TRANSMOUNTAIN

Trans Mountain Expansion Project

VersaCold Waterlot 1 Site: Marine Habitat Assessment for Construction and Operation of Temporary Infrastructure (Access Trestle and Trestle) Memo

KMC Document # 01-13283-GG-0000-EV-MEM-0004 R0

KINDER MORGAN CANADA INC.

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Stantec

Memo

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KMC Doc No.:	**01-13283-GG-0000-EV-MEM-0004 R0**	Date:	July 24, 2017

Reference: **VersaCold Waterlot 1 Site: Marine Habitat Assessment for Construction and Operation of Temporary Infrastructure (Access Trestle and Trestle)**

PROJECT OVERVIEW

Trans Mountain Pipeline ULC (Trans Mountain) proposes to construct and operate a temporary trestle and an access trestle at the former VersaCold Waterlot 1 site (Waterlot 1; the site), on the southern shoreline of Burrard Inlet, British Columbia (BC), within the Inner Harbour. This temporary in-water infrastructure would serve as a terminal for loading barges with construction materials and equipment for transport to the Westridge Marine Terminal (WMT) in Burnaby, British Columbia, which will be expanded as part of the Trans Mountain Expansion Project (TMEP). Water taxis would also use the infrastructure at Waterlot 1 to ferry construction crews to the WMT. Installation of the temporary in-water infrastructure at Waterlot 1 is anticipated for late 2017, with removal in early 2020 after approximately 26 months.

Trans Mountain proposes to submit a Project Permit Application (the Application) to the Vancouver Fraser Port Authority (VFPA) for the proposed infrastructure at the Waterlot 1 site. This memorandum supports Trans Mountain's VFPA Application by providing a marine habitat assessment for construction and operation of the temporary infrastructure. The Waterlot 1 Application is separate to an existing Project Permit Application submitted to the VFPA by Trans Mountain in July 2017, for a small temporary flexi-float dock and access ramp at a nearby site (Waterlot 2).

PROJECT DESCRIPTION

Construction of the temporary infrastructure at Waterlot 1 is anticipated to occur in late 2017. In-water works will be restricted to Fisheries and Oceans Canada's (DFO's) least-risk work window for Burrard Inlet (August 16–February 28) and are expected to include the following activities:

- Installation of five 3-ft (0.914 m) diameter mooring piles (0.66 m^2 per pile) in the shallow subtidal zone by use of impact hammer
- Installation of twenty-eight 3-ft diameter piles, and fourteen 2-ft (0.610 m) diameter batter piles (0.29 m^2 per pile), in the shallow subtidal zone by use of impact hammer, necessary to support the temporary trestle
- Installation of eight 2-ft diameter piles and three 2-ft diameter batter piles in the shallow subtidal by use of impact hammer, necessary to support the access trestle
- A small (mobile flexi-float) boat dock will be secured adjacent to the access trestle

Collectively, these works and activities are expected to result in the following impacts to marine habitat:

- Mooring piles will cover a total subtidal area of 3.3 m^2 (0.66 m^2 per pile)
- Combined footprint of the piles to support the temporary trestle will be 22.6 m^2, and the footprint of the piles supporting the access trestle will be 3.2 m^2
- Above-water platform of the access trestle will cover approximately 372 m^2, of which 42 m^2 overlaps the intertidal zone, and 330 m^2 overlaps the subtidal zone
- Above-water platform of the temporary trestle will span 803 m^2, and the small flexi-float dock will cover an area of 93 m^2; both these areas will lie above the subtidal zone

No clearing of marine riparian vegetation is anticipated for the installation or operation of the temporary infrastructure at Waterlot 1. The access trestle will include a free-span section over the intertidal that will be supported by two additional 2-ft diameter piles installed above the higher high water mark.

