



B2D2 Project

Lynn Creek Estuary Offsetting Plan

PLAN-B2D2-0008

Rev.	Date	Reason for Issue	Contributors		Approver
1	Apr 24, 2023	Use	Hatfield	Dynamic Ocean	Victoria Burdett-Coutts
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Requirement ID	Information Requirement	Description	Report Section
Prescribed Information Requirements:			
Schedule 1, section 16 ¹	A detailed description of a plan to offset the death of fish referred to in section 13 and the harmful alteration, disruption or destruction (HADD) of fish habitat referred to in section 14 that were not offset by the habitat credits referred to in section 15, including:	This report includes all the details of the Offsetting Plan for the Berth 2 (B2) Shiploader Replacement Project (B2 Project) at Neptune Bulk Terminals (CANADA) Ltd. (NBT), which will occur in Lynn Creek Estuary (LCE), i.e., the LCE Offset Project. The Offsetting Plan includes all the components required under the Applicant's Guide to Supporting the "Authorizations Concerning Fish and Fish Habitat Protection Regulations".	
Schedule 1, section 16(a)	The geographic coordinates of the location where Offsetting measures will be implemented.	The LCE Offset Project is located at 49° 17.929'N, 123° 2.417'W, in the LCE, 1 km east of B2, in Burrard Inlet.	3.1
Schedule 1, section 16(b)	A small-scale site plan identifying the general location and boundaries of the location where the measures will be implemented.	A map has been developed showing the location and boundaries of the Offsetting.	3.1, Figure 3-1
Schedule 1, section 16(c)	A detailed description of the measures and how those measures will meet their objectives.	This report includes details of measures for meeting the Offsetting objectives.	5.3, 6
Schedule 1, section 16(d)	A detailed description of the monitoring measures that will be implemented to assess the effectiveness of the measures referred to in paragraph (c).	The objective of effectiveness monitoring is to determine whether the proposed Offsetting measures will be effective in offsetting the HADD caused by the B2 Project. Effectiveness monitoring is planned for years 1, 3 and 5 post-construction.	8
Schedule 1, section 16(e)	A detailed description of the contingency measures and associated monitoring measures that will be implemented if the measures referred to in paragraph (c) do not meet their objectives.	Contingency measures are planned that would be implemented if the planned offsetting measures did not meet their objective(s). A post-construction underwater video and bathymetry survey will be undertaken, and as-built drawings prepared for comparison to design drawings. Measures have been defined in response to any potential uncertainties identified.	9

Requirement ID	Information Requirement	Description	Report Section
Schedule 1, section 16(f)	A detailed description of any adverse effects on fish and fish habitat that could result from the implementation of the plan.	There is potential for adverse effects on fish and fish habitat related to construction of the LCE Offset Project. There are mitigations in place to reduce the risk of these occurring. Potential adverse effects include: <ul style="list-style-type: none"> Reduction in marine water quality due to increased turbidity from rock placement and exposure to deleterious substances (i.e., accidental spill); and Physical damage to marine fauna (crushing, burial, or mortality). 	5
Schedule 1, section 16(g)	A detailed description of the measures and standards that will be implemented to avoid or mitigate the adverse effects and how those measures will meet their objectives.	Fisheries and Oceans Canada's (DFO's) measures to protect fish and fish habitat and Codes of Practice have been reviewed and all those that are relevant and can be successfully implemented are included.	5.3
Schedule 1, section 16(h)	The timeline for the implementation of the plan.	It is expected to take two to three weeks to construct the LCE Offset Project. The Offsetting will be constructed ahead of the B2 Project.	3.3
Schedule 1, section 16(i)	An estimate of the cost of implementing each element of the plan.	The costs associated with the implementation of each element of the plan are provided in a letter titled Lynn Creek Estuary Offset Project Cost Estimate (NBT, 2023f)	n/a
Schedule 1, section 16(j)	If the implementation of the plan requires access to lands, water sources or water bodies that are not owned by the applicant, a description of the steps that are proposed to be taken to obtain the authorization required for the applicant, the Department of Fisheries and Oceans and anyone authorized to act on the Department's behalf to access the lands, water sources or water bodies in question. This information is not required if the applicant is Her Majesty ² in right of Canada, Her Majesty in right of a province or the government of a territory.	n/a	n/a



Fisheries Management Objectives			
Consideration 1.1	Did you consider local fisheries management objectives in your planning process?	The local fish management objectives (e.g., KWL (2017)) were considered.	6
Consideration 1.2	If yes, please identify the fisheries management objective(s)/plan considered and, if applicable, reference the relevant sections.	Increasing habitat for salmon in Burrard Inlet estuaries.	6
Consideration 2	Please identify any effects that the proposed work, undertaking or activity may have on achieving these objectives.	It is expected that the proposed work will aid in achieving this objective by providing additional salmon habitat in the LCE.	6

Table notes:

¹ Schedule 1 of the Authorizations Concerning Fish and Fish Habitat Protection Regulation

² Now His Majesty



ACRONYMS AND DEFINITIONS

Acronym	Definition
AFA	Application for Authorization
B2	Berth 2
B2 Project	Berth 2 Shiploader Replacement Project
BC	British Columbia
BCIT	British Columbia Institute of Technology
BCCF	BC Conservation Foundation
BKR Project	Bull Kelp Restoration Project
BMP	Best Management Practice
CD	Chart Datum
CCEMP	Contractor Construction Environmental Management Plan
CEMP	Construction Environmental Management Plan
CNV	City of North Vancouver
DFO	Fisheries and Oceans Canada
DFO-FHPP	Fisheries and Oceans Canada Fish and Fish Habitat Protection Program
DNV	District of North Vancouver
Dynamic Ocean	Dynamic Ocean Consulting Ltd.
HADD	Harmful alteration, disruption or destruction of fish habitat
HCTF	Habitat Conservation Trust Foundation
IFMP	Integrated Fisheries Management Plan
LCE	Lynn Creek Estuary
Musqueam	Musqueam Indian Band
NBT	Neptune Bulk Terminals (CANADA) Ltd.
NHC	Northwest Hydraulic Consultants
NSSK	North Shore Streamkeepers
QP	Qualified Professional
RA	Regulatory Authority
ROV	Remotely Operated Vehicle
Squamish	Squamish First Nation
the Port Authority	Vancouver Fraser Port Authority
Tsleil-Waututh	Tsleil-Waututh Nation
UBC	University of British Columbia
VanPile	Vancouver Pile Driving Ltd

1 INTRODUCTION

1.1 Background

To offset the harmful alteration, disruption, or destruction of fish habitat (HADD) associated with Neptune Bulk Terminals (CANADA) Ltd. (NBT) Berth 2 (B2) Shiploader Replacement Project (B2 Project), NBT is proposing to implement a habitat enhancement project in Lynn Creek Estuary (LCE) (the LCE Offset Project). Justification for the selection of the LCE Offset Project relative to B2 Project effects is provided in this report. Fisheries and Oceans Canada (DFO) guidance was followed to identify and design the LCE Offset Project.

The Fisheries Protection Policy Statement (DFO, 2019a) includes a range of factors that DFO Fish and Fish Habitat Protection Program (DFO-FFHPP) will consider when making a decision with respect to an application for Authorization and proponents should consider these factors in designing offsetting. It explains that offsetting measures may take a variety of forms ranging from localized improvements to fish habitat to more complex measures that address limiting factors to fish production, and that the choice of appropriate offsetting measures should be guided by:

- The restoration priority for degraded fish habitat.
- Fisheries management objectives.
- The expected death of fish and harmful impacts to fish habitat.

