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Memorandum

Attention	**Fisheries and Oceans Canada**
From:	Krista Englund, Ministry of Transportation and Infrastructure
cc	Peter Troffe, M.Sc., R.P.Bio., Ausenco Sustainability Inc. Luke Wang, R.P.Bio., P.Biol., Ausenco Sustainability Inc.
Subject:	Canal Road Barge Landing – Aquatic Effects Assessment
Date	July 19, 2023
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1.0 Introduction

The Ministry of Transportation and Infrastructure (MoTI) is proposing to construct a temporary barge ramp on South Pender Island to facilitate transport of materials and construction equipment required for remediation of Canal Road (the Project). Canal Road became washed out during a heavy flooding event in November, 2021, as such MoTI is planning to realign and restore the roadway to ensure safety and stability and to minimize the possibility of future failures occurring.

This memorandum has been prepared to outline the proposed works (**Section 2.0**), summarise the underlying biophysical conditions (**Section 4.0**), asses potential effects to fish and fish habitat (**Section 5.0**), recommend additional mitigation measures to minimize risk to fish and fish habitat (**Section 5.1**), and provide an assessment of any residual effects (**Section 6.8**). The information contained within is intended to support a Request for Project Review (RfR) submission to Fisheries and Oceans Canada (DFO), seeking a letter of advice to complete the works detailed herein.

2.0 Project Background

2.1 Barge Landing Location

The proposed barge landing site is on South Pender Island, centered approximately at 48°45'01.3"N and 123°11'17.4"W approximately 3.2km east of the Canal Road remediation Project (**Appendix A**). The Project Area is bounded by to the north and east by the marine waters of the Strait of Georgia, the south by Boundary Passage Drive, and the west by a small headland creating a sheltered embayment. Historically, the Project Area has seen industrial use and has been used as a barge landing and log dump. The historic barge landing includes a previously constructed road base which has been incorporated into the Project design.

2.2 Project Description

In order to install the temporary barge landing, the following in-water works are proposed:

- Geotechnical investigation during construction to determine suitable methodology for pile driving.
- Pile driving (four x 914 mm steel piles).
- Placement of temporary structure on hard rocky substrate in the high intertidal zone.
- Installation of temporary gravel ramp with revetment in the high intertidal zone covering an area of approximately 184.7 m^2 and a volume of 220 m^3.

Current design drawings for the temporary pile installation and barge landing ramp have been appended to this report as **Appendix A**.

2.3 Proposed Construction Methodology

The proposed Project activities include:

- Pile driving (four x 914 mm steel piles),
- Tree clearing (anticipated to be limited to two mature trees, trimming of other nearby trees, and the clearing of understory brush),
- Temporary placement of structure in rocky substrate in the intertidal area,
- Construction of a gravel access road with minimal ground disturbance.

Piles will be installed via impact or vibratory pile driving. Barge ramp infrastructure (i.e. gravel ramp and revetment) will occur following the installation of piles. The barge will be floated into place with the assistance of tugboats.

Installation works will not require pouring of concrete or excavating of upland materials, however the gravel access road construction will require tree clearing and excavation of upland materials. Road works will not involve paving. After the project has been completed and heavy equipment is no longer needed, the barge landing will be decommissioned. The temporary piles, gravel ramp and revetment will be removed in reverse order of the construction sequence and all material will be removed from the site. Decommissioning is expected to begin within a year of operational start.

2.4 Alternatives Considered

2.4.1 Construction Without Heavy Equipment

Construction without use of heavy equipment was considered as an alternative. This alternative would avoid requiring a new barge landing but would increase the duration of construction over more than one season. Tree-felling without the use of a feller buncher would extend the duration of the construction period by approximately two months, pushing the remainder of construction during the limited work window into a second year. Continued disruption to travel on South Pender Island and the risks of more road damage (especially after trees are removed) is considered to represent a risk if the Project is not completed in 2023. Without heavy equipment, many vehicles and loads would need to travel from the existing barge landing on North Pender Island, further creating disruption.

Use of heavy equipment to increase the efficiency of construction during one work window (August to December) is necessary to avoid the risks described above. As a result, the alternative of using smaller equipment and avoiding a barge landing on South Pender Island is not a viable option for the project.

2.4.2 North Pender Island Barge Landing

The existing barge landing on North Pender Island is suitable for use by barges of the size necessary for unloading and loading equipment, materials, and logs. However, a small bridge between north and south Pender islands is unsuitable for transit of heavy vehicles. The South Pender Island Bridge has load restriction due to its lack of structural integrity. Current allowable maximum Gross vehicle Weight is 41,800 kg, but has a single axle rating of 9,100 kg, tandem axle rating of 11,800 kg and a tridem axle rating of 12,700 kg. Due to these restrictions, hauling disposal materials (e.g., rock) in tandems would be over the legal limit and would not be acceptable for the hundreds of truck loads required.

Safety considerations do not allow for use of the existing North Pender Island barge landing location.

2.4.3 Mortimer Spit Park (South Pender Island)

Mortimer Spit Park is a Capital Regional District owned and Pender Island Parks and Recreation Commission managed recreational site on South Pender Island. Mortimer Spit provides waterfront access to a gravel beach. The open gravel beach could support the temporary use by barges (no in-water infrastructure), but it is not suitable for the construction (and eventual decommissioning) of a temporary landing location with revetment and pilings for a barge of a size necessary for unloading and loading equipment, materials and logs. The site is expected to have limited ecological values in upland and marine locations, based on a preliminary reconnaissance. Mitigation for impacts to marine and terrestrial systems is available. Archaeological assessment work at the site indicated the potential for heritage values to be present. Restoration of the environment at Mortimer Spit Park is understood to be difficult due to the high gravel content of the substrate.

Interactions with potential archaeological values at Mortimer Spit Park are not conducive to the use of this site. During consultation with Indigenous Nations there was concern expressed about the use of this location. Temporary use of the location over an approximately year-long period (with revetment and pilings) is not possible. This location only allows for temporary use using a tug to hold the barge in place, with no installed infrastructure.

2.5 Proposed Schedule

Construction is currently planned to be carried out within the DFO BC Marine Timing Windows for Protection of Fish and Fish Habitat windows for Area 18 (Cowichan), beginning in December 01, 2023 and completing by February 15, 2024. Decommissioning of the barge will be completed by October 01, 2024.

3.0 Assessment Methodology

3.1 Upland Habitat

A visual upland assessment was conducted for the Project Area by qualified biologists on May 15, 2023. Assessment included plant species and approximate plant numbers and vegetative cover where relevant (e.g., extent of coverage by invasive plant species such as Himalayan blackberry, *Rubus armeniacus*). Information attained from this survey built upon previous surveys conducted by Ausenco in the area. A detailed photo log of habitat assessments completed has been included as **Appendix B**.

3.2 Intertidal Habitat

The intertidal habitat of the Project Area was visually assessed by qualified marine biologists on May 15, 2023. Substrate type and relative composition were described visually using a generalized Wentworth-based scale (Wentworth 1922; **Table 3.1**). Biophysical information collected included percent coverage of macroalgal species, sessile invertebrate cover, and mobile invertebrate count.

Table 3.1 Substrate Classification (Wentworth 1922)

Substrate Type	Size Range (Diameter in Millimetres)
Bedrock/boulder	>256
Cobble	64–256
Gravel	2–64
Sand	0.06–2
Silt/clay/mud	<0.06
Other*	–

Notes:

*Substrates can also include anthropogenic structures, wood debris and shell hash etc., all of which were characterized under “substrate – other” during field sampling.

> indicates greater than.

< indicates less than.

3.3 Subtidal Habitat

A subtidal habitat assessment of the Project Area was conducted on May 15, 2023. The survey was undertaken by a drop camera operated by qualified marine biologists. Substrate type and relative composition were described visually using the generalized Wentworth-based scale above (Wentworth 1922; **Table 3.1**). Biologists analysed the drop camera footage following the survey and for each camera drop substrate type, vegetation cover, sessile invertebrate cover, mobile invertebrate density, and fish density were recorded.

South Pender Island Barge Landing
South Pender Island, BC

Drop Camera Video Locations

Legend

- Drop Camera Video Location
- Piling Location
- Centreline of the Proposed Road
- Major Contour Line (5 m)
- Minor Contour Line (1 m)
- Bathymetry Line (-1 m)
- Barge Access Road
- Gravel Revetment Ramp
- 4000 Ton Barge

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
3. Vertical datum: CSRS NAD 1983

Sources

- Contains information licensed under the Open Government Licence(s) - Government of British Columbia
- Aerial Image: ESRI World Imagery
- Inset Basemap: ESRI World Topographic Map

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Ausenco

Ministry of Transportation and Infrastructure

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4.0 Biophysical Conditions

The Project Area comprises upland, intertidal, and subtidal habitat. Ausenco biologists conducted a habitat assessment on May 15, 2023, using a drop camera to observe the intertidal and subtidal habitat within the Project Area (**Appendix B**). Observations of the upland habitat were made from offshore. Upland biophysical information has been supplemented with observations from previous environmental assessments conducted as part of the Project.

4.1 Upland Habitat

The Project Area is within the Coastal Douglas-fir Moist Maritime (CDF mm) subzone. Vegetation within the CDF mm subzone is typically dominated by Douglas-fir (*Pseudotsuga menziesii*), western redcedar (*Thuja plicata*), grand fir (*Abies grandis*), bigleaf maple (*Acer macrophyllum)*, western flowering dogwood (*Cornus nuttallii*), and mountain hemlock arbutus (*Arbutus menziesii)*. The understory is dominated by salal (*Gaultheria willon*), dull Oregon-grape (*Mahonia nervosa*), ocean spray (*Holodiscus discolor*) and *Kindbergia oregana* (**Appendix B: Photo 1**). The Project Area encompasses two provincially red-listed ecosystems, Grand Fir / Dull Oregon -grape and Douglas-fir / dull Oregon-grape.

Vegetation observed onsite during the habitat assessment on May 15, 2023 include mature mixed conifer's lining the edge of the rocky cliffs (**Appendix B: Photo 2**). Headland outcrops are lined with mixed grass species, likely dunegrass (*Leymus mollis*) and fescue (*Festuca* spp.).

4.2 Intertidal Habitat

Coastal classes in the Project Area range from rock ramp to rock platform (BC Marine Conservation Analysis 2019). The intertidal habitat comprises rock cliff and shelf (**Appendix B: Photo 3**), with rocky, boulder substrate covered with an algal mat in the wetted, lower intertidal (**Appendix B: Photo 4**). Marine vegetation observed in the intertidal area included rockweed (*Fucus distichus*), sea lettuce (*Ulva lactuca*), sugar kelp (*Saccharina latissima*), bull kelp (*Nereocystis luetkeana*), Turkish towel (*Chondracanthus exasperatus*), and wireweed (*Sargassum muticum*). A diatom mat covered the substrate in the deeper intertidal, and acorn barnacles (*Balanus glandula*) and bull kelp were also observed covering the rocky substrate. A saddleback gunnel (*Pholis ornata*) and a blood star (*Henricia leviuscula*) were the only motile epifauna that were observed in the area.

4.3 Subtidal Habitat

Benthic classes in the area range from muddy flat to muddy depression, to muddy slope to muddy ridge, with a small area of sandy slope. The area is characterized as having high rugosity and the shorezone exposure for the area is categorized as protected (BC Marine Conservation Analysis 2019). Substrate in the Project Area subtidal zone primarily consists of gravel and soft sediments ranging from sand to silt. Macroalgae such as sea lettuce, sugar kelp, and bull kelp (**Appendix B: Photo 5** and **6**) were observed sporadically in the subtidal zone, with some Turkish towel interspersed. Coverage of macroalgae is likely limited by lack of available hard substrate, and much of it was not anchored. A diatom mat was observed covering the sediment and macroalgae (**Appendix B: Photo 7**). Epifaunal invertebrate species observed included gurney's sea pen (*Ptilosarcus gurney;* **Appendix B: Photo 8**), tunicate sp., bryozoan sp., and Dungeness crab (*Metcarcinus magister;* **Appendix B: Photo 9**). Unidentified juvenile fish were observed schooling along the shoreline in the area near the eastern boundary of the project. One harbour seal (*Phoca vitulina*) was observed during the site assessment.