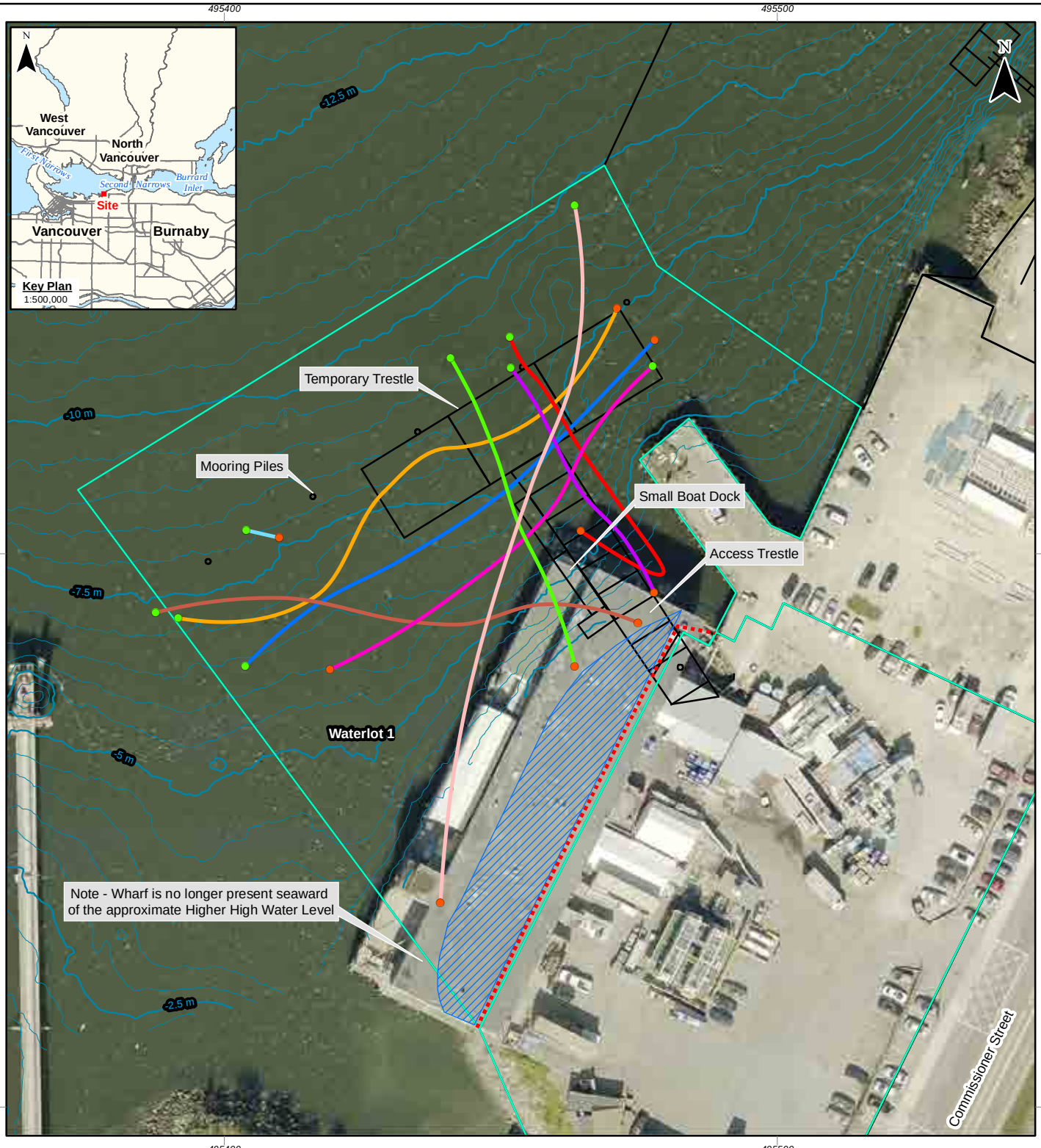
Operational activities at the site will involve the use of the temporary trestle and mooring piles for loading barges with construction materials and equipment for transport to the WMT. The small flexi-float dock will be used by water taxis to ferry construction crews to the WMT. It is anticipated that the infrastructure at Waterlot 1 will be used for the duration of construction at the WMT, which is planned to occur from late 2017 to early 2020. Upon completion of operational use in 2020, the temporary in-water infrastructure will be removed from Waterlot 1.

DESCRIPTION OF EXISTING ENVIRONMENT

METHODS

A literature review of available scientific literature and geospatial records was conducted to characterize existing intertidal and subtidal conditions, species (including marine mammals) and habitats, and ecologically important areas within the Inner Harbour of Burrard Inlet. This data was used to describe the environment surrounding Waterlot 1.

Desktop analysis of existing literature and geospatial records was supplemented with a shoreline reconnaissance program. This program included an intertidal habitat survey and an underwater video survey of subtidal habitat within Waterlot 1 on June 21, 2017. The areas of survey included those within and surrounding the footprint of the proposed temporary infrastructure (Figure 1). The objective of the surveys and the literature review was to document existing environmental conditions to support an assessment of potential effects on species and habitats resulting from the construction and operation of the proposed temporary infrastructure.



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SCALE: 1:1,003

0 10 20 30 40 m

ALL LOCATIONS APPROXIMATE

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MAP NUMBER		PAGE
10494_VERSACOLD_FIG 01		SHEET 1 OF 1
DATE	REF.	REVISION
Jul 2017	7894	0
SCALE	PAGE SIZE	DISCIPLINE
1:1,003	8.5 x11	WB
DRAWN	CHECKED	DESIGN
SS	WB	WB

- Major Bathymetry (2.5 m Interval)
- Minor Bathymetry (0.5 m Interval)
- Project Feature
- Approximate Higher High Water Level
- Waterlot 1
- Area of Intertidal Reconnaissance
- Start of Transect
- End of Transect

Transects

- W1_T1
- W1_T2
- W1_T3
- W1_T4
- W1_T5
- W1_T6
- W1_T7
- W1_T8
- W1_TestTow

Projection: NAD 83 UTM Zone 10N; Bathymetry: CRA Canada Syveys Inc., 05/26/2017; Versacold Property: Revision 0

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

TRANS MOUNTAIN

FIGURE: 1

MARINE HABITAT ASSESSMENT FOR TEMPORARY INFRASTRUCTURE AT VERSACOLD WATERLOT 1

SUBTIDAL VIDEO TRANSECTS AND INTERTIDAL RECONNAISSANCE AREA

TRANS MOUNTAIN EXPANSION PROJECT

Reference: VersaCold Waterlot 1 Site: Marine Habitat Assessment for Construction and Operation of Temporary Infrastructure (Access Trestle and Trestle)

Methods used to complete the reconnaissance program and analyze resulting data were selected based on environmental and safety considerations. The intertidal habitat survey was conducted from boat due to the steepness of the boulder and rip-rap shorelines. The subtidal survey involved dropping a weighted GoPro camera with light fixture from the boat to record video of benthic habitat and species along eight transects (Figure 1). The video was reviewed real-time using an onboard monitor, and supplemented by a detailed desk-based video analysis to characterize habitats and record species presence. Due to cross-shore currents, tows along the subtidal transects were only possible for transects that were perpendicular to the shore. Following a methodology described by Hitchin et al. (2015), where currents lifted the camera off from the seafloor, impeding visibility of the benthic habitat, regular point drops of the camera were favoured rather than towing along the transects.

