

SUSTAINABLE DESIGN



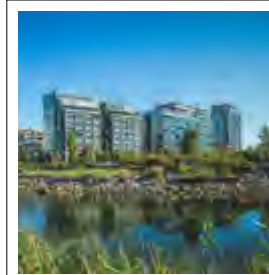
Wood Building Materials

- Project features locally-sourced wood
- Reduced environmental impact of transporting construction materials



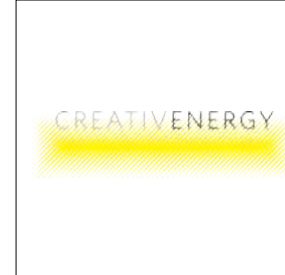
Electric Vehicles

- 40% of vehicle parking stalls to be equipped with electric charging stations



Building Community

- Encourage downsizing from single family detached housing to a mixed use community with shared services



Green Innovation

- Project features innovative use of ocean water to provide heating and cooling
- Reduced demand on the local energy grid



Operable Facades

- Integrate operable windows and doors
- Through-unit plans facilitate natural cross ventilation



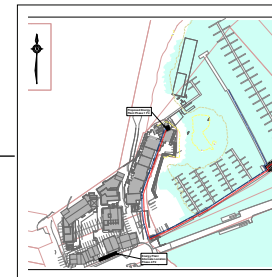
Non-motorized Watercraft

- Facilities to support kayaking, paddle boarding, and canoeing
- Encouraging active, green lifestyles



West Coast Architecture

- Insulated wall area reduces use of energy for winter heating
- Sheltering roof overhangs prevent heat gain in summer.



Renewable On-site Energy Production

- Conventional energy supplemented with ocean water geo-exchange loop
- System reduces GHG emissions



Permeable Surfaces

- Replacing existing brownfield parking lot with permeable surfaces
- New landscaping to improve quality of stormwater runoff



Marine Transportation

- Supplement conventional road delivery of construction materials with barging and water delivery



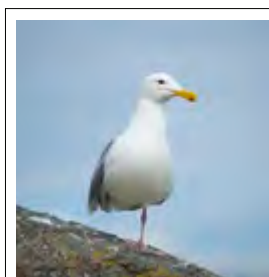
Cycling Support

- Bicycle racks and commercial opportunities for recreational and commuting cyclists



Recycling Facilities

- Integrated facilities encourage best management practices
- GHG emissions reduced through fewer truck trips



Waterfront Habitat

- Restore and enhance existing wildlife habitat
- Improved foreshore and marine life









Naturally Restored Site

- Locally-inspired landscape design
- Better control of stormwater runoff
- Enhanced livability

**Creative Energy Vancouver
Sewell's Marina Redevelopment
Seawater Energy System**

Legend

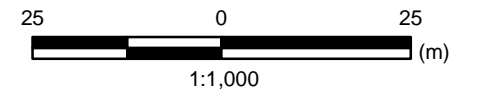
-  Proposed Buildings
-  Contours (0.5m Interval - Chart Datum)
- Tide Water Mark (Chart Datum)**
-  0 m Elevation
-  5 m Elevation
- Proposed Pipe Routing**
-  Return Piping
-  Supply Piping

Note:
All Routes are approximate and subject to confirmation.

Reference: Background render from Merrick Architecture
Context Plan sheet A0.03
Bathymetric contours from Balanced Environmental Biological
Conditions Sewells Biophysical Survey.
Elevations based on chart datum.

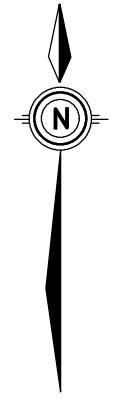
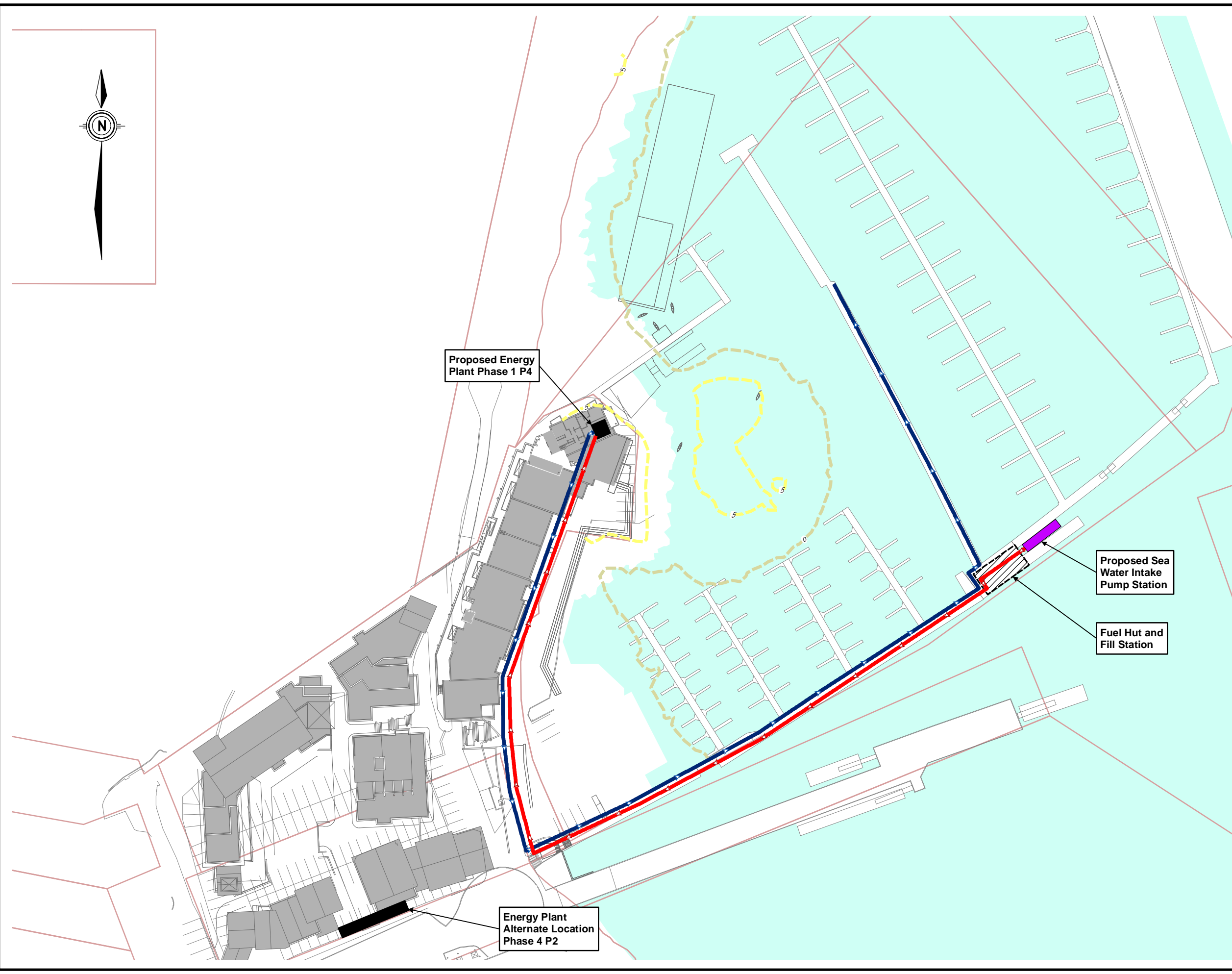