Based on the desktop review, there is potential for Dall's porpoise (*Phocoenoides dalli*), harbour porpoise (*Phocoena phocoena*) harbour seal (*Phoca vitulina*), and minke whale (*Balaenoptera acuturostrata*) to occur in the Project Area off the southern end of South Pender Island. A harbour seal haul out is located along the northern shore of the Project Area (BC Marine Conservation Analysis 2019).

4.4 Wildlife

A desktop review of South Pender Island revealed occurrences of sea otters (*Enhydra lutris*) off the south coast of the island. Bald eagles (*Haliaeetus leucocephalus*) have been observed throughout the island, and great blue heron (*Ardea herodias*) have been observed upland, near the Project Area.

Northwestern garter snake (*Thamnophis ordinoides*), terrestrial garter snake (*Thamnophis elegans)*, common garter snake (*Thamnophis sirtalis*), sharp-tailed snake (*Contia tenius*), rough skinned newt (*Taricha granulosa*), Northern alligator lizard (*Elgaria coerulea*), Western skink (*Plestiodan skiltonianus*), Northern pacific treefrog (*Pseudacris regilla*), and deer mouse (*Peromyscus maniculatus*) have been observed throughout South Pender Island.

4.5 Species at Risk

A list of Species at Risk with potential to occur in the Project Area was developed based on a review of published information and database searches including:

- BC CDC Internet Mapping Tool (DataBC 2023)
  - Area search for known occurrences within a 5 km radius of the centre of the Project Area. Both non-sensitive and masked-sensitive were queried. Non-sensitive occurrences are observations whose exact locations are provided in the mapping service. Masked sensitive occurrences are observations whose exact location are not provided in the mapping service, rather a general area is provided. To obtain the exact location of an occurrence, a regional biologist in the BC Ministry of Environment (MOE) must be contacted.
  - Two non-sensitive occurrences (Douglas fir – dull Oregon grape ecological community, and grand fir – dull Oregon grape ecological community) were reported within 1 km of the Project Area.
  - One masked sensitive occurrence was recorded within 1 km of the Project Area.
- BC CDC Species and Ecosystem Explorer (Government of BC 2023)
  - Ecosections: Strait of Georgia; Habitat Types: Beach, Intertidal Marine, Mudflats, Intertidal, Pelagic, Riparian Herbaceous, Riparian Shrub, Sand Dune, Sheltered Waters – Marine, Splash Zone, and Biogeoclimatic Zone: Coastal Douglas Fir – Moist Maritime
  - Search was restricted to BC Conservation Status: Red (Extirpated, Endangered, or Threatened) or Blue (Special Concern), COSEWIC Status: Endangered, Threatened, or Special Concern. Legal Designation for Species and Ecosystems of Concern: *Federal Species at Risk Act*.

Species and ecological communities at risk observed within a 5 km radius of the Project Area are presented in **Table 4.1**.

Table 4.1 Known Occurrences of Species at Risk Within a 5 km Radius

Common Name	Scientific Name	COSEWIC	BC List
Douglas-fir - Alaska oniongrass ecological community	Pseudotsuga menziesii / Melica subulata		Red
grand fir - dull Oregon-grape ecological community	Abies grandis / Mahonia nervosa		Red
western redcedar - Douglas-fir - Oregon beaked-moss ecological community	Thuja plicata - Pseudotsuga menziesii / Kindbergia oregana		Red
slender popcornflower	Plagiobothrys tenellus	T (NOV 2008)	Red
banded cord-moss	Entosthodon fascicularis	SC (MAY 2015)	Blue
Douglas-fir - dull Oregon-grape ecological community	Pseudotsuga menziesii / Mahonia nervosa		Red
wine-cup clarkia	Clarkia purpurea ssp. quadrivulnera		Red
purple sanicle	Sanicula bipinnatifida	T (MAY 2001)	Red
white meconella	Meconella oregana	E (MAY 2005)	Red
Western screech-owl, *kennicottii* subspecies	Megascops kennicottii kennicottii	T (MAY 2012)	Blue
Lindley's microseris	Uropappus lindleyi	E (MAR 2008)	Red
Macrae's clover	Trifolium dichotomum		Red
Northern red-legged frog	Rana aurora	SC (MAY 2015)	Blue
erect pigmyweed	Crassula connata		Blue
slimleaf onion	Allium amplectens		Blue
California buttercup	Ranunculus californicus	E (NOV 2008)	Red

Critical habitat for sharp-tailed snake (*Contia tenuis*) is present at the southwest end of the island, and critical habitat for marbled murrelet (*Brachyramphus marmoratus*) is located along the southwestern boundary of the island. Great blue heron (*Ardea herodias*) nests and foraging areas (less than 10 colony sites) are present along the majority of the South Pender Island shoreline. The Project Area falls within critical habitat of southern resident killer whales (*Orcinus orca*), and a rockfish conservation area is present along the northern coast of South Pender Island. A complete list of SAR with potential to occur in or near the Project Area can be found in **Appendix C**, however, it should be noted that the shallow depth and substrate of the Project Area will rule out incidences of many of the listed species.

5.0 Potential Effects to Fish and Fish Habitat

Potential effects to fish and fish habitat associated with the construction and operation of the Project, have been defined using DFO Pathways of Effects (POEs[1]). These pathways can be used to evaluate Project-related activities with respect to the type of cause-effect relationships that are known to exist, including the mechanisms by which stressors can ultimately lead to effects on fish and fish habitat, and appropriate management actions to either avoid or mitigate those impacts (Government of Canada 2006).

[1] Adapted from DFO guidance, available online Fisheries and Oceans Canada 2018.

Potential POEs that may occur as a result of the proposed Project, and therefore have potential to result in an adverse effect in the absence of mitigation, have been summarized in **Table 5.1** below.

This discussion of POEs is followed by a description of avoidance and mitigation measures in **Section 5.1** and a summary of potential Project-related residual effects, presented in **Section 6.8**.

Table 5.1 Project Assessment Using DFO's Defined Activities and Timing of Potential Effects

Project Activities	Potential Effects on Fish and Fish Habitat			
	Change in sediment concentrations	Change in contaminant concentrations	Change in habitat structure and cover	Death or Injury to Fish and Marine Mammals
Placement of materials and structures in water	✓	-	✓	✓
Use of industrial equipment	✓	✓	-	✓
Vegetation clearing	✓	-	✓	-

5.1 Changes in Sediment Concentrations

In-water construction activities, including vessel propeller wash, the use of industrial equipment, and temporary pile installation, have the potential to disturb soft sediments and temporarily increase suspended particles (TSS) in the water column. TSS in the marine environment can affect fish, and benthic communities. Increases in TSS will degrade surface water quality. An elevated load of suspended solids in surface water may alter fish movement and distribution within the Project area. For example, certain fish will temporarily have reduced ability to seek and capture prey or avoid predation in the short term (Fisheries and Oceans Canada 2018). The level of confidence that this measure will break the POE is high.

5.2 Change in Contaminant Concentrations

In the unlikely event of an accident or malfunction, uncontrolled spills/releases of waste materials, refuse/ debris, fuels, lubricants, hydraulic fluids, and/or chemicals have the potential to negatively affect surface waters within and beyond the Project Area. Fuels and lubricants are toxic to marine life and often hydrophobic in nature. Hydrocarbons can remain suspended on top of the water surface and spread over a large area, often to a layer several molecules thick, and potentially cause adverse effects to marine species via dermal contact and absorption, mechanical coating, inhalation, or ingestion. Introduction of materials, such as piles, rip rap, and gravel revetment material below the HWM has the potential to introduce foreign substances, such as dust and dirt, or reactive materials into the environment. Given the implementation of mitigation measures outlined in **Section 7.3**, the level of confidence that this POE will be broken is high.

5.3 Changes in Habitat Structure and Cover

The installation of 4 – 914 mm steel piles will result in the alteration of 2.62 m^2 of subtidal substrate. Placement of a gravel ramp and construction of a gravel revetment in the high intertidal zone will result in the alteration of 184.7 m^2 of intertidal habitat. The approximate volume of gravel revetment will be 220 m^3. The existing complex boulder substrate will be converted into a flat gravel ramp reinforced with blast rock or approved granular materials. The gravel ramp will provide habitat for encrusting and burrowing benthic invertebrates. The gravel revetment will provide habitat for sessile benthic invertebrates potentially including anemone, barnacles, and tunicates, while also providing shaded complex refuge habitat for fish.

The removal of 2 trees along the shoreline will result in the alteration of habitat cover. The two trees are located within 30 m of the HWM. Periodic reduction in shading and reduced organic nutrient input into the intertidal zone will occur resulting from the removal of riparian vegetation. Intermittent changes to shading in the intertidal area may change forage fish movements within the area due to increased predation risk. Increased light penetration will, on the other hand, increase macrophyte productivity in areas previously shaded, which will likely increase refuge coverage area, and habitat continuity may be facilitated by shading from the revetment.

5.4 Death or Injury to Fish or Marine Mammals

Some in-water Project activities, such as pile installation and gravel placement, have the potential to cause direct injury or mortality of fish (including eggs and larvae), due to acoustic or pressure changes, or through direct contact with materials (piles) and industrial equipment(as identified by DFO's *Pathways of Effects*; Fisheries and Oceans Canada 2018).

Pile driving can result in large pressure waves being generated and propagating away from the construction area. These rapid pressure changes can physically injure fish through organ damage, hemorrhaging, and swim bladder ruptures, or can lead to direct mortality. Noise generated from vibratory pile driving is expected to be approximately 160 dB (RMS) re: 1 µPa and lower 10 metres from the source based on similar projects (Illingworth and Rodkin Inc 2017). The upper range of this noise level could potentially result in behavioural changes to fish and marine mammals. The thresholds for behavioural changes vary among various fish groups. Behavioural changes have been reported for some species of rockfish (*Sebastes* spp.) at levels as low as 160 dB re:1µPa (McCauley et al. 2000), while several species of cod (family Gadidae) have been recorded to display behavioural changes at over 200 dB re:1µPa and resume previous behaviours within seconds (Wardle et al. 2001). Behavioural changes include startled, stressed, breaking up of the fish school, and moving farther or deeper away from the noise source (ICF Jones & Stokes, and Illingworth and Rodkin Inc and Illingworth and Rodkin Inc 2009). Little is known about the effects of pile driving on fish behaviour. A review by Hastings and Popper (2005) of three field studies of air gun noise effects on fish catch indirectly shows that fish might have moved away from the area or to greater depths beyond their typical vertical position as fish catch rate dropped following the air gun shots. Fish catch rate returned to normal after several days (Hastings and Popper 2005). The behavioural threshold for marine mammals (both cetaceans and pinnipeds) is 160 dB (RMS) re:1µPa (National Oceanic and Atmospheric Administration 2018). The specifics of behavioural changes in response to underwater noise exceeding these levels are less well understood but changes in communications, feeding, and diving behaviours have been studied.

6.0 Recommended Avoidance and Mitigation Measures

The Fish and Fish Habitat Protection Policy Statement outlines a hierarchy of measures and standards for fisheries protection that are to: (1) avoid, (2) mitigate, and/or (3) offset the death of fish and harmful effects on fish habitat caused by the proposed work, undertaking, or activity (Government of Canada 2019a). The statement outlines that the first, and preferred measure, is to avoid Project-related effects. Where avoidance cannot be achieved, then mitigation measures will be implemented to reduce potential effects such as death of fish or HADD as guided by DFO's Standard General Avoidance and Mitigation Measures (Government of Canada 2019b). Project-related construction and operation will be completed following accepted industry standards, best management practices (BMPs), and applicable regulations and standards.

A Project specific Construction Environmental Management Plan (CEMP) will be prepared by the Contractor following award. The CEMP will outline detailed measures to mitigate potential environmental impacts and will be adhered to for the duration of pile driving activities.