PHYSICAL AND OCEANOGRAPHIC SETTING

The physical and oceanographic characteristics of the Inner Harbour are largely driven by surrounding topography and hydrology. The Inner Harbour lies between First and Second Narrows and has a maximum depth of approximately -65 m chart datum (CD) (Stacey et al. 2002). Oceanographic conditions of Burrard Inlet, summarized below, are reported by Nijman 1990. First and Second Narrows experience stronger tidal currents (up to approximately 6 knots) than elsewhere in Burrard Inlet (typically between 0.5 and 2 knots), due to constriction of water movement. The main sources of freshwater input into Burrard Inlet are from two rivers, Seymour River (monthly mean discharges of 3.8-24.9 m^3/s) and Capilano River (monthly mean discharges of 5.7-42.8 m^3/s), which flow into the Central Harbour and First Narrows, respectively. Surface water salinity in Burrard Inlet typically ranges from 20–25 parts per thousand (ppt) during the winter to less than 10 ppt during the summer; however, in deeper waters, salinity remains relatively constant around 29–30 ppt. Deeper water temperatures in Burrard Inlet tend to show less seasonal fluctuation than in shallower waters; however, estuarine and tidal flow at First and Second Narrows can increase levels of vertical mixing within the water column in these areas.

MARINE FISHERIES

Fisheries exist in Burrard Inlet for the five Pacific salmon species (*Oncorhynchus* spp.: Chinook, coho, sockeye, pink and chum), kelp greenling (*Hexagrammos decagrammus*), Pacific herring (*Clupea pallasii*), anchovy (family Engraulidae), flatfish (family Pleuronectidae), red rock crab (*Cancer productus*), Dungeness crab (*Metacarcinus magister*), shrimp and prawns (family Pandalidae), and bivalves (class Bivalvia). Of these taxa, the main groups harvested by commercial fisheries in Burrard Inlet are crab, prawn, and shrimp. Burrard Inlet is closed to bivalve shellfish harvesting due to sanitary contamination concerns (DFO 2016a).

In addition to crustacean fisheries, several other species are harvested in Burrard Inlet. Pacific herring are an important resource for Aboriginal groups in British Columbia, and are used coast-wide for food, social, and ceremonial purposes (DFO 2013). Pacific herring were historically abundant in Burrard Inlet; however, the fishery suffered collapses in 1960, 1970, 2005, and 2007 (Schweigert et al. 2010; Pierson 2011). Lynn Creek and Seymour River are salmon-bearing streams that flow into the Central and Inner Harbours of Burrard Inlet, 2.05 km and 3.1 km northwest of Waterlot 1, respectively (Figure 2). Both watercourses are used by coho, sockeye, pink, and chum salmon. These salmon species are targeted by commercial, recreational and Aboriginal fishers in Burrard Inlet. The Inner Harbour lies within DFO area 28-10, where shore fishing of pink and coho salmon (hatchery) is permitted (among other species). All hook-and-line fishing for groundfish (lingcod and rockfish) was banned in Burrard Inlet in the summer of 2007 due to low abundance of lingcod (Kaufman and Marliave 2010). The groundfish fishery has remained closed in Burrard Inlet to all gear types, including catch-and-release, since 2013 (DFO 2016b).

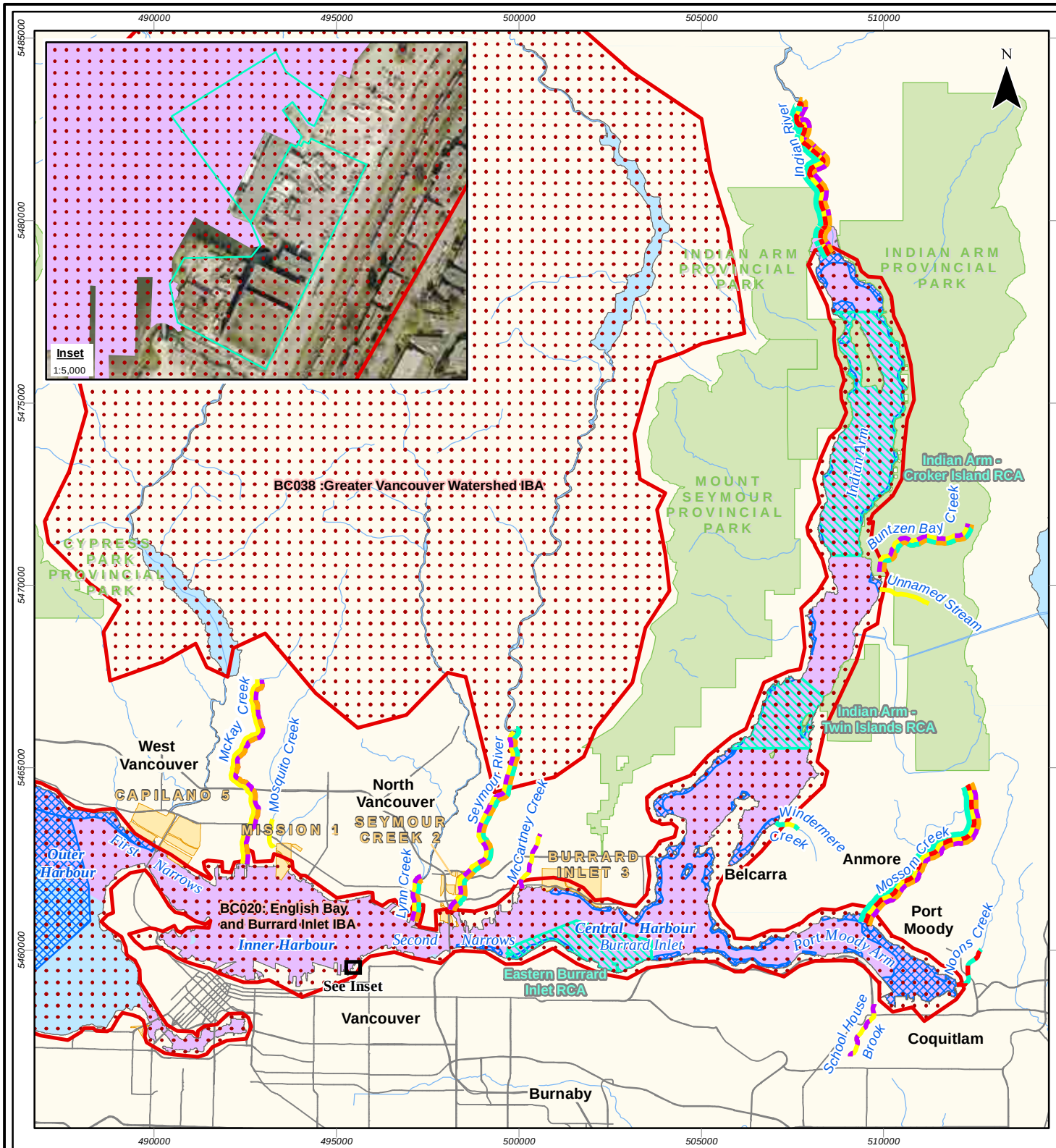
Waterlot 1 is within a DFO Important Area (IA) for Pacific salmon, which spans Burrard Inlet. Several other notable management areas exist near (but not within) Waterlot 1. DFO has identified IAs for Dungeness crab west of Second Narrows and east of First Narrows; however, no IAs for Dungeness crab are present within the Inner Harbour (Figure 2) (Jamieson and Levesque 2012a, b). Furthermore, Rockfish Conservations Areas (RCAs) are present in three locations west of Second Narrows (Eastern Burrard Inlet RCA, Indian Arm – Twin Islands RCA, and Indian Arm – Croker Island RCA) (Figure 2).