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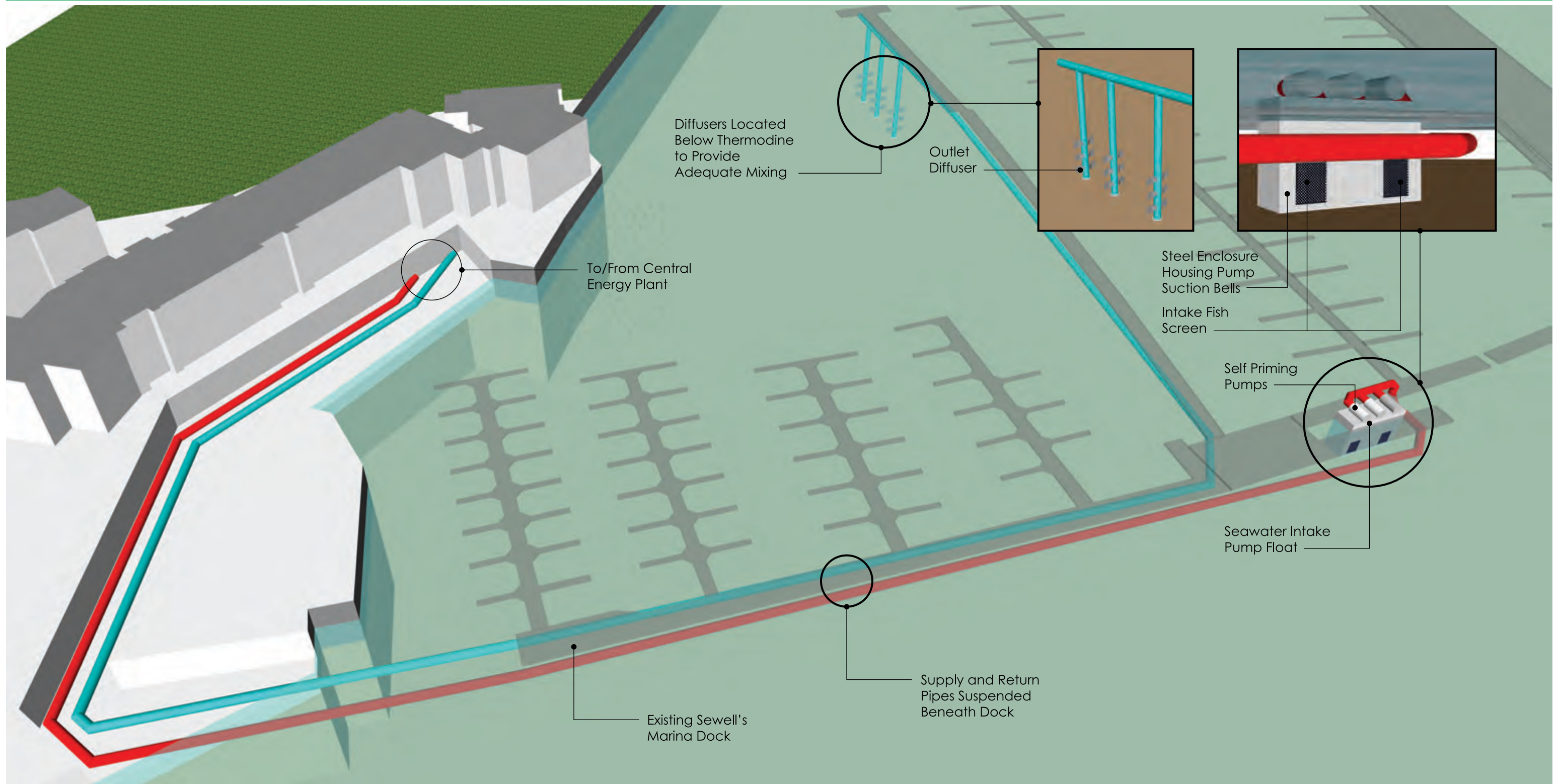


Project No. 3265-016	Date January 2016
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Seawater Intake
DRAFT



