SEASPAN VANCOUVER DRYDOCK WATER LOT EXPANSION

HABITAT ASSESSMENT

June 2021

Prepared for:

Seaspan ULC

North Vancouver, BC

Hatfield Consultants LLP

#200 - 850 Harbourside Drive
North Vancouver, British Columbia, Canada V7P 0A3
Tel: 1.604.926.3261 • Fax: 1.604.926.5389
www.hatfieldgroup.com

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Prepared for:

SEASPAN ULC
10 PEMBERTON AVENUE
NORTH VANCOUVER, BC
CANADA V7P 2R1

Prepared by:

HATFIELD CONSULTANTS LLP
#200 - 850 HARBOURSIDE DRIVE
NORTH VANCOUVER, BC
CANADA V7P 0A3
TEL: 1.604.926.3261 • WWW.HATFIELDGROUP.COM

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LIST OF ACRONYMS

BC	British Columbia
BIEAP	Burrard Inlet Environmental Action Program
BMPs	Best Management Practices
CD	Chart Datum
CDC	Conservation Data Center
CEMP	Construction Environmental Management Plan
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Fisheries and Oceans Canada
EM	Environmental Monitor
EZ	Exclusion Zone
HADD	Harmful Alteration, Disruption or Destruction
IBA	Important Bird Area
QEP	Qualified Environmental Professional
PER	Project and Environmental Review
SARA	*Species at Risk Act*
VFPA	Vancouver Fraser Port Authority

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The following individuals/firms have received this document:

Name	Firm	Email
Russ Bradley	Seaspan ULC	✓
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Daryl Lawes	Seaspan ULC	✓
George Geatros	Seaspan ULC	✓

AMENDMENT RECORD

This report has been issued and amended as follows:

Issue	Description	Date	Approved by	
1	First version of Seaspan Vancouver Drydock Waterlot Expansion – Habitat Assessment	20210223	Stewart Wright Project Director	Rebecca Kordas Project Manager
2	Second version of Seaspan Vancouver Drydock Waterlot Expansion – Habitat Assessment	20210308	Stewart Wright Project Director	Rebecca Kordas Project Manager
3	Third version of Seaspan Vancouver Drydock Waterlot Expansion – Habitat Assessment	20210622	 Stewart Wright Project Director	 Rebecca Kordas Project Manager

1.0 INTRODUCTION

Hatfield Consultants (Hatfield) has been retained by Seaspan ULC (Seaspan) for environmental management and regulatory support associated with a proposed expansion (the Project) at the Vancouver Drydocks, located at 203 East Esplanade in North Vancouver, British Columbia (BC).

Hatfield has completed this marine Habitat Assessment to support a Fisheries and Oceans Canada (DFO) Request for Review under the *Fisheries Act* and *Species at Risk Act* (SARA) and Vancouver Fraser Port Authority (VFPA) Project and Environmental Review (PER) application.

The Habitat Assessment includes a desktop review of existing studies and marine environmental data for the defined Study Area and the results of a marine field survey completed on January 30 and 31, 2021.

Based on the data reviewed and collected, Hatfield has prepared habitat maps and assessed the value of the habitat with potential to be affected by Project works. Hatfield has assessed the potential for the death of fish and HADD (harmful alteration, disruption, or destruction) to fish habitat and defined avoidance and mitigation measures for the Project. This includes construction methodology inputs, Best Management Practices (BMPs), environmental monitoring and mitigation measures to be implemented during the construction phase. This habitat assessment has been developed in accordance with VFPA PER Guidelines for Habitat Assessment (2015).

2.0 PROJECT OVERVIEW

The Waterlot Project at Seaspan's Vancouver Drydock facility involves the installation of a work pontoon and two additional drydocks (Appendix A1) on the west side of the deep-water outfitting pier. Currently, a Panamax drydock is permanently moored to the east side of the pier (yellow structure with red ship in Figure 1), and a self-contained drydock, the Seaspan Careen, (131 m x 49 m) is moored to the west side of the pier (blue structure in Figure 1). The Careen spends most of the time at this location but is infrequently transported to other Seaspan facilities, as required. Seaspan will be consolidating ship repair activities at Vancouver Drydock and is proposing to add the new infrastructure to better accommodate and service smaller vessels.

Figure 1 Photograph of existing Vancouver Drydock.

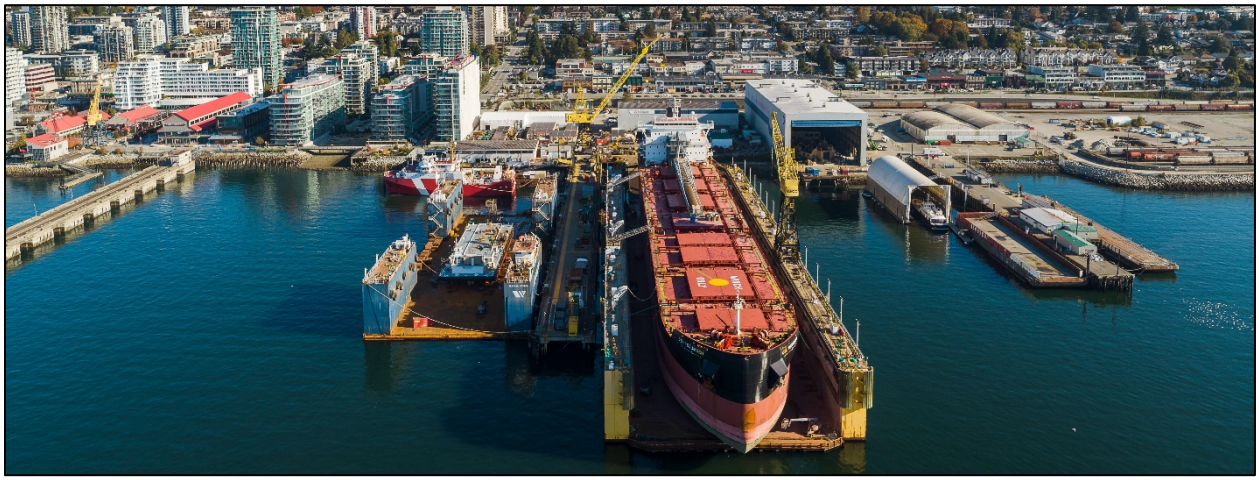

Figure 2 Project Overview.

Legend

- Pile
- Crane
- Bathymetry (Interval 10m)
- Vancouver Fraser Port Authority Boundary
- Existing Water Lot Boundary
- Expanded Water Lot Boundary
- Project Area
- Study Area

Proposed Project Features

- New Work Pontoon
- New 100m Drydock
- New 55m Drydock
- Relocated Existing Careen

0 10 20 40 60 m

Scale: 1:2,500

Projection: NAD 1983 UTM Zone 10N

Data Sources:
a) Project features, water lot, Advisian 2021.
b) Project and study areas, Hatfield 2021.
c) Water lot boundaries, Seaspan 2021.
d) Bathymetry, DFO 2020.
e) Vancouver Fraser Port Authority Boundary, Port of Vancouver 2018.
f) GeoEye-01 50 cm, 15 March 2020, Esri Online Service.

Hatfield

Vancouver Drydock Water Lot Project

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2.1 STUDY AREA

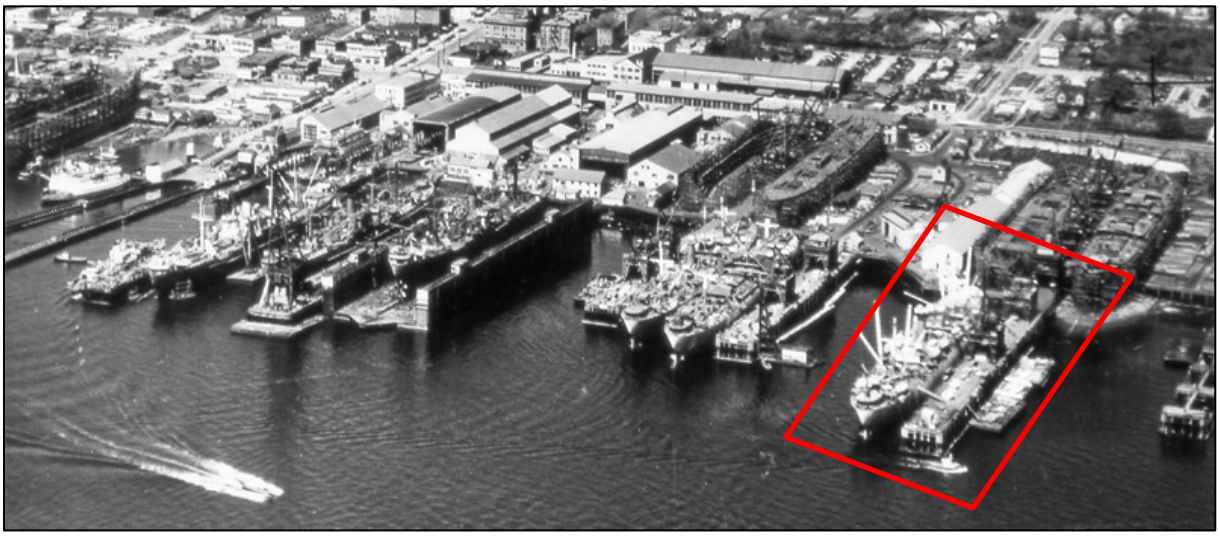
The Project is located within the Vancouver Fraser Port Authority (VFPA) managed federal lands and waters, along the north shore of the Inner Harbour of Burrard Inlet, at 203 East Esplanade (Figure 2). Within the Study Area, the water depth ranges from about 5 m to 20 m below chart datum (CD; Figure 2; Appendix A2).

2.2 SITE HISTORY

The north shore of Burrard Inlet has a long history of shipbuilding, originating with the Wallace Shipyard (later renamed Burrard Dry Dock) in 19061 (Figure 3). These facilities were just west of Vancouver Drydock's current location (shown by the red polygon in Figure 3). In 1941, the shipyards expanded east to build four new berths and four new piers, including the Vancouver Drydock deep-water outfitting pier (red polygon in Figure 4). The Panamax drydock was built in 1982 to service even larger vessels (Webb 1996).

Figure 3 Wallace Shipyards on the north shore of Burrard Inlet, c. 1932[1].

Figure 4 Expanded shipyards, including current Seaspan facilities, c. 1944[1].



[1] Northshore shipyard information and photographs from The Museum of North Vancouver (https://monova.ca), accessed 2 February, 2021.

2.3 PROJECT DESCRIPTION

A floating work pontoon will be installed on the west side of the deep-water outfitting pier (Figure 2, Appendix A1). This will be used to access the existing Careen and two additional floating drydocks to expand ship repair operations. These structures will be brought in from off site (i.e., they will not be constructed on site). They will be floating and anchored in place by monopiles using 1.2 m and 1.5 m diameter steel piles. To make room for the arrangement of the new drydocks, the existing Careen will be moved 40 m to the south and will be anchored in place by monopiles. A total of six piles will be installed to moor and hold the various floating vessels in position. The piles will be placed in water that ranges in depth from 8 m to 17 m below CD as shown in Figure 2. Piles will be driven into the substrate using vibratory hammers and, if necessary, impact hammers. Drilling may be required to advance piles depending on the density of the underlying till in the location of each pile. Once penetration depths are achieved, the piles will be cleaned out to facilitate concrete infill using tremie pour methods. Additional structural steel sections or reinforcing bar cages, if required, will be installed prior to the tremie process into the cleaned-out pile. Water inside the piles will be monitored and captured during infilling and disposed of off site to ensure it does not spill over into the surrounding marine environment (further details can be found in the Project Construction Environmental Monitoring Plan (CEMP)). Concrete for filling inside of the piles will be supplied either from the support barge or pumped from delivery trucks that would arrive and drive onto the existing pier.

The project construction is planned to begin October 2021, with anticipated finalization in February 2022.

The work pontoon is composed of reinforced steel cellular construction measuring 98 m long x 13 m wide x 1 m deep. The work pontoon will be oriented 90 degrees to the outfitting pier with access via a lightweight ramp hinging off the fixed pier edge. All three drydocks (including the existing Careen) will be accessed using heavy ramps connected to the work pontoon. The work pontoon will be held to its anchor pilings using ring clamps which allow the work pontoon to move up and down with the tide. Overhead lighting, and utilities such as electricity, potable and gray water, and compressed air, will all be available from the work pontoon.