The restoration priority for degraded fish habitat explains that DFO-FFHPP prefers to enhance previously degraded habitat over undertaking restoration projects in pristine habitats.

The Fisheries Protection Policy (DFO, 2019a) states that in some instances the most desirable offsetting measures may be a replacement of the same type of habitat that is affected, but in other situations, better outcomes for fisheries may be achieved by undertaking Offsetting in water bodies or for fish species other than those affected by the work, undertaking or activity being considered for Authorization. Therefore, a broad range of alternatives is considered in this Offsetting Plan.

This Offsetting Plan includes the components required under the Applicant's Guide to Supporting the "Authorizations Concerning Fish and Fish Habitat Protection Regulations" which is summarized in the Table of Concordance within this document.

1.2 Document Scope

This Offsetting Plan has been developed to support NBT's Application for Authorization (AFA) (NBT, 2023a) and has been informed by the following guidance:

- DFO: Applicant's Guide Supporting the "Authorizations Concerning Fish and Fish Habitat Protection Regulations" (Government of Canada, 2021).
- DFO: Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the *Fisheries Act* (DFO, 2021).
- DFO: Measures to Protect Fish and Fish Habitat (DFO, 2022b).
- DFO: Fish and Fish Habitat Protection Policy Statement (DFO, 2019a).
- DFO: Aquatic species at risk map (DFO, 2023).
- Burrard Inlet Action Plan (KWL, 2017).

- Tseil-Waututh Nation Construction Environmental Management Plan Requirements (Tseil-Waututh, 2022).

1.3 Supporting Documents

Several documents have been developed to support the Offsetting Plan (see Table 1-1). Each document was developed to consider pertinent guidance when available which is described in the Document Scope section of each report.

Table 1-1: Supporting Documents

Document Title	Description
Lynn Creek Estuary Construction Environmental Management Plan (NBT, 2023d)	The LCE Construction Environmental Management Plan (CEMP) describes the mandates of pertinent regulatory authorities, associated legislation to confirm permit approvals, and relevant compliance requirements for the construction of the offset project. This document details and outlines commitments and adherence to relevant Best Management Practices (BMPs), the potential environmental effects, and project-specific mitigation and monitoring measures to be implemented during construction to minimize negative effects to physical, biological, and socio-economic features associated with construction.
Lynn Creek Estuary Fish and Fish Habitat Existing Conditions Report (NBT, 2023e)	The existing conditions report was developed to summarize the fish (including marine mammals) and fish habitat existing conditions within the LCE location. Study areas were defined for the LCE which is described in Section 1.1 of the report. Field programs were conducted to assess the subtidal, intertidal, and terrestrial habitats available.
Application for Authorization Supplementary Report (NBT, 2023a)	This document summarizes the requirements for the Application for Authorization (AFA) for the B2 Project and details where pertinent information is provided in supporting documents. A table of concordance based on DFO-FFHPP criteria has been developed to support clear communication on application content.
Lynn Creek Estuary Offsetting Basis of Design and Drawing Report (NHC, 2023b)	The Lynn Creek Estuary Offsetting Design Basis and Drawing Report consist of a design basis memo and preliminary engineering drawings. The design basis memorandum outlines the technical basis of design supporting the habitat offset requirements outlined in the AFA. It includes environmental and engineering design criteria, operating conditions, user requirements, codes, safety, materials, and constructability. The design drawings provide geodetic location of the structure, plans, sections and details of the proposed habitat offset, including elevation and areas of specific features, types and volumes of materials.
Lynn Creek Estuary Offset Preliminary Hydraulic Assessment Memorandum (NHC, 2023a)	Preliminary results of the hydraulic model Northwest Hydraulic Consultants is developing will be presented in the Lynn Creek Estuary Preliminary Hydraulic Assessment Memorandum. The model will be used to inform potential for localized sedimentation in the vicinity of the LCE Offset Project, and will include wind-wave and tidal functions in Burrard Inlet, as well as freshwater inputs from Lynn Creek. The assessment will be part of the Detailed Design Report.
Lynn Creek Estuary Contractor Construction Environmental Management Plan (LCE CCEMP)	The Contractor will be responsible for the development of a CCEMP (Contractor Construction Environmental Management Plan) which will at a minimum meet the requirements stipulated in this LCE CEMP (Lynn Creek Estuary Construction Environmental Management Plan) and the commitments identified in any issued permits or approvals, including, but not limited to, the following: <ul style="list-style-type: none"> • Spill response and clean-up procedures in the form of a Spill and Emergency Response Plan. • Fuel management procedures. • Any site staging/access information.

1.4 Indigenous Engagement

NBT has been planning and undertaking early engagement with Indigenous Groups since the initiation of discussions for the B2 Project in July of 2021, including Tsleil-Waututh Nation (Tsleil-Waututh), Musqueam Indian Band (Musqueam) and Squamish First Nation (Squamish). Discussions on B2 Project effects and offsetting are underway. Further details on the status of engagement with Indigenous Groups are provided in the Indigenous Consultation and Stakeholder Engagement Report (NBT, 2023c).

1.5 Stakeholder Communication

Several stakeholders have been engaged by NBT either due to their interest in habitat restoration initiatives or due to their proximity to the LCE Offset Project. Stakeholders that have been engaged include Vancouver Pile Driving Ltd (VanPile) and North Shore Streamkeepers (NSSK). Further details on the status of these discussions are provided in the Indigenous Consultation and Stakeholder Engagement Report (NBT, 2023c).

2 OFFSET JUSTIFICATION

2.1 Offsetting Objectives

DFO's Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the *Fisheries Act* (Nov 2019) includes guiding principles:

1. Measures to offset should support fisheries management objectives and give priority to the restoration of degraded fish habitat.
2. Benefits from measures to offset should balance the adverse effects resulting from the works, undertakings or activities.
3. Measures to offset should provide additional benefits to the ecosystem.
4. Measures to offset should generate self-sustaining benefits over the long term.

As per principle 2, any offset for HADD must be demonstrated to achieve habitat equivalency. This can be aligned with the principle of 'no net loss' or in fact 'net gain' in habitat value or productivity.

While both in-kind and out-of-kind measures are considered by DFO, there is a preference for in-kind, or at least similar habitat to that affected by a project, if possible, and it makes sense to do so. This is consistent with DFO's historic approach of a hierarchy of compensation options, which had at the top, increasing productive capacity of in-kind habitat in the same ecological unit, that has the same natural integrity, structure, and function of the habitat that was adversely affected, with a preference to working on-site before moving off-site (DFO, 2017). However, it is now acknowledged that in some cases out-of-kind offsets may provide greater benefits (DFO, 2021).

2.2 Considering Indigenous Peoples Perspectives in Developing an Offsetting Plan

Based on the outcome of engagement with Indigenous Groups, an overarching objective of increasing salmon productivity was selected. Further information is provided in the Indigenous Consultation and Stakeholder Engagement Report (NBT, 2023c).

2.3 Habitat Offsetting and Enhancement Projects in Burrard Inlet

Numerous habitat enhancement projects have been and continue to be implemented around Burrard Inlet. An early example was the construction of an artificial reef by the Vancouver Fraser

Port Authority (the Port Authority) at Cates Park in 1995. Multiple projects were undertaken under the Habitat Conservation Trust Foundation (HCTF) Pilot Program as summarized in Table 2-1.