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Author: J.Lau

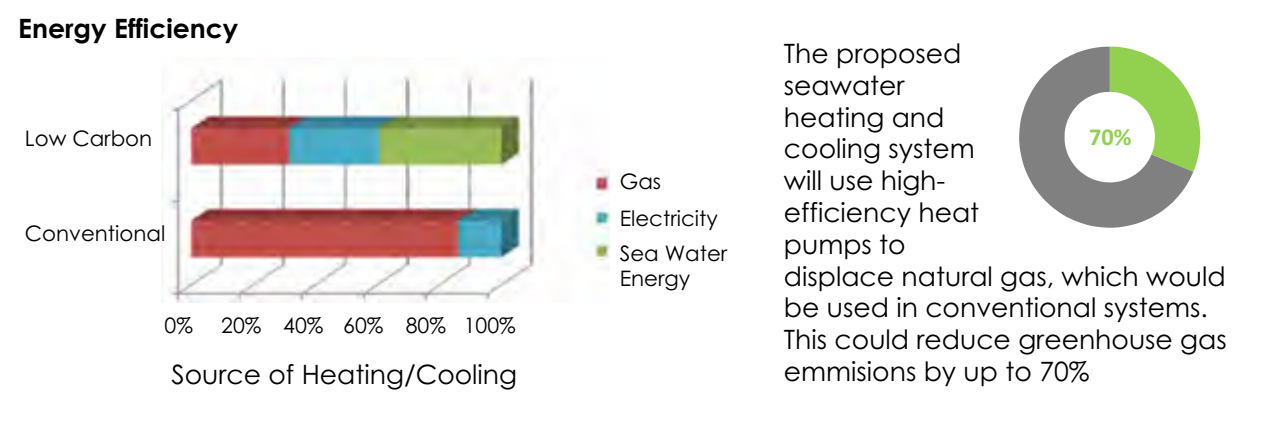
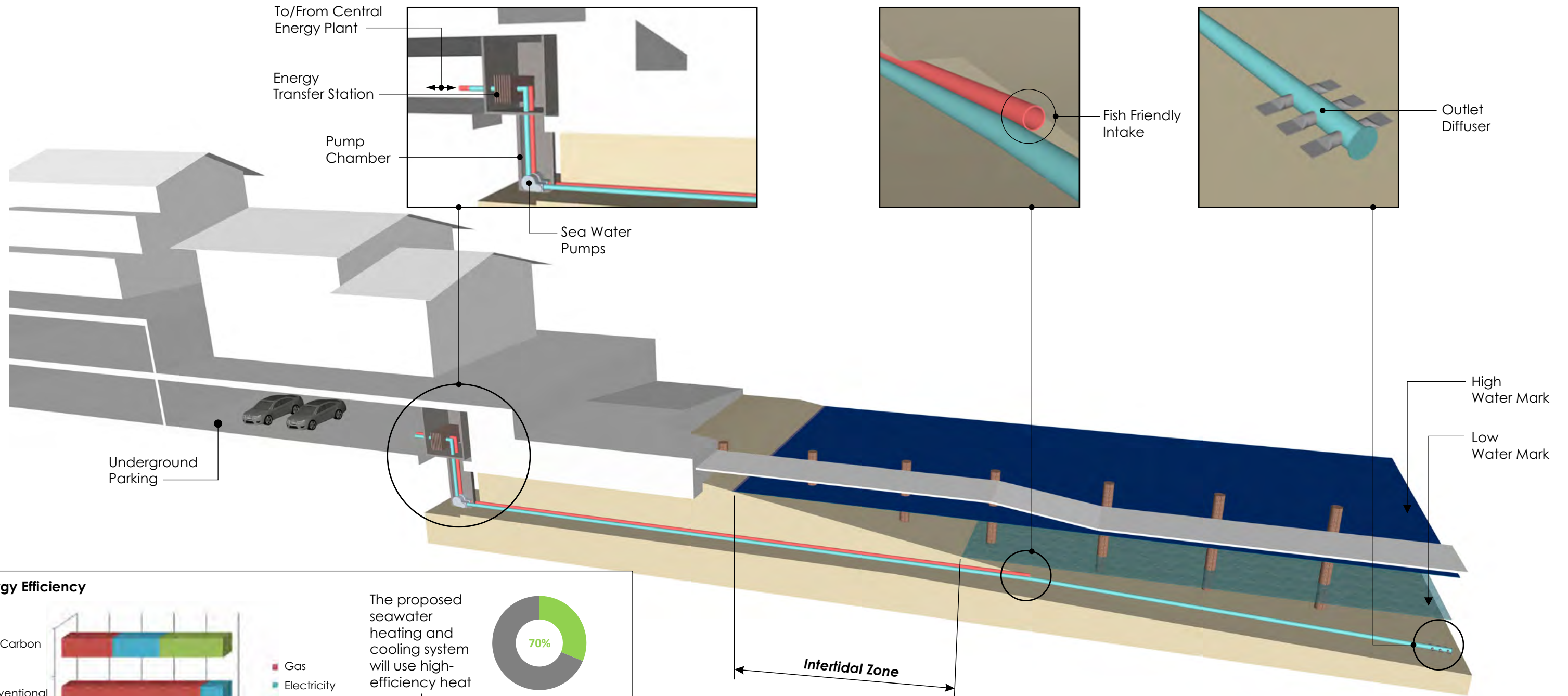


Note:
Piping layout as shown is conceptual and subject to confirmation of location and installation method.

Horseshoe Bay Seawater Heating/Cooling System Concept

January 2016

Creative Energy Canada Platforms Corp.
SEWELL'S LANDING SEAWATER HEATING/COOLING SYSTEM