Both new floating drydocks are fabricated from steel plate and are essentially smaller versions of the existing Careen. The larger one will measure approximately 100 m long x 30 m wide x 10 m deep. This drydock would have a working draft of 2.5 m and when fully loaded will have its deck level approximately 0.4 m above water level. The walls extend 7 m above deck level and house the pump rooms as well as additional ballast chambers. The floating drydock will rise and fall with the tide against floating ring fenders that surround the adjacent vertical piles. To pick up cargo for maintenance and repair, this drydock can submerge up to 8 m to accommodate a 4,500 tonne, 10 m depth vessel.

The smaller of the two new floating drydocks (Figure 2) will measure approximately 55 m in length and is otherwise proportional to its 100 m sister drydock in dimensions. Its capacity is expected to be limited to less than 1,500 tonnes.

Since the existing Careen will need to be moved 40 m to the south, it will be situated past the south end of the outfitting pier and therefore will require therefore will require a mooring line to the south end of the Panamax.

The new drydocks are expected to operate on an approximate three-week cycle period with vessel repairs. The lift times will not coincide but will be randomly determined by the nature of the vessel repairs required. Except when retrieving vessels for repair, the drydocks will remain at berth in their working location during their service life.

3.0 STUDY METHODS

3.1 LITERATURE REVIEW

A desktop review of existing publicly available information was conducted for the Study Area and the surrounding Burrard Inlet Inner Harbour to inform and support the subsequent field assessment. The information was assembled to characterize known marine habitat features, potential species presence, and potential migratory, refuge or spawning areas, including species at risk and wildlife of potential conservation concern.

Data sources reviewed and evaluated and/or information collected for relevance to this assessment included:

- BC CDC: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre
- BC Ecosystem Explorer: which lists species status provincially and federally: http://a100.gov.bc.ca/pub/eswp/
- Electronic Atlas of the Flora of British Columbia: Algae identification: http://ibis.geog.ubc.ca/biodiversity/eflora/algae.html
- DFO, New Salmon Escapement Database System: https://open.canada.ca/data/en/dataset/c48669a3-045b-400d-b730-48aafe8c5ee6
- DFO, Pacific Herring Spawning Records – Strait of Georgia: http://www.pac.dfo-mpo.gc.ca/science/species-especes/pelagic-pelagique/herring-hareng/herspawn/sog_map-eng.html
- DFO, Pacific Ocean Recreational Fisheries Information Page: http://www.pac.dfo-mpo.gc.ca/fm-gp/rec/tidal-maree/a-s28-eng.html
- DFO, Pacific Ocean, Aquatic Species at Risk Map: https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html
- DFO, Pacific Ocean, Project Near Water: http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html.
- DFO, Rockfish Conservation Areas: https://www.pac.dfo-mpo.gc.ca/fm-gp/maps-cartes/rca-acs/index-eng.html
- Important Bird Areas, including great blue heron colony areas: https://www.ibacanada.com/mapviewer.jsp?lang=EN
- Sensitive Habitat Information Mapping: https://cmnbc.ca/atlas_gallery/shim-sensitive-habitat-inventory-and-mapping
- Species at Risk Registry: The public registry for Species at Risk in Canada: http://www.sararegistry.gc.ca/sar/index/default_e.cfm

3.1.1 Physical Conditions

Burrard Inlet covers 11,300 ha. The total length of the shoreline is approximately 190 km (BIEAP 2011). The Inlet is naturally divided into six basins: the Outer Harbour, False Creek, Inner Harbour, Central Harbour, Port Moody Arm, and Indian Arm. The Project is located in Burrard Inlet's Inner Harbour, along a manmade shoreline where wave exposure has been classified as protected (VFPA ShoreZone Portal, 2017).

The three largest freshwater discharges into Burrard Inlet are the Seymour, Capilano and Indian rivers. Smaller streams with estuaries of significance include Mosquito Creek, Mackay Creek, and Lynn Creek. All three of these smaller streams occur within 3 km of the Study Area, with the nearest one, Mosquito Creek, located 1 km west of the Study Area.

3.1.2 Fish Species and Life Stages

Estuarine habitat in Burrard Inlet is used for rearing and migration by seven salmonid species: Chinook (*Oncorhynchus tshawytscha*), chum (*Oncorhynchus keta*), coho (*Oncorhynchus kisutch*), pink (*Oncorhynchus gorbuscha*), sockeye (*Oncorhynchus nerka*), steelhead (*Oncorhynchus mykiss*), and cutthroat trout (*Oncorhynchus clarki*; Levings et al. 2004). Juvenile salmon use nearshore areas in Burrard Inlet during spring and summer months (Levy 1997) and originate from 17 known spawning streams in the Inlet, as well as from the Fraser River (Naito & Hwang 2000). A summary of pacific salmon biology and life stages is provided in Table 1.

There is potential for salmonids to be present in the Study Area, whether it be staging of adults prior to migration into freshwater or more likely, juveniles that recently migrated into the marine environment. Mosquito Creek, McKay Creek and Lynn Creek are salmon-bearing watercourses in the vicinity of the Study Area and Lynn Creek is the third largest salmon-bearing river on the north shore. Lynn Creek has been classified as endangered in the lower two-thirds of the watershed due to riparian removal, urbanization, culverting, and degraded water quality (DFO, 1998). A summary of the timing of salmon spawning migrations in the three salmon-bearing streams nearest to the Study Area is in Table 2.

The BC Ecosystem Explorer, BC CDC, Fisheries Information Summary System Habitat Wizard, Sensitive Habitat Information Mapping, and the Pacific Ocean Recreational Fisheries Information page were reviewed to identify other potential fish species that could occur in the Study Area. Several marine and anadromous fish species have the potential to occur in Burrard Inlet, and therefore in the Study Area, including: kelp greenling (*Hexagrammos decagrammus*), lingcod (*Ophiodon elongates*), Pacific sand lance (*Ammodytes hexapterus*), Pacific tomcod (*Microgadus Proximus*), pile perch (*Rhacochilus vacca*), rock sole (*Lepidpsetta sp.*), plainfin midshipman (*Porichthys notatus*), shiner perch (*Cymatogaster accipenserinus*), bay pipefish (*Syngnathus leptorhynchus*), and whitespotted greenling (*Hexagrammos stellen*).

3.1.3 Fish Habitat

Potential fish habitat in the Study Area includes various species of algae, substrate such as cobble and gravel, and anthropogenic debris such as old piles and tires. These habitats provide refuge from predators, foraging and spawning areas (TWN 2017).

Table 1 Summary of general biological and life history characteristics of five species of Pacific salmon (DFO 2019a).

Life History Characteristic	Coho *O. kisutch*	Sockeye *O. nerka*	Pink *O. gorbuscha*	Chum *O. keta*	Chinook *O. tsawytscha*
Season when eggs hatch	Spring	Spring	Spring	Spring	Spring
Length of stay in freshwater	1-2 years; 1 year is common.	1 month to 2 years	Virtually none; often straight to ocean.	Virtually none; often straight to ocean.	Ocean-type: 60-150 days Stream-type: 1-2 years
Primary rearing habitat	Stream	Lake/Stream	Estuary	Estuary	Stream/Ocean
Size at ocean migration	10 cm or more	Variable, 6.5 to 12 cm	About 3.3 cm	2.8 to 5.5 cm	5 to 15 cm
Ocean voyage	4 to 18 months	16 months to 4 years	18 months	2 to 5 years	4 months to 5 years
Age at return to freshwater	During 2nd to 4th year	During 3rd to 5th year	During 2nd year	During 3rd to 5th year	During 2nd to 6th year
Season/month of return	Late summer to January	Mid-summer to late autumn	July to September	July to October	Spring to fall; some rivers support more than one run.
Number of eggs per female	2,000-3,000	2,000-4,500	1,200-2,000	2,000-3,000	2,000-17,000 (generally 5,000-6,000)
Preferred spawning area	Small streams	Near and in lake systems.	Close to ocean	Above turbulent areas or upwellings	Very broad tolerances

Table 2 Timing of salmon spawning migrations in salmon-bearing streams and rivers within 3km of the Study Area (DFO 1989; Greenbank et al. 2001; Hancock and Marshall 1986; Naito and Hwang 1992).

Watershed	Coho *O. kisutch*	Sockeye *O. nerka*	Pink *O. gorbuscha*	Chum *O. keta*	Chinook *O. tsawytscha*
MacKay Creek	Mid-October to late December	Not present	Unknown	Unknown	Not present
Mosquito Creek	Mid-September to late December.	Not present	Not present	Not present	Not present
Lynn Creek	June to early January	Not present	Early September to late October	Early October to late November	Mid-October

Red, green and brown algal species are present throughout Burrard Inlet and potentially in the Study Area, including sugar kelp (*Saccharina latissima*) and bull kelp (*Nereocystis luetkeana*). These algae species provide habitat, food, shelter and nursery environments for fish, invertebrates, and some other algae. Their biomass also provides oxygen through primary productivity to nearshore food webs (Bates 2004). Algae begin life as microscopic spores and most require a hard stable substrate to attach to, free from fine sediment like silt, which may bury or smother them.

Sugar kelp is a common brown macroalgae that grows on rocks in the low intertidal and shallow subtidal zone, along protected to semi-protected shorelines (Fretwell 2016). Sugar kelp is dependant on light and rocky substrate to attach to. The presence of this species in the subtidal may suggest an intermittently disturbed area (Guiry 2000). Sugar kelp is an ecologically important species as it is a primary producer and provides food and shelter for fish, shellfish, invertebrates, and other algae (Bates 2004; Christie et al. 2009).

Bull kelp is another species of brown macroalgae, that grows on larger substrates (large cobble, boulder) in the low intertidal and subtidal zones of semi-exposed habitats or high-current areas (Brietzke et al. 2016). It forms extensive forests in rocky habitats in the subtidal zone along the coast of BC. Based on surveys of existing kelp beds in Burrard Inlet undertaken by Tsleil-Waututh Nation (TWN), it grows at depths between 0 and 5 m below CD, with a mean depth of 2.2 m below CD (NHC 2019). Elsewhere in BC bull kelp can grow in up to 20 m water depth (Springer et al. 2007) but it has not been observed at this depth in Burrard inlet. Bull kelp forests are linked to commercially important fish including forage fish such as Pacific herring and Pacific sand lance, as well as salmon species at different life stages (Lamb 2011). The forests are grazed upon and provide shelter for numerous invertebrates and provide fish of various life stages with shelter and food (Connor and Baxter 1989). Because bull kelp forests can reduce current velocities and dampen wave energy, mammals and birds may seek refuge among them (Mork 1994).

3.1.4 Marine Mammals

Several marine mammals have been observed in Burrard Inlet, including stellar sea lions (*Eumetopias jubatus*), California sea lions (*Zalophus californianus*), harbour porpoises (*Phocoena phocoena*), Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), false killer whales (*Pseudorca crassidens*), killer whales (*Orcinus orca*), grey whales (*Eschrichtius robustus*), and humpback whales (*Megaptera novaeanfliae*). Cetaceans (whales and dolphins) are infrequent visitors to Burrard Inlet (Haggarty 2001) although sightings are becoming more common. They are unlikely to occur in the Study Area due to the shallow depths. Pacific harbor seals (*Phoca vitulina richardsi*) are common in Burrard Inlet and have potential to occur in the Study Area. Harbour seals are not considered at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and have no status under the *Species at Risk Act* (SARA; Government of Canada 2019).

3.1.5 Birds

The Study Area is located within the Important Bird Area (IBA) of English Bay, Burrard Inlet & Howe Sound. This IBA was designated for three species at the global level: western grebe, Barrow's goldeneye and surf scoter; and one species at the national level: great blue heron. Although the Study Area is located within the IBA, and marine birds have the potential to pass through or feed in the area, there is no land in the Study Area, therefore, no land-based habitat suitable for birds such as riparian and intertidal vegetation, tidal flats, marshes, and grasses (FLNRO 1997).

3.1.6 Species at Risk

Species at risk are identified by both provincial and federal governments following ranking systems. The provincial ranking system applies to species that have been assessed by the Conservation Data Centre (CDC). The federal ranking system applies to species that have been assessed by COSEWIC. The CDC and COSEWIC publish lists of species at risk. A preliminary list of species was generated from the provincial database by querying the CDC Species and Ecosystem Explorer database to identify listed species that have the potential to occur in proximity to the Project Area. The Species at Risk Public Registry and DFO aquatic species at risk maps were also reviewed to identify potential aquatic species at risk within the vicinity of the Project Area. Aquatic species at risk that could potentially be found within a 1 km radius of the Project area are summarized in Table 3.