MARINE MAMMALS

Marine mammals that are listed on Schedule 1 of the *Species at Risk Act* (SARA) and occasionally sighted in Burrard Inlet, include: harbour porpoise (*Phocoena phocoena*), southern resident and transient killer whale (*Orcinus orca*), and Steller sea lion (*Eumetopias jubatus monteriensis*) (BC Cetacean Sightings Network 2013; Coastal Ocean Research Institute 2016; Tsleil-Waututh Nation 2016). Harbour seal (*Phoca vitulina*), which are not listed under SARA, are the most abundant and frequently sighted marine mammal species in Burrard Inlet, and are observed year-round (Tsleil-Waututh Nation 2016; DFO 2010). One harbour seal was observed temporarily within Waterlot 1 during the intertidal reconnaissance survey.

MARINE BIRDS

Waterlot 1 is located within the English Bay and Burrard Inlet Important Bird Area, which is globally important for western grebe (*Aechmophorus occidentalis*), Barrow's goldeneye (*Bucephala islandica*), and surf scoter (*Melanitta perspicillata*), and nationally important for the great blue heron (*Ardea Herodias*) (Figure 2). A large colony of nesting pelagic and double-crested cormorants lies approximately 2.7 km west of Waterlot 1, on Second Narrows Bridge (IBA Canada 2017). Several species were also observed within or flying over Waterlot 1 during the reconnaissance survey: bald eagle (*Haliaeetus leucocephalus*), pelagic cormorant (*Phalacrocorax pelagicus*), and herring gull (*Larus argentatus smithsonianus*). One of the herring gulls was seen to feed on an ochre seastar in the intertidal at Waterlot 1.



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SCALE: 1:150,000

0 1 2 3 4 5 km

ALL LOCATIONS APPROXIMATE

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MAP NUMBER		PAGE
10494_VERSACOLD_FIG 02		SHEET 1 OF 1
DATE	REF.	REVISION
Jul 2017	7894	0
SCALE	PAGE SIZE	DISCIPLINE
1:5,000	8.5 x11	WB
DRAWN	CHECKED	DESIGN
SS	WB	WB

- Highway
- Watercourse
- Waterbody
- Provincial Park
- Indian Reserve
- Land of British Columbia
- Fisheries and Oceans Canada Important Areas for Dungeness Crab
- Rockfish Conservation Areas (RCA)
- Fisheries and Oceans Canada Important Areas for Pacific Salmon
- Important Bird Area (IBA)

Salmon Species

- Coho
- Chinook
- Sockeye
- Chum
- Pink

- Waterlot 1

Projection: NAD 83 UTM Zone 10N; Provincial Park: BC MFLNRO; Indian Reserve: Geographic Data Discovery Service; Important Areas for Pacific Salmon: DFO; Salmon-bearing Streams: BC MOE; Rockfish Conservation Areas: DFO; Important Areas for Dungeness Crab: DFO; IBA, Important Bird Areas Canada.

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TRANS MOUNTAIN

FIGURE: 2

MARINE HABITAT ASSESSMENT FOR TEMPORARY INFRASTRUCTURE AT VERSACOLD WATERLOT 1

KEY ENVIRONMENTAL RESOURCE AREAS IN BURRARD INLET

TRANS MOUNTAIN EXPANSION PROJECT

Reference: VersaCold Waterlot 1 Site: Marine Habitat Assessment for Construction and Operation of Temporary Infrastructure (Access Trestle and Trestle)

INTERTIDAL HABITAT

The shoreline at, and surrounding, the landfall point of the planned access trestle in Waterlot 1 has recently (within the last two years) been modified through the removal of a wharf and installation of a crushed rock foreshore (Photo 1). Artificial habitat is the predominant shoreline type within Waterlot 1, and throughout the surrounding Inner Harbour (Province of British Columbia 2017). Other shoreline types (sand flat, rock cliff and tidal marsh or lagoon) exist east of the Inner Harbour by First Narrows and east of the Second Narrows Bridge. Within Waterlot 1, intertidal rocky substrate transitions from cobble, in the upper intertidal, to small boulders in the lower intertidal.