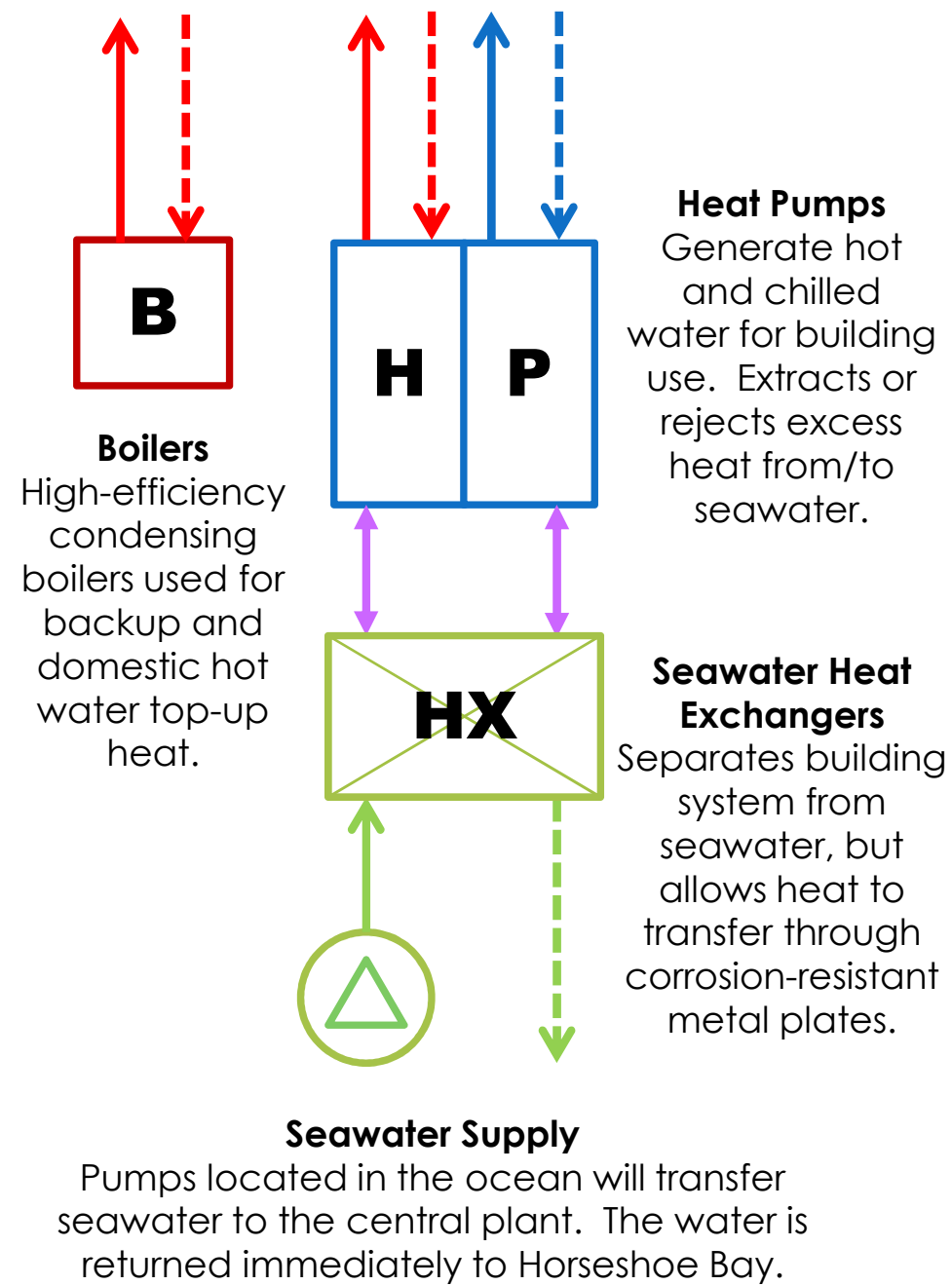
Note:
 Piping layout as shown is conceptual and subject to confirmation of location and installation method.

Horseshoe Bay Seawater Heating/Cooling System Concept

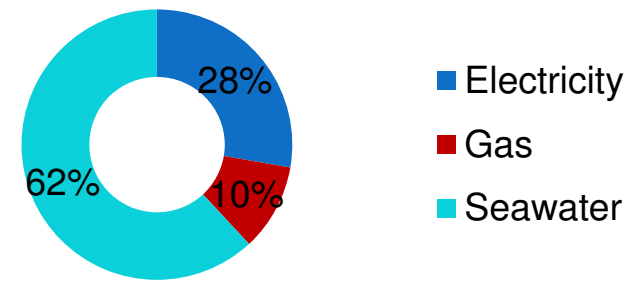
May 2015

Sewells Landing Seawater Energy System – HORSESHOE BAY

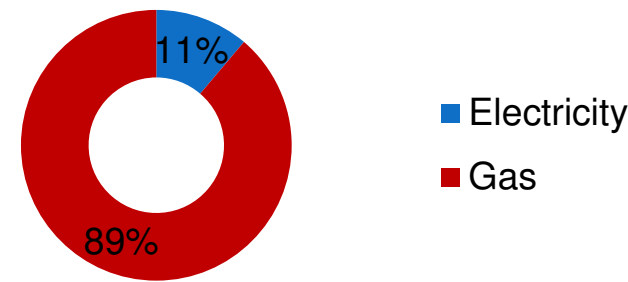
PROCESS



ENERGY USE



Proposed CreativEnergy Seawater Energy System

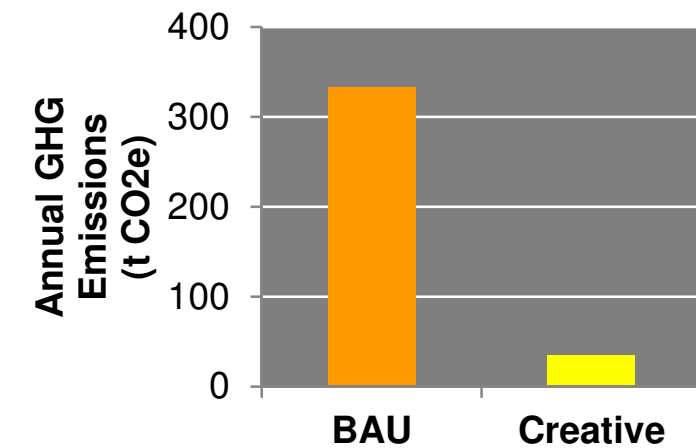


Typical Boiler & Air-Cooled Chiller Plant

It is expected that all of the space heating and cooling will be done by the heat pumps, as well as about two-thirds of domestic hot water heating. The overall system will be three-times more efficient than a typical boiler-based system.

ENVIRONMENT

Greenhouse Gas Emissions (GHGs)
The system will reduce GHGs by up to 90% by using free heat from seawater and clean electricity.



Marine Environment

The current design will minimize the footprint on the seabed and foreshore by using floating pumps and running pipes along the docks. No chemicals will be used in the seawater-handling components, and thermal pollution will be mitigated with the outfall design.

TRANSPORTATION STUDIES

Sewell's Landing Development
West Vancouver, BC
Transportation Impact Assessment:
Final Report (Revised)

Prepared for
Westbank Projects Corp.