Table 2-1: HCTF Approved Restoration Projects in Burrard Inlet (2013-2014)

Project	Proponent	Funding
New Brighton Park Estuary and Renfrew Creek Restoration	British Columbia Institute of Technology (BCIT)	Seed Funding (\$5000)
Stanley Park Salmonid Enhancement Planning (Beaver Creek)	Stanley Park Ecology Society	Seed Funding (\$5000)
Seymour River Estuary Restoration Project	Metro Vancouver	Seed Funding (\$5000)
Roche Creek Estuary Assessment and Restoration Plan Development	BC Conservation Foundation (BCCF)	Seed Funding (\$5000)
Mossom Creek Watershed Habitat Enhancement and Stewardship	Mossom Creek Hatchery	\$10,000
Mosquito Creek Estuary Restoration Plan	Squamish	Seed Funding (\$5000)
Kwahulcha (Lynn Creek) Estuary Restoration Project	BCCF	Seed Funding (\$5000)
Mackay Creek Estuary	Northwest Hydraulic Consultants (NHC)	\$160,000

A restoration and enhancement project was carried out in Lynn Creek Harbourview Park during 2014 – 2016. As part of this project, invasive and non-native plants were removed, geotextiles to suppress invasive plant growth were installed, soil improvements and riparian planting occurred (KWL, 2022). In the LCE, a gravel bar was restructured to retain natural debris, approximately 100 logs were installed onto gravel bars, and intertidal islands were constructed (KWL, 2022).

Eelgrass replanting was undertaken in the LCE, supported by the District of North Vancouver (DNV) and the NSSK. This project was unsuccessful due to public use of the beach and herbivory of the eelgrass by crabs (Doug Swanston *pers comms*).

In 2020, a boulder augmentation reef was created in the LCE, led by the NSSK between 0 m and +1.2 m Chart Datum (CD). The boulder augmentation reef was created to provide additional macroalgae habitat (i.e., fish habitat) for juvenile salmonids outmigrating into the LCE. Assessment of the boulder augmentation reef in 2021 and 2022 revealed that at least 22 invertebrate species and 10 algae species, including sugar kelp, have colonized the boulders (Seacology, 2021, 2022).

Offsetting in Mackay Creek involved the removal of a weir that was acting as a fish barrier in the Creek. This project was aligned with the HCTF and BCIT programs, which involved improvements to the intertidal habitat in the channelized section of the Mackay Creek Estuary. The addition of large woody debris and tidal marsh planting aimed to provide habitat to migrating salmon. The project was largely successful, although there have been challenges with the establishment of marsh plants due to herbivory. The DNV and the City of North Vancouver (CNV) undertook the Lower Mackay Creek Enhancement to provide increased flood protection capacity in the Creek and improve salmon habitat. In 2022, Seaspan built a habitat offsetting project further south in Mackay Creek Estuary, which included a variety of fish habitats (kelp, marsh and riparian) spanning the subtidal and intertidal, to provide habitat to migrating salmon.

A major enhancement project in Burrard Inlet is the Port Authority Habitat Enhancement Program's Maplewood Marine Restoration Project (Port Authority, 2018a). This was built as habitat offsetting for the Centerm Expansion Project and habitat banking. The enhancement includes intertidal mudflat, an eelgrass bed and subtidal rock reef habitat. This is similar to the New Brighton Park Shoreline Habitat Restoration Project that was completed in 2017 on the south shore of Burrard Inlet's Inner Harbour (Port Authority, 2018b), which includes intertidal mudflat and saltmarsh habitats.

There have also been habitat enhancement projects at the Vancouver Convention Centre and around Stanley Park. All of these examples provide useful insight and lessons learned to plan an offsetting project.

2.4 Offsetting Alternatives Considered

NBT reviewed habitat offsetting options for the B2 Project within the NBT water lot and more broadly in Burrard Inlet. The alternatives considered are described here.

2.4.1 Burrard Inlet Offsetting Options Assessment

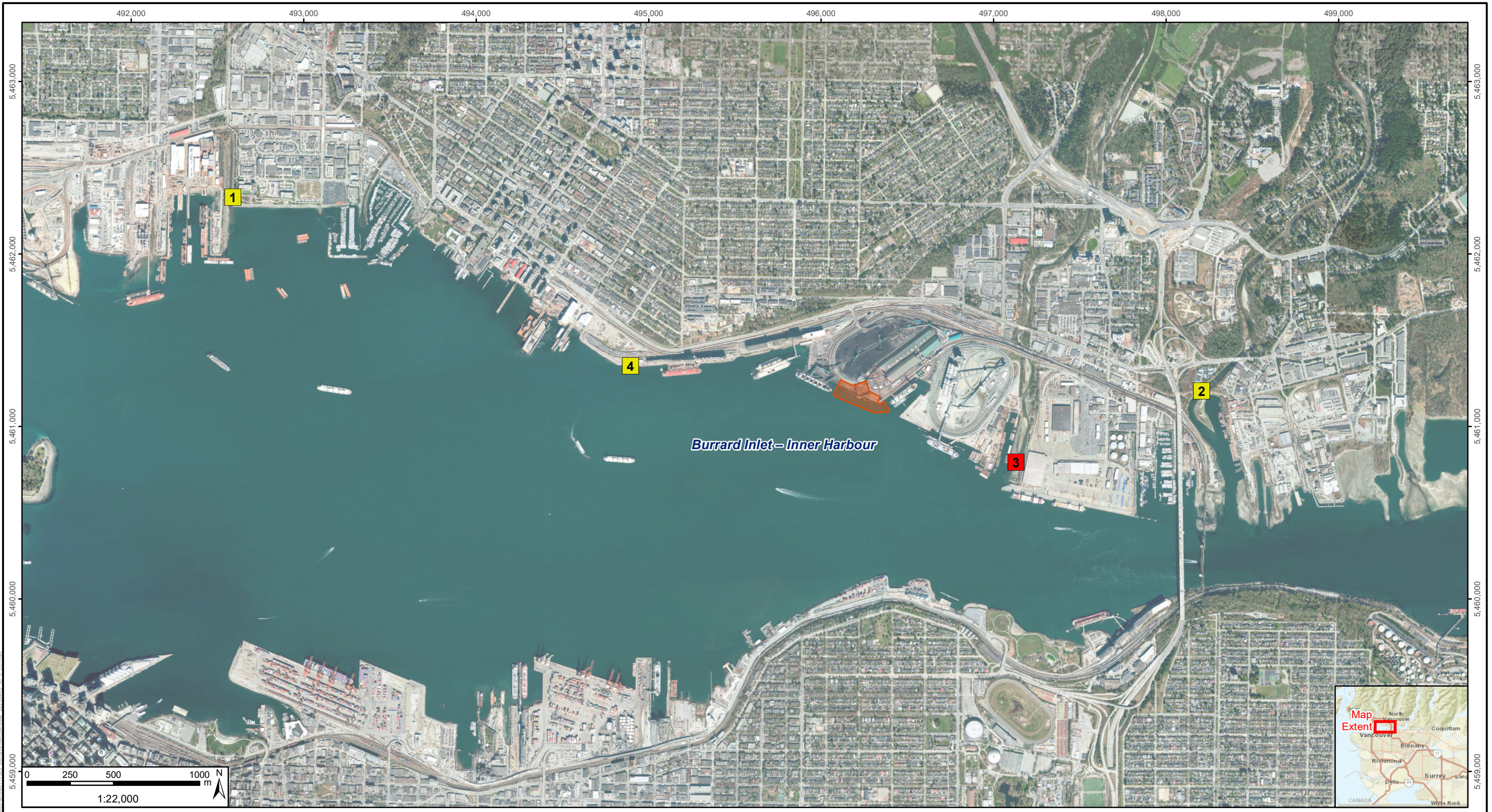
Offsetting options were considered within the Inner Harbour of Burrard Inlet. The locations of these options are depicted in Figure 2-1 and are summarized in Table 2-2.