The habitat in the upper intertidal zone at Waterlot 1 is characterized as steep cobble, with a sparse coverage of rockweed (*Fucus gardneri*; approximately 20% by area) and sea lettuce (*Ulva* spp.; approximately 30% by area). The coverage of cobbles with sea lettuce increases through the mid-intertidal (to approximately 90% coverage). Few red algae were present with sparsely distributed patches of Turkish washcloth (*Mastocarpus papillatus*) on cobbles in the mid intertidal zone, and occasional splendid iridescent seaweed (*Mazzaella splendens*) identified on cobbles and boulders in the lower intertidal zone. Sugar kelp (*Saccharina latissima*) is the predominant algal species attached to lower intertidal boulders (coverage approximately 40%) (Photo 1 and Photo 2). These algal compositions are typical of pioneer communities and differ from the more ecologically advanced, climax communities in surrounding areas (such as in Waterlot 2, which features a developed band of kelps including sugar kelp, bull kelp and Japanese wireweed [*Sargassum muticum*]). This difference is unsurprising given recent modifications of the foreshore in Waterlot 1, and an associated short period for colonization by algae since that activity.

No invertebrates or fish were seen in the intertidal zone from the boat during the survey; however, based on the presence of dense colonies of mussels (*Mytilus* sp.) and acorn barnacles (*Balanus glandula*) on piles of a wharf immediately west of Waterlot 1, these species likely also inhabit Waterlot 1, albeit at low densities. Based on known habitat preferences by local species and subtidal survey observations, juvenile Pacific salmon, various life stages of surfperches (*Embiotocidae*), and red rock crab are expected to use vegetated intertidal rocky habitat at the site for feeding and refuge. Vegetation in the intertidal is also expected to provide some nutrient enrichment to marine organisms that use soft-sediment habitats in the shallow subtidal at the site.

Reference: **VersaCold Waterlot 1 Site: Marine Habitat Assessment for Construction and Operation of Temporary Infrastructure (Access Trestle and Trestle)**

Photo 1 **Rockweed, Sea Lettuce and Sugar Kelp Attached to Cobbles and Boulders in the Intertidal at Waterlot 1**

Photo 2 **Rockweed, Sea Lettuce and Sugar Kelp Attached to Cobbles and Boulders in the Intertidal at Waterlot 1**

SUBTIDAL HABITAT

The shallow subtidal zone of Waterlot 1 is predominantly muddy and flat—similar to other areas of Burrard Inlet (BC Marine Conservation Analysis 2017). A narrow strip of the shallow subtidal (to approximately -2 m CD) is formed by boulders, which then transitions to mud with shell with scattered small cobbles, pebbles and anthropogenic debris in deeper waters (which were surveyed to a depth approximately -9.7 m CD) (Photo 3). Anthropogenic debris was observed during the subtidal survey, and was ubiquitous throughout the survey area (Appendix A, Photos A - 1 to A - 3; Appendix B, Table B-1). This debris included wood (common along eight of the nine transects surveyed, T6 being the exception), metal (observed frequently along each transect, except along T6 and T7), glass bottles (encountered along transects T3, T4, T7 and T8), pile coils (present mid-transect T8), car tires (two were observed near the start of transect T2, and one near the start of transect T7), concrete (observed mid-transect along T3), and netting (near the end of transect T8).

Photo 3 **Typical Mud, Shell and Small Cobble Substrate Encountered During the Subtidal Survey in Waterlot 1 (Near Start of Transect T2)**

Sugar kelp was the predominant kelp species present on boulders and cobbles in the shallow subtidal to approximately -5 m CD (up to approximately 60% coverage by area), with some sea lettuce also present. Several stipes of bull kelp (*Nereocystis luetkeana*) were identified attached to boulders and cobbles in the shallow subtidal, but this species did not form continuous beds in the area (Appendix A, Photos A-9 and A-10). No eelgrass was encountered during the subtidal survey within Waterlot 1, nor in a subtidal survey of Waterlot 2 adjacent to (and northwest of) the site.

There were 105 individual benthic invertebrates identified during the subtidal survey at Waterlot 1, representing three phyla (*Cnidaria, Arthropoda*, and *Enchinodermata*), and nine species (Appendix A, Photos A-3 to A-6, and Appendix B, Table B-2). Painted anemone (*Urticina crassicornis*, n=39) and giant plumose anemone (*Metridium farcimen*, n = 38) were the most abundant benthic invertebrates encountered during the subtidal survey, and were observed throughout the subtidal survey area attached to cobbles and anthropogenic debris. Dungeness crab (n = 6) were predominantly (with one exception) found deeper than -7 m CD in areas of mud with cobble or

anthropogenic debris, whereas two red rock crab were observed shallower in the subtidal (at -4 m and -6 m CD). Ten mottled stars (*Evasterias troschelii*), five ochre sea stars, and one leather star (*Dermasterias imbricata*) were identified across a range of depths and substrates in the subtidal. Two orange sea pen (*Ptilosarcus gurneyi*) were observed in mud substrate near the start of transect T7, and the southwestern boundary of Waterlot 1, at a depth of approximately -7 m CD. Although no shrimp were encountered during the survey at Waterlot 1, based on subtidal surveys of similar local habitats in Burrard Inlet (Stantec Consulting Ltd. 2013), it is anticipated that subtidal muddy habitat at the site is also used by Pandalid shrimp.

Three finfish were encountered during the subtidal survey in Waterlot 1; all were recorded along transect T8 (Appendix A, Photo A-7 to Photo A-9). One Pacific spiny dogfish (*Squalus suckleyi*) was observed swimming over mud and wooden debris at the start of transect T8 at a depth of approximately -9.5 m CD. Near the start of transect T8, one flatfish was observed in muddy substrate at approximately -7.5 m CD. A single kelp perch (*Brachyistius frenatus*) was observed among boulders and dense stands of sugar kelp (approximately 60 % coverage by area) near the end of transect T8, at a depth of approximately -1 m CD.