Date
February 2016

Prepared by
Bunt & Associates

Project No.
4241.43

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EXECUTIVE SUMMARY

Westbank Projects Corp. is proposing a mixed-use residential and commercial development along the Horseshoe Bay waterfront in the District of West Vancouver. The development will feature approximately 159 residential townhome/condominium units and an increase of approximately 5,000 square feet of marina-commercial uses. The project is planned to be constructed by mid-October 2018. Sewell's marina and the existing Boathouse Restaurant will remain and be integrated with the proposed new development.

A total of 493 parking stalls are planned for the site. This parking supply consists of 238 spaces for resident use and 255 stalls to replace existing surface level marina and commercial parking within the site. The project's proposed parking supply is expected to sufficiently accommodate the proposed density and uses of the site.

Traffic operations analyses indicate all of the study area intersections currently operate at very satisfactory Levels-of-Service (LOS) for Existing (2015) Summer and Non-Summer peak period conditions. Additionally, the future traffic operations analysis indicates all of the study area intersections shall continue to operate at very satisfactory LOS for both Summer and Non-Summer peak period conditions even with full occupancy of the proposed project.

District staff has also requested that this Transportation Impact Assessment evaluate the future traffic operations of intersections along the Horseshoe Bay waterfront assuming a reconfigured two-way traffic operation along Bay Street between Nelson Avenue and Royal Avenue. This reconfiguration is currently being considered as part of the District's Horseshoe Bay Streetscape Study efforts. Based on the analysis presented in this report, this reconfiguration is also expected to provide acceptable traffic operations along the waterfront. It is noted this two-way reconfiguration is not imperative to providing satisfactory levels of traffic flow along Nelson Avenue.

Based on the analysis outlined in this study, it is concluded that the proposed form and density of the proposed development can be supported from a transportation perspective.

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1. INTRODUCTION

1.1 Background

Bunt & Associates has been retained by Westbank Projects Corp. to conduct a Transportation Impact Assessment for the proposed Sewell's Landing project in the District of West Vancouver. The location of the development site is illustrated in **Exhibit 1-1**.

Westbank is proposing a uniquely West Vancouver flavoured residential development, consisting of approximately 159 condominium dwelling units, sculpted into the sloping hillside and waterfront terrain of the Horseshoe Bay community. The site currently includes 10,000 square feet (sf) of marina-commercial space (not including the existing Boathouse Restaurant). A re-organization of the existing marina-commercial uses with a limited increase (+5,000 sf) of marina-commercial space is proposed. The existing Boathouse Restaurant building would be retained together with the marina facility.

Initial consultations with the District of West Vancouver and the community began with the Paul Merrick concept for the site in 2008/09. As the concept of the project continued to unfold over the past five (5) years, the Sewell's project team has welcomed feedback from neighbouring residents, community stakeholders and District staff. As such, the development has been built on Paul Merrick's concept and is further enhanced with changes reflecting input provided by the community and development guidance policies in the District's Official Community Plan (OCP). Pending municipal approvals, the project is planned with a construction start in mid-September 2016 with completion targeted for mid-October 2018.

In consultation with District of West Vancouver staff, Bunt & Associates has examined the potential transportation impacts of this proposed redevelopment by conducting a comprehensive assessment for the site. Included in this analysis are a Traffic Impact Study, Parking Analysis, and a Multi-Modal Network / Infrastructure Review.

1.2 Report Structure

This report is structured in the following manner:

- **Section 2** – Describes the existing transportation system, including bicycle, walking, transit and vehicle modes of travel, and establishes the general scope for the planned study network.
- **Section 3** – Outlines the development and specifically the transportation aspects including potential traffic impacts and vehicular parking.
- **Section 4** – Sets out the methodology for predicting the vehicle trip generation for the project, using data that is consistent with the characteristics of the development design and the planned

infrastructure and initiatives to support it. It also assesses the effect of the development traffic on the study road network.

- **Section 5** – Provides a summary of the key findings and recommendations of the Transportation Assessment.

The purpose of this report is to identify the potential transportation impacts of the proposed development and recommend appropriate mitigation measures to ensure that these impacts can be reasonably accommodated by the area transportation system.



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Exhibit 1-1 Location Map

Sewell's Landing Transportation Study
4241.43 October 2015 Scale NTS



2. EXISTING CONDITIONS

2.1 Site Location and Context

The project site is located at 6695 Nelson Avenue along the Horseshoe Bay waterfront in the District of West Vancouver, BC, and is currently zoned as Marine Zone 3 "M-3".

2.2 Existing Street Network

The study area intersections depicted on **Exhibit 2-1** have been selected based on consultation with District staff. The following section of this report provides a description of the study area's existing configuration, roadway functions, design characteristics and intersection controls.

2.2.1 Bay Street

Bay Street, between Nelson Avenue and Royal Avenue, functions as a one-way road, oriented in the westbound direction, and providing two lanes of travel. Along the waterfront, Bay Street provides on-street parking along both edges of the street. During the weekday morning and weekday afternoon, the hourly volumes are 56 and 163 vehicles per hour (vph), respectively. During the Saturday afternoon peak hour, this section of Bay Street carries approximately 142 vph. Bay Street at Nelson Avenue and Bay Street at Royal Avenue are currently unsignalized intersections.

East of Royal Avenue to Keith Road, Bay Street is a two-way road providing one lane of travel in each direction and connects to Highway 1 (towards other areas of the Lower Mainland).

2.2.2 Nelson Avenue

Between Bay Street and Chatham Street, Nelson Avenue is a one-way road providing one lane of travel with a posted speed limit of 30 kilometres per hour (km/h). For this section of Nelson Avenue, on-street parking is provided along the east side of the roadway. Nelson Avenue functions as one of the primary outbound routes for vehicle traffic leaving the Horseshoe Bay community. Traffic volumes along this segment of Nelson Avenue currently are 50 and 137 during the weekday AM and PM peak hours, respectively. During the Saturday afternoon peak hour, Nelson Avenue carries approximately 133 vehicles.