Most of the species in Table 3 typically inhabit waters deeper than the Study Area. Based on depth, habitat characteristics present in the Study Area, and known ranges of various at-risk species, the only species with the potential to occur in the Study Area is the stellar sea lion (*E. jubatus*). However, stellar sea lions are infrequent visitors to Burrard Inlet (TWN 2017) and given the limited number of fish observed and the high volume of vessels it is unlikely that stellar sea lions would be present in the Study Area. Based on depth alone, the northern abalone (*H. kamtschatkana*) could potentially be found within the Study Area, however, they inhabit exposed or semi-exposed rocky shorelines (COSEWIC 2009) and are extremely rare due to overharvesting. Abalone require a stable substrate, such as bedrock or large boulders while loose sediment such as cobbles and silt are generally not suitable habitat.

Although the ranges for these species at risk overlap with the Project Area, there is no 'critical habitat' for any aquatic species at risk found within 1 km of the Study Area (DFO 2019b; Appendix A3).

Table 3 Listed aquatic species with the potential to occur within 1 km of the Project area.

Scientific Name	Common Name	BC List[1]	SARA Status[2]	COSEWIC Status[3]
Acipenser medirostris	Green Sturgeon	Blue	Special Concern	Special Concern
Cetorhinus maximus	Basking Shark	-	Endangered	Endangered
Dermochelys coriacea	Leatherback Sea Turtle	Red	Endangered	Endangered
Eschrichtius robustus	Grey Whale	Blue	Special Concern	Special Concern / Endangered
Eumetopias jubatus	Steller Sea Lion	Blue	Special Concern	Special Concern
Galeorhinus galeus	Tope	-	Special Concern	Special Concern
Haliotis kamtschatkana	Northern Abalone	Red	Endangered	Endangered
Hexanchus griseus	Bluntnose Sixgill Shark	-	Special Concern	Special Concern
Megaptera novaeangliae	Humpback Whale	Blue	Special Concern	Special Concern
Orcinus orca	Killer Whale (Transient population)	Red	Threatened	Threatened
Phocoena phocoena vomerina	Harbour Porpoise	Blue	Special Concern	Special Concern
Sebastes ruberrimus	Yelloweye Rockfish	-	Special Concern	Special Concern

Table 3 (Cont'd.)

Scientific Name	Common Name	BC List[1]	SARA Status[2]	COSEWIC Status[3]
Sebastes sp. type I	Rougheye Rockfish type I	-	Special Concern	Special Concern
Sebastes sp. type II	Rougheye Rockfish type II	-	Special Concern	Special Concern
Sebastolobus altivelis	Longspine Thornyhead	-	Special Concern	Special Concern

[1] BC List: Red = species that are extirpated, endangered, or threatened; Blue = species that are of special concern.

[2] Schedule 1 of SARA is the official list of species at risk in Canada. It includes species that are extirpated, endangered, threatened, and of special concern; however, the general prohibitions do not apply to species of special concern.

[3] COSEWIC is an independent advisory panel to the Minister of Environment and Climate Change Canada that meets twice a year to assess the status of wildlife species at risk of extinction. It includes species that are extirpated, endangered, threatened, and of special concern.

3.2 HABITAT SURVEY

3.2.1 Survey Methods

A field-based habitat survey was undertaken to build on the desktop review and to assess and characterize the marine environment potentially affected by the Project. The habitat survey consisted of underwater video transects conducted by divers, and a land-based site inspection.

A dive team, consisting of four divers and a communications specialist conducted video transects within the Study Area on January 30 and 31, 2021 between 10:00 and 15:30, during a high tide of approximately 3 to 4 m above CD. The survey was conducted along eight transects parallel to the shoreline that ranged in length from 50 m to 125 m (Figure 5). The depth of the transects ranged from approximately 5 to 20 m below CD. The divers were equipped with a live feed video camera and a two-way communication system allowing for back-and-forth communication with the dive crew. Video and audio data were transmitted to the surface via the umbilical tether. At the surface, the communications specialist and Hatfield marine biologists reviewed real-time footage of the dive and engaged in two-way communication with the diver.

Hatfield marine biologists were onsite to direct divers and make land-based observations of the shoreline and record observations of marine mammals and birds in the area. There was no backshore vegetation present to be assessed. Following the survey, video footage with diver annotation was analyzed by Hatfield marine biologists to identify and summate observed organisms, habitats, and substrates. Physical substrate characteristics observed were described according to the categories in Table 4. Anthropogenic debris is also providing substrate, and this was recorded during the survey.

Table 4 Substrate categories for the habitat field assessment (DFO 1990).

Substrate	Definition	Size (mm)
Silt	Loose sedimentary deposit	<0.0625
Sand	Loose granular material	0.0625 – 2
Gravel	Loose fragments of rock	2 – 64
Cobble	Loose stone larger than gravel, smaller than a boulder	64 – 256
Boulder	Detached mass of rock	>256
Shell hash	Surface substrate layers are dominated by loose shell accumulations	2 – 64

4.0 EXISTING ENVIRONMENT

4.1 PHYSICAL CONDITIONS

The Project area (covered by transects 1 to 6) ranges in depth from 7 to 20 m below CD, although depths are slightly shallower (5 to 10 m below CD) to the north (covered by transects 7 and 8; Appendix A2 and Figure 5). Within the Project Area the substrate was mostly silt, with some patches of cobbles and one patch of gravel (Figure 5; Figure 6). Where cobbles and gravel occurred, they were covered by a layer of silt. There was one boulder observed in the Study Area (Figure 5; Figure 6). Debris was present throughout the Study Area. Most items were antique-looking glass bottles, which had clearly been there for some time, and are not related to activities at the Vancouver Drydock. Larger debris included wooden piles and tires. There is no intertidal habitat in the Study Area, and no riparian or terrestrial vegetation to be assessed.

4.2 MARINE VEGETATION

Algae abundance was minimal, due to the lack of hard substrate and abundance of silt in the Study Area (Figure 5). Most algae need a hard substrate to adhere to, such as rock. Twelve clusters of identifiable algae, all under 20 cm, were observed in the Study Area, most were attached to debris and were partially decomposed. A dozen clumps of unidentifiable decomposing algae were also observed attached to empty worm tubes or wrapped around debris (e.g., Figure 7, not shown in Figure 5). Sea lettuce (*Ulva spp.*) was the most abundant identifiable taxa and was observed four times (Figure 5). Other algae species were found in deep water attached to debris, including rockweed (*Fucus gardneri*) and red algae. Pink encrusting algae was observed on the boulder (Figure 5). The cobbles were covered by a layer of silt, so recruitment of algae such as kelp would be hindered or impossible. Based on Hatfield's knowledge of the surrounding area and surveys conducted by Hatfield in Burrard Inlet during the summer months, common habitat-forming species such as sugar kelp (*Saccharina latissima*) and bull kelp (*Nereocystis luetkeana*) are unlikely to occur in the Project Area due to the water depth and the abundance of silt. Bull kelp, for example, is known to only occur in Burrard Inlet between 0 and 5 m CD (NHC 2019).

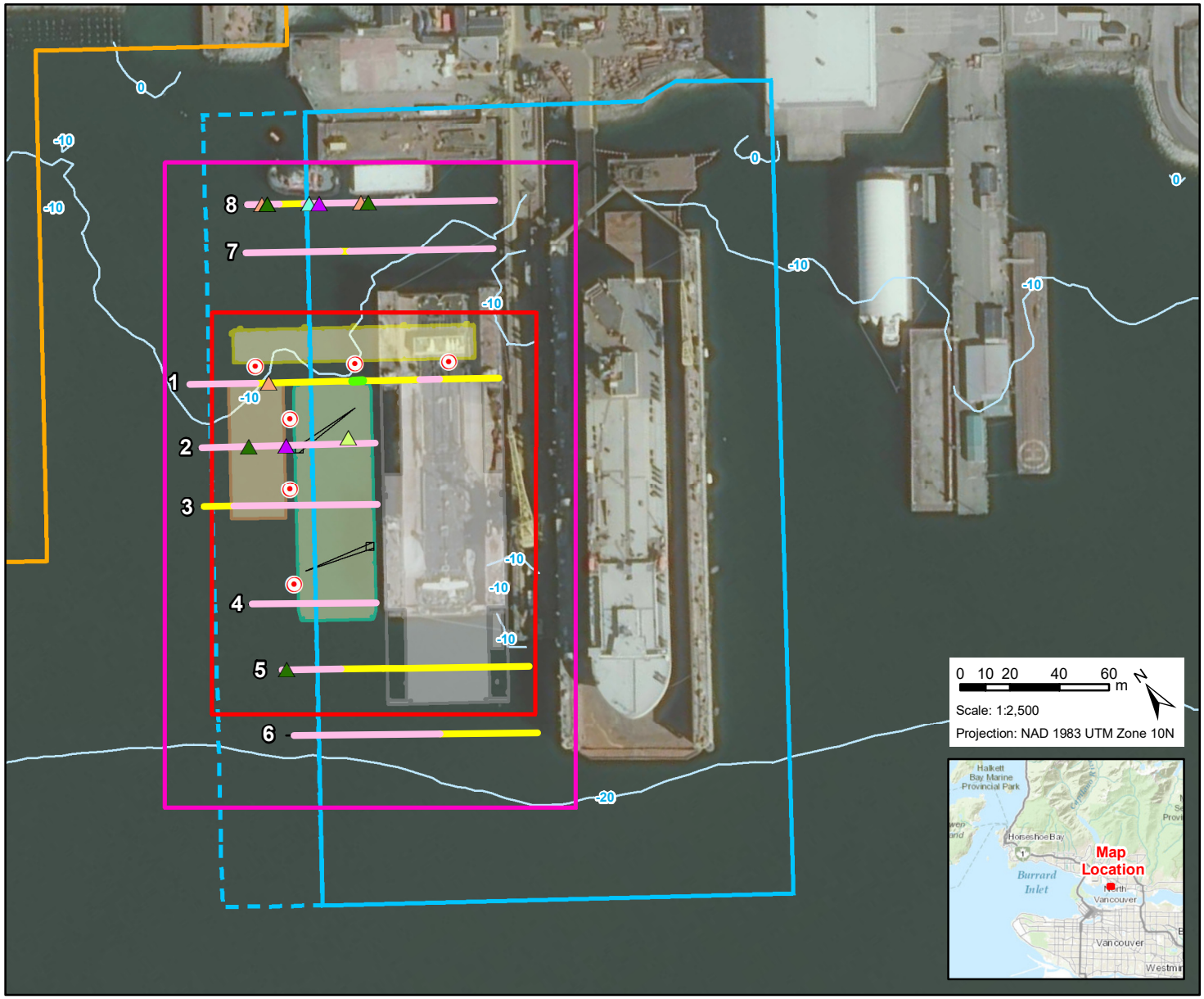
4.3 FISH

Twenty-three fish were observed in the Study Area (Table 5, Figure 8). Fish were mostly observed on the silty substrate or in/around debris. The most abundant fish was the snake prickleback (*L. sagitta*; Figure 9). The largest fish species observed were two buffalo sculpins (*Enophrys bison*; Figure 10).

Table 5 Fish observed in the Study Area.

Common name (*scientific name*)	Abundance
Bay pipefish (*Sygnathus leptorhynchus*)	1
Blackeye goby (*Rhinogobiops nicholsii*)	2
Buffalo sculpin (*Enophrys bison*)	2
English sole (*Parophrys vetulus*)	1
Roughback sculpin (*Chitonotus pugetensis*)	1
Snake prickleback (*Lumpenus sagitta*)	16
TOTAL	**23**

Figure 5 Map of substrate types and marine vegetation in the Study Area.



Legend

- Pile
- Crane
- Bathymetry (Interval 10m)
- Transect
- Vancouver Fraser Port Authority Boundary
- Existing Water Lot Boundary
- Expanded Water Lot Boundary
- Project Area
- Study Area

Proposed Project Features

- New Work Pontoon
- New 100m Drydock
- New 55m Drydock
- Relocated Existing Careen

Substrate

- Boulder
- Gravel and Silt
- Silt
- Cobble and Silt

Algae

- F. distichus
- Ulva spp.
- Pink Encrusting Algae
- Red Bladed Algae
- Red Filamentous Algae
- Unknown Decomposing Kelp

Data Sources:

a) Project features, water lot, Advisian 2021.
b) Transects, Seaspan 2021.
c) Substrate, algae, project and study areas, Hatfield 2021.
d) Water lot boundaries, Seaspan 2021.
e) Bathymetry, DFO 2020.
f) Vancouver Fraser Port Authority Boundary, Port of Vancouver 2018.
g) GeoEye-01 50 cm, 15 March 2020, Esri Online Service.

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Vancouver Drydock Water Lot Project

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Figure 6 Representative photos of the four types of substrate in the Study Area.

Cobble and silt: Cobbles were present in some of the Study Area and were always covered in silt. Photo from T1, under careen.