2.4.2 Onsite Offsetting






Onsite offsetting within the NBT water lot was considered. However, all options were either not ideal for fish habitat characteristics or were within areas slated for potential development in the NBT ten-year capital plan.

Table 2-2: Offsetting Alternatives Review in Burrard Inlet

Offsetting Option	Strengths	Weaknesses	Location in Figure 2-1
Mackay Creek estuarine channel enhancements on the east bank	<ul style="list-style-type: none"> West bank has already been restored. Identified as a priority by NSSK. 	<ul style="list-style-type: none"> Engagement with other stakeholders would be required. The restoration required is expected to greatly exceed the offsetting requirements of the B2 Project 	1
Other North Shore creek enhancement	<ul style="list-style-type: none"> There are extensive threats to the North Shore creeks. Groups such as NSSK have habitat enhancement plans in place. 	<ul style="list-style-type: none"> No obvious program identified through engagement. Does not meet DFO-FFHPP preference for 'like for like'. Habitat is freshwater whereas the Project HADD is marine. Funding mechanisms are already available for such improvements. 	n/a
Seymour River marsh restoration	<ul style="list-style-type: none"> Restores a rare habitat in Burrard Inlet. 	<ul style="list-style-type: none"> Permission from CN rail would need to be obtained. The restoration required is expected to greatly exceed the offsetting requirements of the B2 Project. 	2
Richardson Terminal	<ul style="list-style-type: none"> Large area of subtidal habitat that is out of the main navigation channel. Similar habitat to the Project HADD. 	<ul style="list-style-type: none"> The restoration may greatly exceed the offsetting requirements of the B2 Project. Availability of site to NBT for restoration is uncertain. 	4



LEGEND:

 B2 Project Footprint	 LCE Offsetting Project
 Mackay Creek estuarine channel enhancements on east bank	 Richardson Terminal
 Seymour River marsh restoration	

SOURCE / NOTE:
 a) Offsetting options, Hatfield 2022.
 b) B2 project footprint, digitized by Hatfield (2023) using Drawing No. 20230328-002, Rev. A "Berth 2 and Lynn Creek Estuary Project Location and Footprint", Neptune Bulk Terminals, March 2023.
 c) Background, Orthophoto 10 cm, 13 April 2021, Esri Online Service.

REV	YYYY-MM-DD	DESCRIPTION	DRAWN	APPROVED
ISSUES/REVISIONS				

VENDOR:


ISSUED AS RECORD COPY (YES/NO) NO

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TITLE:
 Offsite Offsetting Alternatives Considered

Figure 2-1

SCALE: SHEET 1 OF 1 DRAWING NO. REV: A

2.5 Bull Kelp Restoration Project

Existing conditions studies within the NBT water lot in 2022 showed that bull kelp is present in both the B2 footprint and the western water lot of NBT. NBT is exploring opportunities for funding through a collaboration with the University of British Columbia (UBC) and Dynamic Ocean Consulting Ltd. (Dynamic Ocean) for the enhancement and restoration of bull kelp in 'microhabitat environments' (Bull Kelp Restoration [BKR] Project). Microhabitat environments are small areas of unique habitat compared to the surrounding environment and can create habitat connectivity in the broader marine environment. These microhabitats can provide valuable refuge for marine life in developed coastal environments such as Burrard Inlet. If funding is approved, the pilot phase of the BKR Project would consist of laboratory cultivation of juvenile kelp for outplanting, and the relocation of existing bull kelp within the B2 water lot. If the pilot program were successful, there would be opportunity for the development of a habitat restoration initiative within the new B2 footprint.

NHC has been contracted to undertake a feasibility study of the hydrodynamic conditions within the existing B2 area where bull kelp is known to exist, and the potential area that has been identified for bull kelp restoration. If Neptune is successful in proposal opportunities with UBC, or if there is opportunity for the BKR Project to be undertaken as a habitat bank initiative, the biological component of the BKR Project would proceed.

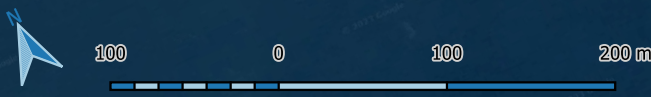
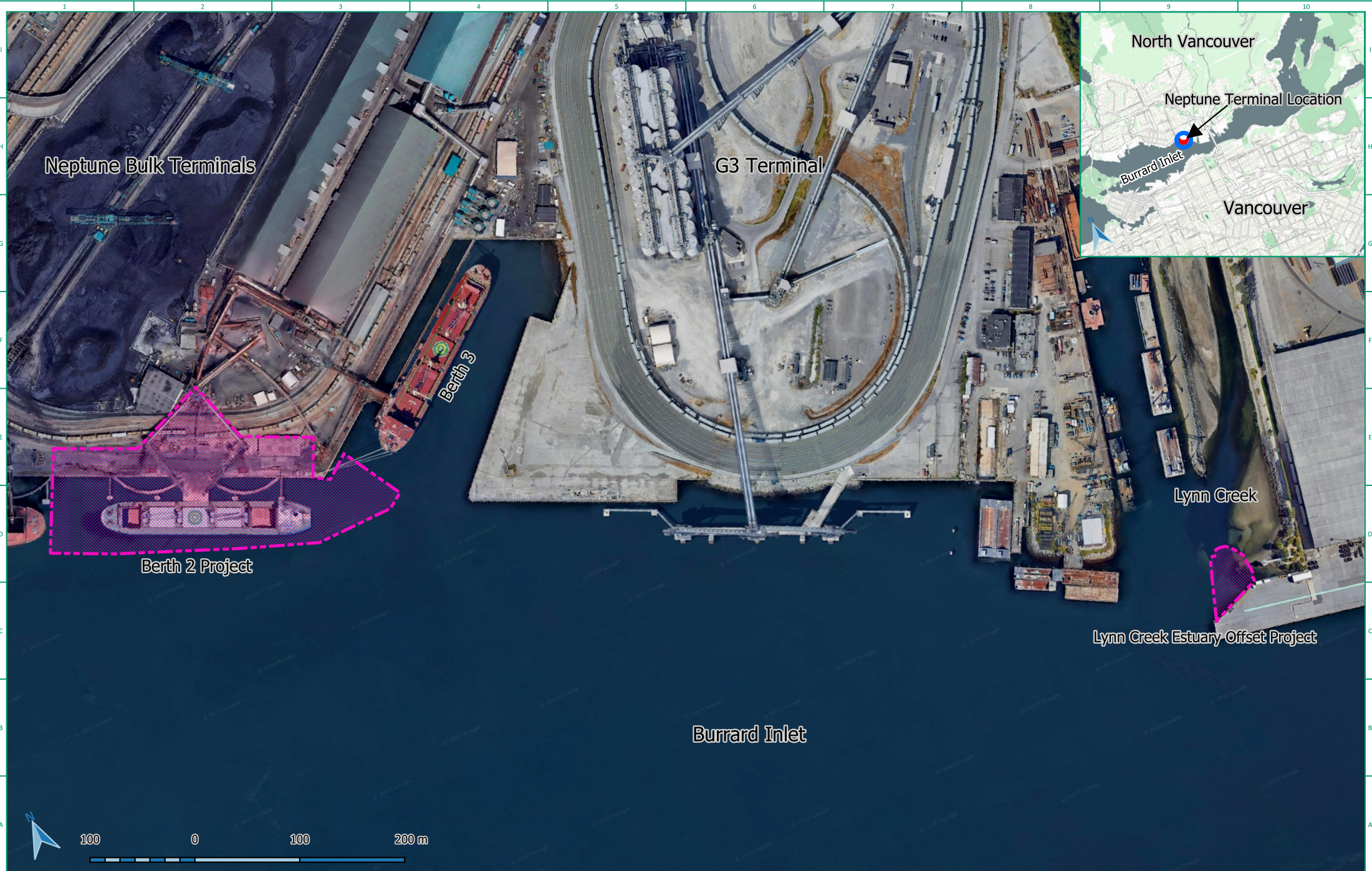
3 PROPOSED OFFSETTING

3.1 Offsetting Location

The LCE Offset Project is located in the LCE, 1 km east of B2, in Burrard Inlet (49° 17.929'N, 123° 2.417'W) (Figure 3-1; Photo 3-1).