6.1 Environmental Management

The following guidance documents have been considered, in the development of these work practices:

- Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al. 1992).
- Standards and Best Practices for Instream Works (Government of BC 2004).
- Measures to Avoid Causing Harm to Fish and Fish Habitat (Government of Canada 2013).
- Canadian Water Quality Guidelines for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment 2021).
- British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture (Government of BC 2019).
- A Field Guide to Fuel Handling, Transportation and Storage (Government of BC 2002a).
- Summary of Environmental Standards and Guidelines for Fuel Handling, Transportation, and Storage (Hollenberg 1995).
- BC Guidelines for Industry Emergency Response Plans (Government of BC 2002b).

The recommended mitigation measures were developed based on the current understanding of the Project scope and timing as well as the applicable Project activities (**Section 2.0**) and DFO POEs (**Section 5.0**) (Fisheries and Oceans Canada 2018).

6.2 Avoidance Measures

Avoidance (i.e., prevention) measures for potential Project-related environmental effects were considered prior to the development of mitigation strategies. Where avoidance of Project effects is not possible or practical, mitigation measures and BMPs are identified for each of the potential effects. Avoidance measures considered during the planning phase of the Project include site selection, Project design/redesign (**Section 2.0**), and timing; while those considered for implementation during the construction phase include implementing BMPs and acoustic and water quality monitoring.

6.2.1 Construction Timing

The Project Area lies within the DFO BC Marine Timing Windows Area 18 (Cowichan). Timing windows of least risk for this area are:

- Summer work window: July 1 to October 1
- Winter work window: December 1 to February 15.

All construction, operation, maintenance, and decommissioning activities in water or on intertidal areas should be timed to occur within reduced risk work windows to avoid or limit possible impacts on fish such as sensitive life history stages of forage fish (e.g., reproduction, migration). Construction and decommissioning works are currently planned to be carried out within the DFO BC Marine Timing Windows for Protection of Fish and Fish Habitat windows where practicable.

6.3 Implementation of Best Management Practices and Management Plans

Applicable BMPs and Operational Statements should be implemented to guide works that may affect fish and fish habitat. It is recommended that the Contractor prepare a CEMP, containing detailed descriptions of BMPs for works associated with Project activities, along with clear definitions of the procedures and controls to mitigate potential Project effects, and environmental objectives to be used in construction and effectiveness monitoring. The following are some of the elements which should be considered in the CEMP:

- Pile Driving Management
- Underwater Noise Management
- Machinery and Equipment Management
- Erosion, Sediment, and Drainage Management
- Waste Management
- Hazardous Material Management
- Fuel Storage, Handling, and Emergency Spill Response
- Fire Preparedness
- Sensitive Habitat Features and Species at Risk
- Marine Environment Protection
- Emergency Preparedness and Response
- Environmental Monitoring.

6.4 Pile Driving and Underwater Noise Monitoring

Standard management and industry practices for underwater noise will be adhered to so sound levels that may cause harm to fish are not exceeded (BC Marine and Pile Driving Contractors Association 2003; Vagle 2003), and are identified as follows:

- A vibratory hammer will be used when practical to reduce sound levels during piling.
- A hydrophone will be used during start up of vibratory pile installation, along with visual observations, to confirm assumptions and to verify that sound levels remain below the SMP threshold for fish harm from pile driving (peak sound pressure level (SPL) 30 kPA, or approximately 206 dB re 1 µPa). This SMP criterion will be applied up to a 10 m range from the activity, as suggested by DFO for previous projects generating underwater noise (Racca et al. 2007). Pile-driving activities generating peak SPL levels that exceed the threshold or that cause fish kills will be mitigated such that acceptable levels are reached (e.g., using mitigation measures such as bubble curtains). Hydrophone monitoring will be conducted during vibratory piling, for the time necessary to confirm that SPL is below the thresholds outlined above, after which vibratory pile driving may be continued with only visual monitoring of activities. Hydrophone monitoring will be recommenced should there be a material change in pile driving activities including; change in substrate, change in depth, change in pile size or material, or change in hammer type (e.g. impact piling). Noise monitoring parameters for mitigating harm to marine mammals can be found in **Section 6.7.1**.

- Should rock socketing be required, water quality monitoring will be conducted (as per **Section 6.7.3**) to determine if sediment laden fluid is not escaping the pile.
- Should rock socketing be required during pile installation, all drilling fluid, cuttings, and spoil must be removed from the pile and captured. No debris should be released to the marine environment during rock socketing.
- Should impact pile driving be required, hydrophone monitoring will be conducted for the duration of impact pile driving activities to confirm that SPL does not exceed 30 kPA, or approximately 206 dB re 1 µPa, at 10 m from the pile driving activities.
- The Underwater Noise Management Plan will outline specific underwater noise reduction and dampening methods and technologies and will address adaptive monitoring and mitigation requirements for managing pile-driving sound levels.
- All pile driving operations will stop and additional mitigation measures will be installed, in the event of a fish kill.
- Impact pile driving will only be conducted with the implementation of additional mitigation measures. If noise can not be abated a bubble curtain over the full length of the wetted pile to reduce underwater noise levels and to reduce the likelihood of fish interacting too closely with the pile during driving operations (Tsouvalas and Metrikine 2016).

6.4.1 Bubble Curtain

As a pro-active mitigation measure, an initial visual inspection of the bubble curtain will be conducted using an underwater video camera, after the bubble curtain is deployed and before the start of impact pile driving. During the impact pile driving operation, an underwater video camera will be used to inspect the curtain if noise exceedances are observed. In addition, if the bubble is removed and re-set, another visual inspection will be completed using an underwater video camera. The following will be confirmed:

- There are no kinked or twisted hoses.
- Every ring is producing bubbles along the entire length.
- The bottom ring is at the seabed when the system has full airflow (all rings are turned on).

Other mitigation measures that may be recommended to avoid noise exceedances include reducing the blow force of the hammer and increasing air flow to the bubble curtain. In the case of a noise exceedance, work will be stopped and pile driving operation will be assessed to determine which mitigation efforts can be implemented prior to restarting pile driving. These mitigation measures may include reducing hammer force, increasing bubble curtain pressure, inspecting the bubble curtain using a diver, adding weight to the bubble curtain, and/or adding more rings to the bubble curtain. Under this scenario, any restart to pile driving will follow slow start up procedures.

6.4.2 Contingency Plan

- If underwater noise guideline exceedances are detected at any sampling locations, or deemed likely to occur, the following mitigation measures shall be implemented:
  - The EM shall communicate the results of ongoing underwater noise monitoring regularly with the Contractor.
  - The EM will immediately communicate a spike or exceedance of applicable guidelines to the Contractor.

6.5 Spills and Containment

- A *Spill Prevention and Emergency Response Plan* should be prepared by the contractor and reviewed by all site workers. The *Spill Prevention and Emergency Response Plan* should include, at a minimum, the following:
  - Notification and alerting procedures for spill/release.
  - Containment, recovery, and clean-up procedures.
  - On-site spill/release clean-up materials, equipment, and locations.
  - Names and telephone numbers of persons and organizations that may be contacted in the event of a potential environmental incident.
- A readily available supply of spill prevention and emergency response equipment in effective working condition should be maintained on site and on each heavy piece of equipment or machinery at all times. Site workers should be sufficiently trained in the use of spill prevention and emergency response equipment and how to deal with environmental emergency situations.
- Store all fuel, diesel, hydraulic fluid, and oils in secure areas with spill containment measures in place. Land based fuel storage should be located beyond initial construction areas inland of the site.
- Regularly scheduled inspections of all hazardous material equipment for signs of leakage should be conducted. Visual inspections should also include ensuring that all emergency response equipment and personal protective equipment are in place.
- All equipment and machinery (e.g., cranes, barges, pile driving equipment, tending vessels) used on site should be in good repair and free of excess fuel, diesel, hydraulic fluid, oil and/or grease (as well as invasive species/noxious weeds) and should be checked routinely for any fluid leaks.
- Biodegradable (vegetable-based) hydraulic fluid, oil and fuel should be used where possible in equipment and machinery operating in the foreshore.
- To the extent practicable, physical works in the intertidal zone should be undertaken in the dry during low tide periods. In-water works in the intertidal zone should be precluded or minimized through all reasonable or practical measures.
- No equipment, machinery or tools shall be washed in or near aquatic receptors as this has the potential for toxic deleterious materials (e.g., residues from oils, fuel etc.) to enter the marine environment.
- All non-hazardous and hazardous waste materials shall be removed from the site and properly disposed of at an approved waste facility.
- Non-hazardous materials should be segregated from hazardous waste materials through a recycling and waste management program that includes labelled receptacles for non-hazardous waste materials, including recyclable materials, and hazardous waste materials.
- Appropriate off-site disposal sites for non-recyclable and recyclable non-hazardous waste materials and for hazardous waste materials should be identified.
- Regular clean up and disposal guidelines to prevent the unnecessary accumulation of excessive waste should be implemented.

6.6 Erosion, Sediment, and Drainage Management

- An Erosion, Sediment, and Drainage Management Plan (ESDMP) will be developed and implemented by the Contractor. This plan will:
  - Assign implementation and monitoring roles.
  - Require site personnel to review the ESDMP, understand their roles and responsibilities, and be properly trained and equipped to conduct spill response activities.
- Implement control measures for sediment-laden water. The SEC Plan will contain the following mitigation requirements:
  - Use temporary drainage measures as necessary to keep excavations and site free from water.
  - Restore to the original gradient all upland areas disturbed during construction.
  - If necessary, protect all upland disturbed areas with appropriate erosion control blankets, or hydroseed.
  - Locate and secure barges/vessels and other water-borne equipment in such a way as to prevent grounding onto intertidal foreshore or the seabed. Ensure that barges, vessels, and water-borne equipment will not ground on lowest low-water tides.
  - Minimize the use of barge stabilizing spuds to mitigate effects on the foreshore and seabed. Use anchors instead of spuds whenever practical.
  - Reduce vessel speeds to an appropriate speed limit required to eliminate excess wake along the shoreline and disruption of seabed sediments.
  - Minimize disturbance to the intertidal zone :
  - Minimize the area of vegetation clearing will be to the extent possible. When removing invasive species, minimize excessive soil disturbance to minimize new introductions.
  - Clearly delineate the limits of construction activities and place appropriate buffers around any sensitive environmental features prior to vegetation clearing.
  - Prevent wheels and tracks of land-based equipment from entering the water at any time. If working in the intertidal zone, this will require careful monitoring of the change in tide levels.
  - Operate marine vessels to avoid seabed grounding and propeller wash. Propeller wash can be avoided by operating vessels in water with a minimum clearance of 1.5 m between the propeller and the seabed.
  - Carry out all physical activities in a manner that prevents induced sedimentation of foreshore and near shore areas and induced turbidity of local waters, and the release of sediment, sediment-laden waters, and turbid waters to the aquatic environment.
  - Ensure that equipment operators are properly trained, and operate equipment based on best industry practices, which include utilizing techniques that minimize the re-suspension of sediments in the water column.
  - Cover exposed areas to prevent soil erosion and sediment runoff, particularly bare slopes which can be covered with coco-matting or mulch. Avoid clearing during heavy rainfall when sediment runoff potential is greatest.
  - Utilize silt fencing, hay bales, geotextile fabric or other runoff management systems to control and contain soil erosion and sediment runoff from entering the marine environment.
  - Establish site entrances and implement measures to prevent tracking of soil/sediment to the riparian and high-water mark areas to prevent introduction to the marine environment.

- Operate and manoeuvre barges and any tending vessels in such a way as to prevent disturbance to seabed materials, particularly areas adjacent to during dredging activities, which could otherwise result from grounding of barges and re-suspension of solids from propeller wash. Propeller wash can be minimized by operating vessels in water with a minimum clearance of 1.5 m between the propeller and the seabed.
- Control or prevent from occurring sediment runoff on material supply barges. Barges should not be washed or hosed down to remove residual supply materials (i.e., gravel/sand for beach construction), as this could result in sedimentation/turbidity of the water column from finer fractions and the potential for toxic deleterious materials (e.g., residues from oils, fuel etc.) to enter the marine environment.
- Monitor the continued effectiveness of all implemented measures and replace, repair, or improve as needed. Continually monitor the site for new sources of soil erosion and sediment runoff, and implement measures to control runoff and erosion, as needed. Leave control measures in place until the affected work areas are stabilized and there is no longer a risk of sediment runoff, sedimentation, or soil erosion.