South of Chatham Street, Nelson Avenue is a two-way facility providing one lane of travel in each direction. To the south, Nelson Avenue eventually intersects Marine Drive and Rosebery Avenue via a roundabout-controlled intersection.

2.2.3 Bruce Street

Bruce Street is a two-way neighbourhood street providing one lane of travel in each direction. Bruce Street is lined by single family homes (towards Nelson Avenue) and commercial areas (towards Royal Avenue). Much of the traffic along Bruce Street is oriented in the eastbound direction.



Exhibit 2-1
Study Area

Sewell's Landing Transportation Study
4241.43 October 2015 Scale NTS

2.2.4 Marine Drive

In the study area, Marine Drive is a two-way facility providing one lane of travel in each direction. Similar to Nelson Avenue, Marine Drive provides connectivity for project outbound vehicles to Highway 1. Intersections #4 and #7 were reconfigured to roundabout intersections several years ago.

2.2.5 Royal Avenue

Royal Avenue (in the study area) functions as a two-way roadway providing one (1) travel lane in each direction and on-street parking on both sides of the street. South of Bay Street, Royal Avenue carries hourly volumes range between 139 and 177 vph during the weekday morning and evening peak hours, respectively.

2.2.6 Highway 1

Highway 1 provides access to / from the Horseshoe Bay Ferry Terminal. During ferry arrivals, surges of vehicular traffic in the range of 800 vph leave the Ferry Terminal and travel southbound along Highway 1. In the opposing [northbound] direction, up to 322 vph perform a northbound left towards Keith Road/Douglas Street during the weekday PM peak hour. Please note Bunt & Associates has obtained and utilized the existing traffic signal timing plans for the intersection of Highway 1 at Keith Road/Douglas Street (from the Ministry of Transportation and Infrastructure) in the following analysis.

2.3 Existing Traffic Volumes and Operations

As directed by District staff, traffic counts were conducted by Bunt during a “non-holiday” Summer weekend when Horseshoe Bay vehicular traffic is typically at its peak - the traffic counts were collected on Friday August 14th and Saturday August 15th 2015. The counts covered the weekday morning (7:00am to 9:00am), weekday afternoon (3:00pm to 7:00pm), and Saturday mid-day (11:00am to 3:00pm) peak traffic periods. The traffic volumes also include traffic volumes associated with the nearby from the arrival of Horseshoe Bay BC Ferries Ferry Terminal. The existing traffic counts have been included in this report in **Appendix A**.

2.3.1 Study Area

Intersections included in the study area and their existing traffic control type are summarized in **Table 2-1** (next page).

Table 2-1: Study Intersections

INTERSECTION	TRAFFIC CONTROL
Nelson Avenue (NS) at Bay Street/Wolseley Street (EW)	Unsignalized
Nelson Avenue (NS) at Chatham Street (EW)	Unsignalized
Nelson Avenue, Marine Drive, Rosebery Avenue	Roundabout
Royal Avenue (NS) at Bay Street (EW)	Unsignalized
Royal Avenue (NS) at Bruce Street (EW)	Unsignalized
Keith Road (NS) at Bay Street (EW)	Unsignalized
Highway 1 (NS) at Douglas Street (EW)	Traffic Signal
Roundabout - Keith Road, Marine Drive	Roundabout

The weekday AM and PM peak-hour traffic volumes are illustrated in **Exhibit 2-2** and **Exhibit 2-3**, respectively. The Saturday mid-day peak hour volumes are shown in **Exhibit 2-4**. As shown on Exhibit 2-3, a traffic screenline of the study area indicates a peak of approximately 500 vph currently access Horseshoe Bay via Nelson Avenue, Chatham Street, and Royal Avenue; this occurs during the weekday PM peak hour.

2.3.2 Existing Traffic Operations

The traffic operations for the study area were evaluated using Trafficware’s Synchro traffic analysis tool. The analysis is based on the intersection capacity analysis procedures outlined in the Highway Capacity Model (HCM) to assess traffic ‘volume to capacity’ (v/c) ratios and intersection delays. Furthermore, the corresponding delays are associated with Levels of Service (LOS) as shown below on **Table 2-2**.