POTENTIAL EFFECTS

Based on understanding of the planned works, and the existing environmental conditions, potential effects to species and habitats resulting from the construction and operation of the temporary infrastructure in Waterlot 1 are:

- Temporary loss (for approximately 26 months between August/September 2017 and December 2020) of approximately 29.1 m^2 of predominantly soft-sediment substrate in the shallow subtidal due to the presence of five mooring piles and 54 piles used to support the temporary trestle and access trestle
- Potential mortality of a small number of infaunal, sessile or slow-moving benthic invertebrates (e.g., painted anemone, giant plumose anemone, sea stars, orange sea pen), relative to local abundance of the same species throughout Burrard Inlet, due to crushing during pile installation. It is anticipated that more mobile species of invertebrate (e.g., Dungeness crab, shrimp), and demersal finfish (e.g., flatfish) will actively avoid sites of pile installation, moving away from the site during the setup process prior to impact-hammer pile driving
- Potential behavioural disruption of fish, or injury or death of fish, due to barotrauma injuries, caused by underwater noise generated by impact-hammer pile driving
- Potential disturbance to marine mammals that may be present in Burrard Inlet through underwater noise generated by impact-hammer pile driving, and operation of vessels
- Partial shading (for a period of approximately 26 months) of a small area of vegetated intertidal and shallow subtidal rocky habitat under the footprint of the access trestle, and small flexi-float dock
- Potential increase in mortality risk for flying marine birds that may be disoriented by deck lighting and fly into hard surfaces on the water and along local shorelines

In addition to the potential effects listed above, it is possible that operation of vessels may result in the accidental strike of marine mammals, resulting in their injury or mortality.

MITIGATION MEASURES

The following key mitigation measures will be implemented to avoid or reduce potential adverse effects to species and habitats resulting from in- and near-water construction activities at Waterlot 1 and operation of the temporary infrastructure.

- Mooring piles and piles to support the temporary trestle and access platform will be installed during the DFO least-risk work window for Burrard Inlet (August 16–February 28).
- A bubble curtain will be installed around piles during impact-hammer pile driving.
- Underwater noise monitoring will be conducted during impact-hammer pile driving to verify that pressure levels do not exceed 30 kPa (fish injury threshold; BC Marine and Pile Driving Contractors Association 2003) outside of the bubble curtain.
- A marine mammal monitor will be onsite to monitor marine mammal exclusion areas during impact-hammer pile driving: 150 m radius around piles for harbour seals; 1,000 m initial radius around piles for cetaceans and marine mammal species at risk, adjusted to meet the 160 dB (marine mammal behavioural disturbance threshold; National Oceanic and Atmospheric Administration [NOAA] n.d.) based on underwater noise monitoring conducted during impact-hammer pile driving. Further details of this measure are provided in the Environmental Monitoring section below.
- Impact-hammer pile driving will be restricted to daylight hours to facilitate effective visual monitoring of the 150-m harbor-seal zone and 1,000 m cetacean and marine mammal species at risk zone.
- Construction crews will maintain a 100-m separation distance between the marine environment and fuel or hazardous material storage sites, and oil change and refuelling areas, unless otherwise approved by an environmental inspector.
- During periods of bird migration and/or during extreme weather events, bird strike warnings will be issued to marine construction vessels with a request to reduce deck lighting.
- Project-related vessels will travel at slow speeds (less than 10 knots) and avoid rapid acceleration to limit the intensity of acoustic emissions (both above and below the water surface) and to decrease the likelihood of striking marine mammals, infrastructure or other vessels.
- Appropriate erosion and sediment control measures (e.g., coir logs, erosion control matting, sediment fence and crushed gravel) will be implemented in accordance with a site-specific erosion and sediment control plan during near-water construction activities to limit sediment runoff into the marine environment.

The mitigation measures outlined above, along with other relevant mitigation measures, as appropriate, will be detailed in the TMEP's Temporary Construction Lands and Facilities Environmental Protection Plan, as amended and filed in compliance with the National Energy Board Condition 78 Facilities Environmental Protection Plan.

RESIDUAL EFFECTS

Following the implementation of mitigation measures, predicted residual effects to species and habitats resulting from in- and near-water construction activities at Waterlot 1, and operation of the temporary infrastructure are expected to include:

- The temporary loss of 29.1 m^2 of shallow subtidal soft-sediment habitat for a period of up to 26 months due to the presence of mooring piles and piles to support the temporary infrastructure. Similar subtidal soft-sediment habitat is abundant and widely available throughout the Inner Harbour of Burrard Inlet; therefore, species dependence on the affected habitat is considered low. Following removal of the piles, benthic invertebrates are expected to recolonize affected areas of subtidal soft-sediment and restore the habitat community to pre-construction conditions within several months (e.g., within 6–8 months; Newell et al. 1998). Due to the small geographic extent, relative to large areas of similar habitat nearby and the temporary nature of this effect, the loss of 29.1 m^2 of subtidal habitat is not expected to affect the ability of fish and invertebrates to complete one or more of their life processes. Therefore, this effect is not expected to result in a localized effect to finfish or invertebrate populations.
- Mortality of a small number of infaunal or sessile/slow moving species (e.g., painted anemone, giant plumose anemone, sea stars, orange sea pen), relative to local abundance of the same species throughout Burrard Inlet, through crushing that is limited to the pile footprints (a combined area of 29.1 m^2). The pile footprints will affect less than 0.03% of subtidal soft-sediment habitat within a 250-m distance of the proposed infrastructure. Given the anticipated low numbers of individuals affected by mortality by crushing, relative to the expected abundance of the same species throughout the Inner Harbour, this loss of a small number of individuals is not expected to result in a localized effect to finfish or invertebrate populations.
- Partial shading of intertidal and shallow subtidal vegetated habitat under the access trestle and small boat dock may occur while the infrastructure is present at the site; the degree of shading will vary throughout the day. Ecological effects are likely to be limited because the intertidal algal communities in Waterlot 1 are pioneer communities of relatively lower ecological value than that of climax algal communities nearby. Temporary shading of intertidal and subtidal vegetated habitat at the site, near the access trestle and small boat dock, is not expected to result in a measurable reduction in habitat productivity, or cause long-term or irreversible effects to fish and invertebrates using these habitats.
- Restricting impact-hammer pile driving to DFO's least risk window for Burrard Inlet (August 16–February 28) will reduce interaction with fish, and the use of bubble curtains and in-water sound pressure monitoring to limit sound pressures to 30 kPa will limit adverse effects to fish that are nearby (e.g., barotrauma). Fish are not expected to be measurably harmed by underwater noise generated during impact-hammer pile driving. Fish are expected to temporarily avoid areas of active pile installation sites; this behavioural effect is expected to be reversible.
- The monitoring of exclusion zones for marine mammals around active impact-hammer pile driving is expected to limit the potential for behavioural disturbance of marine mammals by underwater noise. The operation of the facility is not expected to cause a measurable change in existing levels of behavioural disruption or vessel strike risk of marine mammals in the Inner Harbour of Burrard Inlet, because vessels will be travelling at slow speeds and avoid rapid acceleration.