6.7 Environmental Monitoring

A qualified Environmental Monitor (EM) will be present during construction activities that may result in harm to fish and fish habitat. The EM will be responsible for monitoring construction activities, documenting compliance, and communicating and providing recommendations on mitigation measures and BMPs which may be implemented during construction.

6.7.1 Marine Mammal Monitoring

The risk of marine mammal interactions (strikes) with the Project is considered low as barges and work vessels will be stationary while construction is taking place. All noise-generating construction activities that take place below the HWM, the MMO will scan the work area prior to the commencement of and during works and document the presence, number, and behaviour of marine mammals in the area. If marine mammals enter the Project area, the MMO will advise the Contractor to stop or modify construction activities until the mammals have cleared the area. Marine mammal exclusion zones and compliance distances will be established by the MMO prior to the start of relevant construction components such as impact pile driving. Marine mammal exclusion zones for impact pile driving will represent the minimum distance required for Project generated underwater water noise to return below auditory disturbance thresholds for marine mammals (160 dB re 1 μPa_{RMS}). As such, Industry standard practice marine mammal exclusion zones of 1000 m should be enforced (Vagle 2003).

6.7.2 Fish Monitoring

While there are no records of herring spawning in the Project area, the marine environment along the southern coast of South Pender Island is known to support fish species that may utilize the habitat for spawning (Fisheries and Oceans Canada 2021). Pacific herring spawning activities were last recorded along the southern coast of South Pender Island in 1980. Should works be conducted outside the least risk window, the EM will conduct visual surveys for fish and signs of spawning within the Project area, including on construction equipment. If signs of spawning fish are observed, the EM will advise the Contractor to stop or modify construction until fish have dispersed. The EM will advise the Contractor and Owner on appropriate mitigation measures to be undertaken should spawning fish be observed.

6.7.2.1 Pacific Herring Spawning

- If spawning Pacific herring are observed at any time during construction, the Owner, Contractor, and EM will be notified immediately. Work timing and activities may be modified accordingly to avoid adverse effects to spawning herring. If construction will occur during the herring spawning season (typically late February – April), daily pre-construction spawning observations will be conducted prior to commencement of construction activities below the HHWLT.
- If feasible, isolation curtains will be employed around the construction area to prevent the attachment of eggs to construction equipment (i.e., barge) and materials.
- If herring eggs are observed on construction equipment, materials, or natural substrate within the Project area, works will be suspended until an appropriately qualified professional is consulted and measures are implemented to avoid harm to adult herring, herring spawn, or herring larvae. The EM may be able to establish an exclusionary buffer around the eggs. Any herring spawn on construction equipment/materials are to remain undisturbed until eggs hatch and larvae emerge, and the buffer is removed. The size and shape of the buffer will depend on various factors, including: foreshore topography and substrate, the type of construction activities to occur next to the buffer, and the requirements for movement of personnel and equipment past the buffer. The buffer will be removed and/or construction equipment/materials be cleared for use following confirmation by the Lead EM, EMs, or their designate that the eggs have hatched. If eggs are observed on the hull of a barge or vessel, it will be towed from the work area and moored until the eggs hatch and larvae emerge.

6.7.3 Water Quality Monitoring

Water Quality Monitoring will be conducted by the EM to verify that water quality is maintained within guidelines established by the Canadian Council of Ministers of the Environment (Canadian Council of Ministers of the Environment 2021) and the BC Ministry of Environment (MOE 2017).

Both total suspended solids (TSS) and turbidity can be used to measure total particulate matter in water. TSS is a measure of the dry weight mass of non-dissolved organic and inorganic solids suspended per unit volume of water, expressed in milligrams per litre (mg/L). Turbidity is a measure of water clarity, specifically the amount light is scattered as it passes through a sample of water and is measured in Nephelometric Turbidity Units (NTU). During a successful water quality monitoring program, the turbidity levels of the most downstream (down-current) sampling location should remain near those of background and within the CCME guidelines at all times, regardless of upstream (up-current) events. Water quality monitoring shall be undertaken by a qualified professional during all in-water construction activities and will use turbidity measured in NTU as a surrogate for TSS, because it can be measured in situ.

The water quality monitoring (WQM) plan will consider, at minimum, the following:

- Sampling sites will be established by the EM prior to the commencement of water quality monitoring or any construction works requiring WQM.
- The first monitoring site shall be established < 30 m down-current (depending on tides) from the construction activity.
- A pair of monitoring sites shall be established 60 m (1 up-current and 1 down-current) from the construction activity.
- Additional paired monitoring sites shall be established at distances of 100 m, 200 m, 500 m, and 1000 m, as required, and as feasible given high level of vessel traffic within the area (1 up-current and 1 down-current to form a paired monitoring site) from the construction activity.

- Water quality measurements will be collected from approximately mid-water depth to avoid contaminating samples with detritus from the surface (dust, pollen, etc.) or with substrate (silt, fines, sand). Where not feasible to collect from mid water depth, the EM will use their discretion to sample from a depth sufficient to meet the above criteria.
- Samples will be collected a minimum of three times per day: prior to start-up, mid-morning during normal construction activities, and end of day following completion of in-water activities.
- Baseline water quality levels will be established prior to the daily start-up and will reflect undisturbed conditions in Beecher Bay, as will samples taken 100m away on the up-current side of construction activity (depending on direction of tidal currents).
- For construction activities that are likely to temporarily increase turbidity and any in-water works taking place outside the DFO least risk window, turbidity monitoring will be conducted at 2 hr intervals while construction is underway.

The monitoring site locations will be continually adjusted as construction is moved throughout the Project area. Turbidity levels of the most down-current sampling location should always remain near those of background and within the CCME guidelines, regardless of up-current events. Impacts to adjacent habitats are not expected, in part, because of natural site conditions (high currents and tidal exchange, existing sedimentation levels) and mitigations within the project design intended to reduce sediment volumes.

The turbidity guidelines for freshwater, marine and estuarine habitats, measured in NTU will be applied during water quality monitoring and are as follows:

- Change from the background of 8 NTU at any one time for a duration of 24 hours in all waters during clear flows or in clear waters (Canadian Council of Ministers of the Environment 2014; Government of BC 2017).
- Change from the background of 2 NTU at any one time for a duration of 30 days in all waters during clear flows or in clear waters (Canadian Council of Ministers of the Environment 2014; Government of BC 2017)
- Change from the background of 5 NTU at any one time when background is 8-50 NTU during high flows or in turbid waters. Change from background of 10% when background is > 50 NTU at any time during high flows or in turbid waters (Canadian Council of Ministers of the Environment 2014; Government of BC 2017).
- Maximum increase of 8 NTU from background levels at any one time when background levels are between 8 and 80 NTU. When background is greater than 80 NTU, will not increase more than 10% of background levels (Canadian Council of Ministers of the Environment 2014; Government of BC 2017).

6.7.3.1 Contingency Plan

- If water quality guideline exceedances are detected at any sampling locations, or deemed likely to occur, the following mitigation measures shall be implemented:
  - The EM shall communicate the results of ongoing water quality monitoring regularly with the Contractor.
  - The EM will immediately communicate a spike or exceedance of water quality guidelines to the Contractor.

- If an exceedance is detected at any sampling location, the EM will collect additional samples (and the corresponding GPS location(s)) from all sampling locations and, if necessary, from the middle of the plume and as close to the source as possible (within safety limits).
- In the event of an exceedance at the 200 m, or 500 m sampling locations, the relevant construction activity will stop immediately. The EM shall collect turbidity samples in situ until all sampling locations are within guideline levels.
- If, after one complete tidal cycle following the completion of the relevant construction activity, turbidity remains elevated, additional mitigation measures may be put in place, at the discretion of the EM and the Contractor.
- Prior to restarting construction, the EM and Contractor will identify the reason for the exceedance and implement additional mitigation measures that may include, but are not limited to:
  - Deploying sediment curtains around the work area,
  - Reducing the rate of work.

6.8 Revegetation Plan

It is anticipated that Project Activities will require the removal of two large trees and the trimming of other nearby trees and understory brush. As such, a revegetation plan will be developed by the Contractor and implemented following completion of the Project. Revegetation will follow the BC MOTI's 2020 Standard Specifications for Highway Construction (Government of BC 2020) where applicable, and relevant sections include:

- SS Section 754: Planting of Trees, Shrubs, and Ground Covers
- SS Section 757: Revegetation Seeding.

A Site Restoration Planting Plan will be prepared by an Appropriately Qualified Professional (AQP) in accordance with the SS Section 754. Prior to planting, any invasive plants present within the planting area will be removed and topsoil will be placed at a depth of 300 mm.

Tree and shrub species to be planted will be similar to the native tree and shrub species found within and adjacent the area to be cleared, which may include:

- Western redcedar (*Thuja plicata*)
- Douglas-fir (*Pseudotsuga menziesii*)
- Grand fir (*Abies grandis*)
- Western flowering dogwood (*Cornus nuttallii*)
- Salal (*Gaultheria shallon*)
- Dull Oregon-grape (*Mahonia nervosa*)
- Oceanspray (*Holodiscus discolor*)
- Nootka rose (*Rosa nutkana*)
- Common Snowberry (*Symphoricarpos albus*).

Revegetation seeding will be applied to all disturbed areas of the Site including all soil cuts and embankment slopes. Custom site-specific blend native seed mixes will be applied. Water may be applied to seeded areas on an as-needed basis during prolonged periods of dry or inclement weather to facilitate seed germination.

To avoid over-competition of tree species, it is recommended that trees be planted at least 2 metres apart from each other while shrubs and ground cover may be planted 1 metre from trees or from other shrubs and ground cover species.

Erosion and sediment control measures will be installed to stabilize soils during and following construction until vegetation is established.

Maintenance and monitoring will be carried out, including managing invasive plants and watering for a period of at least one year following the completion of all planting.

7.0 Residual Effects

This section provides an overview of the potential Project-related residual effects on aquatic and riparian resources, during both the construction and operation phases of the Project, following the application of measures to avoid and mitigate effects, as described in **Section 5.1**.

7.1 Potential Residual Effects

As per federal guidance (Government of Canada 2019b), this assessment of residual effects includes details regarding potential effects associated with each activity, proposed mitigation measures, and a quantitative description of residual effects to fish following implementation of mitigation measures.

Residual effects for this Project were assessed according to specific criteria (**Table 7.1**), to evaluate the potential for adverse effects to fish and fish habitat (any mortality to fish and/or alteration of habitat sufficient to result in a localized impact to the population in the Project area). The potential for notable residual effects is based on industry and federal guidelines, BMPs, and the application of the criteria used to evaluate residual effects outlined in **Table 7.1,** below, and is characterized as follows:

- **Low:** unlikely to result in residual effects.
- **Medium:** moderately likely to result in residual effects.
- **High:** highly likely to result in residual effects.

A summary of potential residual effects by POE and associated activity is provided below as **Table 7.2** and discussed in the following sections. This assessment is conditional upon the implementation of the recommended mitigation measures described in **Section 5.1**.