This location was selected for the following reasons:

- It is the nearest salmon-bearing stream to the B2 Project.
- There are no specific navigation or operational concerns.
- It builds on areas of existing habitat restoration and enhancement in Lynn Creek. The connectivity of these restoration areas is expected to provide greater benefits to local fish populations.



LEGEND:

SOURCES / NOTE:
NAD1983 CORS96 UTM 10N
Scale 1:5000
 Units: meters
 Static (relies on a datum which is plate-fixed)
 Celestial body: Earth
 Method: Universal Transverse Mercator (UTM)

PROJECT: Neptune Terminals B2D2
 SYSTEM: Potash
 ASSET: 221
 DISCIPLINE: Regulatory

REV	YYYY-MM-DD	DESCRIPTION	DRAWN	APPROVED	VENDOR:
A	2023-03-24	Neptune Terminals Environmental Regulatory	C. Knight		

ISSUES / REVISIONS



TITLE: **Berth 2 and LCE Offset Project Footprints, Site Locations**
Figure 3-1

SCALE: As Shown SHEET 1 OF 1 DRAWING NO. 20230324-001 REV: A



Photo 3-1: Aerial Photo of Lynn Creek Estuary

Source: ShoreZone (2017)



LEGEND:

- ROV Survey Area
- LCE Offset Project
- Port Authority Conservation Area
- B2 Project Footprint

Depth
 5.0 m Contour

REV	YYYY-MM-DD	DESCRIPTION	DRAWN	APPROVED
ISSUES/REVISIONS				

SOURCE / NOTE:

- a) ROV survey area, LCE study area, Hatfield 2022
- b) Contours generated using depth points provided by Neptune Terminals in December 2022, Hatfield 2022. Contours have been adjusted to chart datum using a +3.0 m offset.
- c) Conservation area, VFPA 2023.
- d) B2 project footprint, digitized by Hatfield (2023) using Drawing No. 20230328-002, Rev: A "Berth 2 and Lynn Creek Estuary Project Location and Footprint", Neptune Bulk Terminals, March 2023.
- e) Background, Orthophoto 10 cm, 13 April 2021, Esri Online Service.

VENDOR:

ISSUED AS RECORD COPY (YES/NO) NO

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TITLE:
Overview map and Lynn Creek Estuary Study Area

Figure 3-2

SCALE:	SHEET	OF	DRAWING NO.	REV:
	1	1		A

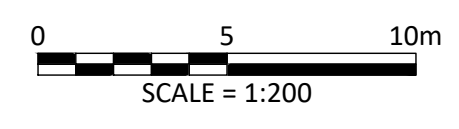
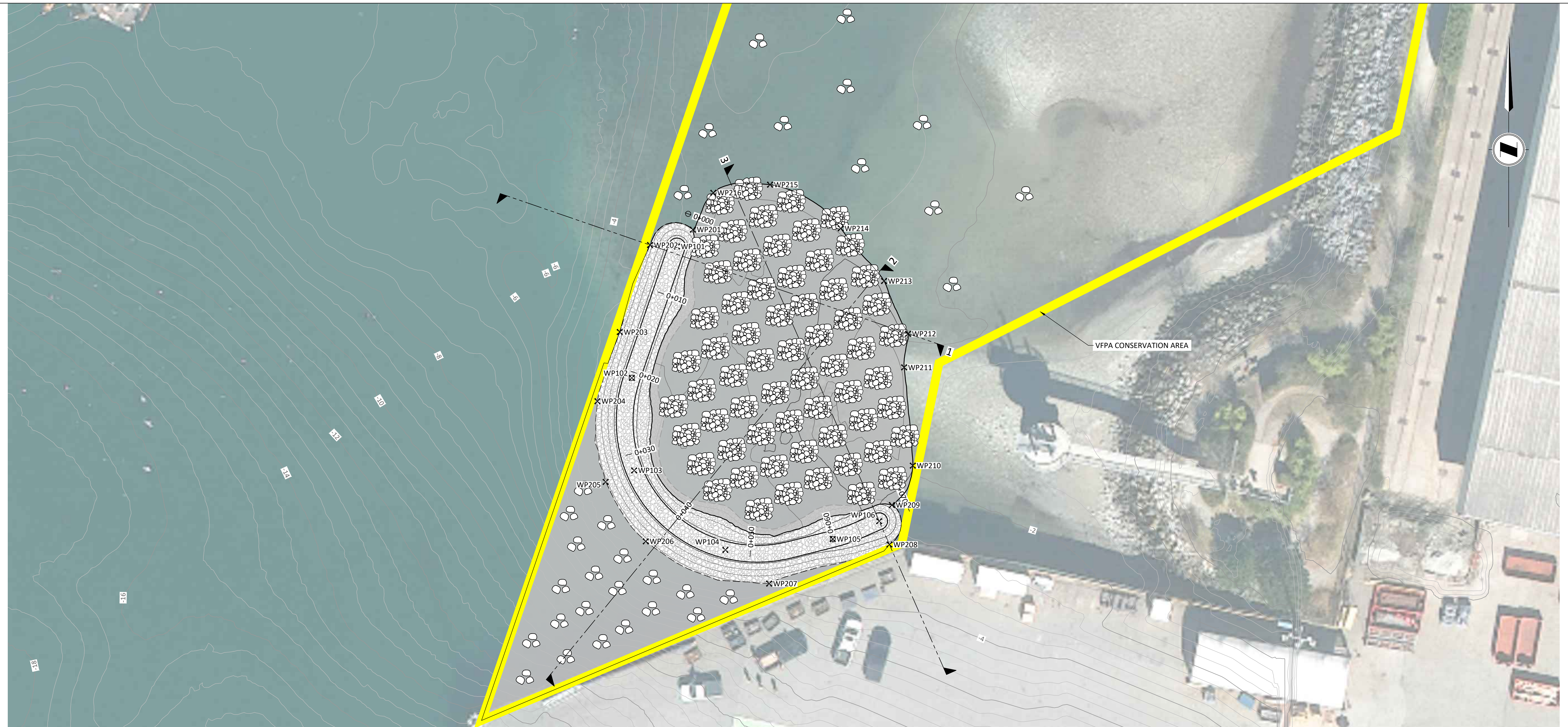
3.2 Offsetting Design

A shallow subtidal rock reef in the LCE has been designed to provide approximately 1,870 m² of critical refuge habitat for outmigrating juvenile salmonids from Lynn Creek and forage fish species in Burrard Inlet (Drawing 3-1, Drawing 3-2) (NHC, 2023b). The LCE Basis of Design Report contains the details of the design (NHC, 2023b).