- Following the implementation of measures to reduce lighting effect on marine birds, and with limited use of the facility in during the hours of darkness, construction and operation of the facility is not expected to result in a measurable increase in mortality risk for marine birds.

Trans Mountain has initiated discussions with DFO regarding the installation and presence of temporary infrastructure in Waterlot 1. Trans Mountain does not anticipate that the proposed works will result in residual *serious harm to fish*; therefore, an authorization under paragraph 35(2) b of the *Fisheries Act* is not expected to be required.

ENVIRONMENTAL INSPECTION AND MONITORING

A qualified environmental inspector will be onsite during installation of the temporary infrastructure to monitor regulatory compliance and the effective implementation of mitigation measures described in the Temporary Construction Lands and Infrastructure Environmental Protection Plan. A marine mammal monitor will establish and monitor the two concentric marine mammal exclusion zones (150 m and 1,000 m) surrounding active pile installation sites. This monitoring activity will reduce potential effects to marine mammals caused by exposure to underwater noise during impact-hammer pile driving. Prior to the commencement of impact-hammer pile driving, visual monitoring will be conducted for cetaceans and marine mammal species at risk within an initial marine mammal exclusion zone, set to a radius of 1,000 m. Simultaneous visual monitoring will also be conducted within a harbour seal-specific exclusion zone, initially set to a radius of 150 m from active locations of impact-hammer pile driving. Impact-hammer pile driving may only commence if no marine mammals are observed within their respective exclusion zones for 30 minutes prior to the start of the activity. The exclusion zone for cetaceans and marine mammal species at risk will encompass the area within which underwater sound pressure levels exceed 160 dB re: 1 µPa (NOAA n.d.). During impact-hammer pile driving, the exclusion zones will be monitored continuously. If a cetacean or marine mammal is observed within their respective exclusion zones, impact-hammer pile driving will be suspended (or rescheduled if deemed necessary) until the individual is observed to leave the exclusion zone or is not re-observed within the exclusion zone for a period of 30 minutes.

SUMMARY AND CONCLUSIONS

The installation and operation of the temporary trestle, access trestle and small flexi-float dock at Waterlot 1 is not expected to result in lasting deleterious effects to existing intertidal and subtidal habitats or species. Shading of vegetated rocky habitats is expected to be partial and vary throughout the day under the access trestle and small boat dock. Although some sessile or slow-moving benthic invertebrates (e.g., painted anemone, giant plumose anemone, sea stars, and orange sea-pen) may be crushed during installation of piles, the number affected is expected to be negligible given the expected abundance of these species across subtidal benthic habitats in the Inner Harbour of Burrard Inlet. Further, these species are likely to quickly repopulate the affected areas when the piles are removed. No long-term or irreversible residual effects are expected with respect to the sustainability or productivity of local invertebrate and fish populations. Potential effects to marine mammals, birds and/or fish from underwater noise, artificial lighting, or vessel movement are expected to be effectively mitigated during operation of the proposed infrastructure and associated marine traffic. Following removal of the temporary infrastructure, intertidal and subtidal habitats are expected to return to pre-construction conditions within several months or less.

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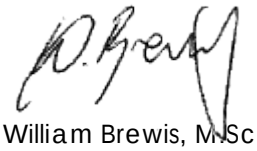

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APPENDIX A:

SUBTIDAL VIDEO PHOTOGRAPHS

Photo A-1 Bottles Scattered Across Subtidal Mud Habitat Along the Test Tow Transect

Photo A-2 Netting, Rope, and Wooden Debris on Mud and Cobble Habitat Near the Start of Transect T3

Photo A-3 Giant Plumose Anemones, Painted Anemones, and Dungeness Crab on a Tire Along Transect T2

Photo A-4 Orange Sea Pen in Subtidal Mud Habitat Near the Start of Transect T7

Photo A-5 Mottled Star on Mud, Pebble, and Shell Substrate Observed Mid Transect T2

Photo A-6 Painted Anemones on Metal Debris Observed Mid Transect T8

Photo A-7 A Pacific Spiny Dogfish Swimming Over Cobble and Mud Habitat Near the Start of Transect T8

