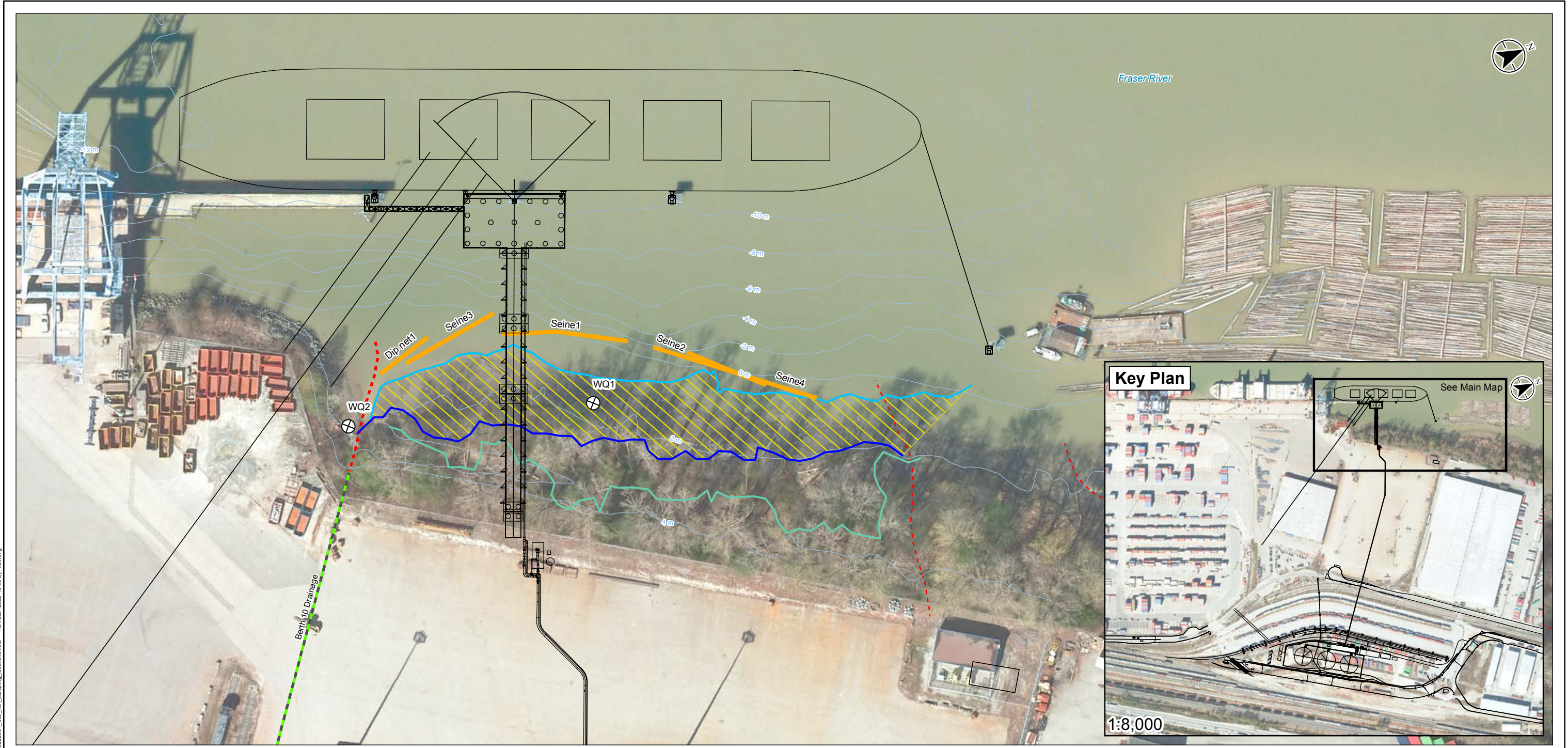
4.2.1.2 Land Drainage Around Berth 10

Based on the City of Surrey online mapping tool COSMOS (2022), there is a drainage ditch that flows from the upland areas of the Fraser Surrey Terminal north towards Berth 10 with its outfall into the Fraser River approximately 45 m southwest of the proposed access trestle (Figure 3; Appendix D, Photos 9 and 10). This drainage was previously an open ditch but was infilled and culverted in 2004 (Google Earth 2022). This culverted drainage is stormwater fed and does not appear to contribute nutrients to any downstream fish habitat (Hemmera 2018a) and is classified as Class C (i.e., insignificant food/nutrient value; no fish present) by the City of Surrey (City of Surrey 2018). The culvert is flap-gated and acts as a barrier to upstream movement of fish.

4.2.1.3 Other Terminal Drainage

Based on Habitat Wizard (2022), there is a culverted watercourse (Watershed Code [WSC]: 100-017379) with its outfall located approximately 85 m upstream from the proposed Berth 10 access trestle. This culverted watercourse runs southeast through the terminal and joins up to Delta Creek approximately 1 km from the outlet on the Fraser River, on the south side of Highway 17 (Government of BC 2022b). Delta Creek (WSC: 100-017600) is a fish bearing watercourse, but the lack of fish observations on the north side of highway 17 and lack of mapping from City of Surrey suggests this portion of the watercourse is likely non-fish bearing.





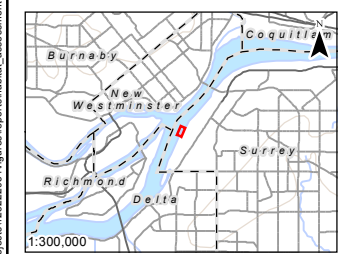
Fraser River

Key Plan

See Main Map

1:8,000

\\ca01183-pla\p1\work\projects\123222054\figures\report\fish_habitat_assessment\fig_123222054_003_fish_sampling_locations.mxd Revised: 2022-10-05 By: kwong



- Water Quality Sample
 - Project Components
 - Fishing Station
 - Field-Mapped Shoreline Back Channel
 - High Water Mark
 - Low Water Mark
 - Bathymetric Contour (2 m)
 - Intertidal Mudflat
 - Culvert
- Watercourse (Fish Classification)**
- Class AO
 - Class C

Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
 3. Imagery: ESRI World Imagery 2021
 4. Watercourse Classification: City of Surrey COSMOS



Project Location: Surrey, BC
 NTS 50K Grid: 092G02
 Project Number: 123222054
 Prepared by: KWONG on 20220502
 Requested by: KBUJNOWICZ on 20220502
 Checked by: LTRUDELL on 20220930

Client/Project/Report: DP World (Canada) Fraser Surrey Canola Oil Transload Facility Habitat Assessment

Figure No. **3** Revision No. **2**

Title: **Fish Sampling and Water Quality Locations**

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

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4.2.2 Species at Risk

4.2.2.1 Fish

The Fraser River is one of the world's most productive salmon rivers, supporting all seven Pacific salmon species as well as other salmonid species such as trout (CHRS 2022). A list of fish species of conservation concern (i.e., any species that have been listed by Committee on the Status of Endangered Wildlife in Canada [COSEWIC], Province of BC, or *Species at Risk Act* [SARA]) that have the potential to occur in the Lower Fraser River are provided in Table 1.



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Table 1 Fish Species of Conservation Concern with the Potential to Occur in the Lower Fraser River

Fish Species	Life Stage	Population Present (Location)	COSEWIC ¹	BC List ¹	Schedule ²	SARA ²	Observed within the Project Footprint
Chinook Salmon (<i>Oncorhynchus tshawytscha</i>)	<ul style="list-style-type: none"> • Adult spring or fall freshwater migration • Juvenile rearing • Smolt ocean migration 	Lower Fraser summer (Upper Pitt)	E	NS	NS	NS	Chinook captured, but unknown stock of origin
		Middle Fraser spring/fall					
		North Thompson spring/summer					
		Okanagan population					
		South Thompson summer					
		Upper Fraser spring					
		Lower Fraser spring	SC				
		Lower Fraser summer/ fall	T				
		Middle Fraser spring/summer					
Coho Salmon (<i>Oncorhynchus kisutch</i>)	<ul style="list-style-type: none"> • Adult spring or fall freshwater migration • Juvenile rearing • Smolt ocean migration 	Interior Fraser population	T	NS	NS	NS	Not observed



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Table 1 Fish Species of Conservation Concern with the Potential to Occur in the Lower Fraser River

Fish Species	Life Stage	Population Present (Location)	COSEWIC ¹	BC List ¹	Schedule ²	SARA ²	Observed within the Project Footprint
Sockeye Salmon (<i>Oncorhynchus nerka</i>)	<ul style="list-style-type: none"> Adult fall freshwater migration Smolt ocean migration 	Of 24 designated units (DU) multiple DU are considered Endangered, Threatened or Special Concern, while other DU are considered Not at Risk under COSEWIC	E, T, SC, NAR	NS	NS	NS	Not observed
Steelhead/Rainbow Trout (<i>Oncorhynchus mykiss</i>)	<ul style="list-style-type: none"> Adult spring or fall freshwater migration Juvenile rearing Smolt ocean migration 	Thompson River population Chilcotin River population	E	R	NS	NS	Not observed
Coastal Cutthroat Trout (<i>Oncorhynchus clarkii clarkii</i>)	<ul style="list-style-type: none"> Adult spring or fall freshwater migration Juvenile rearing Smolt ocean migration 	Pacific	NS	B	NS	NS	Not observed
Bull Trout (<i>Salvelinus confluentus</i>)	<ul style="list-style-type: none"> Adult and juvenile rearing 	South Coast British Columbia	SC	B	1	SC	Not observed
Dolly Varden (<i>Salvelinus malma</i>)	<ul style="list-style-type: none"> Adult/Juvenile rearing 	Southern lineage	NS	Y	NS	NS	Not observed
White Sturgeon (<i>Acipenser transmontanus</i>)	<ul style="list-style-type: none"> Adult/Juvenile/Eggs 	Lower Fraser River	T	R	NS	NS	Potential observations
Green Sturgeon (<i>Acipenser medirostris</i>)	<ul style="list-style-type: none"> Adult/Juvenile/Eggs 	Pacific Ocean	SC	B	1	SC	Not observed



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Table 1 Fish Species of Conservation Concern with the Potential to Occur in the Lower Fraser River

Fish Species	Life Stage	Population Present (Location)	COSEWIC¹	BC List¹	Schedule²	SARA²	Observed within the Project Footprint
Eulachon (<i>Thaleichthys pacificus</i>)	<ul style="list-style-type: none"> • Adult freshwater migration/spawning • Larval ocean migration 	Fraser River	E	B	NS	NS	Not observed
Mountain Sucker (<i>Catostomus platyrhynchus</i>)	<ul style="list-style-type: none"> • Adult/Juvenile/Eggs 	Pacific	SC	B	1	SC	Not observed
Brassy Minnow (<i>Hybognathus Hakinsoni</i>)	<ul style="list-style-type: none"> • Adult/Juvenile 	Pacific	NS	B	NS	NS	Not observed

NOTES:

1. Information from BC Species and Ecosystem Explorer (BC CDC 2022)

B: Blue, Y: Yellow, R: Red.

2. Information from Species at Risk Registry (Government of Canada 2021)

T: Threatened, E: Endangered, SC: Special Concern, NS: No Status, NAR: Not at Risk



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Likelihood of SARA Listed Fish Species within the Project Area

While green sturgeon and mountain sucker (both SARA and COSEWIC listed; Table 1) have the potential to be within the Lower Fraser River, they are unlikely to be within the specific Project area. Green sturgeon generally prefer estuarine and marine habitats and are therefore quite rare in freshwater environments (COSEWIC 2004) as observed at Berth 10. The nearest observation of green sturgeon is at the mouth of the Fraser (Government of BC 2022b). Mountain sucker tend to use smaller, high-gradient streams with moderate current and gravel to cobble substrate (COSEWIC 2010). Observations of mountain sucker have been recorded further upstream from the Project area (approximately 74 km upstream), as well as one observation at the mouth of the Fraser River (Government of BC 2022b).

Bull trout (blue listed in BC, and on Schedule 1 of SARA) have been observed approximately 10 km upstream from the Project area at the confluence with Pitt River (Government of BC 2022b). While juvenile bull trout rearing habitat is typically low velocity side channels and pools (Roberge et al. 2002), both the anadromous and non-anadromous forms may be present at or near the Project area as they migrate out towards the ocean or to forage in the localized area (Hemmera 2018a).

The lower Fraser River white sturgeon population, while not SARA listed, are provincially red listed and COSEWIC Endangered status (COSEWIC 2003a). Juvenile white sturgeon prefer side channels and sloughs (Glova et al. 2008) with adults typically found in deep near-shore areas with sand and fine gravel substrate. Spawning sites have been reported to be non-turbulent with near-bed velocities averaging 1.7 m/s, with fast-flowing, turbulent water over clean, large rock substrate also reported as spawning habitat (Kestrel Consulting 2005). Based on this, and the results from field assessments, it is anticipated that foraging, adult white sturgeon are present within and/or adjacent to the Project area.

4.2.2.2 Marine Mammals

Harbour seals (provincially yellow-listed and not at risk by COSEWIC) are the most common seal species and one of the most abundant marine mammal species in BC which can be partially attributed to protection under the *Marine Mammal Protection Act* 1972 (MMPA). Harbour seals haul out on land and rest on a variety of structures, including rocky shores, mud flats, sandbars, and man-made structures. They are a year-round resident within the Fraser River and typically inhabit estuarine and coastal waters, and breed locally with time of day, tides, weather, season, food availability, and to find mates. Tidal heights and freshwater flow may also influence feeding activities (Yurk and Trites 2000).

Harbour seals were the most abundant marine mammal observed during land-based surveys for Port Metro Vancouver's Robert's Bank Terminal 2 Project, with a total of 112 sightings over the course of 30 days (Hemmera 2014). They have been known to travel 50 km up the Fraser River from the Pacific Ocean.

The California sea lion population (provincially yellow listed and not at risk by COSEWIC) is currently estimated at 238,000 with approximately 3,000 California sea lions wintering in BC from September to May.



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Females and juveniles remain in California and Mexico, while adult and sub-adult males will travel as far north as central Vancouver Island following the movement of prey, including squid, octopus, herring, hake, anchovy, lamprey, dogfish, rockfish, mackerel, and small sharks (COSEWIC 2003b). They have been known to travel inland in cooler weather and to live in freshwater for periods of time.

Harbour seal have high potential to occur within or adjacent to the Project footprint based on the aquatic habitat available within and adjacent to the Project footprint, and the relative abundance of the harbour seal within the Fraser River.

Likelihood of SARA Listed Marine Mammals Species within the Project Area

Steller sea lions have been reported to congregate in estuaries in autumn when salmon are spawning, and at the mouth of the Fraser River in spring when eulachon are running (Bigg 1985; Bigg et al. 1990) with a preference for feeding about 60 km offshore during summer and within a range of 200 km from shore in winter (Government of Canada 2012). Some have been known to travel 35 km upriver (Government of Canada 2012). Steller sea lions are provincially blue listed and listed as Special Concern by COSEWIC and under Schedule 1 of SARA.

The closest documented haul-out site closest to the Project is near Sand Heads at the mouth of the Fraser River, approximately 22 km from the Project location (Jeffries et al. 2000).

No marine mammal observations were made during field surveys conducted on April 18 and 19, however there is potential for both harbour seal and steller sea lion to be found within the lower Fraser River, especially during fish migration windows as predators will follow fish into the lower reaches of rivers.

4.2.3 Fish Habitat within the Project Area

The shoreline within the Project area has been mapped as low productivity at the southwestern end of Berth 10 adjacent to the eastern face of the existing terminal. Higher productivity habitat was classified at along the shoreline around Berth 10 using Fraser River Estuary Management Program (FREMP) habitat classification data from 2008 (Figure 2; FREMP 2008²). The shoreline immediately adjacent to the Berth 10 is considered low productivity habitat in which habitat features and functions are limited due to existing disturbed shoreline conditions (i.e., green-coded; FREMP 2008). The banks have been altered with placement of riprap and past development at the terminal. On top of the riprap bank is a band of vegetation (less than 5 m wide). Vegetation present within this band includes a mix of native and invasive tree, shrub, and herbaceous species (see Section 4.3.2.2).