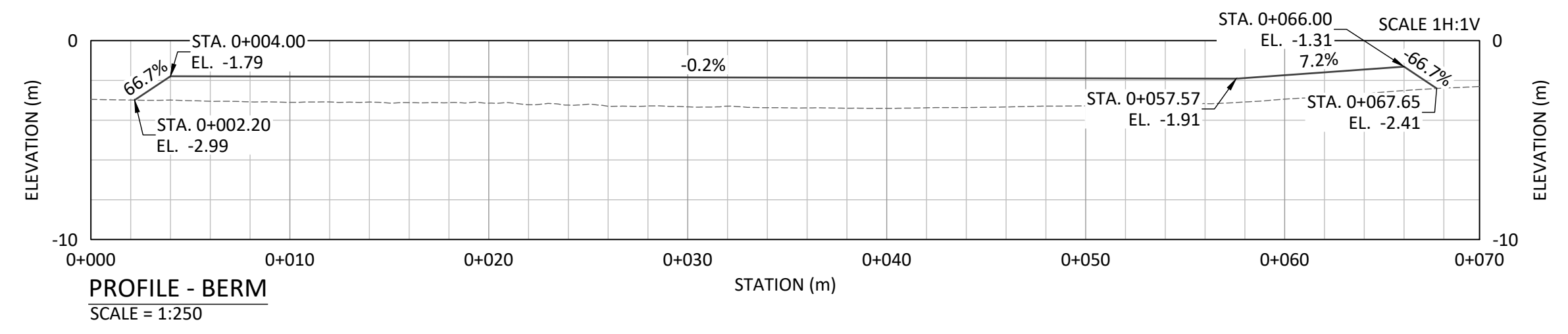
The reef elevation was selected to optimize kelp growth (KWL, 2017; NHC, 2023b). Three size categories of boulders will be used, with the larger boulders placed at lower elevations and to the west for stability, surrounding the smaller boulders placed on the top of the reef, towards the east (NHC, 2023b). The design also includes clusters of boulders on the upper bench (NHC, 2023b). The design is structurally varied and contains intertidal and subtidal habitat to provide refuge for both forage fish and rearing juvenile salmonids (NHC, 2023b). It has been designed to increase habitat complexity in the LCE and to support the growth of kelp and other macroalgal species (NHC, 2023b).

The designs were developed based on the existing conditions in the LCE Study Area (NBT, 2023e), using data from existing kelp beds in Burrard Inlet, hydrodynamic modelling and discussions with stakeholders, technical experts, coastal engineers and contractors (NHC, 2023b). The LCE Offset Project is expected to be self-sustaining and no maintenance will be required. The LCE Offset Project can act as a pilot project for further establishment of nearshore marine habitats in similar locations within Burrard Inlet, which is of interest to Indigenous Groups, the Port Authority and stakeholders.

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PLAN VIEW
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LEGEND

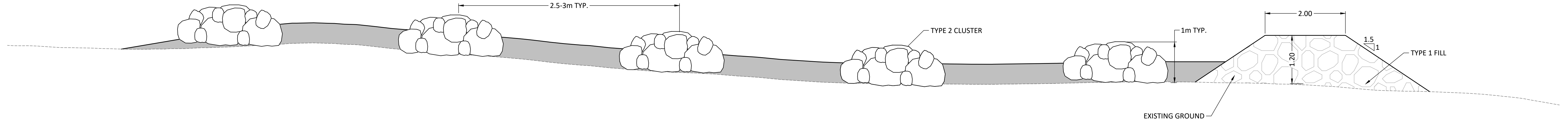
- TYPE 1
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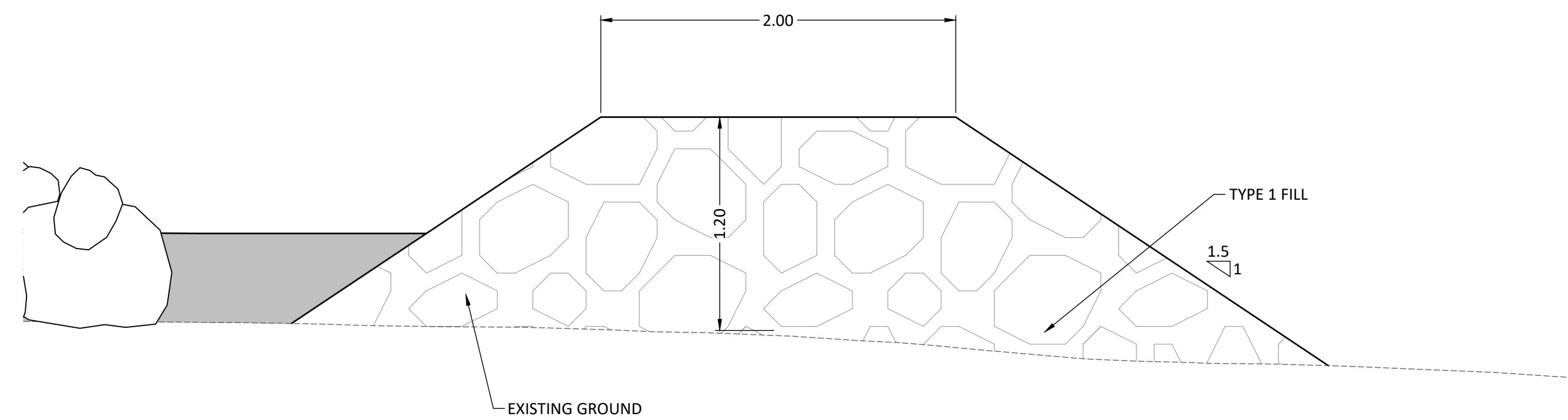
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LOWER LYNN CREEK HABITAT OFFSETTING ROCKY REEF CONCEPTUAL DESIGN		
PLAN AND PROFILE		
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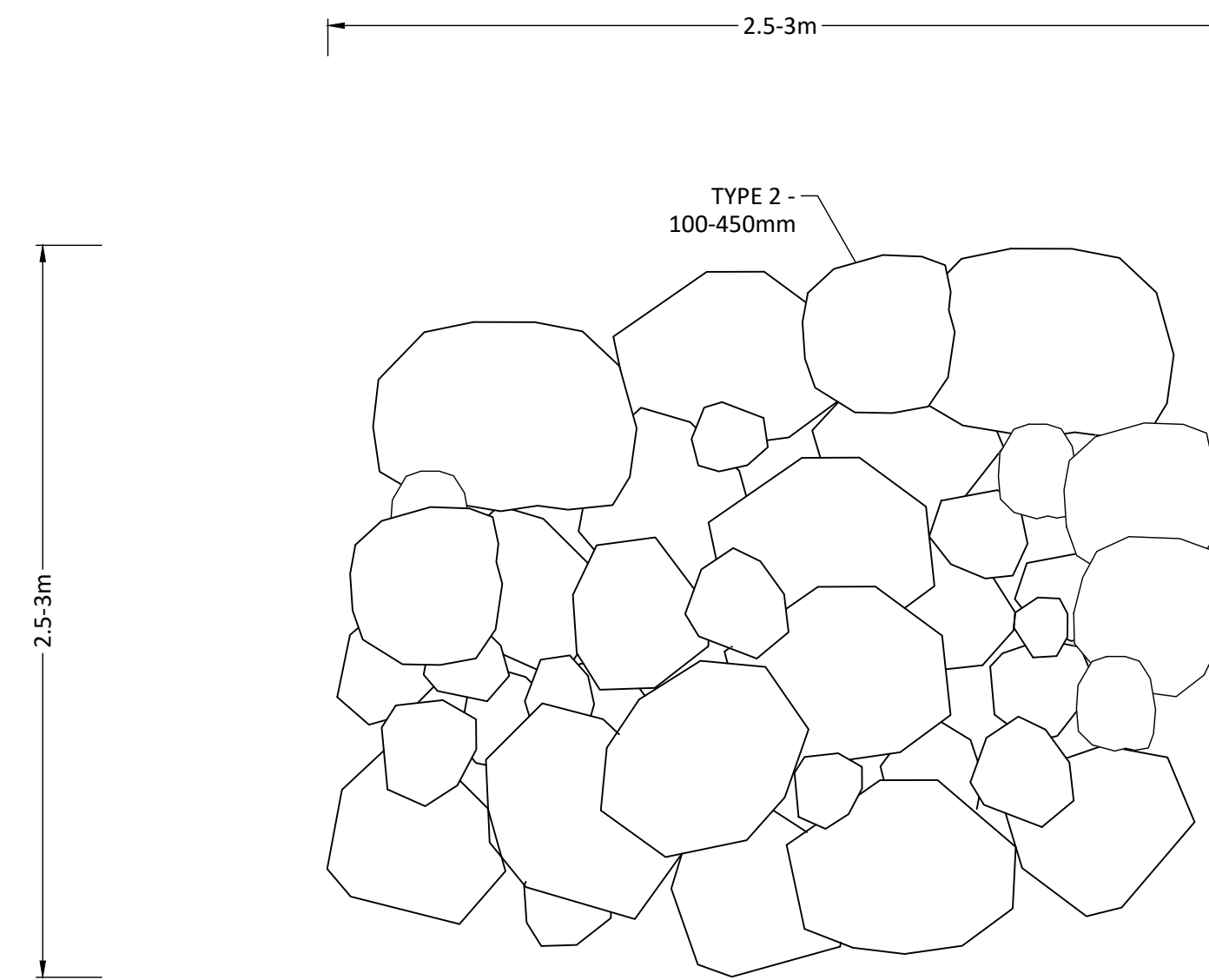
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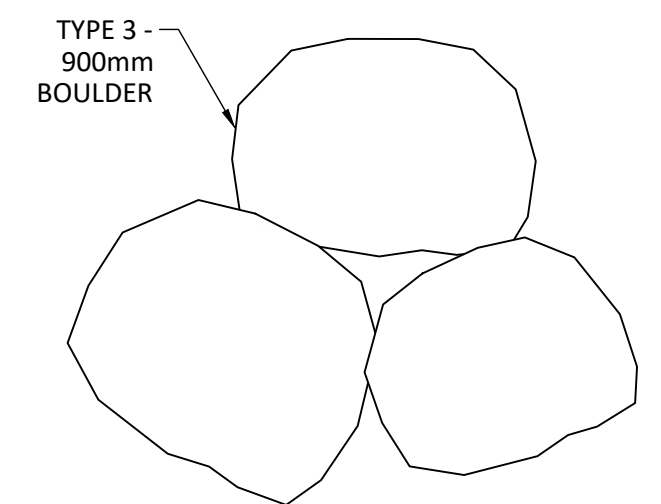
TYPICAL SECTION
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DETAIL - TYPE 1 ROCK
1:25