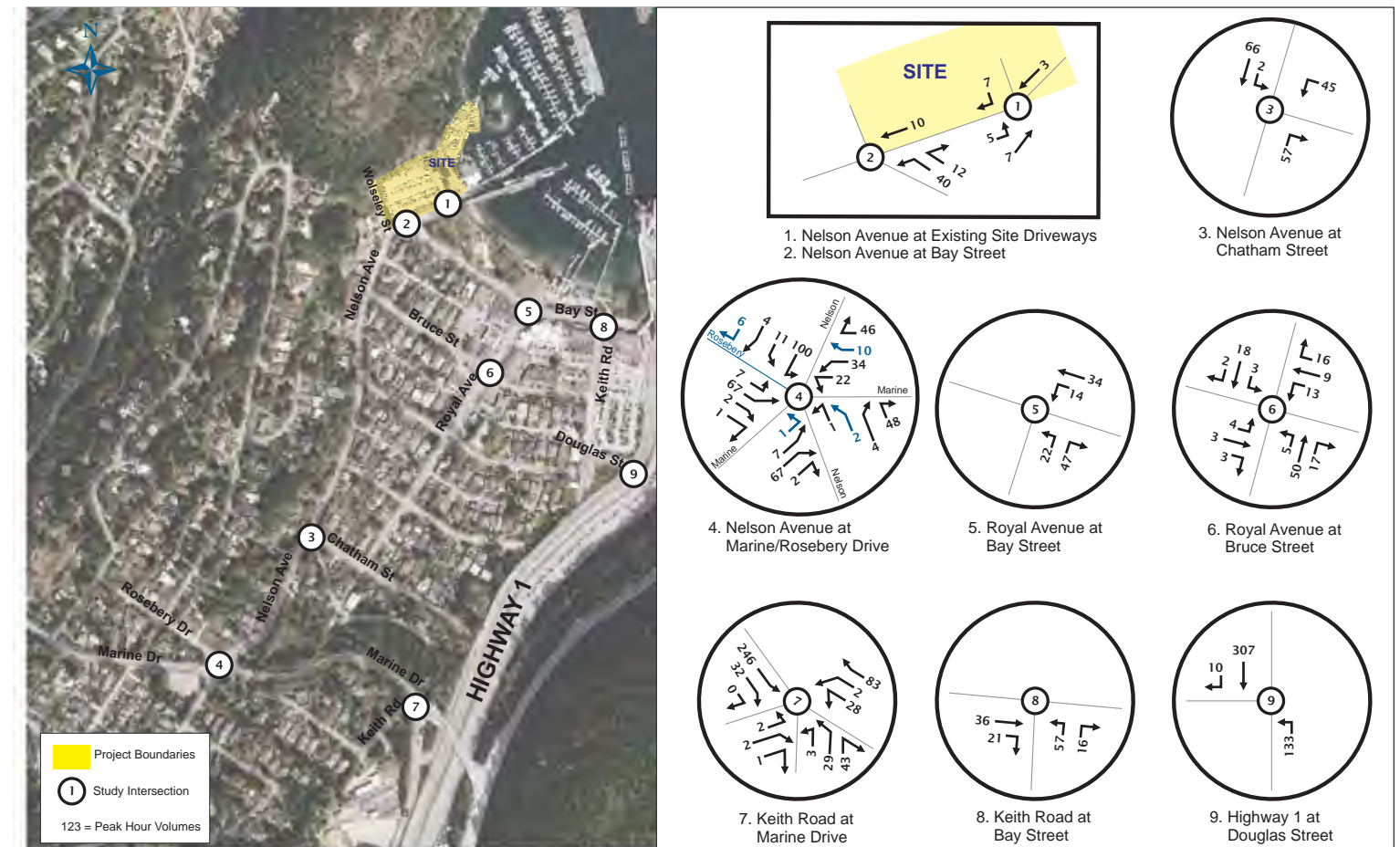
Table 2-2: Level of Service Thresholds

Level of Service	Control delay per vehicle (seconds)		
	Signalized	Roundabouts	Stop Control
A	0 to 10.00	0 to 10.00	0 to 10.00
B	10.01 to 20.00	10.01 to 20.00	10.01 to 15.00
C	20.01 to 35.00	20.01 to 35.00	15.01 to 25.00
D	35.01 to 55.00	35.01 to 50.00	25.01 to 35.00
E	55.01 to 80.00	50.01 to 70.00	35.01 to 50.00
F	80.01 and up	70.01 and up	50.01 and up

The output from the traffic modeling is included in **Appendix B** of this report, and the operation for the study area intersections are summarized in **Table 2-3** (next page). As shown in Table 2-3, all of the study area intersections currently operate within capacity and generally excellent Levels of Service during the existing traffic conditions.

Table 2-3: Existing Traffic Operations

Intersection	Movement	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
		V/C	HCM LOS	V/C	HCM LOS	V/C	HCM LOS
Nelson Avenue (NS) at Bay Street/Wolseley Street (EW)	SBT	0.02	A	0.07	A	0.07	B
	WBL	0.03	A	0.06	A	0.06	A
	WBL/R	0.03	A	0.06	A	0.06	A
Nelson Avenue (NS) at Chatham Street (EW)	NBR	0.04	A	0.09	A	0.08	A
	SBL/T	0.00	A	0.01	A	0.01	A
	WBL	0.05	A	0.07	A	0.09	A
Roundabout - Nelson Avenue, Marine Drive, Rosebery Avenue	Nelson NB	0.06	A	0.05	A	0.06	A
	Nelson SB	0.10	A	0.19	A	0.18	A
	Marine EB	0.08	A	0.08	A	0.08	A
	Marine WB	0.09	A	0.19	A	0.18	A
	Rosebery	0.08	A	0.03	A	0.03	A
Royal Avenue (NS) at Bay Street (EW)	Overall	0.10	A	0.19	A	0.18	A
	NBL/R	0.08	A	0.15	A	0.21	A
Royal Avenue (NS) at Bruce Street (EW)	WBL/T	0.06	A	0.14	A	0.16	A
	NBL/T/R	0.00	A	0.00	A	0.00	A
	SBL/T/R	0.00	A	0.01	A	0.01	A
	EBL/T/R	0.01	A	0.05	B	0.05	B
Roundabout - Keith Road, Marine Drive	WBL/T/R	0.05	A	0.12	B	0.16	B
	Marine NB	0.08	A	0.15	A	0.15	A
	Marine SB	0.21	A	0.19	A	0.18	A
	Keith EB	0.01	A	0.01	A	0.01	A
Keith Road (NS) at Bay Street (EW)	Marine WB	0.09	A	0.17	A	0.14	A
	Overall	0.21	A	0.19	A	0.18	A
	NBL/R	0.09	A	0.22	A	0.20	A
Highway 1 (NS) at Keith Road/Douglas Street (EW)	EBT/R	0.07	A	0.09	A	0.10	A
	NBL	0.34	B	0.40	B	0.40	B
	Overall	0.14	B	0.34	A	0.31	A