High productivity (i.e., red-coded) shoreline habitat is mapped within the Project footprint for the proposed access trestle to Berh 10 (Figure 2; Appendix D, Photo 7). Higher productivity habitat is defined as including productive and diverse habitat features that support critical fish functions (FREMP 2008). This stretch of shoreline habitat (approximately 430 m long) is classified as an intertidal marsh populated with graminoids and forbs (FREMP 2008).

² [FREMP – BIEAP Habitat Atlas – Community Mapping Network \(cmnbc.ca\)](https://cmnbc.ca/FREMP-BIEAP-Habitat-Atlas-Community-Mapping-Network)



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This observed habitat continues for approximately 180 m upstream until it transitions to an intertidal unvegetated mudflat behind the existing breakwater (FREMP 2008).

Existing fish shoreline habitat in the Project area of Berth 10 primarily includes shade and shelter from within the riprap banks, the pre-existing pile-supported gangway at Berth 10 and associated dolphins, as well as within a shoreline back channel. Tidal influence in the area provides periods of shallow depth and slower velocity habitats along the shoreline (Hatfield Consultants 2018) outside the existing maintenance dredge area along both north and south side of the berth. The Fraser River constructed breakwater and berm may around berth 1 through 10, may provide holding habitat for adult salmonids migrating (Hemmera 2018a).

Approximately 40 m downstream from the proposed access trestle at Berth 10, at the drainage outfall, is an outlet/inlet (depending on the tide) to a back channel that has broken the shoreline into a vegetated island along the shore (Figure 2; Appendix D, Photo 12 and 13). This back channel runs parallel to the fence line and intersects with the proposed footprint of the access trestle. The channel is well defined with structured banks and muddy substrate for approximately 95 m before it becomes wider, less defined, and more vegetated with shrubs and grasses. At the location of the proposed access trestle, the shoreline channel bankfull width is approximately 6 m (Appendix D, Photo 18). The channel does not have a clear connection with the mainstem on the eastern end with water dispersing across the shoreline vegetation at high flows/tides (Appendix D, Photo 19). Along the shore there is an eroded channel with water flowing into the mainstem (Appendix D, Photo 21), but the connection between this outlet and the back channel was not identified in the field at low tide. This back channel likely provides some aquatic habitat during high tides. This back channel has accumulated large woody debris, undercut banks, and riparian vegetation to provide shelter and refuge.

The back channel has an intermittent connection to the Fraser River, and likely inconsistent flow determined by the influence of tide on river water levels. The back channel has low potential to support foraging fish, due to low flow and observed in-channel vegetation in wet conditions.

According to the City of Surrey's fish classification mapping, Berth 10 drainage (Figure 3) is continuously classed as Class C up until the outfall connection to the Fraser River. Fish passage into the drainage ditch from the Fraser River is prevented by a flap gate. Beyond the outfall and flap gate, the drainage has been previously classified as Class A/O watercourse, however it is tidally influenced with intermittent flow and unlikely to support salmonid fish species year-round.

To the south of the back channel, along the terminal fence line, there is approximately 10 m of riparian vegetation including deciduous trees and shrubs. The vegetated area/island between the mainstem and the back channel is approximately 20 m wide and is composed of black cottonwood (*Populus trichocarpa*) and red alder (*Alnus rubra*), Pacific crab apple (*Malus fusca*), Pacific ninebark (*Physocarpus capitatus*), common snowberry (*Symphoricarpos albus*), and reed canarygrass (*Phalaris arundinacea*; invasive) (see Section 4.3.2 for more details on vegetation).



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Substrate in the Project area is predominantly composed of fine sediment including clayey silt (Appendix D, Photo 22). Preliminary benthic invertebrate sampling completed by Hemmera (2018) found that benthic invertebrate productivity within the sheltered berthing area was lower (i.e., less than half) than the reference site in the mainstem of Fraser River and the Annieville Channel (Hemmera 2018a). The observed lower benthic abundance around Berth 10 is indicative of watercourse health and habitats affected by riparian vegetation loss and degraded water and sediment quality. Low benthic invertebrate productivity also suggests relatively poor fish foraging habitat relative to other parts of the Fraser River i.e., Annieville Channel (Hemmera 2018a).

4.2.4 Water Quality within the Project Area

In-situ water quality sampling was conducted at two different water quality stations (Figure 2) at varying levels of tides and water depths (approx. 0.5 m) within the water column (Appendix A). The main water quality station was located at the location of the proposed access trestle along the shore. The second station was located within the outlet/inlet of the back channel near the Berth 10 drainage culvert. The latter station was made during the second day as the tide was too high to safely access the first station.

The Canadian Council of the Ministers of the Environment (CCME) dissolved oxygen (DO) guideline for early life stages of cold-water biota is 9.5 mg/L, and for non-spawning life stages of cold-water biota is 6.5 mg/L (CCME 2022). Dissolved oxygen within the Project area ranged from 11.93 mg/L to 12.45 mg/L, well above these guidelines (Table 2). The CCME guideline for pH is 6.5-9.0, and the pH at the Project area ranged from 6.39 to 7.37, mostly within the CCME guideline except for two measurements which were slightly lower (6.37 and 6.39; Table 2).

Average water temperature across the water column was 7.0°C (range of 6.5°C to 8.5°C; Table 2) which is within the optimum migration range for salmonids of 2.3°C to 20.0°C and is slightly lower for the rearing range of 8.0°C to 17.0°C (BC MECCS 2021). For trout species (i.e., cutthroat trout and rainbow trout), the measured temperatures met the optimum rearing range of 5.0°C to 19.0°C (BC MECCS 2021).

For char species (i.e., bull trout and Dolly Varden), the measured temperatures were within the rearing range of 5.0°C to 17°C. Turbidity was observed to be highest at low tide (60.82 NTU and 50.59 on April 18 and 19 respectively) and lowest at high tide (35.45 NTU and 19.6 NTU on April 18 and 19 respectively; Table 2).



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Table 2 Water Quality Results from April 18-19, 2022, Within and Around the Proposed Project Area

Location	Date	Time	Tide (m) ¹	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductivity (µs/cm)	Salinity (ppt) ²	pH	Turbidity (NTU)
WQ1 (Within area of proposed trestle)	2022-04-18	12:01:18	1.26	6.6	12.45	97.8	0.07	6.51	35.45
	2022-04-18	13:41:00	0.61	6.8	12.35	100.8	0.07	6.37	52.24
	2022-04-18	15:03:21	0.39	6.6	12.27	97.1	0.07	7.04	60.82
WQ2 (Downstream from culvert)	2022-04-19	10:05:15	2.42	6.5	12.1	105.2	0.08	6.39	19.6
WQ1 (Within area of proposed trestle)	2022-04-19	12:29:00	1.23	8.5	11.99	109	0.03	7	44.98
	2022-04-19	14:46:00	0.44	7	11.93	108.1	0.08	7.37	50.59

¹ Tide elevation in chart datum reported at nearest station
² Parts per thousand



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4.2.4.1 Salinity Within the Project Area

Salinity did not vary throughout changes in the tidal cycle or water levels at the Project site and ranged from 0 and 0.05 mg/L (PSU) and 0.07 PPT. The saltwater wedge therefore does not extend into the Berth 10 Project area. Measurements were taken over one tidal cycle starting with a high of 2.8 m at 05:56 and a low of 1.2 m at 14:59 on 31 May 2022 with measurements logged every 15 minutes. Discharge volumes taken at Hope hydrometric station ranged between 5,880 m³ and 6,070 m³ (Government of Canada 2022b).

4.2.5 Fish Presence Within the Project Area

The Fraser River provides year-round fish habitat for a variety of life stages including migration, rearing, and overwintering, including all five Pacific salmon (*Oncorhynchus spp.*) as well as trout, making it a Class A stream (i.e., it is inhabited or potentially inhabited by salmonids year-round; City of Surrey 2018). Forty-six fish species have been documented within the Lower Fraser River (McPhail and Carveth 1994), 11 of which are considered species of conservation concern (see Section 4.2.2). A complete list of fish likely to be present in the Lower Fraser River can be found in Appendix B.

Adult salmon use the mainstem of the Fraser River and Annieville Channel as a migratory corridor to upstream spawning habitats during mid-summer to late fall each year. Juvenile salmon use both the mainstem and nearshore habitats for either downstream migration in early spring, rearing or both dependent upon species and specific life history strategies. Adfluvial Dolly Varden char and resident cutthroat likely use the nearshore environment for feeding. Adult eulachon (*Thaleichthys pacificus*) use Annieville Channel and mainstem Fraser as a migratory corridor to access upstream spawning habitats in February and March and larval eulachon migrate passively downstream during April and May into the ocean past the Project area. Given the low salinity observed at the Berth 10 area, adult and juvenile white sturgeon habitat use is expected with deeper low flow habitats behind the breakwater at the terminal (Glova et al. 2008).

A total of 171 individual fish of seven different species were caught during two days of sampling in April 2022. No SARA listed species were captured (Table 3). Species captured during beach seining included chum salmon (*Oncorhynchus keta*), chinook salmon (*Oncorhynchus tshawytscha*), white sucker (*Catostomus commersonii*), redbelt shiner (*Richardsonius balteatus*), and leopard dace (*Rhinichthys falcatus*). The alternate seining technique captured two species found lower in the water column including starry flounder (*Platichthys stellatus*) and sculpin (*Cottidae spp.*) (Table 3). Salmonid fish lengths ranged from 30 to 58 mm, while non-salmonid species lengths ranged from 28 to 76 mm (Appendix C). Dip netting resulted in no fish caught within the berth area or within shoreline channels.



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Table 3 Fish Summary from Seining within Proposed Project Area

Fishing Method	Date	Start Time	End Time	Shoreline Seined (m)	Net Length (m)	Area Seined (m ²)	Chum Salmon	Chinook Salmon	White Sucker	Redside shiner	Leopard Dace	Starry Flounder	Sculpin Spp.
Seine 1	2022-04-18	13:10:22	13:17:07	30	5	150	7	4	1	60	0	0	0
Seine 2	2022-04-18	15:05:32	15:15:18	n/a	6	n/a	0	0	0	0	0	2	2
Seine 3	2022-04-19	12:50:54	13:20:09	25	6	150	24	30	0	21	1	0	0
Seine 4	2022-04-19	13:55:23	14:01:03	30	3	90	2	5	0	12	0	0	0
Total:							33	39	1	93	1	2	2
NOTE: n/a: not applicable as the seine net was cast out from shore and area seined could not be estimated													



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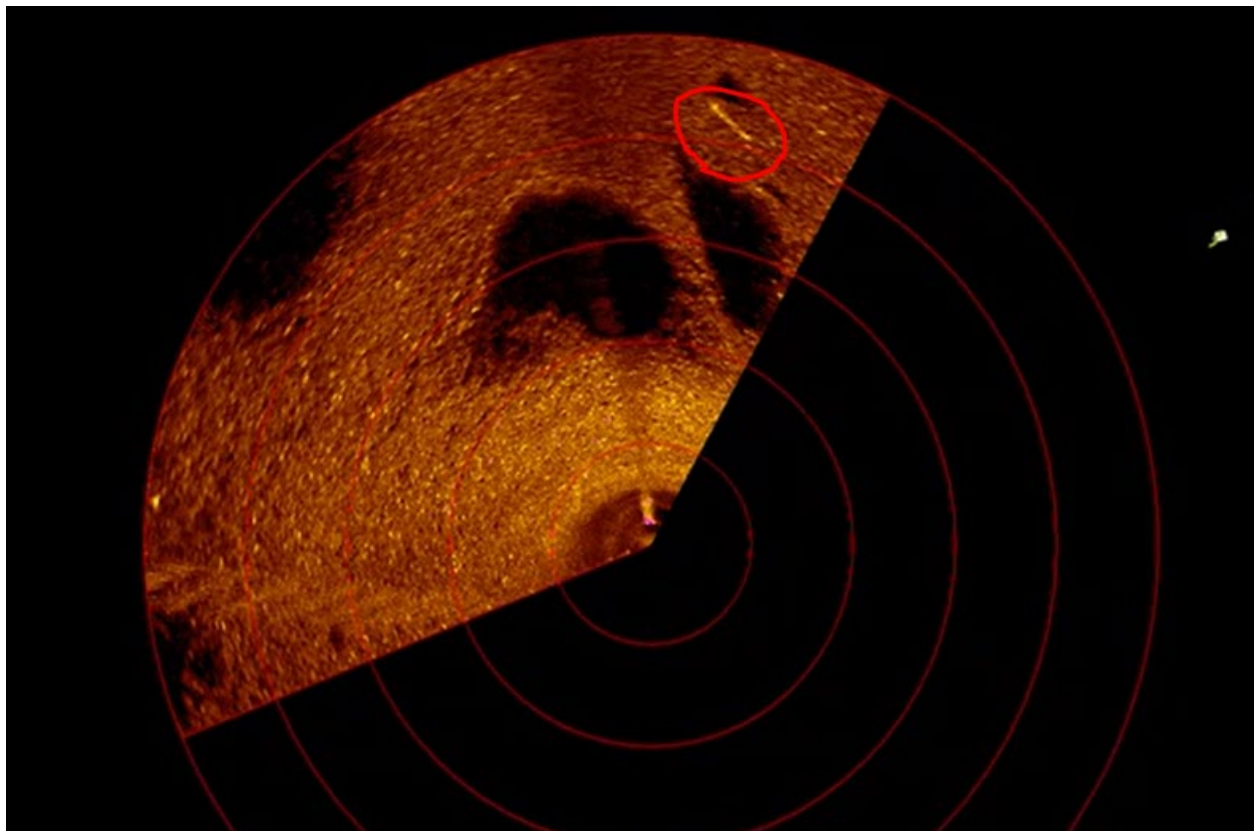
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4.2.5.1 Side scan Sonar and Hydroacoustic

Side Scan Sonar Observations

The results of the side scan sonar indicated the presence of at least one adult white sturgeon within 40 m of the end of the existing gangway at Berth 10. A white sturgeon was measured as over 1 m in length and was observed slowly moving (Figure 4) within the dredged area of Berth 10 area within 5 to 40 m of the side scan sonar transducer placed at the gangway. The observed image was identified as a fish given its movement patterns outside of river water levels and flows. Other anthropogenic objects within the 40 m radius of the side scan sonar were verified as sheet pile wall present to the south-east of the Berth 10 platform. The fish was present within the survey area for greater than 30 minutes. Other observations of up to three sturgeon, based on size and shape, were noted on the river bottom at 10 to 13 m depths outside the Berth 10 area within the dredged area of the channel.

Figure 4 Adult Sturgeon (circled in red) Within 40 m of the Side Scan Sonar Location



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Hydroacoustic Observations

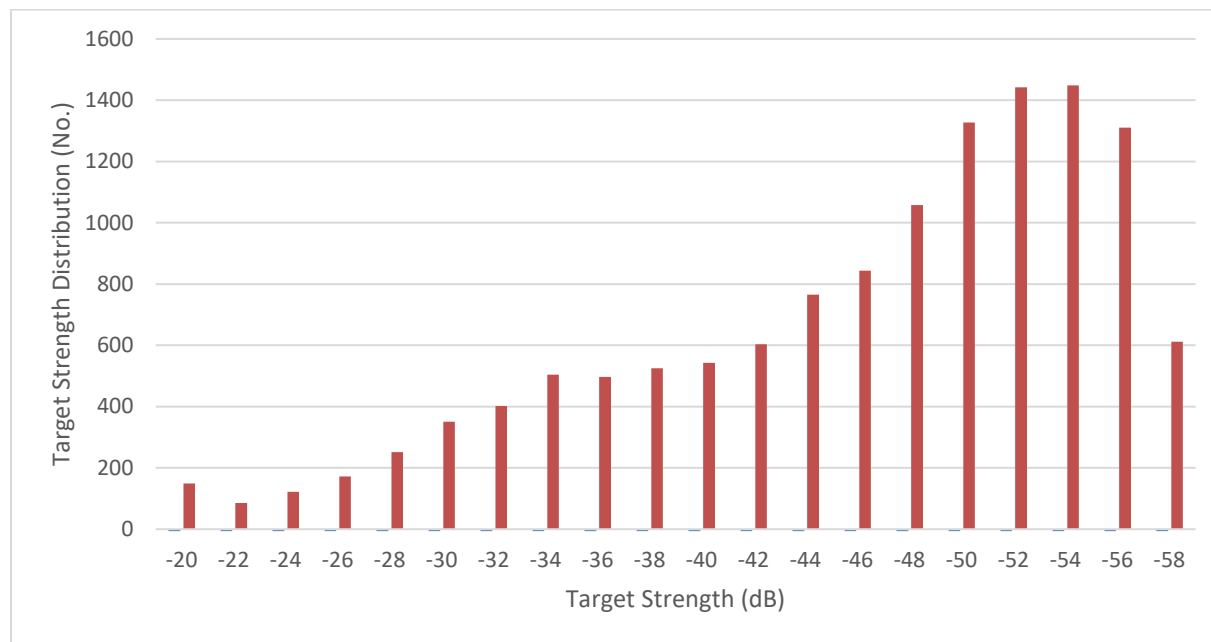
Table 4 shows hydroacoustic survey effort completed during surveys on the 24 May 2022. Results are shown per hydroacoustic ID, relevant to differences in transducer direction and transducer orientation.