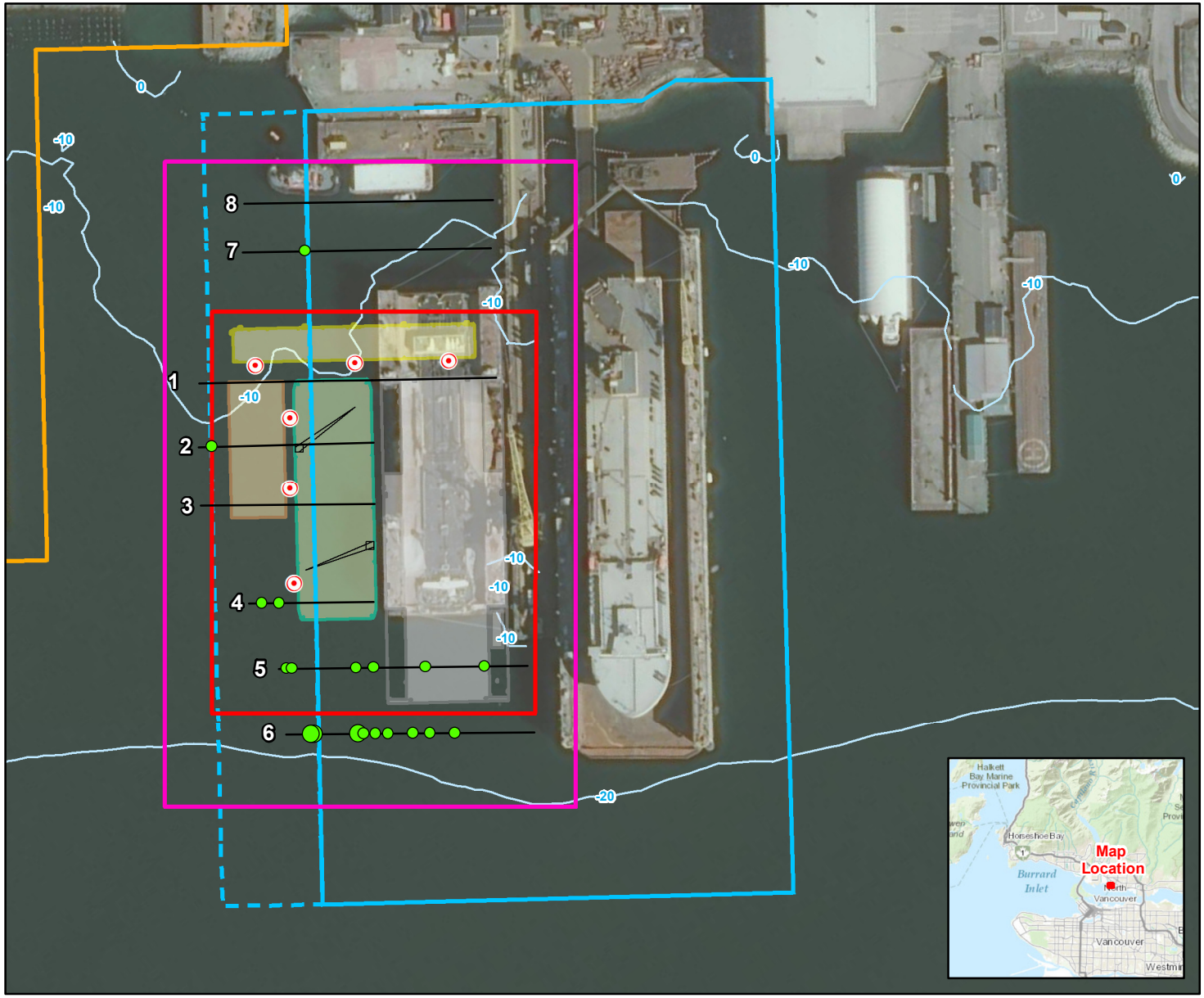
Silt: Silt was the dominant substrate in the Study Area. Photo from T3.

Gravel and silt: Gravel was only found in one patch of the Study Area. Photo from T1.

Boulder: A single boulder was found on T2.

Figure 7 Unknown algae and detritus attached to an empty worm tube.

Figure 8 Map of fish observed in the Study Area.



Legend

- Pile
- Crane
- Bathymetry (Interval 10m)
- Transect
- Vancouver Fraser Port Authority Boundary
- Existing Water Lot Boundary
- Expanded Water Lot Boundary
- Project Area
- Study Area

Proposed Project Features

- New Work Pontoon
- New 100m Drydock
- New 55m Drydock
- Relocated Existing Careen

Species Type

- Fish

Abundance

- 1
- 2 - 10

0 10 20 40 60 m

Scale: 1:2,500

Projection: NAD 1983 UTM Zone 10N

Data Sources:
a) Project features, water lot, Advisian 2021.
b) Transects, Seaspan 2021.
c) Fauna, project and study areas, Hatfield 2021.
d) Water lot boundaries, Seaspan 2021.
e) Bathymetry, DFO 2020.
f) Vancouver Fraser Port Authority Boundary, Port of Vancouver 2018.
g) GeoEye-01 50 cm, 15 March 2020, Esri Online Service.

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Vancouver Drydock Water Lot Project

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Figure 9 **Snake prickleback (*L. sagitta*) observed in the Study Area.**

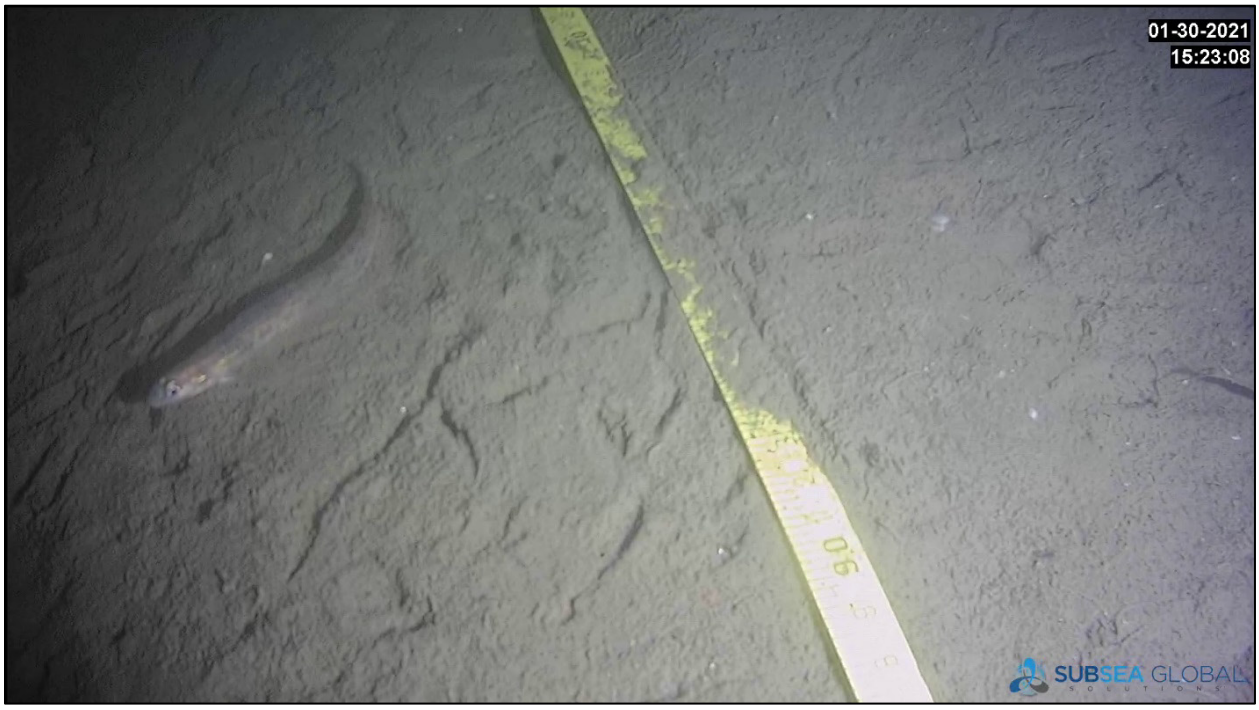


Figure 10 **Buffalo sculpin (*Enophrys bison*) observed in the Study Area, on debris, among giant plumose anemones (*Metridium farcimen*).**

4.4 MARINE MAMMALS

Two Pacific harbour seals (*Phoca vitulina richardsi*) were observed in the Study Area during the dive surveys (one each of the two days).

4.5 MARINE BIRDS

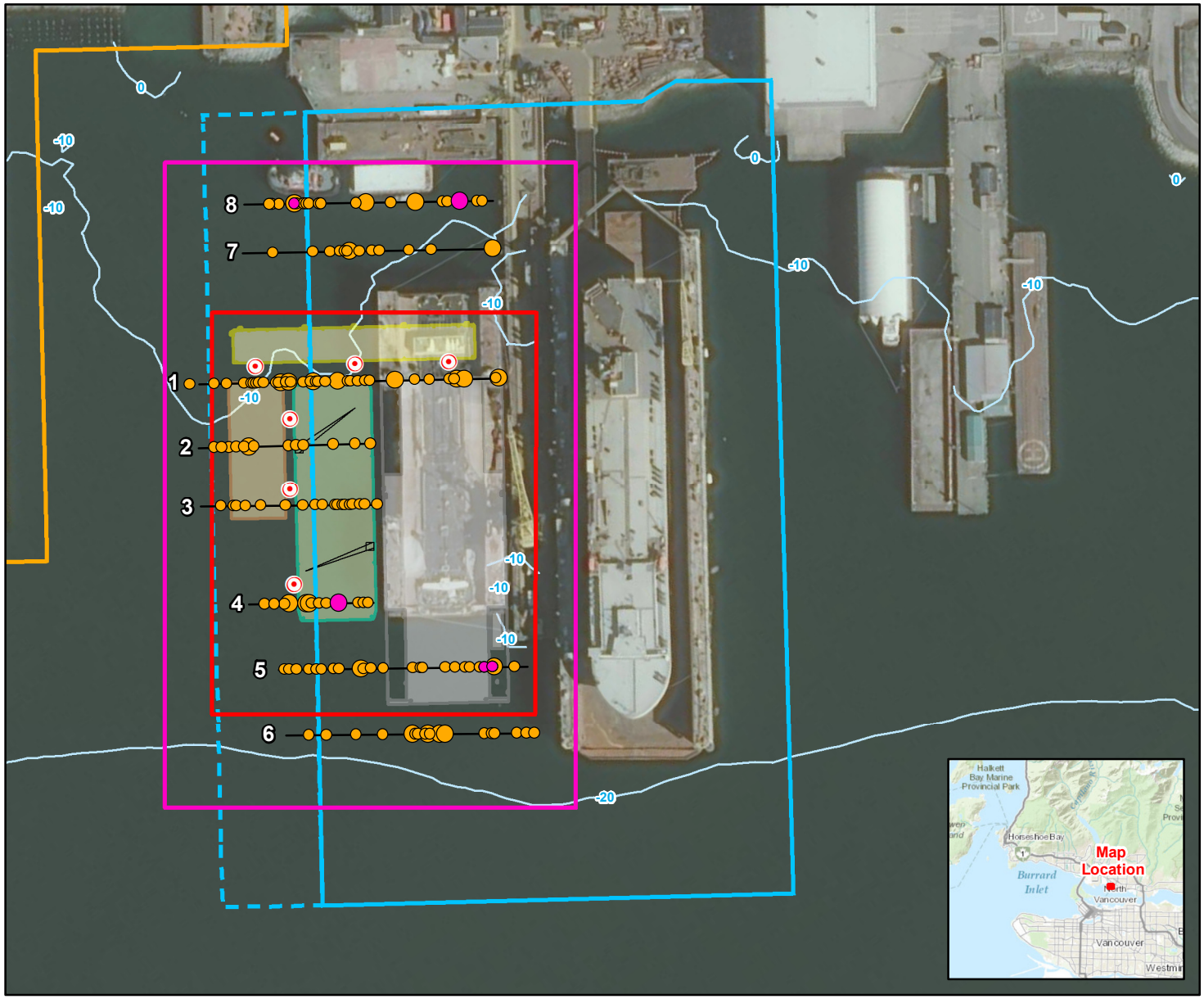
Glaucous-winged gulls (*Larus glaucescens*), Canada geese (*Branta canadensis*), Barrow's golden eye (*Bucephala islandica*), and cormorants (*Phalacrocorax* sp.) were observed passing through the Study Area during the dive surveys (Figure 11).

Figure 11 Birds observed in the Study Area.