DETAIL - TYPE 2 CLUSTER (TOP VIEW)
1:25



DETAIL - TYPE 3 900mm BOULDER
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LOWER LYNN CREEK HABITAT OFFSETTING ROCKY REEF CONCEPTUAL DESIGN		
TYPICAL SECTION AND DETAIL		
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3.3 Offsetting Construction and Schedule

The LCE Offset Project will take approximately two to three weeks to construct and will occur ahead of B2 Project construction, between January and February of 2024, during the DFO recommended least risk window for fish for the Burrard Inlet. As such, LCE Offset Project construction will occur before the B2 Project impact to fish habitat occurs to avoid time lag in the availability of fish habitat in the area.

Construction will occur during winter high tides (during at least 3.2 m high tide). Rock would be placed using marine-based equipment (i.e., by barge), using a clamshell bucket controlled by crane and derrick.

The LCE CEMP describes mitigations for potential negative effects of construction (NBT, 2023g).

4 DESCRIPTION OF FISH AND FISH HABITAT IN THE OFFSETTING AREA

A Study Area within the LCE was assessed through field-based riparian, intertidal and subtidal (Remotely Operated Vehicle (ROV)) surveys and desktop review (see Section 1.3 of (NBT, 2023e) for a description of Study Area and ROV Survey Area) (Figure 3-2). This information can be found in the LCE Existing Conditions Report (NBT, 2023e), along with a full desktop review of Burrard Inlet in the B2 Existing Conditions Report (NBT, 2023b).

The substrate within the 1,867 m² Offsetting footprint is composed of sand, cobble, and boulder. The boulder area is the small pilot boulder augmentation project constructed by NSSK in 2020 (Section 2.3) and occupies approximately 72 m². The remaining area is composed of approximately 90% sand and 10% cobble. The percent coverage of invertebrates and algae observed during the ROV Survey Area was less than 1% in the Offsetting footprint.

5 POTENTIAL EFFECTS ON FISH AND FISH HABITAT OF THE LCE OFFSET PROJECT

Section 35 of the *Fisheries Act* prohibits the death of fish or HADD. The goal of DFO-FFHPP in applying this Fish and Fish Habitat Protection Policy Statement (DFO, 2019a) is to provide a framework for the conservation and protection of fish and fish habitat.

Fish habitat is defined in subsection 2(1) of the *Fisheries Act* to include all waters frequented by fish and any other areas upon which fish depend directly or indirectly to carry out their life processes. The types of areas that can directly or indirectly support life processes include but are not limited to spawning grounds and nursery, rearing, food supply and migration areas. DFO-FFHPP interprets HADD 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, 2019a).

Construction activities have the potential to impact fish and fish habitat. There are other potential effects related to construction, that are not expected to affect fish or fish habitat, such as land-based effects, accidental introduction of invasives, increased construction noise, and reduced air quality. These effects are outlined in the LCE CEMP Section 4 (NBT, 2023d). Those specifically related to fish and fish habitat are summarized in the following subsections.

5.1 Reduction in Marine Water Quality

5.1.1 Increased Turbidity

There is a risk of increased turbidity during rock placement either by re-suspension of sediments on the seafloor or by sediments introduced with the new material. Mitigations are in place to reduce this risk (described in the LCE CEMP (NBT, 2023d)), including the careful placement of material, turbidity monitoring by a qualified professional (QP), and ensuring the new material does not contain fine sediments. If mitigations are implemented, the risk of increased turbidity from this activity is considered low.

5.1.2 Accidents and Malfunctions

There is the potential for accidental spills to occur during marine construction from barges and equipment. Best Management Practices (BMPs) and mitigations for waste management and spill and emergency response are identified in the LCE CEMP (NBT, 2023d), to avoid effects to fish and fish habitat.

5.2 Physical Damage to Marine Fauna

Mortality of motile species (i.e., crab, fish) could occur during rock placement. Although sessile organisms are most susceptible to burial and crushing, habitat surveys revealed a low abundance of these organisms in the LCE Offset Project Study Area. These individuals would not contribute to the productivity of relevant fisheries. Mitigations will be implemented to avoid physical damage to marine fauna, including a pre-construction invertebrate salvage. Details of all mitigations including the salvage can be found in 6.4 of the LCE CEMP (NBT, 2023d).

5.3 Measures and Standards

DFO-FFHPPs measures to protect fish and fish habitat and Codes of Practice have been reviewed (DFO, 2019b, 2022b). All those that are relevant and can be successfully implemented are included. The DFO measures to protect fish and fish habitat that are implemented include: preventing the death of fish, maintaining fish passage, including access to Lynn Creek, ensuring proper sediment control, and preventing entry of deleterious substances in water (DFO, 2022b). There are no DFO Codes of Practice that apply to this project (DFO, 2019b).