Table 4 Hydroacoustic Survey Effort

Hydroacoustic Survey ID	Location		Tide Description	Transducer Direction	Transducer Orientation	Time		Flow (Knots)
	Start	End				Start	End	
B1	49.191157°N 122.910542°W	-	Flood	South-east	Horizontal	11:47	12:07	-
B2	49.191157°N 122.910542°W	-	Flood	South-west	Horizontal	12:08	12:38	-
B3	49.191157°N 122.910542°W	-	High flood	North-west	Horizontal	12:38	12:50	-
B4	49.191157°N 122.910542°W	49.191051°N 122.910492°W	High flood	North-west to south-east	Downward	13:00	13:09	2.0

Figure 5 below shows target strength (TS) distribution numbers (no.) recorded across a TS; dB ranging from the highest value of -20 to the lowest value for analysis of -58. The results below are indicative of total hydroacoustic survey effort.

Figure 5 Target Strength Distribution (No.) across a Target Strength (dB) range of -20 to -58



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Observed target strength is affected by fish body morphology, the presence or absence of a gall bladder, skeletal composition, the amount of oils, and acoustic frequency of a fish in the water column (BioSonics 2011). Fish that are larger and have a greater difference in density compared to the surrounding water and therefore have higher TS values than small fish or those fish with a lower difference in density compared to water (e.g., those without an air-filled swim bladder). Previous studies have reported that a TS > -30 dB indicates that the length of the fish is greater than 60 cm, with fish ranging between -30 and -18 dB a possible indicator of sturgeon (Tao et al 2009). Other studies of sturgeon indicate a TS distribution between 25.8 dB and 31.6 dB based on a body length between 74 cm and 92 cm. Fish of 20 cm or 50 grams (g) have previously been found to have TS values which range between -30 dB and 43.8 dB (Parker-Stetter et al. 2009). The results in Figure 5 indicate that most TS values occurred between -48 to -52 dB, with distribution numbers decreasing with increased TS.

Fish density per unit area was also calculated from the data collected and is shown per 1 m² in Table 5 below. An average for all four hydroacoustic ID based on total fish density per unit area is also shown in the table with the average calculated as 0.18 per 1 m². The extent and distribution of fish is shown through visual interpretation in Appendix E. A representative echogram is provided in Appendix E.

Table 5 Fish Density Per Unit Area (1 m²) by Hydroacoustic ID

Hydroacoustic Survey ID	Fish Density Per Unit Area (1 m ²)
B1	0.05
B2	0.19
B3	0.37
B4	0.12
Average Fish Density Per Unit Area (1 m²)	0.18



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4.2.6 Marine Mammal Observations

A documented 25 species of cetacean, 5 species of pinniped and 1 species of sea otter are known to occur in BC seasonally or year-round (Heise et al. 2007); with several species of marine mammals known to occur within the southern Strait of Georgia. Grey whale (*Eschrichtius robustus*), southern resident killer whale (*Orcinus orca*), and humpback (*Megaptera novaeangliae*) foraging and migratory areas exist in the southeast Strait of Georgia, Boundary Bay, and Haro Strait with critical habitat for southern residents established within the southeast Strait of Georgia and at the mouth of the Fraser River. Observations of killer whale have been made to the south-east of Westham Island at the mouth of the Fraser River, with humpback activity documented to the west of Westham Island (Westpac Midstream Vancouver 2019) and grey whale activity noted as far east within the Fraser River as the Port Mann bridge in 2007 after a single grey whale was thought to have lost its way within the river; no other sightings of grey whale have been made within the Fraser River and no cetaceans are expected to be found within or adjacent to the Berh 10 Project area.

Species with the potential to occur within or adjacent to the Project footprint include steller sea lion (*Eumetopias jubatus*), harbour seal (*Phoca vitulina*) and California sea lions (*Zalophus californianus*). Peak abundance of both typically coincides with seasonal physical and biological factors such as availability of prey.

4.3 TERRESTRIAL ENVIRONMENT RESULTS

The following results were compiled from desktop review and a visit to the Project site by a wildlife biologist as well as information collected in the riparian habitats during field visits noted in Section 4.2. Desktop records and observations are displayed on Figure 6 and Figure 7.

4.3.1 Wildlife and Wildlife Habitat

4.3.1.1 Desktop Results

The Project area was identified as being industrial use with likely some riparian features present (iMap BC 2022). The area is likely to support small and mid-sized mammals (i.e., rodents, raccoon, coyote), and a variety of birds (both migratory and raptors). The Project site is located adjacent to the edge of the Boundary Bay - Roberts Bank - Sturgeon Bank site (Fraser River Estuary) Important Bird Area. The Wildlife Tree Stewardship Atlas documented a bald eagle nest within 50 m of the Project footprint that was reported to be inactive or missing in 2008 (WTSA 2022).



BIOPHYSICAL HABITAT ASSESSMENT

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Species at Risk

There are 23 species of Conservation Concern³ that have the potential to occur within or adjacent to the Project footprint (Table 6 and Figure 6). In the proposed recovery strategy for barn owl (*Tyto alba*), Environment and Climate Change Canada have mapped a geospatial area within which critical habitat may be found (Environment and Climate Change Canada 2021) This area overlaps the Project footprint.

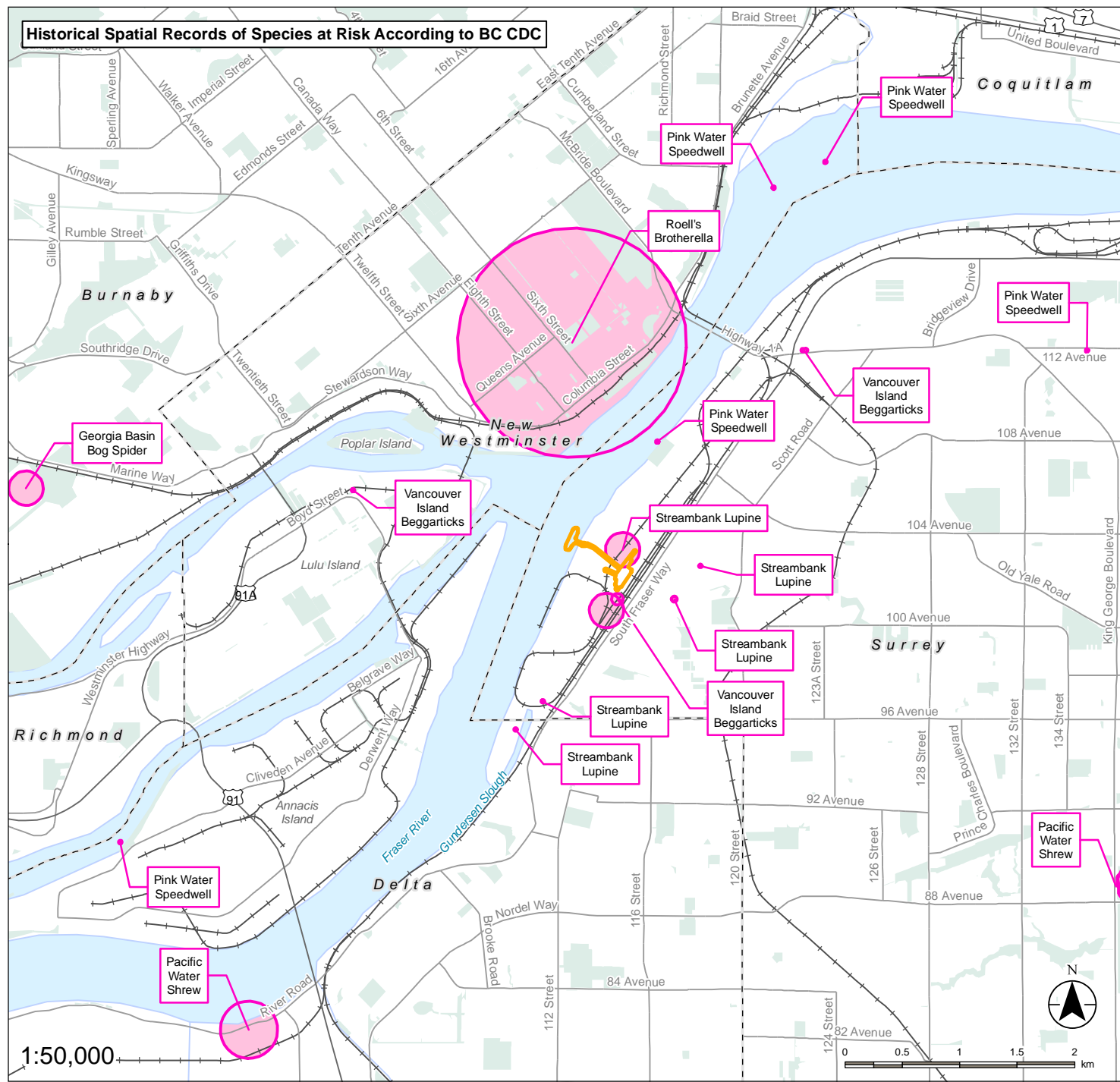
Records of little brown myotis (*Myotis lucifugus*), Pacific water shrew (*Sorex bendirii*), great blue heron, (*Ardea herodias fannini*), green heron, common nighthawk, black swift, barn swallow, western screech-owl (*Megascops kennicottii kennicottii*), band-tailed pigeon, bald eagle and northern red-legged frog are reported as occurring within five km of the Project footprint. Little brown myotis typically hibernate in caves with maternity colonies existing in attics of buildings, under bridges, in rock crevices, or in cavities of canopy trees in forests (Environment Canada 2013). Pacific water shrew prefer moist, coastal forests and require access to slow-moving creeks and/or wetlands to forage (Lindgren 2004). Great blue heron typically nests in colonies in riparian areas, and important foraging habitat includes tidal mudflats, riverbanks, lakeshores, and wetlands (Vennesland 2004).

The Project footprint has the potential to provide nesting habitat for barn swallow and bald eagle, as well as foraging habitat for great blue heron, western screech owl, and peregrine falcon. The nests of bald eagles are protected year-round under Part 34 b of the *General Wildlife Act*. Barn swallow is federally listed under Schedule 1 of SARA, which prohibits damaging or destroying the residence (i.e., nest) of a listed species. A barn swallow nest is considered a residence from May 1 through August 31, whether it is occupied by a bird or not (Government of Canada 2019). Western screech owl prefers riparian habitat with mature, large diameter trees for nesting, treed habitat for roosting, and riparian or conifer woodlands and edges of open habitats for foraging. Peregrine falcon will use tall infrastructure while foraging, and increasingly uses these sites for nesting (COSEWIC 2017).

³ A species of Conservation Concern includes provincially red and blue listed species, species that are listed as Special Concern, Threatened, or Endangered on SARA or COSEWIC, or species that are of regional significance (e.g., bald eagle).

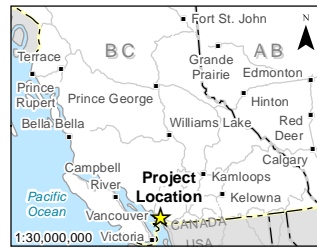
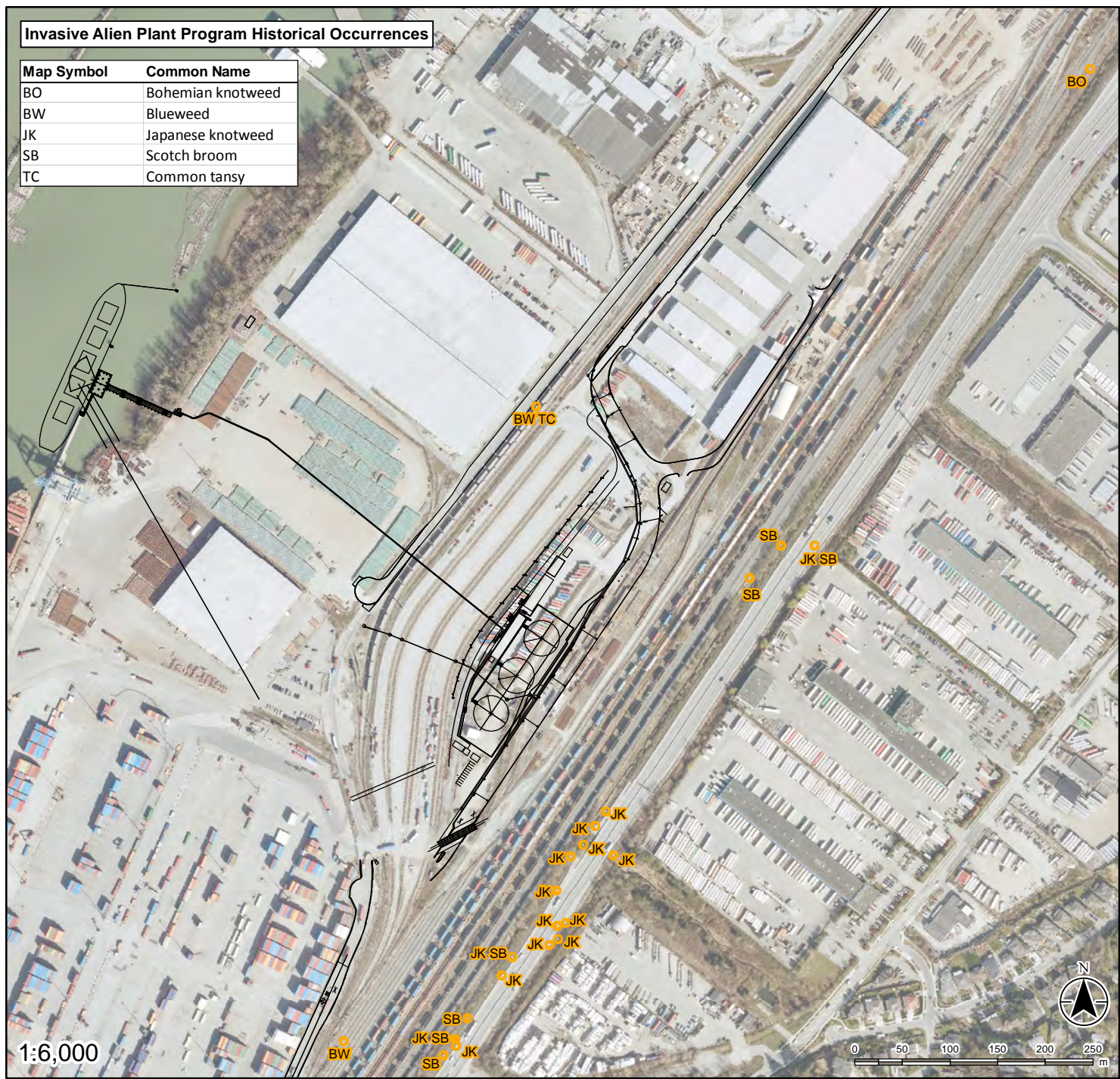