Table 7.1 Criteria Used to Evaluate Residual Effects on Fisheries Resources

Characteristic and Description		Rank and Description of Associated Residual Effect	
Likelihood	Likelihood and risk of the residual effect occurring	Likely	Residual effect likely to occur
		Unlikely	Residual effect unlikely to occur
Duration	Length of time over which the residual effect is expected to persist. For example, is the duration short enough that it does not diminish the ability of fish to carry out one or more of its life processes?	Short-Term	Days to weeks
		Moderate-Term	Months to 1 year
		Long-Term	More than 1 year to permanent
Magnitude	Intensity of the effect relative to natural or baseline conditions	Negligible	No measurable change in fish populations, fish habitat quality or quantity parameters
		Low	A measurable change within the range of natural variability, but not affecting fish population viability
		Moderate	A measurable change outside the range of natural variability, but not posing a risk to fish population viability
		High	A measurable change outside the range of natural variability that may affect long-term fish population viability
Geographic Scale	Geographic extent / distribution of the residual effect. For example, is the scale small enough that the disturbance will not displace fish that would otherwise be occupying the habitat?	Site	Site/segment, localized effect, or temporary displacement of fish (within the immediate Project area)
		Reach	Waterbody significantly impacted or permanent displacement (outside the immediate Project Area)
		Waterbody	Majority of waterbody impacted or permanent displacement (impacts extended into the Strait of Juan de Fuca)
Reversibility	Potential for the effect to be reversed or naturally return to baseline level after the disturbance has ceased (or after a period of time after the disturbance has ceased)	Reversible	Baseline conditions will be naturally restored after disturbance has ceased
		Irreversible	Baseline conditions will not be naturally restored after disturbance has ceased
Ecological Context	The availability and condition of the habitat to be altered, relative to nearby fish habitat. For example, is the habitat that is being altered or destroyed the only habitat of its type and quality in the area of the Project?	Prevalent	Altered habitat is prevalent and widely distributed in the waterbody is still suitable
		Limited	Altered habitat is confined to small areas or has limited distribution in the waterbody and is significantly reduced in quality
		Rare	Altered habitat is rare or limiting (critical habitat, species at risk) and is no longer suitable

Table 7.2 Residual Effects Assessment for Project-related Effects on Fisheries Resources

Pathway of Effect (see Table 5.1)	Associated Project Activities (see Table 5.1)	Applicable Mitigation Measures	Evaluation of Residual Effect						Potential for Adverse Residual Effects to Fisheries Productivity
			Likelihood	Duration	Magnitude	Geographic Scale	Reversibility	Ecological Context	
Change in Sediment Concentrations	• Use of Industrial Equipment • Placement of materials and structures in water • Vegetation clearing	• Implement Water Quality Monitoring as per **Section 6.7.3**.	Likely	Short Term	Low	Site	Reversible	Prevalent	Low
Change in Contaminant Concentrations	• Use of Industrial Equipment	• Implement Fuel Storage, Handling, and Emergency Spill Response Plan as per **Section 6.5**. • Verify that all machinery is clean and well maintained; fuel, wash and maintain equipment in an appropriate location that is set back from the water body or is isolated with secondary containment; use biodegradable fluids in machinery; have spill kits on hand, on work vessels, barges, and tugs.	Unlikely	Short Term	Low	Site	Reversible	Prevalent	Low
Change in Habitat Structure and Cover	• Placement of materials and structures in water • Vegetation clearing	• Position barges and water-borne construction equipment with enough clearance to prevent damage to fish habitat.	Likely	Moderate Term	Low	Site	Reversible	Prevalent	Low
Death or Injury to Fish and Marine Mammals	• Use of Industrial Equipment • Placement of materials and structures in water	• Implement Underwater Noise Management, Fish Monitoring, and Marine Mammal Monitoring as per **Section 5.1.** • Position barges and water-borne equipment away from sensitive fish habitat. • Vessels will adhere to all relevant marine mammal regulations and setback distances. • Implement hydroacoustic monitoring, vibratory pile driving, and any other relevant BMPs as per the CEMP (**Appendix C**).	Unlikely	Short Term	Low	Site	Irreversible / Reversible	Prevalent	Low

7.2 Change in Sediment Concentration

Implementation of water quality monitoring during pile driving and removal and material placement will allow for real-time monitoring of turbidity levels to confirm that mobilized sediments do not exceed the relevant water quality guidelines established by the Canadian Council of Ministers of the Environment. Water quality monitoring is a routinely and widely implemented practice on many marine construction programs throughout coastal and riverine waters in BC. Based on the evaluation criteria in **Table 7.1**, and the residual affects assessment in **Table 7.2**, a change in sediment concentration is likely to occur for a short-term duration. A change in sediment concentration associated with Project works is expected to be low in magnitude and reversible. Given that any change in sediment concentration is expected to be restricted to the site, on the localized geographic scale, and the habitat that may be affected is classified as prevalent, in an ecological context, the potential for adverse residual effects to fisheries productivity as a result of any change in sediment concentration during Project works is assessed to be low.

7.3 Change in Contaminant Concentration

Materials to be placed below the HWM will be tested to ensure they are non-reactive and free from excess dirt, dust, and other foreign materials. Implementation of the Fuel Storage, Handling, and Emergency Spill Response Plan will provide immediate response and remediation of any unanticipated accident or malfunction. Testing of materials prior to placement below the HWM will occur to ensure that materials will not affect the surrounding water and sediment quality. Proposed Project works are unlikely to result in a change in contaminant concentration. Any changes in contaminant concentration are expected to be short-termed, reversible, low in magnitude and localized in geographical extent. The habitat that may be affected is classified as prevalent. Overall, the potential for adverse residual effects to fisheries productivity is assessed to be low.

7.4 Change in Habitat Structure and Cover

The installation of the piles and temporary revetment are likely to result in a low magnitude change in habitat structure and cover for a moderate term of duration. The change in habitat structure and cover will be limited to the site and will be reversed when the piles and revetment are decommissioned.

Given the temporary nature of the piles and hard rocky substrate in the high intertidal, the minimal footprint of the temporary revetment, and the ubiquity of similar habitat types in the area the potential for adverse residual effects to fisheries productivity associated with change in habitat structure and cover is assessed to be low.

7.5 Death or Injury to Fish or Marine Mammals

Working in the relevant fish windows, using vibratory piling methods, implementation of underwater noise monitoring, and having additional mitigation available such as bubble curtains should they be required are not expected to result in death or Injury to fish or marine mammals. Potential residual effects associated with underwater noise, if any, are expected to be of short-term duration and low magnitude, and be constrained to the Project site. Overall, the potential for adverse residual effects to fisheries productivity is assessed to be low.

8.0 Conclusion

Project activities relevant to this assessment include the temporary installation four - 914 mm steel piles, construction of a gravel access road, the removal of two trees, and development of an intertidal revetment for off loading.

During the construction the Project, potential adverse effects to fish and fish habitat within the Project area may be as follows:

- Changes in sediment concentrations from the use of industrial equipment and the placement of materials in water.
- Changes in contaminant concentrations resulting from accidental spills during the use of equipment in and near water.
- Changes in habitat structure and cover resulting from the installation of piles.
- The incidental injury or mortality of fish resulting from pile installation and the use of equipment.

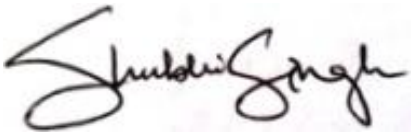
The Project is expected to result in the temporary disturbance of a maximum of 187.3 m^2 (2.62m^2 for pile and 184.7 m^2 for revetment, respectively) of soft substrate fish habitat situated within the Project area as a result of the temporary pile installation and gravel revetment installation.

Based on Project design and activities described in **Section 2.0** and with the effective implementation of the mitigation measures outlined in **Section 5.1**, The Project is unlikely to result in significant adverse residual effects or Harmful Alteration, Disruption or Destruction to fish and fish habitat.

9.0 Closure

We sincerely appreciate the opportunity to have assisted you with this project and if there are any questions, please do not hesitate to contact the undersigned by phone at 604.669.0424.

Report prepared by:
Ausenco Sustainability Inc.



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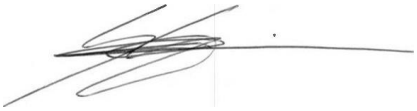

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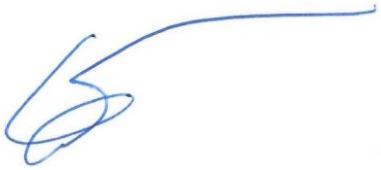

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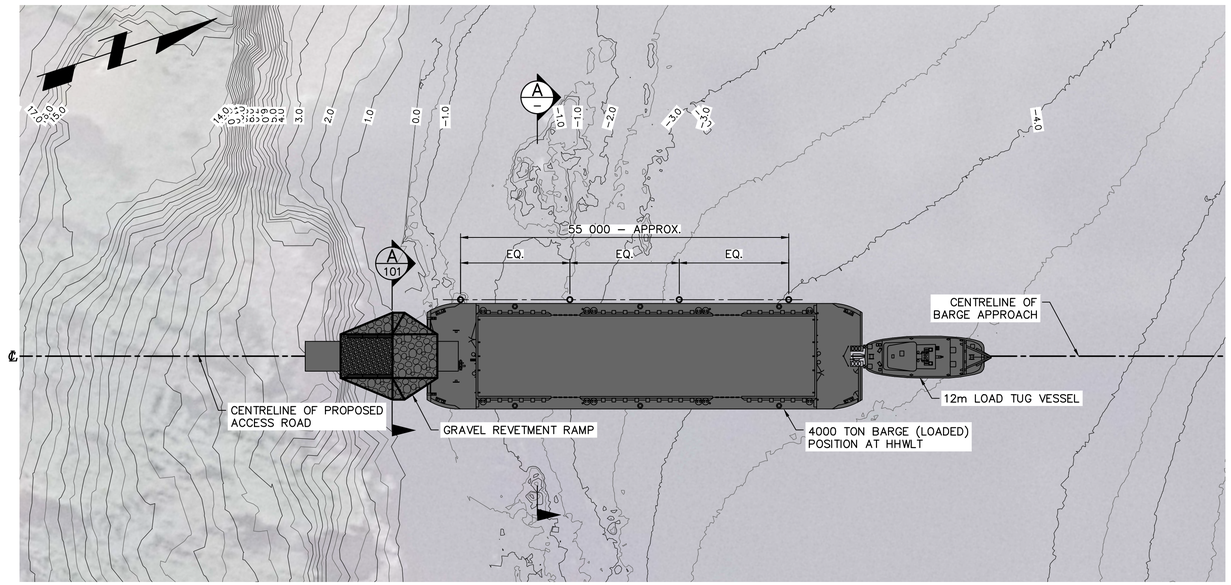
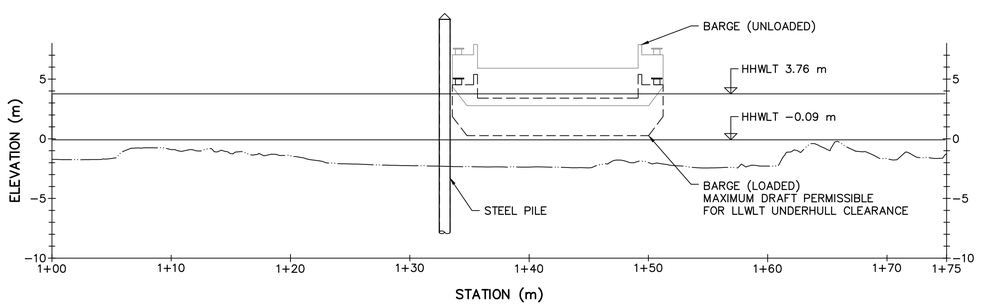
Appendix A

Project Design Drawings

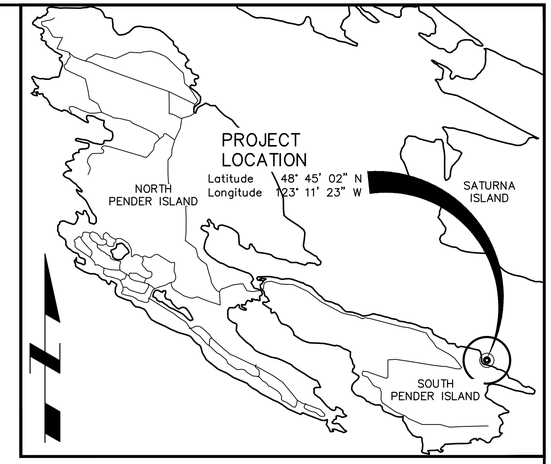


PLAN
SCALE 1:500

PROFILE
SCALE 1:500



SECTION A–
SCALE 1:250



KEY PLAN
NTS

DESIGN CRITERIA:

1. DESIGN INTENT:

1.1. CONSTRUCTION OF A TEMPORARY BERTH NEEDED FOR SAFE TEMPORARY BERTHING AND MOORING OF A BARGE USED TO BRING PROJECT MATERIALS TO AND FROM THE SITE. PILE LAYOUT AND LOCATIONS MAY VARY TO SUIT ALL INTENDED BARGE VESSELS.