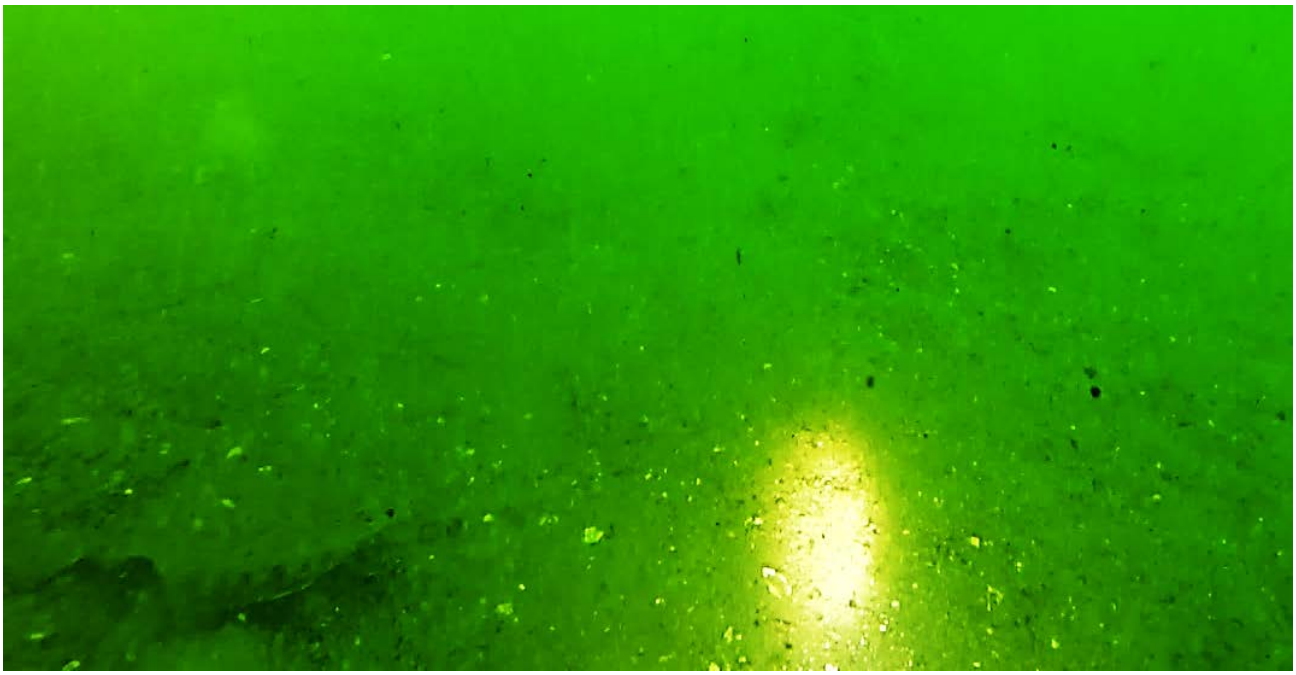

Photo A-8 A Flatfish Swimming Over Mud and Shell Habitat Near the Start of Transect T8

Photo A-9 A Kelp Perch Swimming Over Boulders and Sugar Kelp Near the End of Transect T8

Photo A-10 Bull Kelp Attached to a Small Cobble in Predominantly Mud and Shell Habitat Near the End of Transect T1

APPENDIX B:

SUBTIDAL SURVEY DATA

Table B-1 Subtidal transect information, water depths, substrates, and algae at VersaCold Waterlot 1

Transect	Test Tow	T1	T2	T3	T4	T5	T6	T7	T8
Transect Depth Ranges (m below CD)	7.6 to 8.2	2.5 to 8.5	6.0 to 7.0	7.0 to 8.2	6.4 to 7.6	1.0 to 9.2	3.2 to 9.1	1.5 to 7.3	1 to 9.7
Substrate Types	M, A	M, Ms, P, C, B, A	M, Ms, P, C, A	M, Ms, C, A	M, Ms, C, A	M, Ms, C, B, A	M, Ms, P, C	M, Ms, P, C, B, A	M, P, C, A
Macroalgae (depths in m below CD and substrate type)	—	Sl (2.5, B); U (2.5, B); Nl (3.3, C)	—	—	—	Sl (3.7, B, C)	—	Sl (1.5 to 4.9, B, C)	Sl (1.0 to 3.5, C, B)

NOTE:

(—) No vegetation recorded

Key to Substrate Types:

M	Mud
Ms	Mud with shell
B	Boulder
C	Cobble
P	Pebble
A	Anthropogenic debris

Key to Macroalgae Species:

U	*Ulva* sp.
Sl	*Saccharina latissima*
Nl	*Nereocystis luetkeana*

Table B-2 Species recorded along subtidal video transects at VersaCold Waterlot 1

Common Name	Scientific Name	Transect/ Number of Individuals Per Transect									Total Number of Individuals
		Test	T1	T2	T3	T4	T5	T6	T7	T8	
Cnidarians											
Giant plumose anemone	*Metridium farcimen*	2	5	10	8	—	—	2	8	3	**38**
Plumose anemone	*Metridium senile*	—	—	—	—	—	—	—	2	—	**2**
Painted anemone	*Urticina crassicornis*	1	1	4	4	7	2	6	8	6	**39**
Orange sea pen	*Ptilosarcus gurneyii*	—	—	—	—	—	—	—	2 [a]	—	**2**
Echinoderms											
Mottled star	*Evasterias troschelii*	1	1	1	2	—	—	2	1	2	**10**
Ochre sea star	*Pisaster ochraceus*	—	1	1	—	1	—	—	1	1	**5**
Leather star	*Dermasterias imbricata*	—	—	—	—	—	—	—	1	—	**1**
Crustaceans											
Dungeness crab	*Metacarcinus magister*	—	—	1	1	2	—	—	1	1	**6**
Red rock crab	*Cancer productus*	—	1	—	—	—	—	1	—	—	**2**
Finfish											
Flatfish	Pleuronectidae	—	—	—	—	—	—	—	—	1	**1**
Kelp perch	*Brachyistius frenatus*	—	—	—	—	—	—	—	—	1	**1**
Pacific spiny dogfish	*Squalus suckleyi*	—	—	—	—	—	—	—	—	1	**1**

NOTE:
(—) No individuals observed
a Value corresponds with one colonial sea pen