Historical Spatial Records of Species at Risk According to BC CDC



Invasive Alien Plant Program Historical Occurrences

Map Symbol	Common Name
BO	Bohemian knotweed
BW	Blueweed
JK	Japanese knotweed
SB	Scotch broom
TC	Common tansy



- Highway
- Road
- Railway
- Watercourse
- Waterbody
- - - Municipal Boundary
- Local Greenspace
- Project Boundary
- Species and Ecosystems at Risk - Publicly Available Occurrence
- Project Components
- Invasive Alien Plant Program (IAPP) Occurrence

Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: DataBC, Government of British Columbia; Natural Resources Canada
 3. Imagery: City of Surrey 2020



Project Location: Surrey, BC
 NTS 50K Grid: 092G02
 Project Number: 12322054
 Prepared by: KWONG on 20220928
 Requested by: GROUSSEAU on 20220928
 Checked by: LTRUPELL on 20220930

Client/Project/Report:
 DP World (Canada)
 Fraser Surrey Canola Oil Transload Facility
 Habitat Assessment

Figure No. **6** Revision No. **2**

Terrestrial Resources Existing Information

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BIOPHYSICAL HABITAT ASSESSMENT

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Table 6 Wildlife Species of Conservation Concern with the Potential to Occur¹ Within or Adjacent to the Project Footprint

Common Name	Scientific Name	BC List	COSEWIC	SARA	Occurrence within 5 km of Project ²	Observed within Project Footprint
Mammals						
Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>	Blue	-	-	-	Not observed
Little brown myotis	<i>Myotis lucifugus</i>	Yellow	E	E	Yes	Not observed
Pacific water shrew	<i>Sorex bendirii</i>	Red	E	E	Yes	Not observed
Olympic shrew	<i>Sorex rohweri</i>	Red	-	-	-	Not observed
Trowbridge's shrew	<i>Sorex trowbridgii</i>	Blue	-	-	-	Not observed
Birds						
Great blue heron, <i>fannini</i> subspecies	<i>Ardea herodias fannini</i>	Blue	SC	SC	Yes	Observed
American bittern	<i>Botaurus lentiginosus</i>	Blue	-	-	-	Not observed
Rough-legged hawk	<i>Buteo lagopus</i>	Blue	NAR	-	-	Not observed
Green heron	<i>Butorides virescens</i>	Blue	-	-	Yes	Not observed
Common nighthawk	<i>Chordeils minor</i>	Yellow	SC	T	Yes	Not observed
Black swift	<i>Cypseloides niger</i>	Blue	-	-	Yes	Not observed
Barn swallow	<i>Hirundo rustica</i>	Blue	SC	SC	Yes	Observed
Caspian tern	<i>Hydroprogne caspia</i>	Blue	-	-	Yes	Not observed
Western screech-owl, <i>kennicottii</i> subspecies	<i>Megascops kennicottii</i>	Blue	T	T	Yes	Not observed
Black-crowned night heron	<i>Nycticorax</i>	Red	-	-	-	Not observed
Band-tailed pigeon	<i>Patagioenas fasciata</i>	Blue	SC	SC	Yes	Not observed
Bald Eagle ³	<i>Haliaeetus leucocephalus</i>	Yellow	-	-	Yes	Observed
Purple martin	<i>Progne subis</i>	Blue	-	-	Yes	Not observed
Barn owl	<i>Tyto alba</i>	Red	T	T	Yes	Not observed
Peregrine falcon	<i>Falco peregrinus anatum</i>	Red	NAR	SC	Yes	Not observed
Amphibians and Reptiles						
Western toad	<i>Anaxyrus boreas</i>	Yellow	SC	SC	-	Not observed
Northern red-legged frog	<i>Rana aurora</i>	Blue	SC	SC	Yes	Not observed



BIOPHYSICAL HABITAT ASSESSMENT

Description of Existing Environment
January 6, 2023

Table 6 Wildlife Species of Conservation Concern with the Potential to Occur¹ Within or Adjacent to the Project Footprint

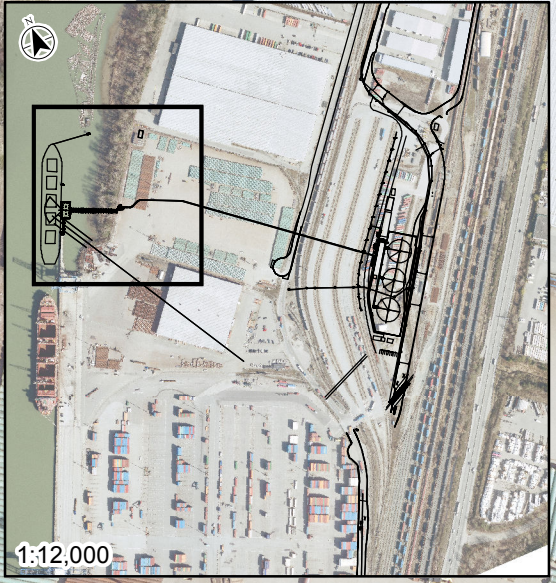
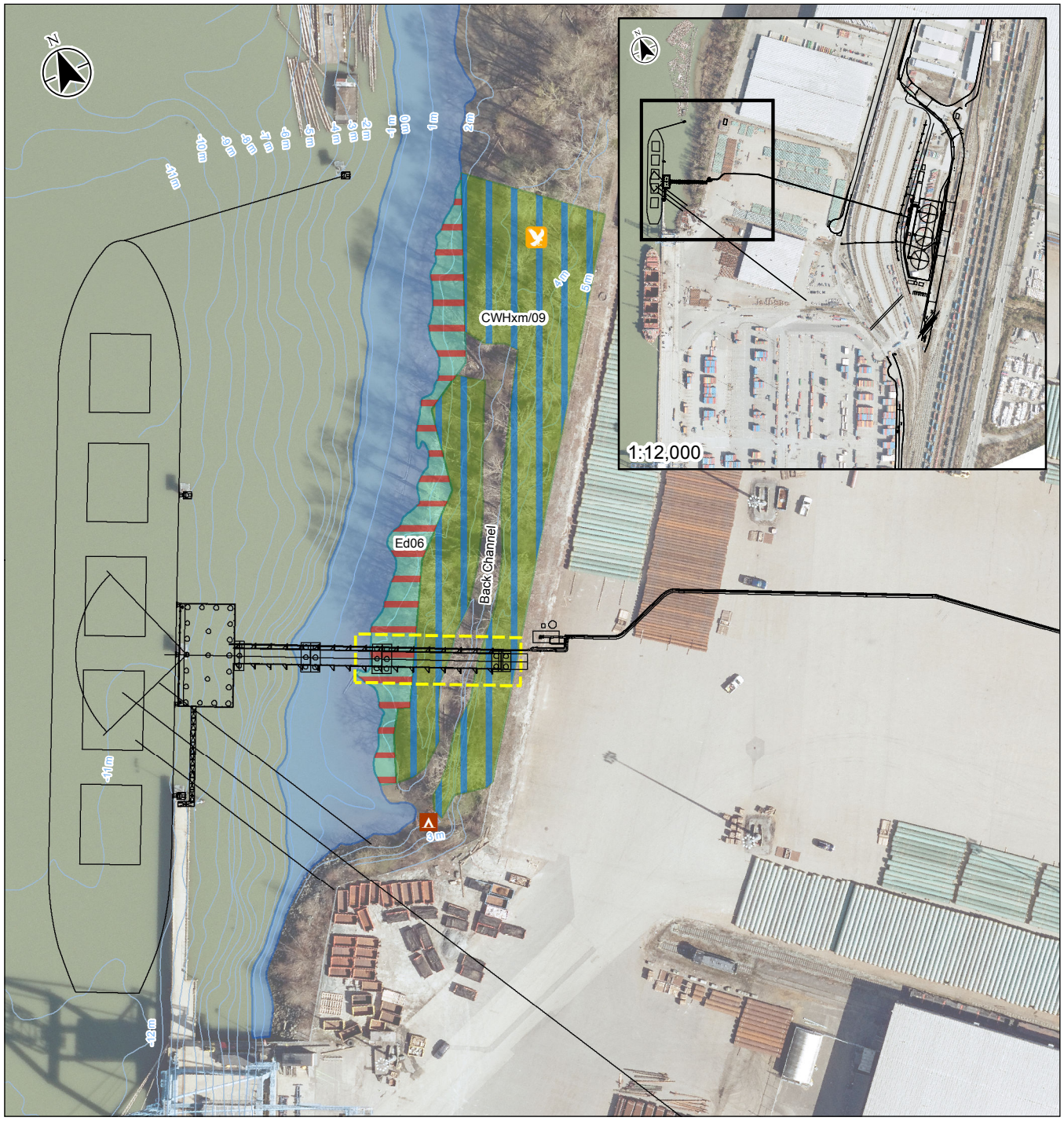
Common Name	Scientific Name	BC List	COSEWIC	SARA	Occurrence within 5 km of Project ²	Observed within Project Footprint
Gastropods						
Oregon Forestsnail	<i>Allogona townsendiana</i>	Red	E	E	-	Not observed
<p>NOTES:</p> <ol style="list-style-type: none"> Some species have been filtered from this list based on known regional occurrence or specific habitat availability within the Project footprint (e.g., species that require large swaths of mature forest or grassland, etc). Observation data from BC CDC 2022; EBird 2022; E-Fauna 2022 Bald eagle is not a Species at Risk, but it is a species of regional significance and best practices include mitigations for breeding birds, nests, and nest trees <p>BC List:</p> <ul style="list-style-type: none"> Yellow = species that are apparently secure and not at risk of extinction. Blue = species that are of Special Concern, sensitive to human activities or natural events. Red = species that have, or are candidates for, Extirpated, Endangered, or Threatened status in British Columbia. Endangered species are facing imminent extirpation or extinction. <p>COSEWIC/SARA:</p> <ul style="list-style-type: none"> SC = Special Concern, a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events T = Threatened, a species that is likely to become endangered if limiting factors are not reversed E = Endangered, a species facing imminent extirpation or extinction NAR = Not at Risk, species is not currently at risk of extinction <p>Information from BC Species and Ecosystem Explorer (BC CDC 2022)</p>						

4.3.1.2 Field Results

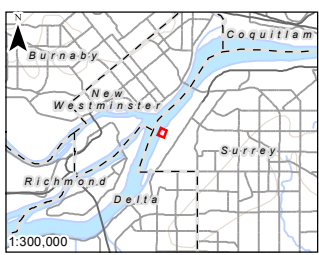
Two adult eagles were observed perching near a stick nest on March 3, 2022, approximately 100 m east of the Berth 10 Project site and the nest was determined to be active (Figure 7). One adult eagle was observed within the stick nest on May 31, 2022.

Barn swallows were observed flying under and perching on the Berth 10 gangway with twigs and branches. Barn swallows are known to nest in small colonies of no more than 10 pairs and prefer nesting within artificial structures such as bridges and platforms (COSEWIC 2011). Based on the observed activity, it is likely that barn swallows are nesting under the Berth 10 gangway.



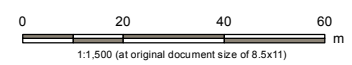


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- Bathymetric Contour (1 m)
- Project Components
- Estimated Construction Access Area
- Blue Listed Ecological Community
- Red-Listed Ecological Community

- Active Bald Eagle Nest (Approximate Location)
- Potential Beaver Lodge (Approximate Location)
- Tidal Shallow Water Wetland
- Ed06: Lyngbye's sedge – Douglas' water hemlock estuarine marsh
- CWHxm/09: black cottonwood/red-osier dogwood mid-bench floodplain community



Project Location: Surrey, BC
 NTS 50K Grid: 092G02
 Project Number: 12322054
 Prepared by KWONG on 20221125
 Requested by MRAMSAY on 20221125
 Checked by GROUSSEAU on 20221128

Client/Project/Report
 DP World (Canada)
 Fraser Surrey Canola Oil Transload Facility
 Habitat Assessment

Figure No. **7** Revision No. **4**

Terrestrial Field Survey Results

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The following wildlife were also observed during field surveys:

- Deceased adult beaver discovered in high intertidal area, and evidence of beaver activity (i.e., gnawed tree stumps)
- Bald eagle (*Haliaeetus leucocephalus*) perched on trees adjacent to nest and generally flying around the area upstream and east of Berth 10
- Eastern cottontail (*Sylvilagus floridanus*)
- Anna's hummingbird (*Calypte anna*)
- Song sparrow (*Melospiza melodia*)
- Black capped chickadee (*Poecile atricapillus*)
- American crow (*Corvus brachyrhynchos*)
- White crowned sparrow (*Zonotrichia leucophrys*)
- Warbling vireo (*Vireo gilvus*)
- Yellow warbler (*Setophaga petechia*)
- Violet-green swallow (*Tachycineta thalassina*)
- Bewick's wren (*Thryomanes bewickii*)
- House finch (*Haemorhous mexicanus*)
- Spotted towhee (*Pipilo maculatus*)
- Barn swallow (*Hirundo rustica*)
- Killdeer (*Charadrius vociferus*)

4.3.2 Vegetation and Wetlands

4.3.2.1 Desktop Results

The Project is located within the Coastal Western Hemlock (CWH) very dry maritime (xm1) biogeoclimatic subzone and the Georgia depression. This zone typically has cool summer and mild winters with mean annual temperatures of 8°C.

Metro Vancouver Sensitive Ecosystem Inventory (SEI) Mapping indicates that the Project study area includes 60% marsh wetland and 40% riparian mudflat at lower elevations and mid-bench floodplain community at slightly higher elevations (Metro Vancouver 2022). All of the sensitive ecosystem types within the vicinity of the Project area are characterized as being of poor quality according to SEI mapping criteria which considers such factors as the patch size, context (i.e., situated among industrial development), and condition (i.e., contains relatively high proportions of non-native invasive plant species).

A search of the BC CDC Ecosystems Explorer database resulted in a list of 14 red-listed and 16 blue-listed ecological communities that have the potential to occur within the Project footprint according to their known range boundaries (Table 7). Aerial imagery and photos from the field assessments completed for aquatics and wildlife were reviewed to determine if suitable habitat for these communities is present



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within the Project footprint. Of the 30 red and/or blue-listed ecological communities with the potential to occur based on their known ranges, potentially suitable habitat for two-thirds of them is not present in the Project, i.e., there are no conifer-dominated stands, no bogs, or arbutus trees. The ecological communities with potential to occur based on their known ranges and potentially suitable habitat in the Project footprint, includes eight blue-listed and two red-listed ecological communities (Table 7).