2. PROJECT DATUM AND TIDAL DATE:

2.1. TIDAL ELEVATIONS AT THE SITE ARE BASED ON VALUES PUBLISHED BY THE CANADIAN HYDROGRAPHIC SERVICE (CHS) FOR BEDWELL HBR 07350.
2.2. ALL ELEVATIONS REFERENCE CHART DATUM AND ARE SHOWN IN METRES:

•HIGHER HIGH WATER LEVEL	=HHWLT	+3.67m
•LOWER LOW WATER LEVEL	=LLWLT	–0.07m
•MEAN WATER LEVEL	=MWL	+2.27m

3. DESIGN VESSELS:

3.1. PILES HAVE BEEN DESIGNED FOR THE MAXIMUM BARGE VESSEL SIZE NOTED BELOW. PILES MAY BE ADJUSTED TO SUIT SMALLER BARGE VESSELS SO LONG AS THE MINIMUM REQUIRED DRAFT IS ACHIEVED.

MAXIMUM ALLOWABLE BARGE PHYSICAL CHARACTERISTICS	
DEADWEIGHT TONNAGE (DWT)	4000 TONS
LENGTH (MOULDED)	73.152m (240'–0")
BREADTH (MOULDED)	17.678m (58'–0")
DEPTH (MOULDED)	4.267m (14'–0")
DESIGN DRAFT (LOADED)	3.505m (11'–6")
DESIGN DRAFT (UNLOADED)	1.000m (3'–0")
RAMP LENGTH	20.830m (68'–4")

3.2. BARGE OPERATOR IS RESPONSIBLE FOR ACTIVE MONITORING OF TIDE LEVELS AND POSITIONING BARGES TO ENSURE ADEQUATE UNDER KEEL CLEARANCE AT ALL TIMES.
3.3. MAXIMUM BARGE BERTHING VELOCITY 0.30 m/sec.
3.4. BARGES MUST HAVE RAMPS PROVIDED FOR SHORE ACCESS TO THE GRAVEL REVETMENT RAMP.

DRAWING LIST	
DWG. No.	DWG. TITLE
6880–100	GENERAL ARRANGEMENT
6880–101	PILE PLAN, SECTIONS & DETAILS

GENERAL NOTES:

1. GENERAL

1.1. ALL WORK SHALL CONFORM TO WORKSAFE BC OCCUPATIONAL HEALTH AND SAFETY REGULATIONS, TRANSPORT CANADA NAVIGATION PROTECTION PROGRAM AND SPECIFIC REGULATORY AGENCIES HAVING JURISDICTION INCLUDING THE CANADIAN COAST GUARD.
1.2. DO NOT SCALE THE DRAWINGS. ALL DIMENSIONS ARE GIVEN IN MILLIMETRES UNLESS NOTED OTHERWISE. ELEVATIONS ARE GIVEN IN METRES AND ARE REFERENCED TO TIDE AND CHART DATUM.
1.3. CONTRACTOR SHALL VERIFY ALL EXISTING DIMENSIONS AND EXISTING CONDITIONS AT THE SITE PRIOR TO STARTING WORK. ANY DISCREPANCIES BETWEEN THE FIELD CONDITIONS AND THE DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER OF RECORD PRIOR TO FABRICATIONS AND CONSTRUCTION.
1.4. BATHYMETRIC DATA AND CONTOURS PROVIDED BY THE MCELHANNEY SURVEY DATED APRIL 5, 2023.
1.5. PRIOR TO THE INSTALLATION OF PILES THE CONTRACTOR SHALL CONFIRM THE GEOTECHNICAL CONDITIONS BY COMPLETING A TEST PILING PROGRAM TO THE SATISFACTION OF THE ENGINEER.

2. STEEL PIPE PILES

2.1. STEEL PIPE PILES CONFORM TO ASTM A252 GRADE 2.
2.2. PILES SHALL BE INSTALLED TO THE MINIMUM EMBEDMENT INDICATED.
2.3. CUT OFF PILES HORIZONTALLY AT ELEVATION INDICATED.

3. CONSTRUCTION

3.1. PILE INSTALLATION (DRIVEN / DRILLED / ROCK SOCKETED) TO BE DETERMINED DURING FUTURE CONTRACTOR TEST PILING PROGRAM.
3.2. FINAL PILE LOCATIONS TO BE DETERMINED BASED ON THE CONTRACTORS BARGE REQUIREMENTS. 4000 DWT BARGE VESSEL CONSIDERED TO BE THE MAXIMUM FEASIBLE SIZE AND IS SHOWN FOR REFERENCE.
3.3. EXTENTS OF FORESHORE FILL REVETMENT RAMP SHOWN IS APPROXIMATE.

McElhanney
SUITE 500, 3960 QUADRA STREET
VICTORIA BC, CANADA V8X 4A3
PH (250) 370 9221
FAX 1-855-407-3895

Rev	Date	Description	Init
PA	2023–06–16	ISSUED FOR 100% REVIEW	MF

REVISIONS

BRITISH COLUMBIA
Ministry of Transportation & Infrastructure
South Coast Region

VANCOUVER ISLAND DISTRICT
PENDER ISLAND CANAL ROAD DIP SLIDE

GENERAL ARRANGEMENT
PLANS, SECTIONS & GENERAL NOTES

PREPARED UNDER THE DIRECTION OF

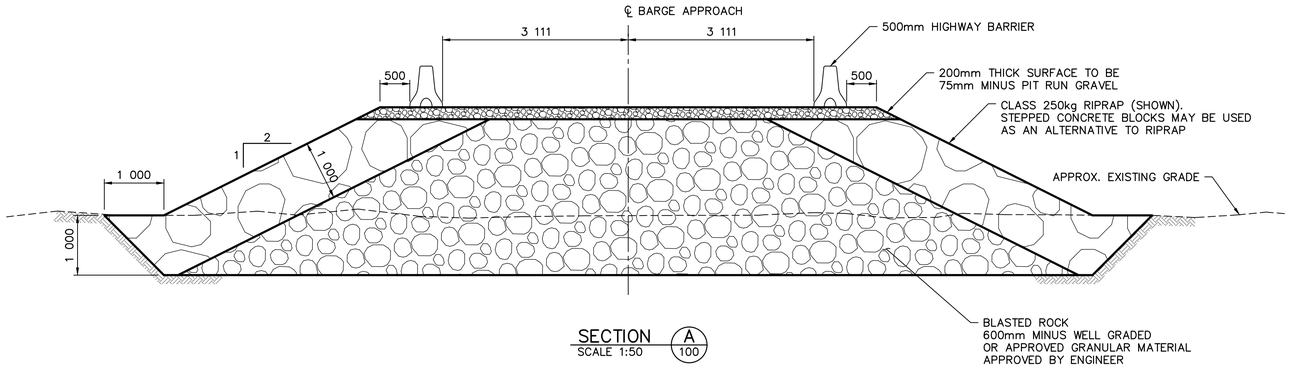
ENGINEER OF RECORD

DATE

DESIGNED HH DATE 2023–05–11
CHECKED MF DATE 2023–06–14
DRAWN JTH DATE 2023–06–16
SCALE AS NOTED
NEGATIVE No.

FILE No.	PROJECT No.	REG.	DRAWING No.
2110–00169–00	18102–0000	–	NNNN–100 PA

CANCEL PRINTS BEARING PREVIOUS LETTER



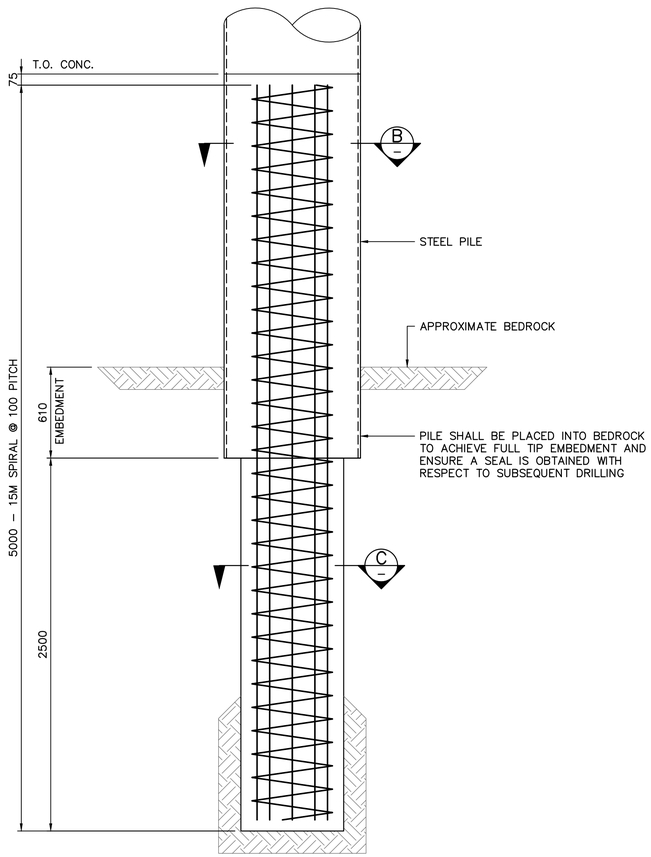
SECTION A
SCALE 1:50 100

PILE LAYOUT
SCALE 1:150

PILE INSTALLATION TABLE

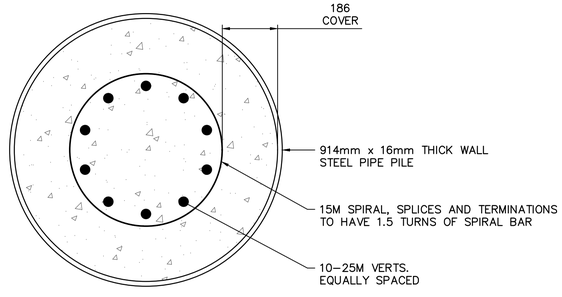
PILE	PILE DIAMETER (mm)	PILE WALL THICKNESS (mm)	PILE MATERIAL GRADE	NORTHING	EASTING	CUTOFF EL. (m)	ESTIMATED SEABED EL. (m)	MIN. EMBEDMENT (m)	ESTIMATED TOTAL PILE LENGTH (m)
P1	914	16	ASTM A252 GR.2	5399695.928	486150.048	10.00	−1.22		
P2	914	16	ASTM A252 GR.2	5399713.421	486155.533	10.00	−2.66		
P3	914	16	ASTM A252 GR.2	5399730.914	486161.019	10.00	−3.60		
P4	914	16	ASTM A252 GR.2	5399748.408	486166.505	10.00	−4.03		

NOTE:
EMBEDMENT DEPTHS AND ESTIMATED TOTAL PILE LENGTHS TO BE CONFIRMED FOLLOWING TEST PILING BY CONTRACTOR.