4.6 MARINE INVERTEBRATES

A total of 1137 individual marine invertebrates were observed in the Study Area (Figure 12, Appendix A4). Anemones were the most abundant taxa (Figure 14, Appendix A4) and included three species: Giant plumose anemones (*Metridium farcimen*), painted anemones (*Urticina crassicornis*) and burrowing anemones (*Anthopleura artemisia*). The second most abundant taxa were crabs and included four species, though Dungeness crabs (*Cancer magister*) were by far the most abundant (Figure 12). Sea stars were somewhat abundant, with 39 observed in total (Appendix A4). Marine invertebrates (especially sessile species) were mostly found on hard surfaces, including debris and cobbles.

Figure 12 Map of crabs and shrimp observed in the Study Area.



Legend

- Pile
- Crane
- Bathymetry (Interval 10m)
- Transect
- Vancouver Fraser Port Authority Boundary
- Existing Water Lot Boundary
- Expanded Water Lot Boundary
- Project Area
- Study Area

Proposed Project Features

- New Work Pontoon
- New 100m Drydock
- New 55m Drydock
- Relocated Existing Careen

Species Type

- Crab
- Shrimp

Abundance

- 1
- 2 - 10

0 10 20 40 60 m

Scale: 1:2,500

Projection: NAD 1983 UTM Zone 10N

Data Sources:
a) Project features, water lot, Advisian 2021.
b) Transects, Seaspan 2021.
c) Fauna, project and study areas, Hatfield 2021.
d) Water lot boundaries, Seaspan 2021.
e) Bathymetry, DFO 2020.
f) Vancouver Fraser Port Authority Boundary, Port of Vancouver 2018.
g) GeoEye-01 50 cm, 15 March 2020, Esri Online Service.

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Vancouver Drydock Water Lot Project

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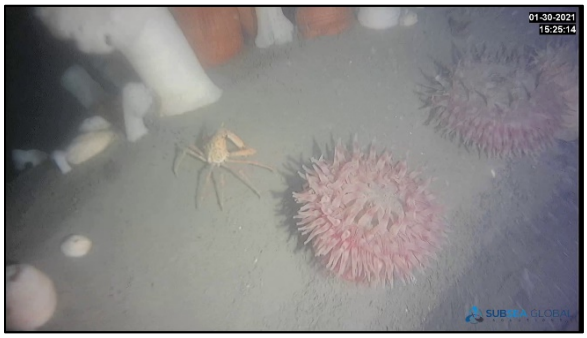
Table 6 Marine invertebrates observed in the Study Area.

Anemones	
Burrowing anemone (*Anthopleura artemisia*)	5
Giant plumose anemone *(Metridium farcimen)*	818
Painted anemone (*Urticina crassicornis*)	74
Crabs	
Dungeness crab (*Cancer magister*)	168
Graceful decorator crab (*Oregonia gracilis*)	3
Longhorn decorator crab (*Chorilia longipes*)	2
Red rock crab (*Cancer productus*)	8
Hydroid colony	
Wine-glass hydroids (*Obelia spp.*)	2
Nudibranchs	
Frosted nudibranch (*Dirona albolineata*)	1
Frosty-tipped nudibranch (*Janolus gelidus*)	1
Monterey sea lemon (*Doris montereyensis*)	1
Spotted leopard dorid (*Diaulula odonoghui*)	2
Sea stars	
Leather sea star (*Dermasterias imbricata*)	14
Mottled sea star (*Evasterias troschelii*)	4
Ochre sea star (*Pisaster ochraceus*)	21
Shrimp	
Coonstripe shrimp (*Pandalus danae*)	7
Sponge	
Demospongiae	4
Tunicate	
Ascidiacea	2
TOTAL	1137

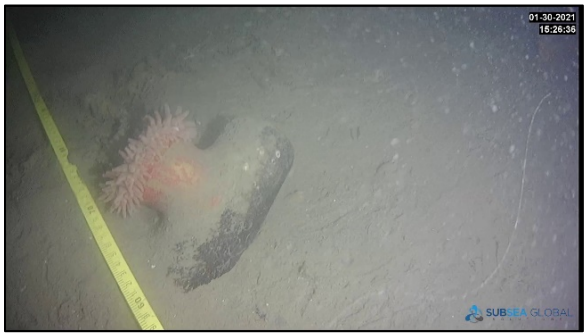
Figure 13 Example photos of marine invertebrates in the Study Area.

Dungeness crabs were observed throughout the Study Area.



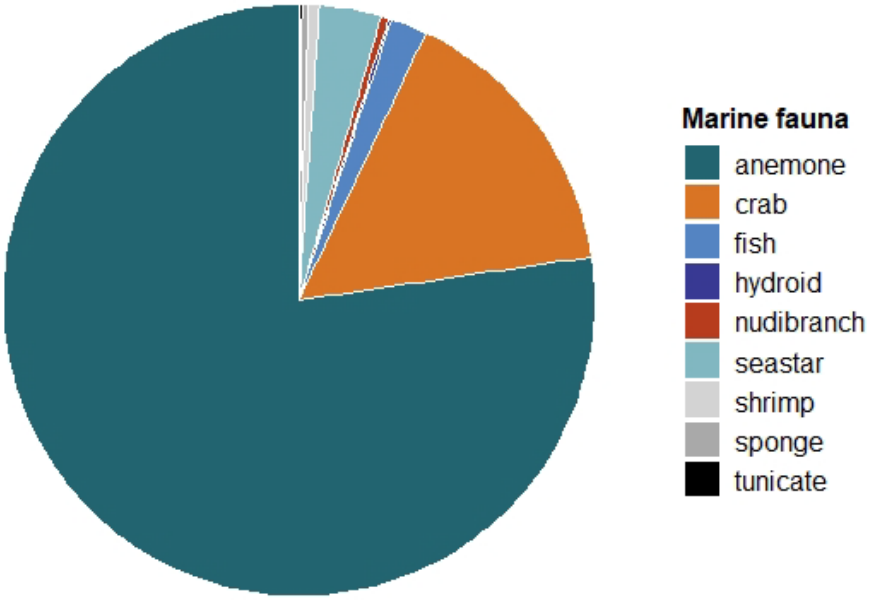
Longhorn decorator crab, painted anemones (pink) and giant plumose anemones (orange and white) on a large tire.

Spotted leopard dorid nudibranch on cobbles and silt.



Painted anemone on a glass bottle.

Figure 14 Proportion of marine fauna observed in the Study Area.



4.7 HABITAT QUALITY SUMMARY

The natural habitat within the Study Area is highly disturbed and has been modified by industrial use since the early 20th century. The substrate is mostly silt, and the patches of seabed that have cobbles or gravel are covered with a layer of silt. Due to the silty nature of the substrate, algae growth is not expected to be successful in this area, even in the summer. This is because algae spores need to adhere to hard surfaces and algae need to be free from silt burial to photosynthesize and grow. Further, the depth of the Study Area (5 to 20 m below CD) is deeper than what is ideal for kelp and most other algae. Lower kelp densities in deeper areas are attributed to lower sunlight penetration. Within Burrard Inlet kelp are generally observed in shallower depths between 0 m and 5 m below chart datum (NHC 2019). Marine fauna in the Study Area included sessile anemones, slow-moving sea stars, and highly mobile crabs and fish.

5.0 POTENTIAL IMPACTS

5.1 IMPACTS RELATED TO DESIGN AND OPERATION

Potential Project related impacts on the environment include increased shading on the seabed beneath the structures, the potential for an increase in artificial light, and the positive impact of increased marine habitat from the introduction of the new structures.

The introduction of the new floating structures and piles has the potential to have a permanent positive impact on marine fauna, mainly due to the introduction of substrate that has the potential to support flora and fauna. Many marine invertebrates colonize and adhere to hard substrates, including steel. For example, within the Study Area, the side of the Careen was thickly covered with marine invertebrates. New structures such as piles and docks could increase the biodiversity of the area and provide the opportunity for macroalgae to grow in an area where it normally could not.

The new structures will increase shading on the seabed in the Study Area. Species observed in the Study Area mostly included invertebrates such as anemones and crabs that are not impacted by decreased sunlight. There were very few species that are dependent on sunlight, such as macroalgae. This very low abundance of macroalgae was due to the depth of the water and abundance of silt. The shaded seabed under the Careen was surveyed as part of the habitat assessment and there was no difference in the marine biota under the Careen compared to the unshaded seabed.

The potential impacts related to the operation of the new structures are expected to be the same as those already mitigated during the operation of the existing drydocks and Careen. Additional lighting will be required, which if pointed towards the water, could cause disorientation in fish (TWN 2017). The lighting plan includes lights that point directly down to minimize light pollution to the marine environment and have motion sensors (to detect humans) to minimize the time lights are active.

5.2 IMPACTS RELATED TO CONSTRUCTION

Pile driving for the installation of the floating structures will occur but other activities such as rock placement will not occur.

Potential temporary and short-term adverse impacts could arise from:

- Accidental spills to water (e.g., concrete, fuel and oil for machinery) during works;
- Changes in habitat use by fish during construction; and
- Increased noise during construction, especially during pile driving activities.

Fish habitat usage may be temporarily altered for the very few fish that were observed, during piling activities. A slight increase in turbidity and noise is expected during piling, which will likely deter fish from using the area. As such, the potential for direct fish mortality because of the Project is considered very low.

6.0 MITIGATION MEASURES

This section outlines recommended avoidance and mitigation measures to be incorporated in the design and planning of the drydock installation including BMPs and other mitigations that will be implemented during construction and operation.

The installation of the drydocks should be completed under the guidance of an Environmental Monitor (EM) and adhere to the environmental protection measures outlined in a Project CEMP. The CEMP will provide specific mitigation measures and define EM monitoring requirements during construction.

The following avoidance and mitigation measures have been developed in consideration of habitat assessment findings and will be incorporated during the planning and design of the new drydocks. The CEMP will include, but is not limited to, the following mitigation measures:

- In-water construction activities shall be conducted during the Least Risk Window for Burrard Inlet of August 16 to February 28.
- Vibratory pile driving will be used preferentially over impact pile driving.
- All in-water pile driving activities shall be monitored by a Qualified Environmental Professional (QEP) for underwater noise (i.e., hydroacoustic monitoring) for the first five days of piling to determine accordance with DFO-defined sound thresholds, and to establish a marine mammal Exclusion Zone (EZ). Marine Mammal Observation shall be conducted in the EZ throughout the duration of in-water piling works if noise levels are determined to go above 160 dB.
- A sound attenuation device (e.g., bubble curtain) will be implemented to reduce sound, as necessary, to ensure accordance with DFO-defined sound thresholds.
- In-water piling works will utilize soft start procedures whereby energy is gradually increased over a 10-minute period.
- Where concrete infilling works are conducted, concrete shall be carefully poured using a tremie pipe to avoid spillage.

- Concrete and concrete-laden water shall not contact Burrard Inlet outside of the piles, either directly or indirectly.
- Deleterious substances shall be prevented from entering the marine environment. Equipment utilized for construction will be maintained and inspections completed to verify they are clean and free of leaks prior to working near water (to be outlined in the CEMP). Preparedness for spills near water will include a drum style spill kit adjacent to the work area.
- Construction activities will be completed using marine-based equipment. Barges shall not ground upon the seabed except for the use of anchors or spuds for positioning.
- Operations and construction shall comply with Seaspan's BMP-04 Site Management and Housekeeping and BMP-02 Waste Management and Recycling (Seaspan ULC 2017a; Seaspan ULC 2017b).
- Equipment will utilize readily biodegradable hydraulic fluids.
- Barges will be refuelled by certified refuelling barges using Transport Canada's Refueling Over Water Procedure and equipment on decks will be refuelled out of the barge's built-in fuel tanks or deck mounted tidy tanks.
- While refuelling, all operators shall stay with the fuel nozzle. Ignition shall be turned off while the vehicle, equipment or machinery is being refuelled. The operator shall immediately shut off the source if a spill occurs.
- All applicable legislation with respect to the handling, transportation, and/or disposal of all materials related to this Project (waste or otherwise) shall be adhered to. These regulations may include (but not be limited to) the BC Hazardous Waste Regulations, Spill Reporting Regulations, Workers Compensation Board Regulations, TDG Regulations, etc.
- No wastewater will be generated on these structures. Stormwater will be treated as follows:
    - While a vessel is drydocked, stormwater and vessel washwater will be collected and processed through the onsite permitted water treatment plant prior to discharge to the city sewer line.
    - If there is no vessel on the drydock, uncontaminated stormwater will drain to the Inlet.
- All permits, licenses and authorizations for works shall be secured prior to commencement.

7.0 POTENTIAL FOR DEATH OF FISH AND HADD

The *Fisheries Act* requires that Project works, undertakings or activities avoid causing;

- the death of fish by means other than fishing; and
- Harmful Alteration, Disruption and Destruction (HADD) unless authorized by the Minister of DFO.