Table 7 Red- and Blue-listed Ecological Communities with Potential to Occur in the Project Footprint

Scientific Name	English Name	BC List	Occurrence within 5 km of Project	Suitable Habitat Potentially Present in Project Footprint
<i>Arbutus menziesii</i> / <i>Arctostaphylos columbiana</i>	arbutus / hairy manzanita	Red	No	No
<i>Carex lasiocarpa</i> - <i>Rhynchospora alba</i>	slender sedge - white beak-rush	Red	No	Yes
<i>Carex sitchensis</i> - <i>Oenanthe sarmentosa</i>	Sitka sedge - Pacific water-parsley	Blue	No	Yes
<i>Eleocharis palustris</i> Herbaceous Vegetation	common spike-rush Herbaceous Vegetation	Blue	No	Yes
<i>Myrica gale</i> / <i>Carex sitchensis</i>	sweet gale / Sitka sedge	Blue	No	Yes
<i>Picea sitchensis</i> / <i>Rubus spectabilis</i> Dry	Sitka spruce / salmonberry Dry	Red	No	No
<i>Picea sitchensis</i> / <i>Rubus spectabilis</i> Very Dry Maritime	Sitka spruce / salmonberry Very Dry Maritime	Red	No	No
<i>Pinus contorta</i> / <i>Sphagnum spp.</i> Very Dry Maritime	lodgepole pine / peat-mosses Very Dry Maritime	Blue	No	No
<i>Populus tremuloides</i> / <i>Malus fusca</i> / <i>Carex obnupta</i>	trembling aspen / Pacific crab apple / slough sedge	Red	No	Yes
<i>Populus trichocarpa</i> - <i>Alnus rubra</i> / <i>Rubus spectabilis</i>	black cottonwood - red alder / salmonberry	Blue	No	Yes
<i>Populus trichocarpa</i> / <i>Salix sitchensis</i>	black cottonwood / Sitka willow	Blue	No	Yes
<i>Pseudotsuga menziesii</i> / <i>Polystichum munitum</i>	Douglas-fir / sword fern	Red	No	No
<i>Pseudotsuga menziesii</i> - <i>Tsuga heterophylla</i> / <i>Gaultheria shallon</i> Dry Maritime	Douglas-fir - western hemlock / salal Dry Maritime	Red	No	No
<i>Rhododendron groenlandicum</i> / <i>Kalmia microphylla</i> / <i>Sphagnum spp.</i>	Labrador-tea / western bog-laurel / peat-mosses	Blue	No	No
<i>Salix sitchensis</i> - <i>Salix lasiandra</i> var. <i>lasiandra</i> / <i>Lysichiton americanus</i>	Sitka willow - Pacific willow / skunk cabbage	Blue	No	Yes
<i>Schoenoplectus acutus</i> Deep Marsh	hard-stemmed bulrush Deep Marsh	Blue	No	Yes



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Table 7 Red- and Blue-listed Ecological Communities with Potential to Occur in the Project Footprint

Scientific Name	English Name	BC List	Occurrence within 5 km of Project	Suitable Habitat Potentially Present in Project Footprint
<i>Selaginella wallacei</i> / <i>Cladina</i> spp.	Wallace's selaginella / reindeer lichens	Blue	No	No
<i>Thuja plicata</i> / <i>Carex obnupta</i>	western redcedar / slough sedge	Red	No	No
<i>Thuja plicata</i> / <i>Lonicera involucrata</i>	western redcedar / black twinberry	Red	No	No
<i>Thuja plicata</i> - <i>Picea sitchensis</i> / <i>Lysichiton americanus</i>	western redcedar - Sitka spruce / skunk cabbage	Blue	No	No
<i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i>	western redcedar / sword fern - skunk cabbage	Blue	No	No
<i>Thuja plicata</i> / <i>Polystichum munitum</i> Dry Maritime	western redcedar / sword fern Dry Maritime	Red	No	No
<i>Thuja plicata</i> / <i>Polystichum munitum</i> Very Dry Maritime	western redcedar / sword fern Very Dry Maritime	Red	No	No
<i>Thuja plicata</i> / <i>Rubus spectabilis</i>	western redcedar / salmonberry	Red	No	No
<i>Thuja plicata</i> / <i>Tiarella trifoliata</i> Dry Maritime	western redcedar / three-leaved foamflower Dry Maritime	Blue	No	No
<i>Thuja plicata</i> / <i>Tiarella trifoliata</i> Very Dry Maritime	western redcedar / three-leaved foamflower Very Dry Maritime	Blue	No	No
<i>Tsuga heterophylla</i> / <i>Buckiella undulata</i>	western hemlock / flat-moss	Blue	No	No
<i>Tsuga heterophylla</i> - <i>Pseudotsuga menziesii</i> / <i>Kindbergia oregana</i>	western hemlock - Douglas-fir / Oregon beaked-moss	Red	No	No
<i>Tsuga heterophylla</i> - <i>Thuja plicata</i> / <i>Struthiopteris spicant</i>	western hemlock - western redcedar / deer fern	Red	No	No
<i>Typha latifolia</i> Marsh	common cattail Marsh	Blue	No	Yes
<p>NOTES:</p> <p>Ecological communities are not tracked by SARA.</p> <p>Provincial status:</p> <ul style="list-style-type: none"> Blue = "native ecological community of Special Concern" (BC CDC 2022) Red = "native ecological community that have or are candidates for, Extirpated, Endangered, or Threatened status in British Columbia. Endangered ecological communities are facing imminent extirpation or extinction" (BC CDC 2022) 				



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A search of the BC CDC Ecosystems Explorer resulted in a list of 24 plant species (including vascular and non-vascular plants) of concern with the potential to occur within the Project boundary based on known range boundaries of the species (Table 8), including one yellow-listed species (listed as Special Concern on Schedule 1 of the SARA); 15 blue-listed species (four of which are listed as Special Concern on Schedule 1 of the SARA, one of which is listed as Endangered on Schedule 1 of the SARA, and the remainder are not listed under the SARA); and eight red-listed species (six of which are listed as Endangered on Schedule 1 of the SARA and one of which is listed as Threatened on Schedule 1 of the SARA, and the remainder are not listed under the SARA; (Table 8).

Suitable habitat for plant species at risk with potential to occur based on their known ranges was assessed based on a review of suitable habitat for each species and the habitat types that are present in the Project area.

Of the 24 species with the potential to occur based on their known ranges, potentially suitable habitat is present in the Project footprint for nine of those species, including one yellow-listed moss (listed as Special Concern on Schedule 1 of the SARA); six blue-listed (one listed as Special Concern on Schedule 1 of the SARA); and two red-listed (both listed as Endangered on Schedule 1 of the SARA; Table 8).

There are known historical occurrences of four plant species at risk within 5 km of the Project: Vancouver Island beggarticks (*Bidens amplissima*; blue-listed; Special Concern by SARA); Roell's brotherella (*Brotherella roellii*; red-listed; Endangered by SARA); streambank lupine (*Lupinus rivularis*; red-listed; Endangered by SARA); and pink water speedwell (*Veronica catenate*; blue-listed Table 8; Figure 6).

Table 8 Plant Species of Conservation Concern with the Potential to occur Within or Adjacent to the Project footprint

Scientific Name	English Name	BC List	COSEWIC	SARA	Occurrence within 5 km of Project (date last observed)	Suitable Habitat Potentially Present in the Project Footprint
<i>Acorus americanus</i>	American sweet-flag	Blue	-	-	No	Yes
<i>Actaea elata</i> var. <i>elata</i>	tall bugbane	Red	E	1-E (2003)	No	No
<i>Berula incisa</i>	cut-leaved water-parsnip	Blue	-	-	No	Yes
<i>Bidens amplissima</i>	Vancouver Island beggarticks	Blue	SC	1-SC (2003)	Yes 1988 ¹	Yes
<i>Brotherella roellii</i>	Roell's brotherella	Red	E	1-E (2018)	Yes 1889 ²	Yes
<i>Cephalanthera austini</i>	phantom orchid	Red	E	1-T (2003)	No	No
<i>Cladonia decorticata</i>	strip-tease pixie	Blue	-	-	No	No



BIOPHYSICAL HABITAT ASSESSMENT

Description of Existing Environment
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Table 8 Plant Species of Conservation Concern with the Potential to occur Within or Adjacent to the Project footprint

Scientific Name	English Name	BC List	COSEWIC	SARA	Occurrence within 5 km of Project (date last observed)	Suitable Habitat Potentially Present in the Project Footprint
<i>Claytonia washingtoniana</i>	Washington springbeauty	Blue	-	-	No	No
<i>Collema flaccidum</i>	flaking tarpaper	Red	-	-	No	No
<i>Dermatocarpon intestiniforme</i>	quilted stippleback	Blue	-	-	No	No
<i>Entosthodon fascicularis</i>	banded cord-moss	Blue	SC	1-SC (2006)	No	No
<i>Fabronia pusilla</i>	silver hair moss	Red	E	1-E (2005)	No	No
<i>Fissidens pauperculus</i>	poor pocket moss	Red	E	1-E (2003)	No	No
<i>Lindernia dubia</i> var. <i>dubia</i>	yellowseed false pimpernel	Blue	-	-	No	Yes
<i>Lupinus rivularis</i>	streambank lupine	Red	E	1-E (2005)	Yes 2013 ³	Yes
<i>Nephroma occultum</i>	cryptic paw	Blue	T	1-SC (2007)	No	No
<i>Pinus albicaulis</i>	whitebark pine	Blue	E	1-E (2012)	No	No
<i>Pyrola aphylla</i>	leafless wintergreen	Blue	-	-	No	No
<i>Scytinium californicum</i>	midlife vinyl	Blue	-	-	No	No
<i>Scytinium polycarpum</i>	peacock vinyl	Yellow	SC	1-SC	No	Yes
<i>Sidalcea hendersonii</i>	Henderson's checker-mallow	Blue	-	-	No	Yes
<i>Syntrichia laevipila</i>	twisted oak moss	Blue	SC	1-SC (2005)	No	No
<i>Triteleia howellii</i>	Howell's triteleia	Red	E	1-E (2005)	No	No
<i>Veronica catenata</i>	Pink water speedwell	Blue	-	-	Yes 2017 ⁴	Yes



BIOPHYSICAL HABITAT ASSESSMENT

Description of Existing Environment
January 6, 2023

Table 8 Plant Species of Conservation Concern with the Potential to occur Within or Adjacent to the Project footprint

Scientific Name	English Name	BC List	COSEWIC	SARA	Occurrence within 5 km of Project (date last observed)	Suitable Habitat Potentially Present in the Project Footprint
<p>NOTES:</p> <p>BC List:</p> <ul style="list-style-type: none"> Blue = “native species of Special Concern” (BC CDC 2022) Red = “native species that have, or are candidates for, Extirpated, Endangered, or Threatened status in British Columbia. Endangered species are facing imminent extirpation or extinction” (BC CDC 2022) <p>SARA list:</p> <ul style="list-style-type: none"> SC = Special Concern, a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events E = Endangered, a species facing imminent extirpation or extinction <p>Information from BC Species and Ecosystem Explorer (BC CDC 2022)</p> <p>¹ BC CDC 2014a ² BC CDC 2014b ³ Hemmera 2018b ⁴ BC CDC 2014c</p>						

There are historical records of Vancouver Island beggarticks along the railway embankment 500 m south-west of the Project footprint although it is possible that this is an extirpated record as surveys in 2008 confirmed that no plants were observed (BC CDC 2022).

The historical record of roell’s brotherella (*Brotherella roellii*) is from 1889 and was recorded 1.8 km north-east of the Project (BC CDC 2014).

Streambank lupine is known to occur on open sandy or gravelly, moist, river or creek bank sites which are near to the coast and with little ground cover. In BC, it is noted as occurring within natural riverbank situations and on gravelly railway beds (COSEWIC 2014). There are historical records of streambank lupine 100 m north-east and 575 m south-west of the railcar unloading and storage layout footprint, with two additional records located along Grace Road to the south-east of highway 17, and one record at the entrance to the DP World Terminal on elevator road (Hemmera 2018b). In BC, 8 populations of streambank lupine are identified which are known from 14 reported sites or subpopulations (MOE 2014). Of the five records identified in proximity to the Project, three were reported as extirpated by development and maintenance activities, with remaining sub-populations and two newly recorded observations last observed in 2013. The observations within the terminal at the rail tracks were recorded to include approximately 70 flowering plants with 100+ seedlings and juveniles, and 25 flowering plants and 66+ seedlings and juveniles near the rail tracks and piled lumber on Alaska Way.



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As of 2013, the population within 100 m of the Project was identified to include approximately 8 flowering plants and >20 seedlings/juveniles and its status as extant. All occurrences were noted as within sand and silt (MOE 2014).

In 2017, pink water speedwell was recorded 850 m north-east of the Project within the Fraser River intertidal area with an occurrence of several plants documented in 2017 within a vegetated tidal mud flat of the Fraser River (Hemmera 2018b). Habitat for pink water speedwell includes wet meadows, ditches, shores, and shallow water along pond edges and slow-moving streams in the lowland and montane zones and occurs within hydric soil moisture regimes (Klinkenberg 2020).

A search was conducted for historical records of invasive species within 1 km of the Project footprint. Table 9 and Figure 7 show the results of historical occurrences of invasive species within 1 km of the Project footprint (IAPP 2022). All these records were identified adjacent to the railway nearest to Highway 17.

Table 9 Historical Invasive Plant Species Occurrences within 1 km of the Project Footprint

Scientific Name	English Name	Status ¹
<i>Fallopia japonica</i>	Japanese knotweed	Provincially noxious
<i>Cytisus scoparius</i>	Scotch broom	Invasive; ISCMV priority species
<i>Echium vulgare</i>	Blueweed	Regionally noxious
<i>Tanacetum vulgare</i>	Common tansy	Regionally noxious
<i>Fallopia x bohemica</i>	Bohemian knotweed	Provincially noxious
NOTES: ¹ Provincially noxious per Schedule A of the Weed Control Regulation. ISCMV priority from ISCMV (2020).		

4.3.2.2 Field Results

Ecological communities and wetlands within the Project footprint (beneath and adjacent to the trestle alignment) consists of mature black cottonwood/red-osier dogwood mid-bench floodplain community (CWHxm/09), Lyngbye's sedge – Douglas' water hemlock estuarine marsh (Em06), and unvegetated tidal shallow water class wetlands (Figure 7 and Appendix D). The Lyngbye's sedge – Douglas' water hemlock estuarine is provincially red-listed (considered endangered or threatened in BC) and the black cottonwood/red-osier dogwood mid-bench floodplain community is provincially blue-listed (special concern; BC CDC 2022).

Wetlands within the Project footprint are within a geographic area where the documented continuing loss or degradation of wetlands has reached critical levels (Lower Mainland) and red-listed wetland ecological communities are designated as ecologically important to a region (ECCC/CWS 2019).

A total of 22 species were recorded during field surveys (Table 10). Seven of these species are considered exotic, and one (yellow flag iris; *Iris pseudacorus*) is provincially noxious.



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No species of conservation concern were observed during 2022 field surveys, however, only one survey was completed, and it was early in the growing season (i.e., in April).

Table 10 Vegetation Species Occurring within or adjacent to the Project Footprint

Scientific Name	English Name	Status ¹
Trees		
<i>Alnus rubra</i>	Red alder	Yellow
<i>Malus fusca</i>	Pacific crab apple	Yellow
<i>Populus trichocarpa</i>	Black cottonwood	Yellow
<i>Thuja plicata</i>	Western redcedar	Yellow
Shrubs		
<i>Cornus sericea</i>	Red-osier dogwood	Yellow
<i>Physocarpus capitatus</i>	Pacific ninebark	Yellow
<i>Rubus armeniacus</i>	Himalayan blackberry	Exotic ²
<i>Rubus spectabilis</i>	Salmonberry	Yellow
<i>Spiraea douglasii</i>	Hardhack	Yellow
<i>Symphoricarpos albus</i>	Common snowberry	Yellow
Grasses and Forbs		
<i>Carex lyngbyei</i>	Lyngbye's sedge	Yellow
<i>Deschampsia cespitosa</i>	Tufted hairgrass	Yellow
<i>Symphotrichum subspicatum</i>	Douglas' aster	Yellow
<i>Potentilla anserina ssp. pacifica</i>	Coast silverweed	Yellow
<i>Juncus balticus</i>	Baltic rush	Yellow
<i>Cardamine hirsuta</i>	Hairy bittercress	Exotic
<i>Anthriscus sylvestris</i>	Wild chervil	Exotic ²
<i>Equisetum arvense</i>	Field horsetail	Yellow
<i>Iris pseudacorus</i>	Yellow flag iris	Exotic ^{2,3}
<i>Juncus effusus</i>	Common rush	Yellow
<i>Phalaris arundinacea</i>	Reed canarygrass	Exotic ²
<i>Verbascum thapsus</i>	Common mullein	Exotic
NOTES:		
¹ Provincial status from BC CDC (2022) Yellow – apparently secure; not at risk of extinction Exotic – introduced species, or those that have moved beyond their native range		
² ISCMV priority species (ISCMV 2020)		
³ Provincially noxious per Schedule A of the Weed Control Regulation		



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5.0 POTENTIAL EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS

In this section, the potential environmental effects of the Project and residual effects remaining after implementation of avoidance and mitigation measures are discussed.

5.1 POTENTIAL EFFECTS OF THE PROJECT ON AQUATIC HABITATS

The Project footprint includes one back channel which runs parallel to the shoreline, the Fraser River, Berth 10 drainage and the Fraser River intertidal zone. Project effects relate to temporary construction activities and permanent infrastructure. Construction activities and permanent operations which have the potential to affect the aquatic environment within the Project footprint include the installation of piles for the bridge spans and the Berth 10 loading platform (Figure 3) e.g., through generation of underwater noise (pile driving and vessel operation) and in-stream shading impacts (Berth 10 platform and spans). In-stream and riparian shading impacts are minimal compared to existing habitat conditions.