DETAIL 1
SCALE 1:20 100

NOTE:
REINFORCEMENT SHOWN FOR TENDER PRICING ONLY. FINAL REINFORCEMENT



SECTION B
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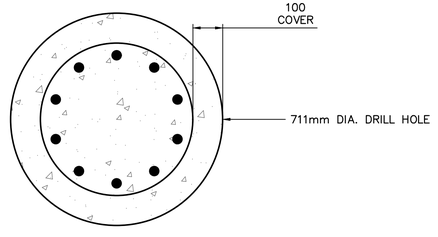

SECTION C
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McElhanney
SUITE 500, 3960 QUADRA STREET
VICTORIA BC, CANADA V8X 4A3
PH (250) 370 9221
FAX 1-855-407-3895

Rev	Date	Description	Init
PA	2023–06–16	ISSUED FOR 100% REVIEW	MF

REVISIONS

BRITISH COLUMBIA
Ministry of Transportation & Infrastructure
South Coast Region

VANCOUVER ISLAND DISTRICT
PENDER ISLAND CANAL ROAD DIP SLIDE

GENERAL ARRANGEMENT
PILE PLAN, SECTIONS & DETIALS

PREPARED UNDER THE DIRECTION OF

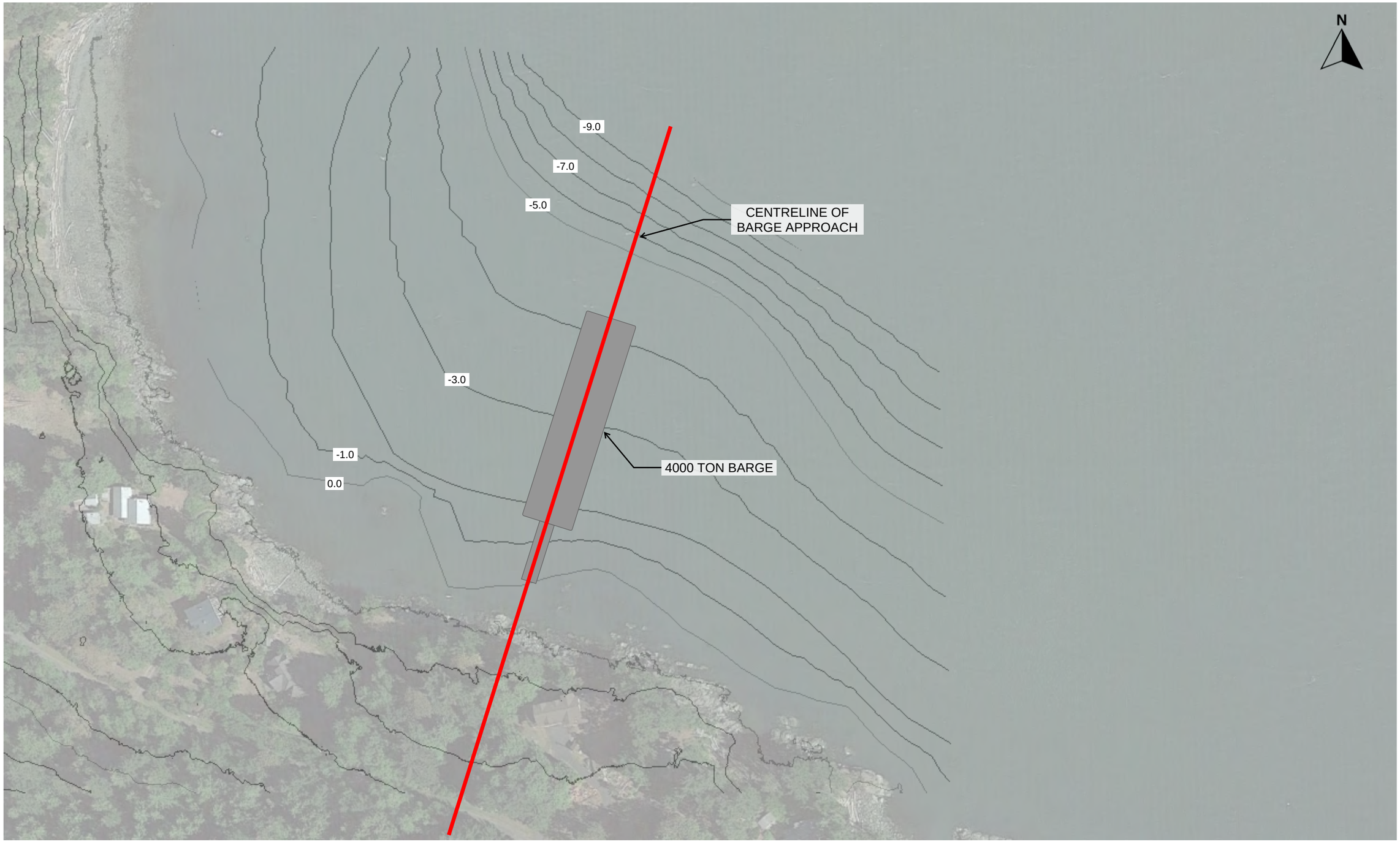
ENGINEER OF RECORD

DATE

DESIGNED HH DATE 2023–05–11
CHECKED MF DATE 2023–06–14
DRAWN JTH DATE 2023–06–16
SCALE AS NOTED
NEGATIVE No.

FILE No.	PROJECT No.	REG.	DRAWING No.
2110–00169–00	18102–0000	–	NNNN–101 PA

CANCEL PRINTS BEARING PREVIOUS LETTER



Rev	Date	Description	Drawn	Design	App'd
A	22/03/2023	ISSUED FOR PRELIMINARY DISCUSSION	HH	HH	MF

ORIGINAL DWG SIZE: ANSI B (11" x 17")

McElhanney

1211 RYAN ROAD
COURTENAY BC
V9N 3R6

SOUTH PENDER ISLAND
BOUNDARY PASSAGE BARGE LANDING

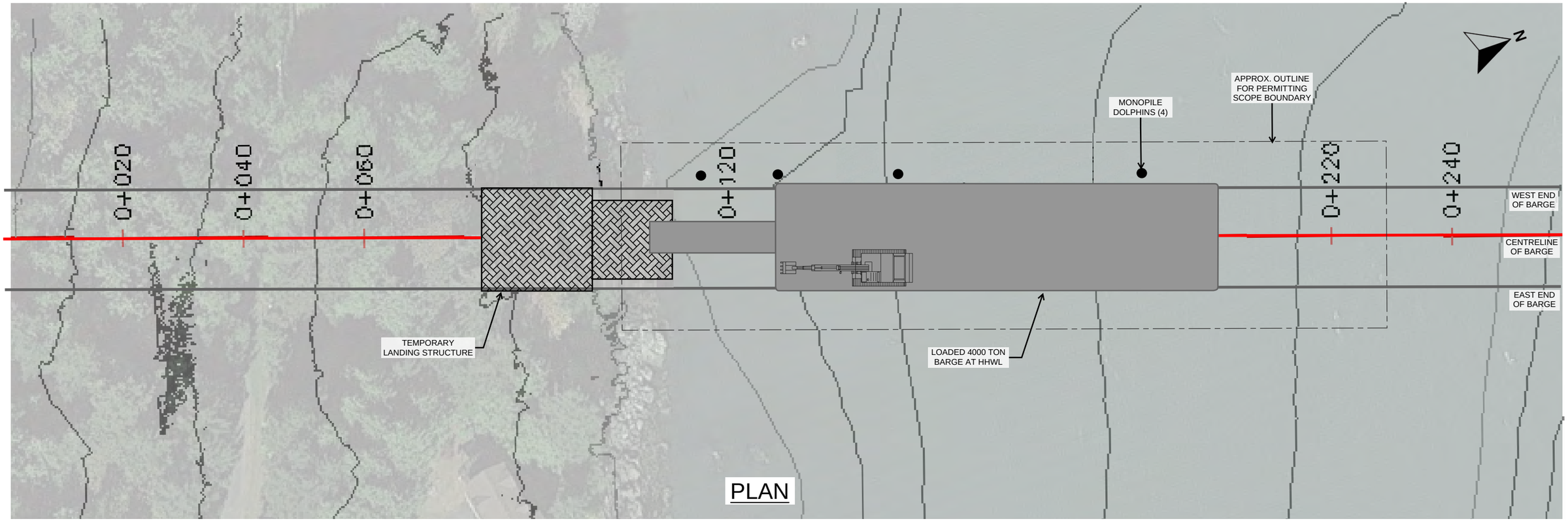
4000 TONNE BARGE PROJECT LOCATION

Drawing No.
001

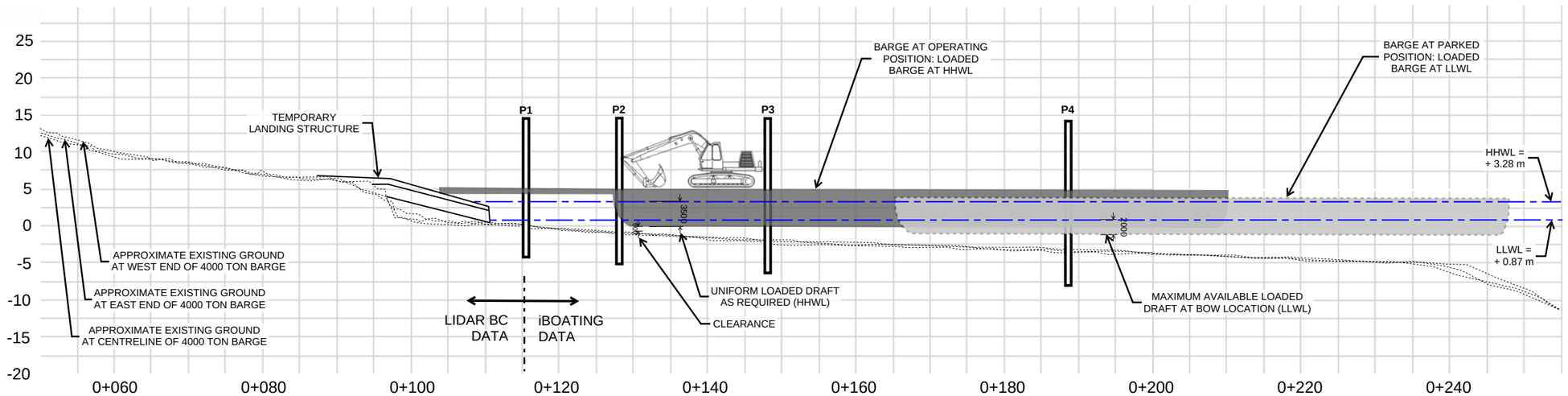
Project Number
2110-00169-00

Rev.
B

DESTROY ALL PRINTS BEARING PREVIOUS REVISION



PLAN



ELEVATION

4000 TON BARGE PHYSICAL CHARACTERISTICS

DEADWEIGHT TONNAGE (DWT)	4000 TONS	
LENGTH (MOULDED)	73.152 m	(240'-0")
BREADTH (MOULDED)	17.678 m	(58'-0")
DEPTH (MOULDED)	4.267 m	(14'-0")
DESIGN DRAFT (LOADED)	3.505 m	(11'-6")
DESIGN DRAFT (UNLOADED)	1.000 m	(3'-0")
RAMP LENGTH	20.830 m	(68'-4")

Rev	Date	Description	Drawn	Design	App'd
A	22/03/2023	ISSUED FOR PRELIMINARY DISCUSSION	HH	HH	MF

ORIGINAL DWG SIZE: ANSI B (11" x 17")

McElhanney
1211 RYAN ROAD
COURTENAY BC
V9N 3R6

SOUTH PENDER ISLAND
BOUNDARY PASSAGE BARGE LANDING

4000 TONNE BARGE PLAN AND ELEVATION

Drawing No. 002

Project Number 2110-00169-00

Rev. B

DESTROY ALL PRINTS BEARING PREVIOUS REVISION

Appendix B
Photo Log

Photo 1 Representative image of the backshore upland environment adjacent to the Project Area. Photo taken January 27, 2023, during previous assessments of the Project Area conducted by Ausenco. Photo is facing north.

Photo 2 Representative image of upland and upper intertidal conditions within the Project Area. Photo taken May 15, 2023, facing southeast.

Photo 3 Overview of the Project Area from upland cliffs. Photo taken January 27, 2023, during previous assessments of the Project Area conducted by Ausenco. Photo is facing northwest.

Photo 4 Intertidal rocky cliff face and cobble/sand pocket beach representative of the upper intertidal areas of the Project Area. Photo taken May 15, 2023, facing southwest.

Photo 5 Bul lkelp (*Nereocystis luetkeana*) as observed in that shallow subtidal with a drop camera. Photo captured from drop camera footage taken May 15, 2023.

Photo 6 Understory kelp and benthic macro algae observed via drop camera in the shallow subtidal. Photo captured from drop camera footage taken May 15, 2023.

Photo 7 Soft subtidal sediments covered in diatomaceous mating observed in the subtidal Project Area. Photo captured from drop camera footage taken May 15, 2023.