Construction activities are not expected to cause permanent adverse impacts to aquatic wildlife or aquatic habitat if the mitigation measures and BMP in section 6.0 and the CEMP are followed. Death of fish will be

avoided via several mitigations, including a soft start to construction, ensuring noise is in accordance with DFO-defined sound thresholds, preventing adverse impacts to water quality, and minimizing disturbance to the seabed and fish habitat (i.e., rocks). Because the construction will only take place during the Least Risk Window, the potential for adverse impacts to fish (i.e., salmon) will be minimized. This is in alignment with DFO's risk-based approach considering the sensitivity of the fish and fish habitat.

HADD is interpreted as "any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes of fish" (DFO 2019c) and Hatfield does not believe there will be such a change due to the addition of the floating structure. The drydock expansion has been designed to minimize contact with the seabed, and the structures themselves are expected to become colonized by invertebrates and algae which will very likely create more fish habitat than was there previously.

7.1 POTENTIAL ADVERSE RESIDUAL IMPACTS

Potential adverse residual impacts (i.e., effects that may reasonably occur after all mitigation is considered) are assessed in the context of the death of fish or HADD. Potential adverse residual impacts may include disorientation of some fish due to increased shading. However, the increased habitat provided by the new structures could be beneficial to habitat-forming kelp and other marine fauna which fish rely on. It is anticipated that the ability for fish to carry out their life processes will not be negatively affected and through the application of relevant construction BMPs, the Project will not cause adverse residual impacts to fish and wildlife or the habitats upon which support their life functions.

8.0 SUMMARY AND CONCLUSIONS

Seaspan intends to expand their drydock facilities in North Vancouver, which includes the installation of a floating work pontoon, two additional floating drydocks and 30 steel piles to support the floating infrastructure. Hatfield has assessed the quality of the habitat in the Study Area using a diver-based video survey and has determined that the habitat is of low quality. Habitat-forming algae, such as kelp, cannot grow in the Study Area due to the abundance of silt, and the depth (i.e., lack of sufficient sunlight penetration). It is Hatfield's opinion that if the proposed mitigation measures outlined in this document and the CEMP are followed, adverse impacts to wildlife, including fish and fish habitat, are not expected to occur as a result of the Project.

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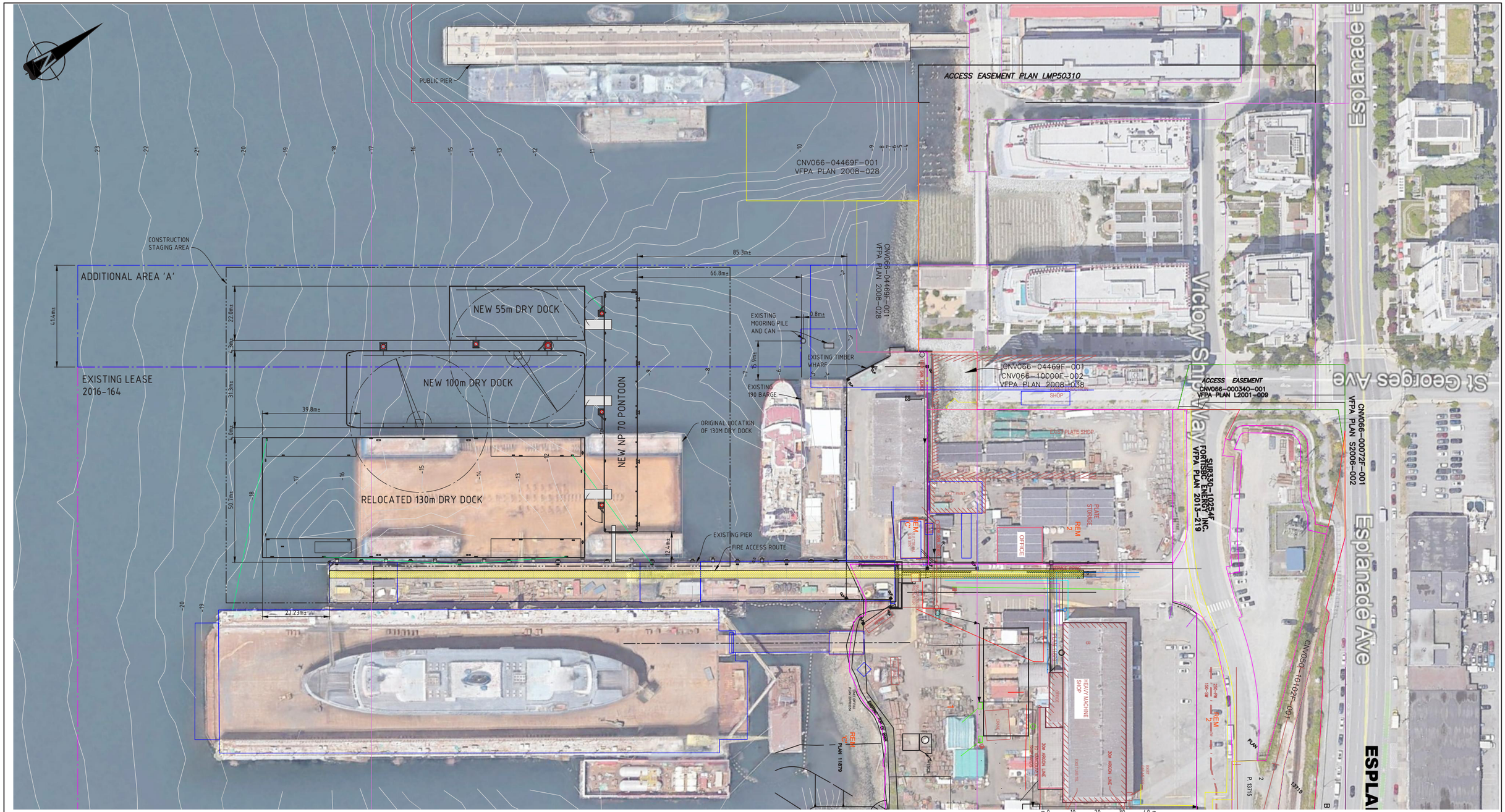
APPENDICES

Appendix A1

Engineering Drawings



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B	23-MAR-21	ISSUED FOR CLIENT REVIEW	GL	-	JJC	GL	DCB	-		
A	10-MAR-21	ISSUED FOR CLIENT REVIEW	GL	-	JJC	GL	DCB	-		

D SHEET | SCALE | SHOWN

OneWay

WORLEY PROJECT No
317086-32308

ENGINEERING AND PERMIT STAMPS (As Required)

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: Mar. 26/21 9:19am

CUSTOMER
seaspan

Advisian
Worley Group

SEASPAN
WATER LOT PROJECT
SITE PLAN

DRG No
317086-32308-00-MA-DGA-1501

REV
C

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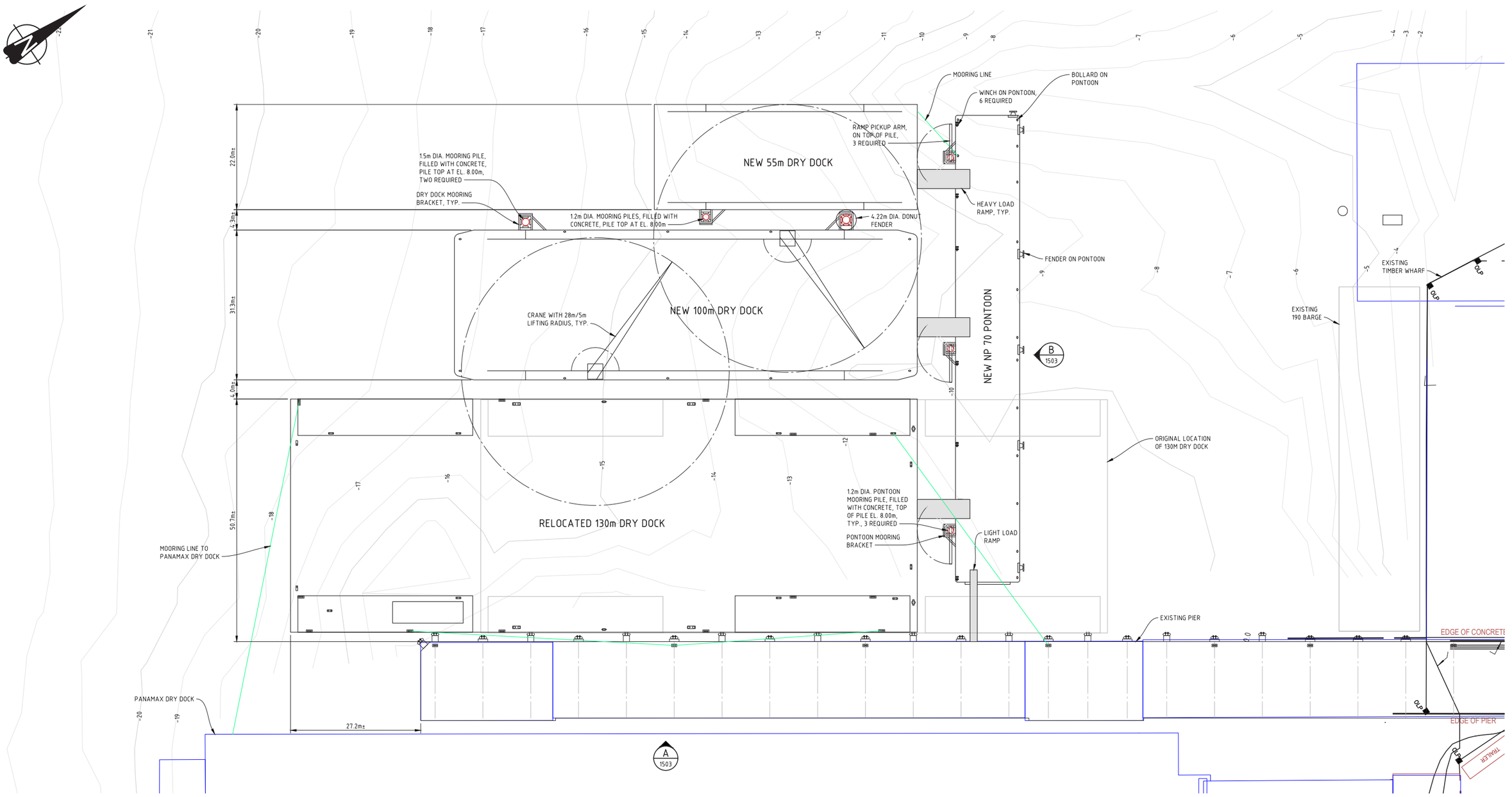

PLAN
1:400

m 0 5 10 15 20m
1:400

REV	DATE (DD-MMM-YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	QAR	REF DRAWING No	REFERENCE DRAWING TITLE
F	25-MAR-21	ISSUED FOR PERMIT	GL	-	JJC	GL	DCB	-		
E	23-MAR-21	ISSUED FOR CLIENT REVIEW	GL	-	JJC	GL	DCB	-		
D	10-MAR-21	ISSUED FOR CLIENT REVIEW	GL	-	JJC	GL	DCB	-		
C	18-FEB-21	ISSUED FOR CLIENT REVIEW	GL	-	JJC	GL	DCB	-		
B	11-FEB-21	ISSUED FOR CLIENT REVIEW	GL	-	JJC	GL	DCB	-		
A	29-JAN-21	ISSUED FOR CLIENT REVIEW	GL	-	JJC	GL	DCB	-		

D SHEET | SCALE | SHOWN

OneWay

WORLEY PROJECT No
317086-32308

ENGINEERING AND PERMIT STAMPS (As Required)