5.1.1 Pathways of Effects

DFO's Pathways of effects (PoE; DFO 2018) describe development projects in terms of the activities involved, the potential cause-effect relationships that exist, and the mechanisms of stressors acting on the aquatic environment. Each cause-and-effect relationship connects the project activity to the potential stressor, and the stressor to an effect on a receptor (i.e., fish and/or fish habitat). Each pathway is an area where mitigation measures can be used to diminish or eliminate the effects of potential stressors. Where mitigation cannot eliminate the effects of a stressor, this stressor remains as a residual effect. The PoE for in-water activities are considered for the Project to evaluate potential or residual effects. The PoE applicable to the Project pertain to the following activities or impacts:

- Use of industrial equipment;
- Placement of materials or structures in water; and
- Vegetation clearing

The Project-related activities that are listed above could potentially lead to the following effects:

- Change in habitat structure and cover via installation of new piles and berth platform;
- Change in suspended sediment concentrations during pile installation.
- Change in contaminant concentrations from industrial equipment.
- Changes in communication or migration patterns or mortality of fish during pile driving, via generation of underwater noise; and
- Changes in behaviour or hearing injury of marine mammals (i.e., seals and sea lions) during pile driving, via generation of underwater noise.



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5.1.1.1 Change in Habitat Structure and Cover

The Project involves the installation of 21 permanent 1.2 m diameter steel piles for the concrete loading arm platform at Berth 10, and 19 permanent 1.2 m diameter steel piles for the loading arm access trestle in which, only 15 will be in-water. Construction of the loading platform, access trestle and connection trestle to the existing Berth 10 wharf have been designed to minimize in-water and over-water construction activities. The area of riverbed modified from the piles for each Project component is provided in Table 11. The new piles will represent a shift from an un-vegetated, silty sand river bottom to the addition of a hard-substrate (steel piles) extending vertically through the water column.

Both the loading platform and access trestle will also have an associated shading effect but is expected to have limited photic effects on productivity given the existing ambient turbidity levels observed in the Lower Fraser River with photic depths understood to differ depending on existing sediment load (Able et al. 2013). Ambient light was also found to vary under marine structures dependent on distance to the pier, tide level and time of day (Able et al. 2013). Studies have additionally found that piers with north to south orientations experience fewer shading effects than east to west orientations as they generally receive more sunlight (Able et al. 2013). No in-water aquatic vegetation was observed at the time of survey, and intertidal vegetation is limited with substrate mainly consisting of sand and clay with minimal opportunities for plant growth. The lack of aquatic intertidal plants, the low density and north to south orientation of the loading platform and access trestle, and the ambient turbidity and bi-diurnal tides indicate the new platform and trestle are unlikely to affect existing fish abundance, feeding and behavioural patterns. The walkway from Berth 9 to Berth 10 is not expected to have a shading footprint or in water supports.

Changes in the habitat structure and cover may alter habitat available for benthic invertebrates, and therefore affect foraging for fish. Pile installation may also cause direct mortality or physical disturbance of benthic invertebrates. Benthic invertebrate distributions were previously found to be lower than the reference in the mainstem of Annieville Channel (Hemmera 2018a), therefore the negligible effect to these species is low.

The footprint area of the piles is small relative to similar habitat available around the Project, and the Project will not cause temporary or permanent barriers to migration of any species. Therefore, changes in habitat from new pile installation is not expected to cause measurable adverse effects fish.

Table 11 Over-water and in-water Project components with associated areas of shading and riverbed modification

Over-water and In-water Component	Number of Piles (1.2 m diameter)	Area of Riverbed Modified (m ²)	Shading Footprint (m ²)
Concrete loading platform at Berth 10	21	25	364
Access trestle	15	17	282
Walkway from Berth 9 to 10	n/a	n/a	n/a



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5.1.1.2 Change in Suspended Sediment and Contaminant Concentrations

Changes in total suspended solids (TSS) levels in the water column may have adverse impacts on fish including mechanical abrasion of gills, hypersecretion of mucous causing respiratory distress at the gills, or physiological stress that could impact growth, feeding behavior and foraging success (Appleby and Scarratt 1989; Bash et al. 2001). The most susceptible life stages are eggs, larvae, and juveniles (Bash et al. 2001). Installation of the piles will cause temporary and localized changes in TSS, and since the ambient turbidity in the Lower Fraser River often exceeds 20 NTU naturally, it is expected that these activities will have negligible effects of aquatic life. Monitoring will be conducted as discussed in Section 6.0.

Constructed structures are unlikely to increase the potential for erosion and scour of the Fraser River given Berth 10 has ongoing routine maintenance dredging and is protected from the mainstem Fraser River by the training berm along the Fraser Surrey terminal.

Benthic invertebrates may also be affected by increases in suspended sediment during pile driving by becoming potentially entrained, or buried, therefore affecting foraging for fish species (Hemmera 2018a). These effects from temporary sediment increases are expected to be negligible due to the ongoing routine maintenance dredging already occurring within the terminal berth area (Hemmera 2018a).

Changes in contaminant concentrations from using industrial equipment during the construction phase will be negligible compared to the industrial nature of the Project area, and the frequency of vessel movement and mooring. Effects are to be localized and minimal with mitigation measures in place. Water quality monitoring will be conducted as discussed in Section 5.0.

5.1.1.3 Change in Communication, Migration, Injury or Mortality of Fish and Marine Animals from Underwater Noise

Unmitigated impact pile driving methods and associated sound pressure waves have the potential to cause injury or mortality in fish (Popper et al. 2014) and hearing injury or behavioural disruption in marine mammals (Southall et al. 2019). Potential effects may include traumatic injury to tissues or organs (e.g., swim bladders in some fish, inner ears of marine mammals); masking of underwater noises used by fish and mammals to detect predators or prey, or for communication; behavioural disturbances that cause fish or mammals to avoid an area, and temporary physical damage to hearing (e.g., Weilgart 2018). Lethal effects in fish can occur from peak sound pressure levels (SPL_{peak}) exceeding 30 kilopascal or 210 dB re 1 micropascal (μPa) (Popper and Hastings 2009), and juveniles can be more sensitive to noise than adults (Casper et al. 2012).

Underwater Noise Thresholds

There are currently no regulations or policies in Canada regarding thresholds for underwater noise to manage potential effects on marine mammals or fish. For fish, environmental assessments and management plans commonly use thresholds described in Popper et al. (2014) or the California Department of Transportation (2015). This evaluation uses the more stringent California Department of Transportation criterion of 183/187 dB (24 hours) and 206/206 dB (peak) for injury to small/large fish.



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For marine mammals, Canada frequently relies on regulatory thresholds and guidance in place in the United States, which are provided by the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration (NOAA). NOAA Fisheries provides guidance for assessing the potential for underwater sound levels to injure or disturb marine mammals. This guidance includes the provision of thresholds that can be used to assess both behavioural disruption and injury.

With respect to behavioural disruption, NOAA Fisheries has historical interim guidance that sets thresholds for broadband underwater root-mean-square Sound Pressure Levels (SPLs) predicted to cause behavioural disruption (NOAA 2018). Impact hammer pile driving is the only Project activity that could potentially generate sound levels sufficient to cause a permanent threshold shift (PTS) and injury (PTS onset) for impulsive noise is 218 dB_{peak} re 1 µPa and 201 re 1 µPa dB_{peak} for continuous noise (Southall et al. 2019).

Prior to mitigation, pile installation by impact or vibratory pile hammer has the potential to cause barotrauma or disturbance, respectively, to nearby fish. Barotrauma would be expected to affect those with swim bladders such as resident species observed in Berth 10. Use of vibratory equipment for pile driving is generally seen as less intrusive with sound levels generated not anticipated to exceed or be close to exceeding peak sound values. Where possible i.e., where substrate allows, vibratory equipment will be used. Additional mitigation measures to attenuate sound levels to acceptable levels (as specified within the Letter of Advice from Fisheries and Oceans Canada [DFO]) will be applied should impact pile driving be required (i.e., bubble curtains; see Section 5.1.2 for additional mitigation measures).

5.1.2 Mitigation Measures for Potential Effects to Aquatic Habitats

Mitigation measures for potential effects on aquatic resources are provided in the Project CEMP, including for:

- Pile installation
- Concrete work
- Fish protection
- Marine Mammals
- Underwater Noise

5.2 POTENTIAL EFFECTS OF THE PROJECT ON TERRESTRIAL RESOURCES

Construction of the Project will entail temporary disturbances to existing vegetation and wildlife habitat to facilitate access and pile installation to support bridge spans. The operational effects on terrestrial habitat are limited to the footprint of permanent piles and overhead components.

5.2.1 Vegetation and Wetlands

The following describes the potential environmental effects of the Project on vegetation and wetlands:



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- Temporary loss of vegetation where selective clearing is required for construction access. Permanent nominal loss (i.e., 5 m²) of a blue-listed ecological community within the footprint of steel piles within the mature black cottonwood/red-osier dogwood mid-bench floodplain community (Figure 7). Changes to vegetation structure beneath the trestle entailing selective tree removal (estimated to be three native deciduous trees) and maintenance of the vegetation beneath the trestle in a shrub-dominated state throughout the operational timeframe of the trestle (if necessary). Vegetation that has been cleared for construction access is expected to naturally regenerate. Shading impacts on vegetation are expected to be limited due to the orientation, height, and width of the trestle.
- Nominal loss of wetland area (7m² within the red-listed Lyngbye's sedge – Douglas' water hemlock estuarine marsh (Em06), and 7m² within the tidal shallow water wetland); however, overall wetland ecological functions are not expected to be lost due to the relatively small area of permanent Project footprint potentially occurring in wetlands (i.e., pile supports for trestle).
- Potential spread of invasive species; noxious weeds are present in and around the Project footprint (i.e., yellow flag iris identified in and around the footprint, and historical records of other species near the railyard). Provincially noxious weeds and other unregulated invasive species can spread or establish new occurrences during mobilization, construction, and post-construction activities, including during equipment mobilization, and soil disturbance
- No streambank lupine or other plant species at risk were observed during field studies, but there is potential that these species are present in and/or around the Project footprint, based on the desktop review.

5.2.2 Wildlife and Wildlife Habitat

The following describes the potential environmental effects of the Project on wildlife:

- Equipment accidents and malfunctions could cause physical impacts to flora, fauna, and wildlife health
- Direct loss or alteration of wildlife habitat could occur through vegetation clearing and ground disturbance, and indirectly through sensory disturbance during construction (i.e., through alteration to Berth 10 platform)
- Change in mortality risk due to ground disturbance and vegetation clearing during construction resulting in physical destruction of key habitat features (e.g., nests); vehicle and equipment movement during construction resulting in accidental mortality of small, less mobile species or individuals (e.g., snakes, rodents)
- Change in wildlife movement due to the alteration of physical barriers, sensory disturbance, or vegetation clearing. Generally high levels of bird activity were observed within and adjacent to the Project footprint. Temporary construction activities are anticipated, following the application of mitigation measures (see Section 5.2.3), to cause minimal disturbance to bird species. The permanent construction i.e., platform and bridge span, are expected to create additional habitat i.e., nesting habitat, for bird species such as barn swallows which prefer to nest in anthropogenic structures



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- Construction noise: general noise generated by construction activities could cause disturbance to nesting birds (e.g., bald eagles or barn swallow), if undertaken during the bird nesting/breeding season

5.2.3 Mitigation Measures for Potential Project Effects on Terrestrial Resources

Mitigation measures to reduce potential effects on vegetation and wildlife are provided in the Project CEMP, and includes pre- and post-construction measures for:

- Vegetation clearing
- Breeding birds
- Species at risk and protected nests, bald eagle, barn owl, and barn swallow
- Noxious weeds and invasive species
- General wildlife management

Prior to construction, a rare plant survey will be conducted to search for red-, blue-, and SARA-listed plant species that could occur in and/or around the Project footprint. If any are found, additional mitigation measures may be required. The survey will be based on provincial standards (i.e., *Inventory and Survey Methods for Rare Plants and Lichens* [RISC 2018]).

An ISA certified arborist will advise regarding selective tree removal, tree protection fencing specifications for retained trees, and selective pruning of retained trees where required.

A site-specific invasive species management plan will be developed prior to construction. The scope of that plan will entail control of existing invasive plant species within the Project area as well as recommendations for mitigation, monitoring and management related to invasive plant species during construction.

Native plant species should be applied to cover exposed soil if necessary to reduce erosion and to reduce the opportunity for invasive plant species to establish. A revegetation plan will be developed for areas of temporary vegetation removal if natural regeneration is not expected.

Prior to construction, the Project area will be surveyed to determine if the biophysical attributes of barn owl critical habitat occur within the Project footprint. The survey will use the definition of biophysical attributes of critical habitat in the barn owl recovery strategy (Environment and Climate Change Canada 2021). The survey will be done in an appropriate season to observe these attributes (e.g. nesting holes of large trees, or nearby structures). Should nesting potential occur within or adjacent to the Project footprint, a qualified biologist will be consulted for appropriate follow up recommendations and mitigation measures.



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Environmental Monitoring
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6.0 ENVIRONMENTAL MONITORING

Environmental Monitoring will be a key component of the environmental management during construction activities. A Qualified Environmental Professional (QEP) will be onsite full-time during on-land and in-water construction activities. Monitoring requirements are outlined in the Project CEMP and include:

- Fish Presence Monitoring
- Underwater Noise and Marine Mammal Monitoring Program
- Acoustic Monitoring
- Water quality monitoring
- Erosion and Sediment Control
- Invasive Plants

Specific plans for fish presence monitoring and an underwater noise and marine mammal monitoring program for the in-water works are provided in the Project CEMP.



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Summary and Conclusions

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7.0 SUMMARY AND CONCLUSIONS

There are Fraser River fish species, marine mammals, bird species, plant species and ecological communities that have the potential to use and/or be observed and encountered in proximity to the planned Project and may overlap with the Project during planned construction activities. Construction of the loading platform, access trestle and connection trestle to the existing Berth 10 wharf have been designed to minimize in-water, over-water and land-based construction activities. The Project has a permanent footprint in the Fraser River and in the vegetated riparian area due to the installation of an estimated 36 new steel pipe piles which are planned to have limited impacts to observed fish habitats within the Project area including Berth 10 and the adjacent shoreline areas after the implementation of mitigation measures. The potential effects to Species at Risk associated with the Project will be managed with preconstruction investigation and within applicable timing windows under the supervision of a QEP. Mitigation measures may be modified by the QEP to accommodate discovery of habitat, species, or ecological communities at risk within or adjacent to the Project footprint. The on-land Project footprint will be constructed almost entirely within existing developed terminal areas, except for the vegetation clearing needed along the Fraser shoreline to accommodate the Berth 10 trestle.

A Marine Mammal and Fish Monitoring Program has been developed as a guide for construction management and fish and marine mammal environmental monitoring plan for the duration of construction, including in-water pile driving. Monitoring and protection of water quality will be implemented by the assigned construction contractor as defined in the Project CEMP. This will include monitoring of relative changes to suspended sediment during pile installation.