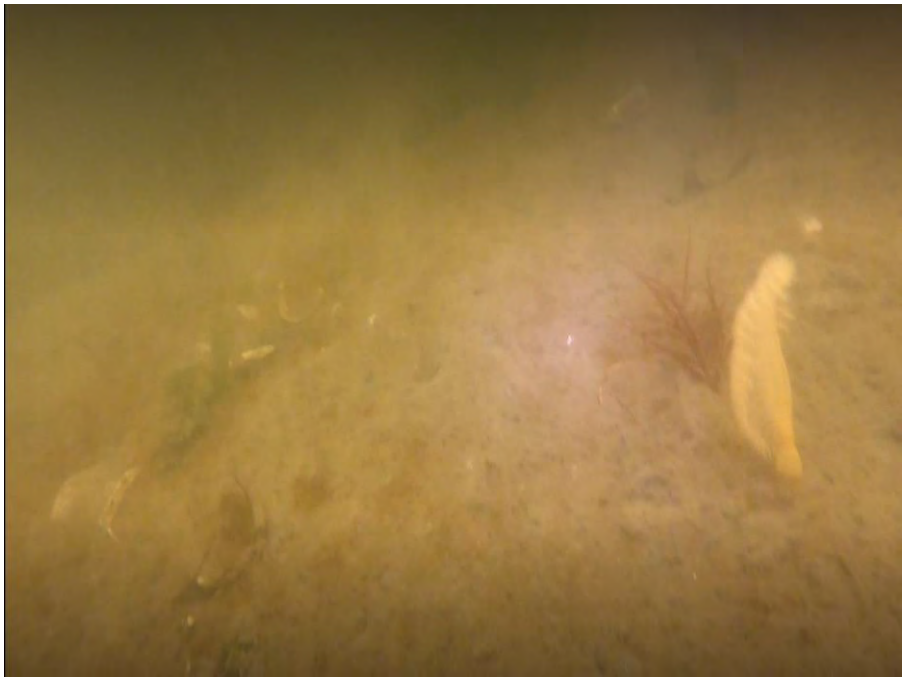


Photo 8 Gurney's sea pen (*Ptilosarcus gurney*) observed in the subtidal Project Area. Photo captured from drop camera footage taken May 15, 2023.

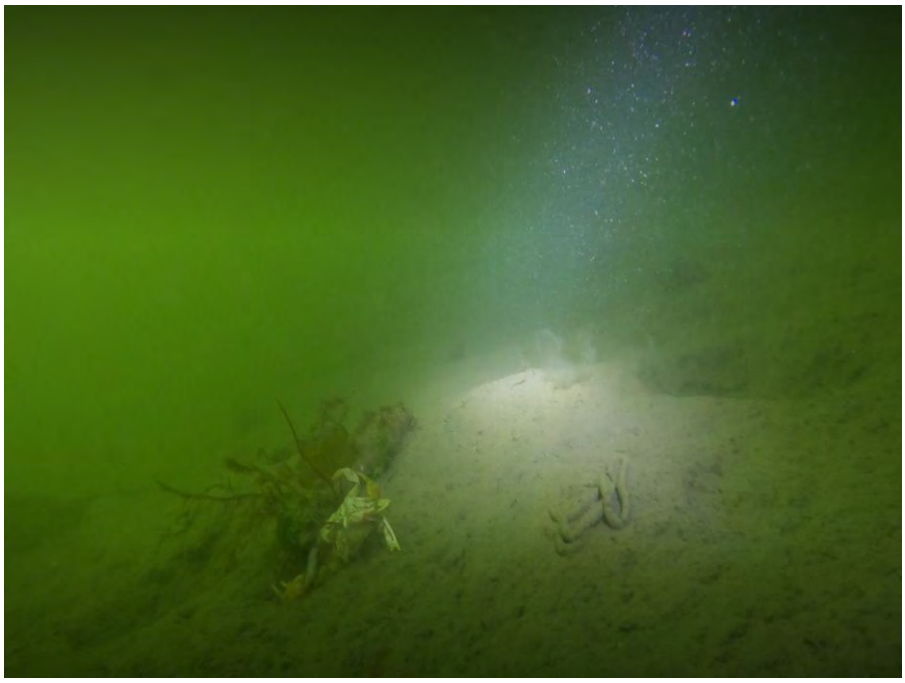


Photo 9 Dungeness crab (*Metcarcinus magister*) skeleton and sand pile inferring the presence of infauna in the shallow subtidal Project Area. Photo captured from drop camera footage taken May 15, 2023.

Appendix C

Species at Risk Assessment

Common Name	Scientific Name	BC List[1]	Global List	COSEWIC[2]	SARA[3]
grand fir / three-leaved foamflower	*Abies grandis / Tiarella trifoliata*	Red	G1	N/A	N/A
yellow sand-verbena	*Abronia latifolia*	Blue	G5 (1988)		
Northern Goshawk, laingi subspecies	*Accipiter gentilis laingi*	Red	G5T2 (2016)	T	1-T (2003)
Western Grebe	*Aechmophorus occidentalis*	Red	G5 (2016)	SC	1-SC (2017)
slimleaf onion	*Allium amplectens*	Blue	G4 (1988)		
Edwards' Beach Moth	*Anarta edwardsii*	Red	GNR	E	1-E (2011)
Wandering Salamander	*Aneides vagrans*	Blue	G4 (2005)	SC	1-SC (2018)
arbutus / hairy manzanita	*Arbutus menziesii / Arctostaphylos columbiana*	Red	G2	N/A	N/A
Great Blue Heron, fannini subspecies	*Ardea herodias fannini*	Blue	G5T4 (2016)	SC	1-SC (2010)
northern wormwood - red fescue / grey rock-moss	*Artemisia campestris - Festuca rubra / Racomitrium canescens*	Red	G1	N/A	N/A
seacoast bulrush Alkali Marsh	*Bolboschoenus maritimus var. paludosus Alkali Marsh*	Red	GNR	N/A	N/A
Marbled Murrelet	*Brachyramphus marmoratus*	Blue	G3 (2016)	T	1-T (2003)
Brant	*Branta bernicla*	Blue	G5 (2016)		
Moss' Elfin, mossii subspecies	*Callophrys mossii mossii*	Red	G4T4 (2001)		
contorted-pod evening-primrose	*Camissonia contorta*	Red	G5 (1988)	E	1-E (2007)
Lyngbye's sedge herbaceous vegetation	*Carex lyngbyei Herbaceous Vegetation*	Red	GNR	N/A	N/A
foothill sedge	*Carex tumulicola*	Yellow	G4 (1985)	E	1-E (2010)
Common Sharp-tailed Snake	*Contia tenuis*	Red	G5 (2016)	E/T	1-E (2003)
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Blue	G4 (2016)		
Erect Pigmyweed	*Crassula connata*	Blue	G5 (1993)		
tufted hairgrass - meadow barley	*Deschampsia cespitosa ssp. beringensis - Hordeum brachyantherum*	Red	G3	N/A	N/A
coastal wood fern	*Dryopteris arguta*	Blue	G5 (2011)	SC	1-SC (2003)
banded cord-moss	*Entosthodon fascicularis*	Blue	G4G5 (2001)	SC	1-SC (2006)
brook spike-primrose	*Epilobium torreyi*	Red	G5 (1988)	E	1-E (2007)
Large Marble, insulanus subspecies	*Euchloe ausonides insulanus*	Red	G5T1 (2010)	XT	1-XT (2003)
Steller Sea Lion	*Eumetopias jubatus*	Blue	G3 (2016)	SC	1-SC (2005)

Common Name	Scientific Name	BC List[1]	Global List	COSEWIC[2]	SARA[3]
Edith's Checkerspot, taylori subspecies	*Euphydryas editha taylori*	Red	G5T1 (2008)	E	1-E (2003)
Dun Skipper	*Euphyes vestris*	Blue	G5 (2020)	T	1-T (2003)
Peregrine Falcon	*Falco peregrinus*	No Status	G4 (2016)	SC	1-SC
Gyrfalcon	*Falco rusticolus*	Blue	G5 (2016)	NAR	
Tufted Puffin	*Fratercula cirrhata*	Blue	G5 (2016)		
American glehnia	*Glehnia littoralis ssp. leiocarpa*	Blue	G5T5 (1991)		
Northern Abalone	*Haliotis kamtschatkana*	Red	G3G4 (2010)	E	1-E
Boisduval's Blue, blackmorei subspecies	*Icaricia icarioides blackmorei*	Blue	G5T3 (2006)		
California Gull	*Larus californicus*	Red	G5 (2016)		
silky beach pea	*Lathyrus littoralis*	Red	G3G4 (2013)	T	1-T (2023)
dune wildrye - beach pea	*Leymus mollis ssp. mollis - Lathyrus japonicus*	Red	GNR	N/A	N/A
Macoun's meadow-foam	*Limnanthes macounii*	Red	G5T1 (2010)	XT	1-XT (2003)
coast manroot	*Marah oregana*	Red	G5 (1990)	E	
Western Screech-Owl	*Megascops kennicottii*	No Status	G4G5 (2016)	T	1-T
Black Scoter	*Melanitta americana*	Blue	G5 (2016)		
Surf Scoter	*Melanitta perspicillata*	Blue	G5 (2016)		
Northern Elephant Seal	*Mirounga angustirostris*	Red	G5 (2016)	NAR	
Ermine, anguinae subspecies	*Mustela richardsonii anguinae*	Blue	G5T3 (2016)		
Little Brown Myotis	*Myotis lucifugus*	Blue	G3G4 (2021)	E	1-E (2014)
sweet gale / Sitka sedge	*Myrica gale / Carex sitchensis*	Blue	G3	N/A	N/A
Double-crested Cormorant	*Nannopterum auritum*	Blue	G5 (2016)	NAR	
Olympia Oyster	*Ostrea lurida*	Blue	GNR	SC	1-SC (2003)
Band-tailed Pigeon	*Patagioenas fasciata*	Blue	G4 (2016)	SC	1-SC (2011)
Red-necked Phalarope	*Phalaropus lobatus*	Blue	G4G5 (2016)	SC	1-SC (2019)
fragrant popcornflower	*Plagiobothrys figuratus ssp. figuratus*	Red	G4T4 (1996)	E	1-E (2010)
slender popcornflower	*Plagiobothrys tenellus*	Red	G4G5 (1988)	T	1-T (2011)
Douglas-fir / dull Oregon-grape	*Pseudotsuga menziesii / Mahonia nervosa*	Red	G2	N/A	N/A

Common Name	Scientific Name	BC List[1]	Global List	COSEWIC[2]	SARA[3]
Douglas-fir / Alaska oniongrass	*Pseudotsuga menziesii / Melica subulata*	Red	G1	N/A	N/A
Cassin's Auklet	*Ptychoramphus aleuticus*	Red	G4 (2016)	SC	1-SC (2019)
Northern Red-legged Frog	*Rana aurora*	Blue	G4	S3	1
California buttercup	*Ranunculus californicus*	Red	G5 (1987)	E	1-E (2011)
American glasswort - sea-milkwort	*Sarcocornia pacifica - Lysimachia maritima*	Red	G3G4	N/A	N/A
batwing vinyl	*Scytinium platynum*	Yellow	G3G4 (2013)	E	1-E (2017)
peacock vinyl	*Scytinium polycarpum*	Yellow	GNR (2000)	SC	1-SC
Wallace's selaginella / reindeer lichens	*Selaginella wallacei / Cladina spp.*	Blue	GNR	N/A	N/A
Henderson's checker-mallow	*Sidalcea hendersonii*	Blue	G3 (2016)		
Zerene Fritillary, bremnerii subspecies	*Speyeria zerene bremnerii*	Red	G5T3T4 (1998)		
western redcedar / vanilla-leaf	*Thuja plicata / Achlys triphylla*	Red	G1	N/A	N/A
Western Redcedar / Osoberry	*Thuja plicata / Oemleria cerasiformis*	Red	G1	N/A	N/A
western redcedar - Douglas-fir / Oregon beaked-moss	*Thuja plicata - Pseudotsuga menziesii / Kindbergia oregana*	Red	GNR	N/A	N/A
western redcedar / common snowberry	*Thuja plicata / Symphoricarpos albus*	Red	GNR	N/A	N/A
Macrae's clover	*Trifolium dichotomum*	Red	G4? (2002)		
Wandering Tattler	*Tringa incana*	Blue	G4G5 (2016)		
Common Murre	*Uria aalge*	Red	G5 (2016)		
Brandt's Cormorant	*Urile penicillatus*	Red	G5 (2016)		
Muhlenberg's centaury	*Zeltnera muehlenbergii*	Red	G5? (1996)	E	1-E (2010)

Notes:

1 BC List: Red = Species that are extirpated, endangered, or threatened; Blue = Species of special concern; Yellow = species and ecological communities that are secure.

2 COSEWIC listing: E = Endangered, T = Threatened, SC = Special Concern.

3 SARA listing: E = Endangered, T = Threatened, SC = Special Concern.