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: Mar. 25/21 3:26pm

CUSTOMER

seaspan

Advisian
Worley Group

SEASPAN
WATER LOT PROJECT
GENERAL ARRANGEMENT
PLAN

DRG No
317086-32308-00-MA-DGA-1502

REV
F

LOCATION: U:\YVR\317086\32308_SVD_WATERLOTEX\1T_DRAWINGS\15_I_AND_E\02_MARINE\317086-32308-00-MA-DGA-1502 TO 1503.DWG
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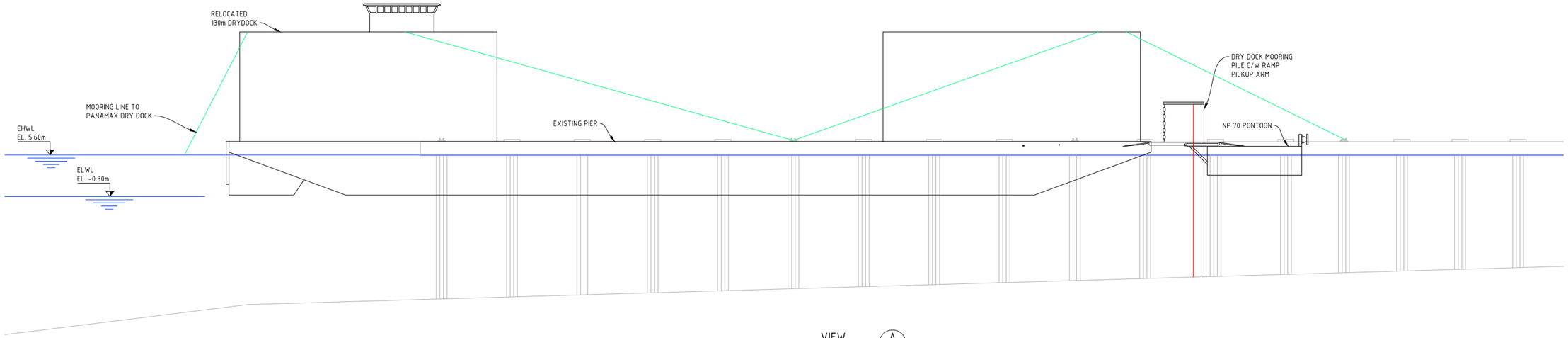
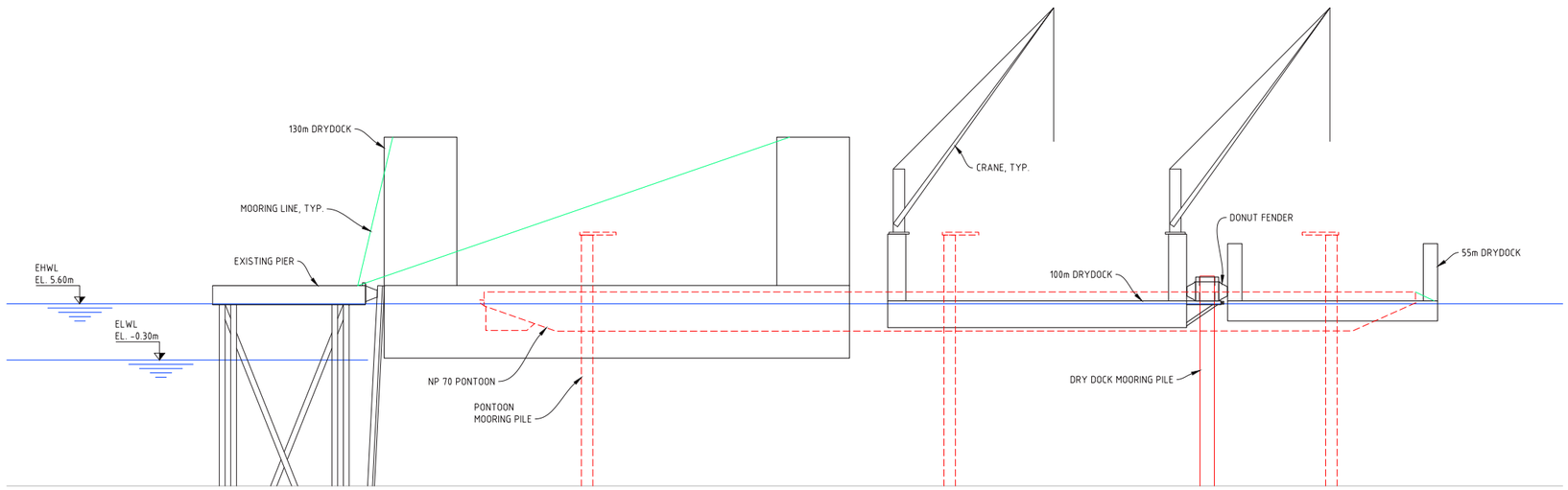
SAVE DATE & TIME: 25/3/2021 3:26:17 PM



VIEW A
1:300
1502



VIEW B
1:300
1502

m 0 5 10 15 m
1:300

REV	DATE (DD-MMM-YY)	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	QAR	REF DRAWING No	REFERENCE DRAWING TITLE
C	25-MAR-21	ISSUED FOR PERMIT	GL	-	JJC	GL	DCB	-		
B	23-MAR-21	ISSUED FOR CLIENT REVIEW	GL	-	JJC	GL	DCB	-		
A	10-MAR-21	ISSUED FOR CLIENT REVIEW	GL	-	JJC	GL	DCB	-		

D SHEET | SCALE | SHOWN

OneWay

WORLEY PROJECT No
317086-32308

ENGINEERING AND PERMIT STAMPS (As Required)

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: Mar. 25/21 3:26pm

CUSTOMER
seaspan

Advisian
Worley Group

SEASPAN
WATER LOT PROJECT
GENERAL ARRANGEMENT
SECTIONS

DRG No 317086-32308-00-MA-DGA-1503
REV C

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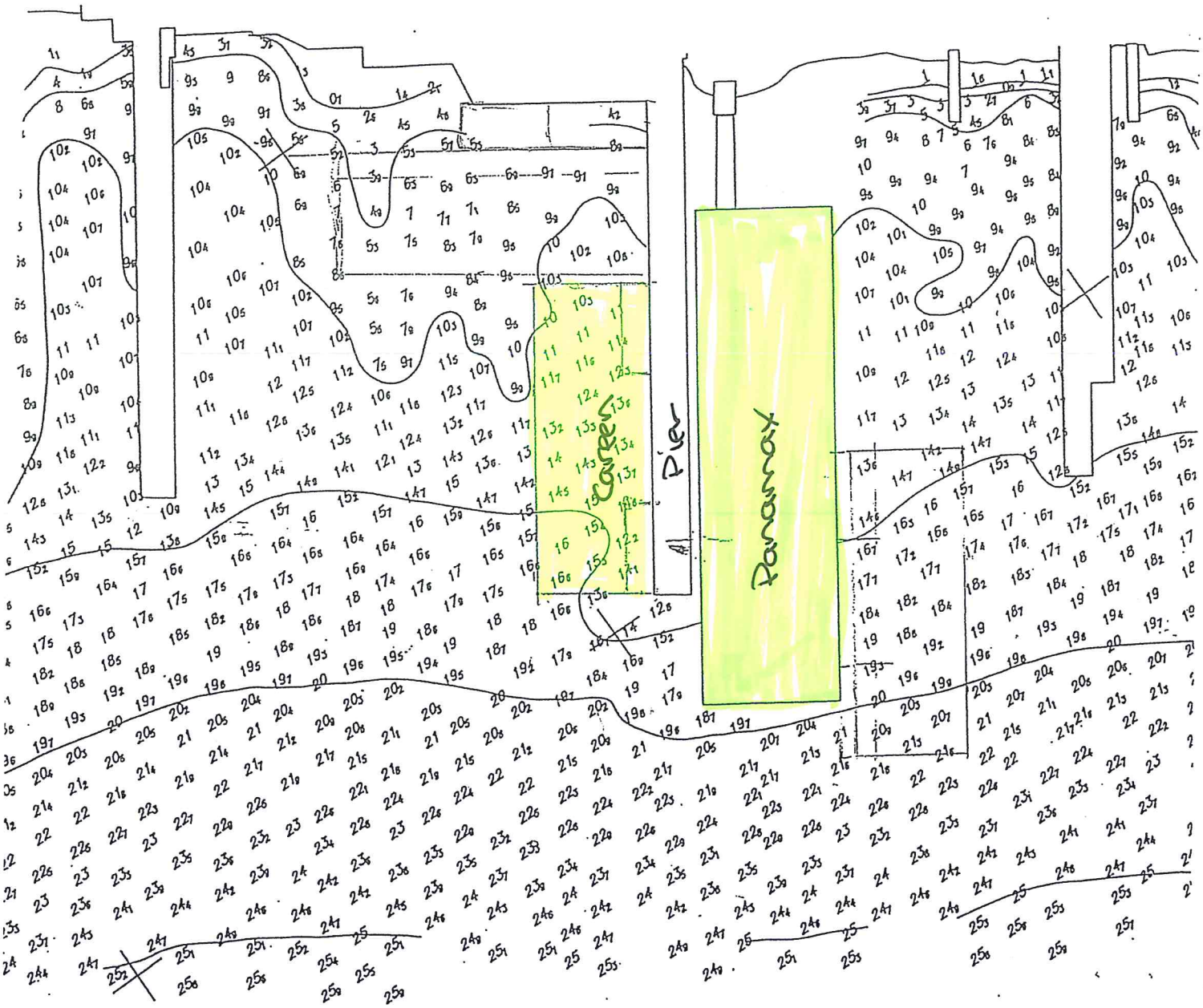
Appendix A2

Bathymetric Chart



- Water Depth @ 0 tide
- All values in meters

1-250

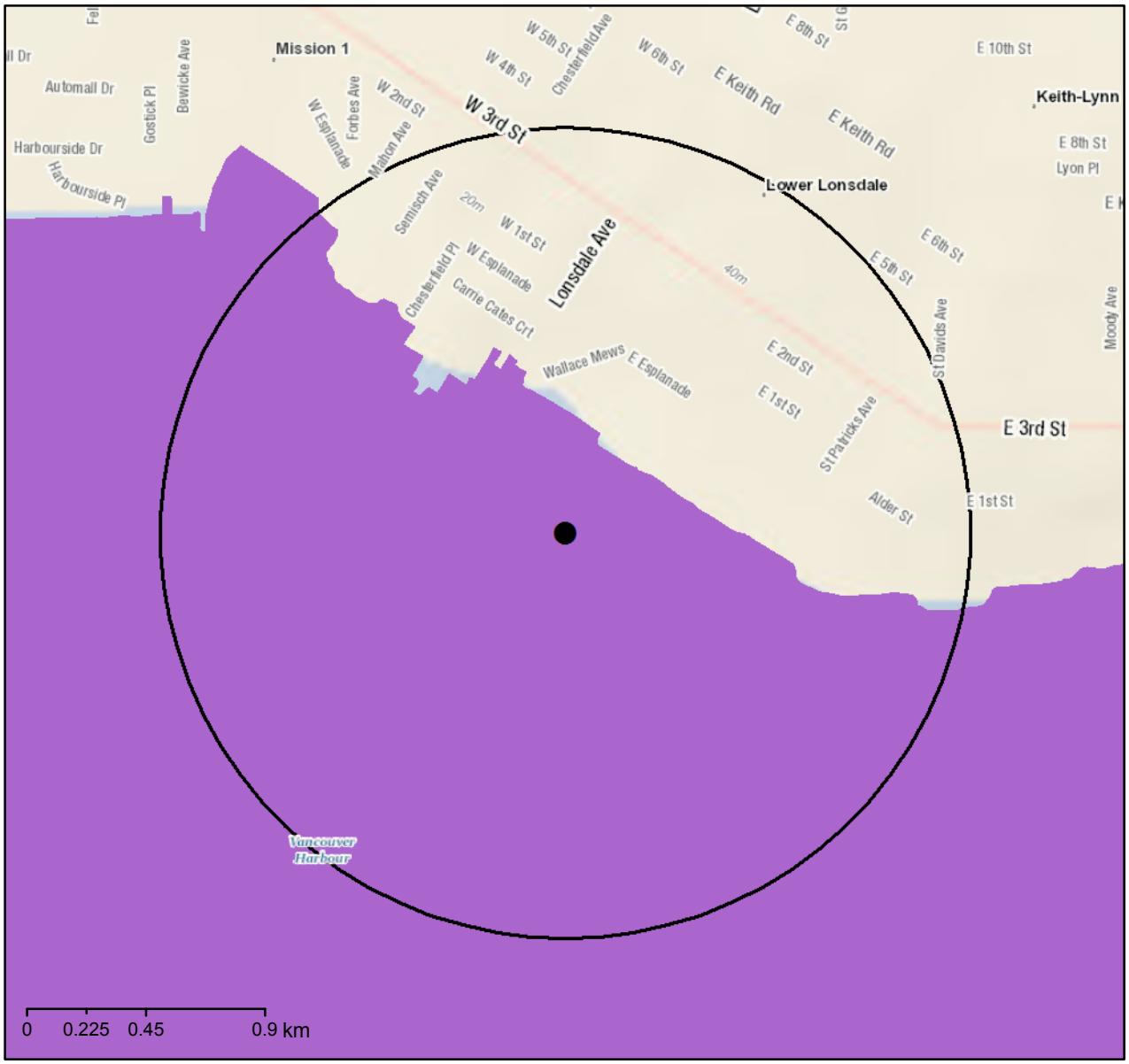
Appendix A3

Aquatic Species at Risk Report

Fisheries and Oceans Canada | Pêches et Océans Canada

Aquatic Species at Risk Report

Canada



One or more aquatic species listed under the Species at Risk Act are found (or potentially found) within the coloured areas.