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BIOPHYSICAL HABITAT ASSESSMENT

Appendix A Water Quality Raw Data
January 6, 2023

APPENDIX A
Water Quality Raw Data

FRASER SURREY CANOLA OIL TRANSLOAD FACILITY

HABITAT ASSESSMENT

Appendix A WQ Data

June 3, 2022

Date (MM/DD/YYYY)	Time (HH:mm:ss)	Depth m	ODO % sat	ODO mg/L	Sal psu	SpCond µS/cm	Turbidity FNU	Temp °C	GPS Latitude °	GPS Longitude °	Measuring Technique
5/31/2022	6:38:56	13.387	103.2	11.28	0.05	107	44.05	11.361	49.19085	-122.9107	15-minute interval
5/31/2022	6:53:56	13.363	103.3	11.29	0.05	108.2	40.46	11.358	49.19085	-122.9108	
5/31/2022	7:08:56	13.331	102.6	11.22	0.05	106.9	42.19	11.371	49.1909	-122.9107	
5/31/2022	7:23:56	13.288	102.6	11.23	0.05	107.6	39.11	11.329	49.19085	-122.9107	
5/31/2022	7:38:56	13.231	103.2	11.3	0.05	107.6	43.42	11.311	49.19086	-122.9107	
5/31/2022	7:53:56	13.168	102.8	11.25	0.05	107.7	42.24	11.313	49.19086	-122.9108	
5/31/2022	8:08:56	13.099	103.2	11.29	0.05	107.4	45.73	11.317	49.19086	-122.9108	
5/31/2022	8:23:56	13.022	103.3	11.31	0.05	107.4	40.97	11.317	49.19085	-122.9107	
5/31/2022	8:38:56	12.941	102.9	11.26	0.05	107.6	51	11.318	49.19085	-122.9107	
5/31/2022	8:53:56	12.858	102.8	11.25	0.05	107.6	44.21	11.309	49.19086	-122.9107	
5/31/2022	9:08:56	12.772	103.7	11.34	0.05	107.1	44.01	11.329	49.19084	-122.9108	
5/31/2022	9:23:56	12.686	103.3	11.31	0.05	107.3	47.23	11.317	49.19086	-122.9107	
5/31/2022	9:38:56	12.601	103.3	11.3	0.05	107.3	44.88	11.331	49.19085	-122.9107	
5/31/2022	9:53:56	11.359	103	11.23	0.05	108.6	35.99	11.484	49.19086	-122.9108	
5/31/2022	10:08:56	11.295	103.3	11.28	0.05	107.5	33.31	11.39	49.19085	-122.9107	
5/31/2022	10:23:56	11.213	103.2	11.27	0.05	107.7	37.09	11.382	49.19086	-122.9107	
5/31/2022	10:38:55	11.135	103.1	11.25	0.05	109.1	34.32	11.416	49.19086	-122.9107	
5/31/2022	10:53:55	11.056	103.2	11.28	0.05	108.6	33.68	11.378	49.19086	-122.9107	
5/31/2022	11:08:55	10.983	103	11.24	0.05	109.6	39.53	11.436	49.19085	-122.9107	
5/31/2022	11:23:55	10.909	103.6	11.32	0.05	107.9	40.17	11.358	49.19085	-122.9107	
5/31/2022	11:38:55	10.845	103.1	11.26	0.05	108.6	37.78	11.41	49.19085	-122.9107	
5/31/2022	11:53:55	10.785	102.8	11.24	0.05	108.3	35.55	11.387	49.19086	-122.9107	
5/31/2022	12:08:55	10.723	102.7	11.19	0.05	110	32.23	11.508	49.19087	-122.9107	
5/31/2022	12:23:55	10.668	102.5	11.19	0.05	109.4	32.25	11.449	49.19086	-122.9107	
5/31/2022	12:38:55	10.616	102.4	11.15	0.05	110.9	31.74	11.547	49.19085	-122.9108	
5/31/2022	12:42:02	11.811	102.4	11.18	0.05	109.6	106.69	11.447	49.19089	-122.9107	1-second interval throughout water column
5/31/2022	12:42:03	11.811	102.4	11.18	0.05	109.6	102.6	11.447	49.19088	-122.9107	
5/31/2022	12:42:04	11.81	102.4	11.18	0.05	109.6	99.24	11.447	49.19088	-122.9107	
5/31/2022	12:42:05	11.81	102.4	11.18	0.05	109.6	97.55	11.447	49.19088	-122.9107	
5/31/2022	12:42:06	11.811	102.4	11.18	0.05	109.6	96.59	11.447	49.19088	-122.9107	
5/31/2022	12:42:07	11.811	102.4	11.18	0.05	109.6	96.52	11.447	49.19088	-122.9107	

FRASER SURREY CANOLA OIL TRANSLOAD FACILITY

HABITAT ASSESSMENT

Appendix A WQ Data

June 3, 2022

Date (MM/DD/YYYY)	Time (HH:mm:ss)	Depth m	ODO % sat	ODO mg/L	Sal psu	SpCond µS/cm	Turbidity FNU	Temp °C	GPS Latitude °	GPS Longitude °	Measuring Technique
5/31/2022	12:42:08	11.809	102.4	11.18	0.05	109.6	97.27	11.447	49.19087	-122.9107	
5/31/2022	12:42:09	11.809	102.4	11.18	0.05	109.6	96.25	11.446	49.19087	-122.9107	
5/31/2022	12:42:10	11.795	102.4	11.18	0.05	109.6	706.64	11.446	49.19087	-122.9107	
5/31/2022	12:42:11	10.648	102.4	11.18	0.05	109.6	365.42	11.446	49.19087	-122.9107	
5/31/2022	12:42:12	9.877	102.4	11.18	0.05	109.7	161.41	11.446	49.19087	-122.9107	
5/31/2022	12:42:13	9.243	102.5	11.18	0.05	109.9	134.4	11.448	49.19087	-122.9107	
5/31/2022	12:42:14	8.751	102.5	11.18	0.05	110.1	102.17	11.452	49.19087	-122.9107	
5/31/2022	12:42:15	8.394	102.5	11.19	0.05	110.3	83.28	11.458	49.19087	-122.9107	
5/31/2022	12:42:16	6.938	102.6	11.19	0.05	110.6	78.75	11.467	49.19086	-122.9107	
5/31/2022	12:42:17	6.199	102.6	11.19	0.05	110.9	70.8	11.477	49.19086	-122.9107	
5/31/2022	12:42:18	5.429	102.7	11.19	0.05	111.3	49.59	11.491	49.19086	-122.9107	
5/31/2022	12:42:19	5.258	102.7	11.2	0.05	111.8	91.41	11.506	49.19086	-122.9107	
5/31/2022	12:42:20	4.931	102.8	11.2	0.05	112.3	40.57	11.527	49.19086	-122.9107	
5/31/2022	12:42:21	3.45	102.9	11.2	0.05	113	42.48	11.549	49.19085	-122.9107	
5/31/2022	12:42:22	2.946	103	11.21	0.05	113.6	49.17	11.579	49.19085	-122.9107	
5/31/2022	12:42:23	2.28	103	11.2	0.05	114.3	47.23	11.61	49.19085	-122.9107	
5/31/2022	12:42:24	2.154	103.1	11.2	0.05	114.9	45.61	11.648	49.19085	-122.9107	
5/31/2022	12:42:25	0.847	103.2	11.2	0.05	115.6	42.25	11.684	49.19085	-122.9107	
5/31/2022	12:42:26	0.108	103.3	11.2	0.05	116.2	40.79	11.73	49.19085	-122.9107	
5/31/2022	12:42:27	0.134	103.4	11.2	0.05	116.8	39.69	11.779	49.19085	-122.9107	
5/31/2022	12:42:28	0.108	103.6	11.21	0.06	117	37.87	11.844	49.19085	-122.9107	
5/31/2022	12:42:29	0.106	103.7	11.2	0	3.9	30.45	11.917	49.19085	-122.9107	
5/31/2022	12:42:30	0.105	103.8	11.2	0	0.9	68.31	11.979	49.19084	-122.9107	
5/31/2022	12:42:31	0.105	103.8	11.19	0	0.5	9.62	12.044	49.19084	-122.9107	
5/31/2022	12:42:32	0.105	103.8	11.18	0	0.6	17.88	12.095	49.19084	-122.9107	
5/31/2022	12:45:52	11.392	102.5	11.17	0.05	110.2	55.5	11.483	49.19084	-122.9108	15-minute interval
5/31/2022	13:00:51	11.341	102.9	11.22	0.05	110.2	33.38	11.462	49.19085	-122.9107	
5/31/2022	13:15:51	11.295	103.1	11.26	0.05	109.5	36.54	11.404	49.19085	-122.9107	
5/31/2022	13:30:51	11.255	103	11.24	0.05	109.9	35.28	11.439	49.19085	-122.9107	
5/31/2022	13:45:51	11.228	103.2	11.28	0.05	109.3	36.06	11.389	49.19085	-122.9107	
5/31/2022	14:00:51	11.201	103.3	11.27	0.05	109.7	34.36	11.418	49.19085	-122.9107	

FRASER SURREY CANOLA OIL TRANSLOAD FACILITY

HABITAT ASSESSMENT

Appendix A WQ Data

June 3, 2022

Date (MM/DD/YYYY)	Time (HH:mm:ss)	Depth m	ODO % sat	ODO mg/L	Sal psu	SpCond µS/cm	Turbidity FNU	Temp °C	GPS Latitude °	GPS Longitude °	Measuring Technique
5/31/2022	14:15:51	11.183	103.3	11.29	0.05	109.2	37.38	11.383	49.19085	-122.9107	1-second interval throughout water column
5/31/2022	14:30:51	11.179	103	11.22	0.05	110.8	33.08	11.544	49.19083	-122.9107	
5/31/2022	14:32:24	10.866	102.9	11.2	0.05	110.6	37.45	11.546	49.19087	-122.9108	
5/31/2022	14:32:25	10.868	102.9	11.2	0.05	110.6	37.76	11.546	49.19087	-122.9108	
5/31/2022	14:32:26	10.87	102.9	11.2	0.05	110.6	38.26	11.546	49.19087	-122.9108	
5/31/2022	14:32:27	10.867	102.9	11.2	0.05	110.6	38.23	11.546	49.19087	-122.9108	
5/31/2022	14:32:28	10.831	102.9	11.2	0.05	110.6	38.12	11.546	49.19087	-122.9108	
5/31/2022	14:32:29	9.611	102.9	11.2	0.05	110.6	38.5	11.546	49.19087	-122.9108	
5/31/2022	14:32:30	8.935	102.9	11.2	0.05	110.6	38.41	11.547	49.19087	-122.9108	
5/31/2022	14:32:31	8.377	102.9	11.2	0.05	110.7	38.41	11.548	49.19087	-122.9108	
5/31/2022	14:32:32	8.225	103	11.21	0.05	110.9	37.99	11.55	49.19087	-122.9108	
5/31/2022	14:32:33	7.053	103	11.21	0.05	111.2	37.88	11.556	49.19087	-122.9108	
5/31/2022	14:32:34	6.285	103.1	11.22	0.05	111.5	37.4	11.564	49.19087	-122.9108	
5/31/2022	14:32:35	5.697	103.1	11.22	0.05	111.8	35.73	11.576	49.19087	-122.9108	
5/31/2022	14:32:36	5.106	103.2	11.22	0.05	112.1	34.64	11.588	49.19086	-122.9108	
5/31/2022	14:32:37	4.957	103.2	11.23	0.05	112.5	34.21	11.607	49.19086	-122.9108	
5/31/2022	14:32:38	3.859	103.3	11.23	0.05	112.8	33.76	11.627	49.19086	-122.9108	
5/31/2022	14:32:39	3.218	103.4	11.23	0.05	113.2	32.8	11.655	49.19086	-122.9108	
5/31/2022	14:32:40	2.632	103.4	11.23	0.05	113.5	32.47	11.686	49.19086	-122.9108	
5/31/2022	14:32:41	2.292	103.4	11.22	0.05	113.8	32.12	11.714	49.19086	-122.9108	
5/31/2022	14:32:42	2.017	103.4	11.21	0.05	113.9	32.04	11.745	49.19086	-122.9108	
5/31/2022	14:32:43	1.548	103.5	11.21	0.05	114.1	32.16	11.773	49.19086	-122.9108	
5/31/2022	14:32:44	1.251	103.5	11.21	0.05	114.3	34.25	11.807	49.19086	-122.9108	
5/31/2022	14:32:45	0.32	103.6	11.21	0.05	114.6	37.55	11.843	49.19086	-122.9108	
5/31/2022	14:32:46	0.091	103.7	11.21	0.05	114.8	29.75	11.89	49.19086	-122.9108	
5/31/2022	14:32:47	0.106	103.8	11.21	0	10.4	16.69	11.935	49.19086	-122.9108	
5/31/2022	14:32:48	0.1	103.9	11.21	0	1.6	47.7	11.988	49.19086	-122.9108	
5/31/2022	14:32:49	0.102	104	11.2	0	0.7	3.4	12.032	49.19086	-122.9108	
5/31/2022	14:32:50	0.103	104	11.2	0	0.6	38.54	12.08	49.19086	-122.9108	
5/31/2022	14:32:51	0.103	104.1	11.19	0	0.5	36.78	12.126	49.19086	-122.9108	
5/31/2022	14:32:52	0.103	104.1	11.19	0	0.4	12.16	12.164	49.19086	-122.9108	

FRASER SURREY CANOLA OIL TRANSLOAD FACILITY

HABITAT ASSESSMENT

Appendix A WQ Data

June 3, 2022

Date (MM/DD/YYYY)	Time (HH:mm:ss)	Depth m	ODO % sat	ODO mg/L	Sal psu	SpCond µS/cm	Turbidity FNU	Temp °C	GPS Latitude °	GPS Longitude °	Measuring Technique
5/31/2022	14:32:53	0.103	104.1	11.18	0	0.4	21.97	12.203	49.19086	-122.9108	
5/31/2022	14:32:54	0.102	104.1	11.17	0	0.4	17.26	12.231	49.19086	-122.9108	
5/31/2022	14:32:55	0.102	104	11.15	0	0.4	8.57	12.253	49.19086	-122.9108	
5/31/2022	14:32:56	0.103	103.9	11.13	0	0.4	280.89	12.265	49.19086	-122.9108	
5/31/2022	14:32:57	0.102	103.8	11.12	0	0.4	109.33	12.27	49.19086	-122.9108	
5/31/2022	14:32:58	0.102	103.7	11.11	0	0.4	73.71	12.274	49.19086	-122.9108	
5/31/2022	14:32:59	0.101	103.6	11.1	0	0.4	34.21	12.278	49.19086	-122.9108	
5/31/2022	14:33:00	0.101	103.5	11.09	0	0.4	23.36	12.282	49.19086	-122.9108	
5/31/2022	14:33:01	0.101	103.5	11.08	0	0.3	22.14	12.287	49.19086	-122.9108	

Note:

1 PSU is approximately 1 PPT

FNU: Formazin Nephelometric Unit

BIOPHYSICAL HABITAT ASSESSMENT

Appendix A Water Quality Raw Data
January 6, 2023

APPENDIX B
Fish Species in Fraser River

FRASER SURREY CANOLA OIL TRANSLOAD FACILITY

HABITAT ASSESSMENT

Appendix B Fish Species in Fraser River

May 13, 2022

Scientific Name	English Name	BC List	COSEWIC	SARA	Exotic
<i>Acipenser medirostris</i>	Green Sturgeon	Blue	SC	1-SC (2006)	-
<i>Acipenser transmontanus</i>	White Sturgeon	No Status	E/T	1-E	-
<i>Acipenser transmontanus</i> pop. 4	White Sturgeon (Lower Fraser River Population)	Red	T	-	-
<i>Hybognathus hankinsoni</i> - Pacific group	Brassy Minnow - Pacific Group	Blue	-	-	-
<i>Oncorhynchus clarkii clarkii</i>	Cutthroat trout	Blue	-	-	-
<i>Rhinichthys osculus</i>	Speckled Dace	Blue	E	1-E (2009)	-
<i>Salvelinus confluentus</i>	Bull Trout	Blue	SC	-	-
<i>Salvelinus confluentus</i> pop. 28	Bull Trout - South Coast Population	Blue	SC	1-SC (2019)	-
<i>Spirinchus</i> sp. 1	Pygmy Longfin Smelt	Red	DD	-	-
<i>Thaleichthys pacificus</i>	Eulachon	Blue	E	-	-
<i>Alosa sapidissima</i>	American Shad	-	-	-	X
<i>Pomoxis nigromaculatus</i>	Black Crappie	-	-	-	X
<i>Lepomis macrochirus</i>	Bluegill	-	-	-	X
<i>Catostomus columbianus</i>	Bridgelip Sucker	Yellow	-	-	X
<i>Ameiurus nebulosus</i>	Brown Catfish	-	-	-	X
<i>Cyprinus carpio</i>	Carp	-	-	-	X
<i>Oncorhynchus tshawytscha</i>	Chinook Salmon	No Status	E/SC/T	-	-
<i>Acrocheilus alutaceus</i>	Chiselmouth	Yellow	-	-	-
<i>Cottus aleuticus</i>	Coastrange Sculpin	Yellow	-	-	-
<i>Oncorhynchus kisutch</i>	Coho Salmon	No Status	T	-	-
<i>Salvelinus malma</i>	Dolly Varden	Yellow	-	-	-
<i>Notropis atherinodes</i>	Emerald Shiner	Unknown	-	-	-
<i>Carassius auratus</i>	Goldfish	-	-	-	X
<i>Couesius plumbeus</i>	Lake Chub	Yellow	DD	-	-
<i>Micropterus salmoides</i>	Largemouth Bass	-	-	-	X
<i>Catostomus macrocheilus</i>	Largescale Sucker	Yellow	-	-	-
<i>Rhinichthys falcatus</i>	Leopard Dace	Yellow	NAR	-	-
<i>Spirinchus thaleichthys</i>	Longfin Smelt	Blue	-	-	-
<i>Rhinichthys cataractae</i>	Longnose Dace	Yellow	-	-	-