The LCE Offset Project will be constructed within DFO's recommended least risk window (Area 28, Vancouver – Burrard Inlet: August 16 – February 28) (DFO, 2014). The LCE CEMP (NBT, 2023d) defines the compliance program that will be implemented during construction of the LCE Offset Project. The Contractor will be required to develop a LCE CCEMP that at minimum meets the requirements outlined in the LCE CEMP and regulatory authority (RA) approvals or permits.

6 MEETING THE OFFSETTING OBJECTIVES

The offsetting objective for the LCE Offset Project is to increase habitat quality for fish species, which will primarily be salmonids in the LCE. Chinook, coho and steelhead migrate along the north shore of the Inner Harbour between First and Second narrows, yet over 95% of the shoreline between First and Second narrows has been infilled and replaced with sheet pile walls, steep rip-rap banks, wharves and berth faces (NHC, 2019). The proposed Offsetting contributes to habitat connectivity by creating a habitat 'island' in Burrard Inlet (adding to others, e.g., Section 2.3) to allow salmon to rest and feed during migration to the open ocean. The Port Authority has also been considering options for habitat restoration and enhancement to support this approach (NHC, 2019). More broadly, the Burrard Inlet Action Plan (KWL, 2017) includes an objective for an increase of 50 ha in estuarine habitat basin-wide and an area increase of at least 25% within each of five different estuaries (KWL, 2017).

Kelp forests support diverse and productive ecological communities throughout temperate and arctic regions worldwide, providing numerous ecosystem services to humans. In Burrard Inlet, kelp forests have declined (KWL, 2017), mirroring global trends (Krumhansl *et al.*, 2016). Increasing kelp habitat in the LCE creates habitat for fish, including juvenile salmon outmigrating from Lynn Creek.

The Pacific Region Integrated Fisheries Management Plan (IFMP) for salmon in southern British Columbia (BC) contains overarching objectives of improving or restoring salmon habitat in marine and non-tidal waters (DFO, 2022a). The LCE Offset Project aligns with an overarching fisheries management objective of increasing salmon habitat. In the Salmon IFMP, Lynn Creek is one of the rivers identified to contain chum spawning habitat. Management targets are not defined for salmon in Burrard Inlet. DFO (2021) explains that where such objectives do not exist or where they do not give priority to the restoration of degraded fish habitat, Indigenous Groups, local organizations and stakeholders may help to identify areas that would benefit from restoration or enhancement.

7 AMOUNT OF OFFSETTING REQUIRED

The Offsetting required to counterbalance the B2 Project HADD should provide ecological benefits that are proportional to the resulting residual effects on fish habitat (DFO, 2021). The same habitat equivalency approach and habitat values were used to calculate the Offsetting footprint as was used to calculate the B2 Project HADD (see Section 9 of the AFA Supplemental Report (NBT, 2023a)).

The substrate within the 1,867 m² Offsetting footprint is composed of sand, cobble, and boulder. The boulder area is the small pilot boulder augmentation project constructed by NSSK in 2020 (Section 2.3) and occupies approximately 72 m². The new Offsetting material will be placed around these boulders so as not to disturb the organisms currently residing there. Thus, the amount of new habitat placed is equal to the entire Offsetting footprint (1,867 m²) minus the existing boulders (72 m²), which is equal to 1,795 m² (Table 4-1). The Offsetting is expected to be relatively high value habitat, thus is assigned a value rating of 4.

The existing substrate within the 1,795 m² footprint is composed of approximately 90% sand (habitat value rating of 1) and 10% unvegetated cobble (habitat value rating of 2). Thus, the increase in productivity of the footprint (5,206) will more than offset the estimated productivity lost due to HADD in the B2 footprint (3,905; Table 4-1).



Table 4-1: Offsetting Habitat Equivalency Calculation

	Habitat Type	Value Ranking	Value Rating	Project Footprint Area (m ²)	Productivity Estimate
Offsetting footprint	Soft substrate	Low	1	0	0
	Unvegetated Cobble	Moderate	2	0	0
	Cobble / Boulder (with kelp)	High	4	1,795	7,181
	Total			1,795	7,181
Existing habitat within Offsetting area	Soft substrate	Low	1	1,616	1,616
	Unvegetated Cobble	Moderate	2	180	360
	Cobble / Boulder (with kelp)	High	4	0	0
	Total			1,796	1,976
Increase in productivity of Offsetting footprint				5,206	
HADD productivity requirement (see AFA Supplemental Report (NBT, 2023a))				3,905	

8 EFFECTIVENESS MONITORING

The objective of effectiveness monitoring is to determine whether the proposed Offsetting measures have been effective in Offsetting the HADD caused by the B2 Project.

Effectiveness monitoring is planned for a duration of five years that will be assessed at three intervals; at one, three and five years post-construction. This is considered a sufficient duration to meet the DFO-FHPP defined criteria, which are as follows:

- biological or physical changes to be reflected in the data collected.
- possible adjustments to the monitoring to better estimate changes in fishery productivity.
- the restored habitat to reach full ecological functionality (that is, supporting fish reproduction, growth, and survival).

Sugar kelp is expected to recruit rapidly to the new substrate through spores from neighbouring beds, as was observed from the boulders placed in 2020 (Seacology, 2022). Other intertidal algae (e.g., rockweed) is expected to recruit to intertidal boulders quickly, as it is ubiquitous in the area.

Metrics have been defined to be met over the five year effectiveness monitoring period. The post-construction monitoring events will be used to determine progress toward these success criteria:

- Macroalgae (e.g., sugar kelp) is abundant (>70% coverage) over the rocky intertidal and subtidal Offsetting areas.
- The boulder bench and slope are stable.

These metrics can be monitored via underwater video, either using a towed video camera, ROV or diver surveys. This survey would be conducted in summer once kelp spores have settled and are growing rapidly. The video method will be used to assess the substrate and determine whether any sediment deposition has occurred, and how that may be affecting the growth of macroalgae. Observations of marine fauna will be recorded.

9 CONTINGENCY MEASURES

Contingency measures are secondary measures that would be implemented if the planned Offsetting measures did not meet the success criteria. A post-construction underwater video and bathymetry survey will be undertaken, and as-built drawings prepared for comparison to design drawings.

The following measures have been defined in response to the uncertainties identified:

- NHC, in conjunction with the Contractor, will provide as-built drawings for the LCE Offset Project. NHC will award substantial completion as per the conditions of the contract. If the LCE Offset Project is determined to not have been built as planned, an adaptive management plan will be presented to DFO-FHPP to rectify the design.
- If the abundance of macroalgae is below the coverage criteria within the success metrics, one of the following will be implemented:
 - kelp seeding.
 - change in the surface substrate.
 - increase in the area of the habitat offset to achieve the same total area of kelp.

10 CLOSURE

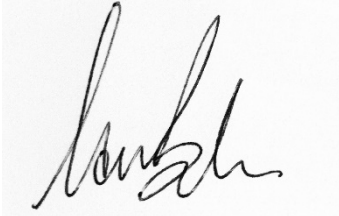
Regulatory professionals from Hatfield, Dynamic Ocean and NBT have contributed to development of this Offsetting Plan. If you have any questions, please contact the undersigned, Victoria Burdett-Coutts.



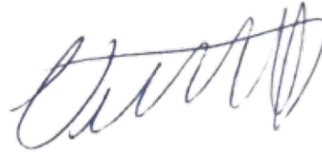
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