- Critical Habitat
- Extirpated, Endangered, or Threatened
- Special Concern

How to use this information:

1. The map and species list are intended to provide a general overview of aquatic species at risk and their critical habitat that may occur within the mapped area.

2. To assess your project go to: www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html

If you encounter an aquatic species at risk in an area that is not currently mapped, please notify your regional Fisheries Protection Program office to ensure that you are compliant with the Species at Risk Act.
The official source of information for species at risk is the Species at Risk Public Registry www.sararegistry.gc.ca

To protect fish and fish habitat, including aquatic species at risk, their residences, and their critical habitat, efforts should be made to avoid, mitigate and/or offset harm. Following the measures to avoid harm will help you comply with the Fisheries Act and the Species at Risk Act.

Critical habitat for these species is found within the outlined area

Critical habitat is identified in recovery strategies or action plans for species listed under Schedule 1 of the Species at Risk Act as extirpated, endangered or threatened.

Name	Where Found	Species Status
	No critical habitat	

Species found (or potentially found) within the outlined area

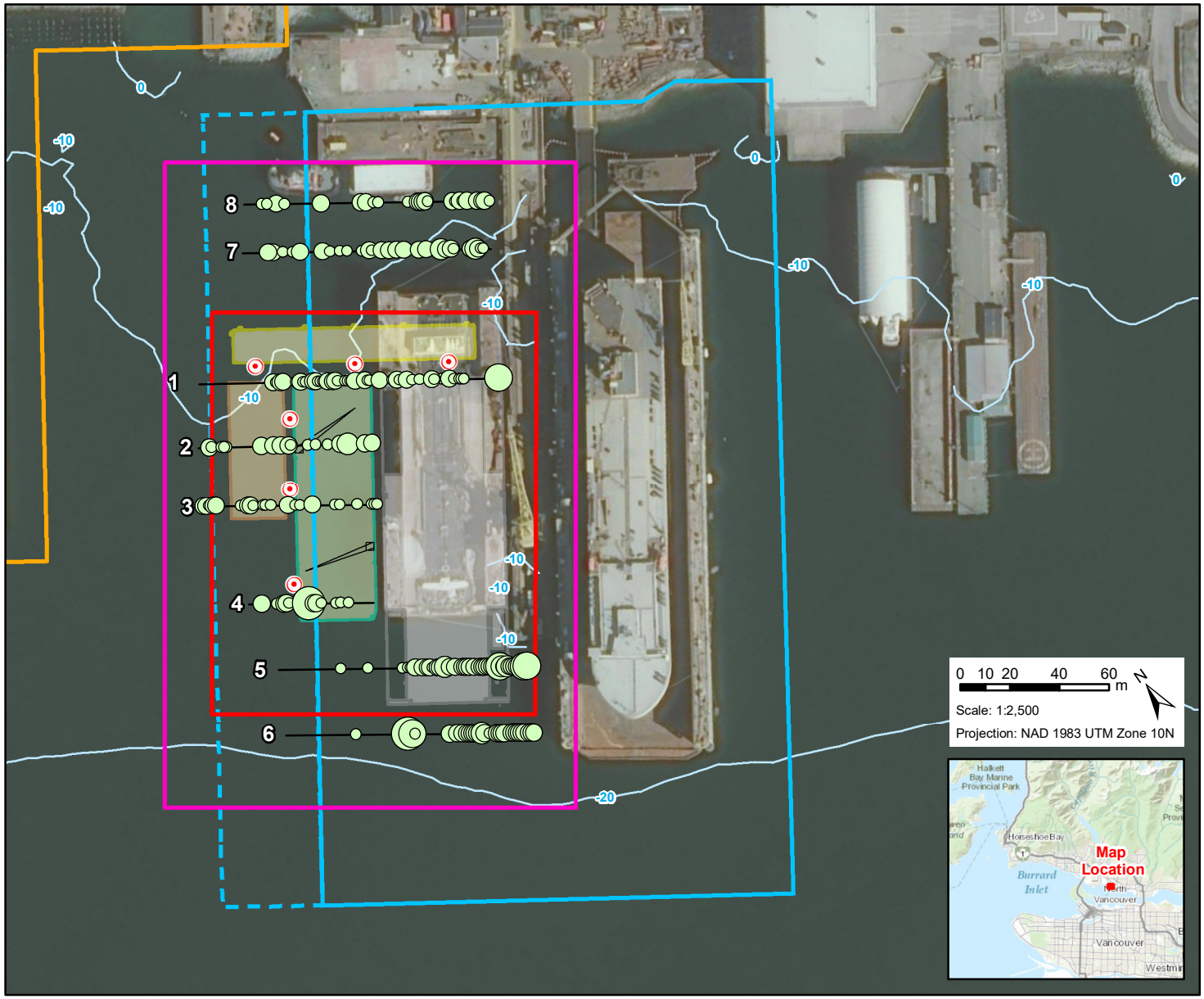
Name	Where Found	Species Status
Basking Shark - Pacific	Pacific Ocean/Océan Pacifique	Endangered
Bluntnose Sixgill Shark	Pacific Ocean/Océan Pacifique	Special Concern
Green Sturgeon	Pacific Ocean/Océan Pacifique	Special Concern
Grey Whale - Eastern North Pacific	Pacific Ocean/Océan Pacifique	Special Concern
Harbour Porpoise - Pacific Ocean	Pacific Ocean/Océan Pacifique	Special Concern
Humpback Whale - North Pacific	Pacific Ocean/Océan Pacifique	Special Concern
Killer Whale - Northeast Pacific Transient	Pacific Ocean/Océan Pacifique	Threatened
Leatherback Sea Turtle - Pacific	Pacific Ocean/Océan Pacifique	Endangered
Longspine Thornyhead	Pacific Ocean/Océan Pacifique	Special Concern
Northern Abalone	Pacific Ocean/Océan Pacifique	Endangered
Rougheye Rockfish type I	Pacific Ocean/Océan Pacifique	Special Concern

Rougheye Rockfish type II	Pacific Ocean/Océan Pacifique	Special Concern
Steller Sea Lion	Pacific Ocean/Océan Pacifique	Special Concern
Tope	Pacific Ocean/Océan Pacifique	Special Concern
Yelloweye Rockfish - Pacific Ocean Inside Waters	Pacific Ocean/Océan Pacifique	Special Concern
Yelloweye Rockfish - Pacific Ocean Outside Waters	Pacific Ocean/Océan Pacifique	Special Concern

Appendix A4

Maps of Invertebrate Abundance in the Study Area

Figure A4.1 Anemones observed in the Study Area.



Legend

- Pile
- Crane
- Bathymetry (Interval 10m)
- Transect
- Vancouver Fraser Port Authority Boundary
- Existing Water Lot Boundary
- Expanded Water Lot Boundary
- Project Area
- Study Area

Proposed Project Features

- New Work Pontoon
- New 100m Drydock
- New 55m Drydock
- Relocated Existing Careen

Species Type

- Anemone

Abundance

- 1
- 2 - 10
- 11 - 20
- 21 - 30
- 31 - 40

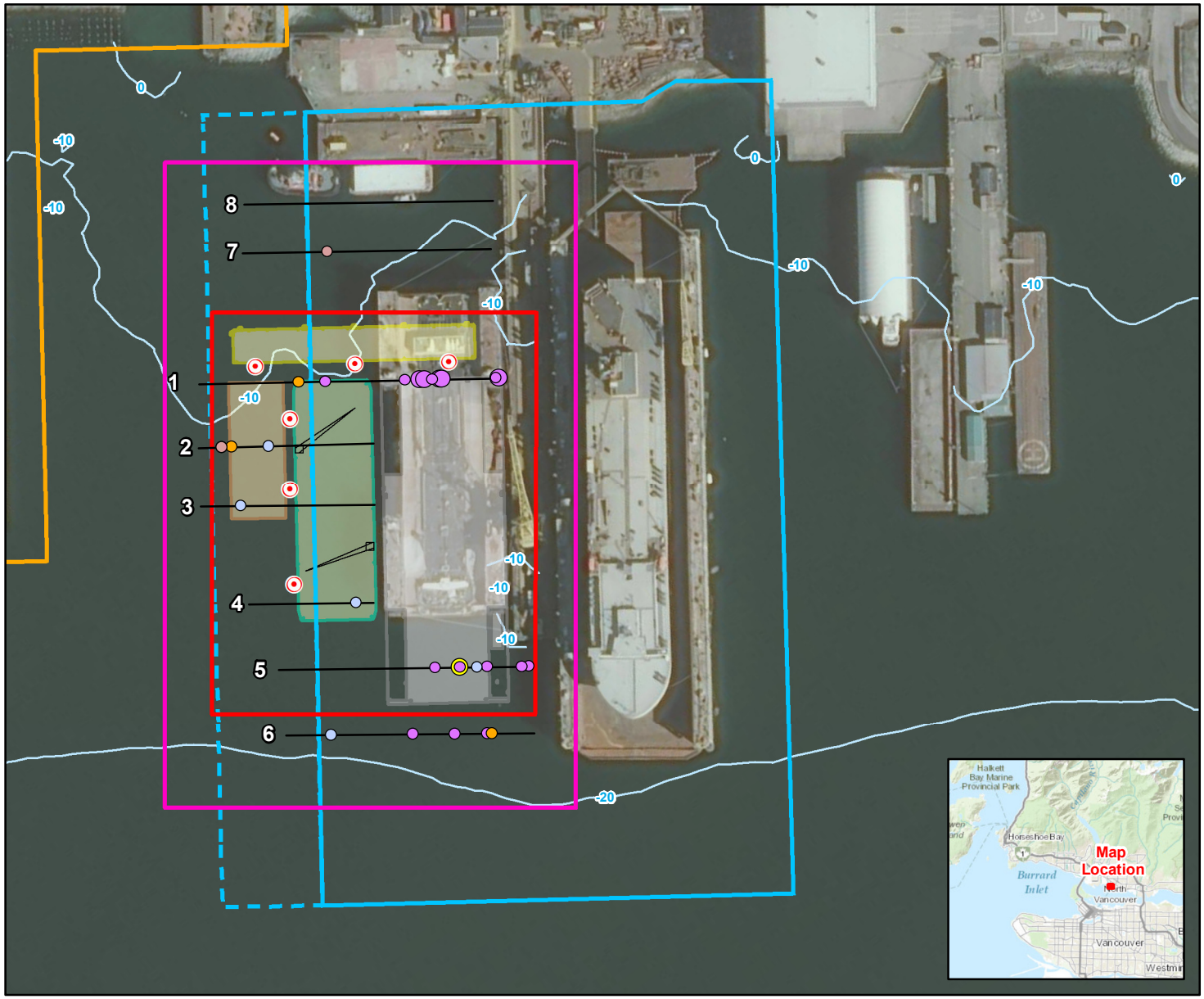
Data Sources:
a) Project features, water lot, Advisian 2021.
b) Transects, Seaspan 2021.
c) Fauna, project and study areas, Hatfield 2021.
d) Water lot boundaries, Seaspan 2021.
e) Bathymetry, DFO 2020.
f) Vancouver Fraser Port Authority Boundary, Port of Vancouver 2018.
g) GeoEye-01 50 cm, 15 March 2020, Esri Online Service.

Hatfield

Vancouver Drydock Water Lot Project

K:\Data\Project\SSPAN10806\A_MXD\SSPAN10806_7_Survey_Fauna_4_20210622_v0_4_AnS.mxd

Figure A4.2 Other marine invertebrates observed in the Study Area.



Legend

- Pile
- Crane
- Bathymetry (Interval 10m)
- Transect
- Vancouver Fraser Port Authority Boundary
- Existing Water Lot Boundary
- Expanded Water Lot Boundary
- Project Area
- Study Area

Proposed Project Features

- New Work Pontoon
- New 100m Drydock
- New 55m Drydock
- Relocated Existing Careen

Species Type

- Hydroid
- Nudibranch
- Seastar
- Sponge
- Tunicate

Abundance

- 1
- 2 - 10

0 10 20 40 60 m

Scale: 1:2,500

Projection: NAD 1983 UTM Zone 10N

Data Sources:
a) Project features, water lot, Advisian 2021.
b) Transects, Seaspan 2021.
c) Fauna, project and study areas, Hatfield 2021.
d) Water lot boundaries, Seaspan 2021.
e) Bathymetry, DFO 2020.
f) Vancouver Fraser Port Authority Boundary, Port of Vancouver 2018.
g) GeoEye-01 50 cm, 15 March 2020, Esri Online Service.

Hatfield

Vancouver Drydock Water Lot Project

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