FRASER SURREY CANOLA OIL TRANSLOAD FACILITY

HABITAT ASSESSMENT

Appendix B Fish Species in Fraser River

May 13, 2022

Scientific Name	English Name	BC List	COSEWIC	SARA	Exotic
<i>Catostomus catostomus</i>	Longnose Sucker	Yellow	-	-	-
<i>Catostomus platyrhynchus</i>	Mountain Sucker	Blue	SC	1-SC (2017)	-
<i>Prosopium williamsoni</i>	Mountain Whitefish	Yellow	-	-	-
<i>Ptychocheilus oregonensis</i>	Northern Pikeminnow	Yellow	-	-	-
<i>Entosphenus tridentatus</i>	Pacific Lamprey	Yellow	-	-	-
<i>Mylocheilus caurinus</i>	Peamouth Chub	Yellow	-	-	-
<i>Cottus asper</i>	Prickly Sculpin	Yellow	-	-	-
<i>Prosopium coulterii</i>	Pygmy Whitefish	Yellow	NAR	-	-
<i>Richardsonius balteatus</i>	Redside Shiner	Yellow	-	-	-
<i>Lampetra ayresii</i>	River Lamprey	Yellow	-	-	-
<i>Cottus cognatus</i>	Slimy Sculpin	Yellow	-	-	-
<i>Micropterus dolomieu</i>	Smallmouth Bass	-	-	-	X
<i>Oncorhynchus nerka</i>	Sockeye Salmon	No Status	E/T/SC/NAR	-	-
<i>Notropis hudsonius</i>	Spottail Shiner	Red	-	-	-
<i>Leptocottus armatus</i>	Staghorn Sculpin	No Status	-	-	-
<i>Platichthys stellatus</i>	Starry Flounder	No Status	-	-	-
<i>Oncorhynchus mykiss</i>	Steelhead	Red	E	-	-
<i>Hypomesus pretiosus</i>	Surf Smelt	No Status	-	-	-
<i>Gasterosteus aculeatus</i>	Threespine Stickleback	Yellow	-	-	-
<i>Catostomus commersonii</i>	White Sucker	-	-	-	-

APPENDIX C

Fish Sampling Raw Data

FRASER SURREY CANOLA OIL TRANSLOAD FACILITY

HABITAT ASSESSMENT

Appendix C Fish Sampling Raw Data

May 13, 2022

StationID	Latitude	Longitude	Date	Start Time (PST)	End Time (PST)	Fishing Method	FishSubType	SpeciesID	Count	Fork Length (mm)	Total Length (mm)	Health
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	45		healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	48		healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	44		healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	55		healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	42		healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Suckers	White Sucker (Catostomus commersoni)	1		55	healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	58		healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	45		healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	45		healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Carps and Minnows	Redside Shiner (Richardsonius balteatus)	1		40	healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	45		healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	45		healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Carps and Minnows	Redside Shiner (Richardsonius balteatus)	1		45	healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Carps and Minnows	Redside Shiner (Richardsonius balteatus)	1		40	healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Carps and Minnows	Redside Shiner (Richardsonius balteatus)	1		45	healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	50		healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Carps and Minnows	Redside Shiner (Richardsonius balteatus)	1		35	healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Carps and Minnows	Redside Shiner (Richardsonius balteatus)	1		40	healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Carps and Minnows	Redside Shiner (Richardsonius balteatus)	1		45	healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Carps and Minnows	Redside Shiner (Richardsonius balteatus)	1		39	healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Carps and Minnows	Redside Shiner (Richardsonius balteatus)	1		40	healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Carps and Minnows	Redside Shiner (Richardsonius balteatus)	1		37	healthy
Seine1	49.191023	-122.910117	2022-04-18	13:10:22	13:17:07	Seine	Carps and Minnows	Redside Shiner (Richardsonius balteatus)	50			healthy
Seine2	49.191525	-122.909583	2022-04-18	15:05:32	15:15:18	Seine	Righteye Flounders	Starry Flounder (Platichthys stellatus)	1		75	healthy
Seine2	49.191525	-122.909583	2022-04-18	15:05:32	15:15:18	Seine	Righteye Flounders	Starry Flounder (Platichthys stellatus)	1		76	healthy
Seine2	49.191525	-122.909583	2022-04-18	15:05:32	15:15:18	Seine	Sculpins	Unknown	1		50	healthy
Seine2	49.191525	-122.909583	2022-04-18	15:05:32	15:15:18	Seine	Sculpins	Unknown	1		44	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	35		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	32		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	40		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	50		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	47		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	31		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	37		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	38		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	40		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	33		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	36		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	35		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	47		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	39		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	37		mortality
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chum Salmon (Oncorhynchus keta)	1	33		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chinook Salmon (Oncorhynchus tshawytscha)	1	35		healthy

FRASER SURREY CANOLA OIL TRANSLOAD FACILITY

HABITAT ASSESSMENT

Appendix C Fish Sampling Raw Data

May 13, 2022

StationID	Latitude	Longitude	Date	Start Time (PST)	End Time (PST)	Fishing Method	FishSubType	SpeciesID	Count	Fork Length (mm)	Total Length (mm)	Health
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chum Salmon (<i>Oncorhynchus keta</i>)	1	45		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chinook Salmon (<i>Oncorhynchus tshawytscha</i>)	1	36		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chum Salmon (<i>Oncorhynchus keta</i>)	1	31		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chinook Salmon (<i>Oncorhynchus tshawytscha</i>)	1	38		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chum Salmon (<i>Oncorhynchus keta</i>)	1	30		healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		28	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		30	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		39	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		32	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		30	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		31	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		30	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		29	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		35	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		32	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		40	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		40	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		35	healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chinook Salmon (<i>Oncorhynchus tshawytscha</i>)	18			healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Salmon and Trout	Chum Salmon (<i>Oncorhynchus keta</i>)	14			healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	8			healthy
Seine3	49.191019	-122.910198	2022-04-19	12:50:54	13:20:09	Seine	Carps and Minnows	Leopard Dace (<i>Rhinichthys falcatus</i>)	1	39		healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		42	healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		34	healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		31	healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		38	healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		45	healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		37	healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		30	healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		53	healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		30	healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		33	healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		31	healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Carps and Minnows	Redside Shiner (<i>Richardsonius balteatus</i>)	1		37	healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Salmon and Trout	Chinook Salmon (<i>Oncorhynchus tshawytscha</i>)	1	41		healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Salmon and Trout	Chinook Salmon (<i>Oncorhynchus tshawytscha</i>)	1	35		healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Salmon and Trout	Chum Salmon (<i>Oncorhynchus keta</i>)	1	37		healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Salmon and Trout	Chum Salmon (<i>Oncorhynchus keta</i>)	1	40		healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Salmon and Trout	Chinook Salmon (<i>Oncorhynchus tshawytscha</i>)	1	38		healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Salmon and Trout	Chinook Salmon (<i>Oncorhynchus tshawytscha</i>)	1	36		healthy
Seine4	49.19133	-122.909855	2022-04-19	13:55:23	14:01:03	Seine	Salmon and Trout	Chinook Salmon (<i>Oncorhynchus tshawytscha</i>)	1	35		healthy

APPENDIX D
Field Visit Photo Log

**FRASER SURREY CANOLA OIL TRANSLOAD FACILITY
HABITAT ASSESSMENT**

Appendix D Field Visit Photo Log

June 17, 2022



Photo 1 Facing northeast at Project area during higher tide. April 12, 2022.



Photo 2 Facing northeast at Project area during receding low tide. April 18, 2022.



Photo 3 Location for proposed platform at berth 10, facing north from shore. April 18, 2022.



Photo 4 Facing northeast on berth 10 wharf. April 12, 2022.

**FRASER SURREY CANOLA OIL TRANSLOAD FACILITY
HABITAT ASSESSMENT**

Appendix D Field Visit Photo Log

June 17, 2022



Photo 5 Facing northeast with berth 10 wharf to left, and rip rapped banks to right. April 12, 2022.



Photo 6 Facing southeast at the shoreline where proposed access trestle is to be built. April 12, 2022.



Photo 7 Facing northeast at shoreline of Project area at low tide. April 18, 2022.



Photo 8 Shoreline facing southwest towards berth 9. April 18, 2022.

**FRASER SURREY CANOLA OIL TRANSLOAD FACILITY
HABITAT ASSESSMENT**

Appendix D Field Visit Photo Log

June 17, 2022



Photo 9 Culvert outfall, facing east towards fence line. April 18, 2022.



Photo 10 Debris guard on culvert outfall. April 19, 2022.



Photo 11 Facing northeast at vegetated island and back channel during high tide. April 19, 2022.



Photo 12 Facing northeast at vegetated island and back channel during receding tide. April 12, 2022.

**FRASER SURREY CANOLA OIL TRANSLOAD FACILITY
HABITAT ASSESSMENT**

Appendix D Field Visit Photo Log

June 17, 2022



Photo 13 Facing east towards fence line and backchannel, low tide. April 18, 2022.



Photo 14 Back channel facing east, low tide. April 18, 2022.



Photo 15 Outlet to backchannel facing east towards culvert and fence line. April 18, 2022.



Photo 16 Back channel during low tide. April 18, 2022.

**FRASER SURREY CANOLA OIL TRANSLOAD FACILITY
HABITAT ASSESSMENT**

Appendix D Field Visit Photo Log

June 17, 2022



Photo 17 Muddy substrate of back channel at low tide. April 19, 2022.



Photo 18 Back channel at approximate location where access trestle is to span. April 19, 2022.



Photo 19 Facing east at eastern end of back channel. April 19, 2022.



Photo 20 Facing west at eastern end of back channel. April 19, 2022.

**FRASER SURREY CANOLA OIL TRANSLOAD FACILITY
HABITAT ASSESSMENT**

Appendix D Field Visit Photo Log

June 17, 2022



Photo 21 Outlet on shore possibly from back channel. April 19, 2022.



Photo 22 Sandy, clay substrate of shoreline. April 18, 2022.



Photo 23 Beach seining along shore within Project area. April 19, 2022.



Photo 24 Starry flounder captured by seining on April 18, 2022.

**FRASER SURREY CANOLA OIL TRANSLOAD FACILITY
HABITAT ASSESSMENT**
Appendix D Field Visit Photo Log
June 17, 2022



Photo 25 Sculpin captured by seining on April 18, 2022.



Photo 26 Chinook salmon captured by seining on April 19, 2022.



Photo 27 Redside shiner captured by seining on April 19, 2022.



Photo 28 Leopard dace captured by seining on April 19, 2022.

**FRASER SURREY CANOLA OIL TRANSLOAD FACILITY
HABITAT ASSESSMENT**

Appendix D Field Visit Photo Log

June 17, 2022

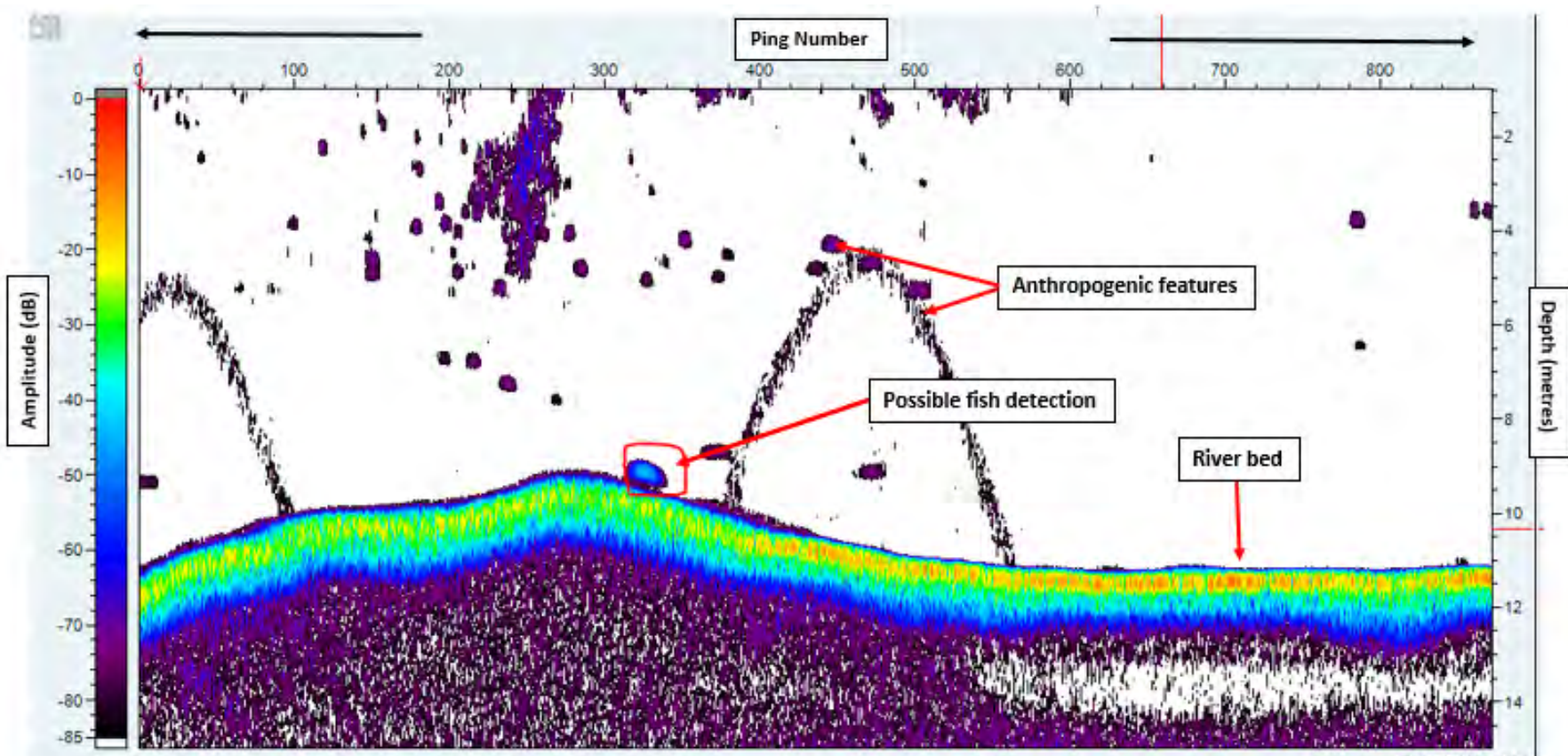


Photo 29 Vegetation along corridor of proposed access trestle. Facing north from fence line. April 19, 2022.



Photo 30 Bald eagle nest in cottonwood tree observed approximately 100 m upstream from proposed Project footprint. April 18, 2022.

APPENDIX E
HYDROACOUSTIC ECHOGRAM DISTRIBUTION



Ping # 659 . 10.31