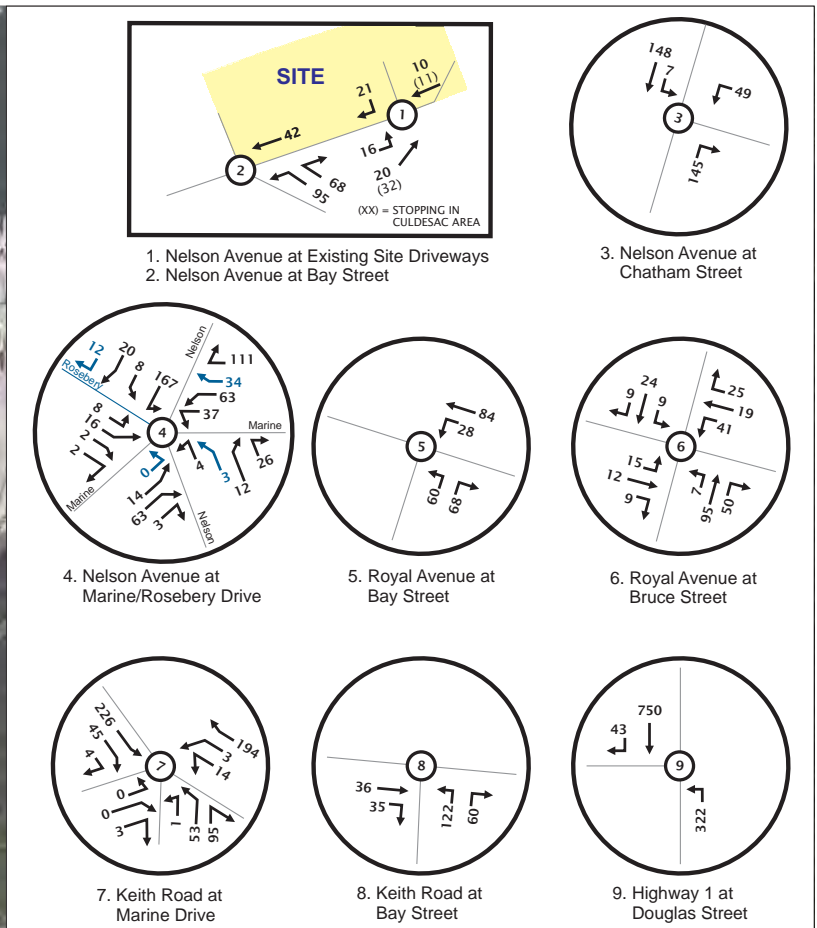


Exhibit 2-3
Existing Conditions
PM Peak Hour Volumes

Sewell's Landing Transportation Study
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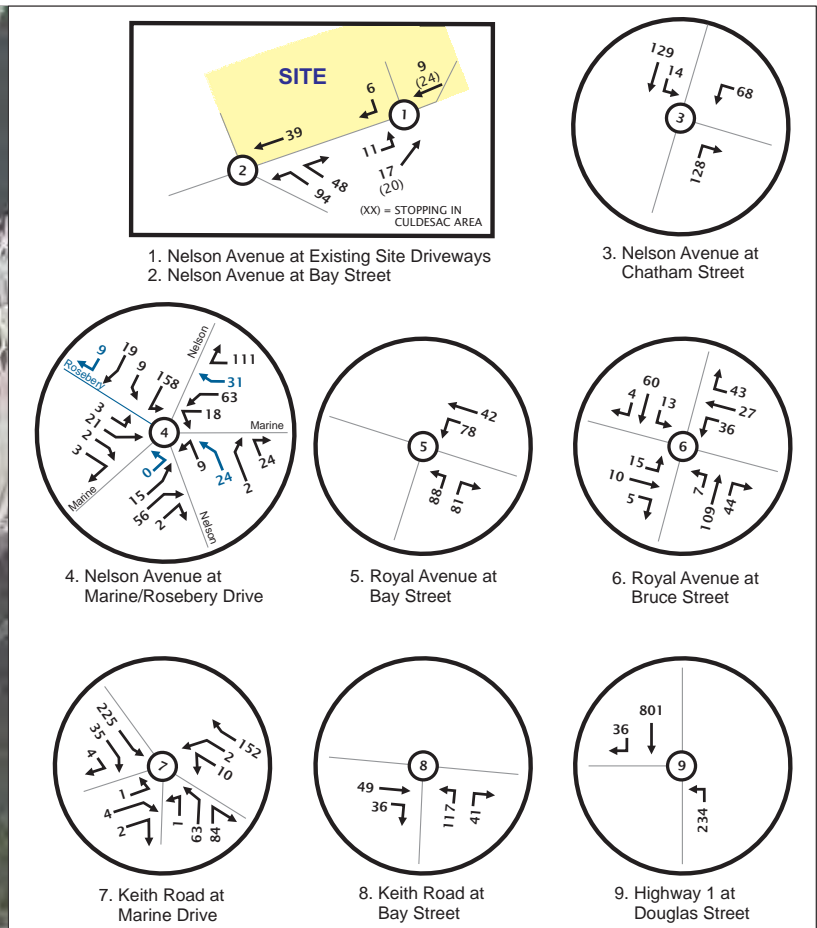


Exhibit 2-4
Existing Conditions
Saturday Mid-day Peak Hour Volumes

Sewell's Landing Transportation Study
4241.43 October 2015 Scale NTS



2.4 Existing Parking Conditions

Exhibit 2-5 illustrates the existing parking areas adjacent to the project site. Parking utilization counts were performed for the above parking areas from 7AM to 7PM on the same days as the intersection traffic counts described in previous Section 2.3. The intent of the parking counts was to capture the parking utilization trends associated with the peak season of the existing Sewell's marina (i.e. the Summer boating season).

Lots "A" through "D" have been grouped together because they are proposed to be reconstructed / reconfigured with the planned project. The count data for parking areas "A" through "D" is graphically presented in **Exhibit 2-6**. As shown, these parking areas provide a total of up to 226 parking stalls.

- Lot "A" is a gated *private-parking* area utilized by the existing Mercury Water Taxi business. This lot provides 10 vehicular parking stalls. This area also serves as a storage area for Mercury Water Taxi trailers and boats, and is not accessible for public use. Lot A" was observed to be 100% occupied during both parking count days.
- Lot "B" provides 28 vehicular parking stalls. During the parking count program, staff observed an occupancy range of 8-11 occupied stalls in Lot "B". The vehicles that were parked in this lot consisted of:
 - 1-4 parked passenger cars;
 - 1 boat occupying approximately 2 vehicular stalls;
 - 3 boat trailers occupying a total of 5 vehicular stalls;
- Lot "C" provides 27 parking stalls and is primarily utilized by the existing Boathouse Restaurant. As shown, Lot "C" is generally occupied during the afternoon hours leading to 6pm (i.e. dinner hours). During the morning hours, this parking area is generally less than 50% occupied.
- Lot "D" is the surface parking lot serving Sewell's marina and adjacent uses. This is a paid-parking lot providing 161 stalls and is operated / managed by Sewell's. As shown on Exhibit 2-6, parking stalls are generally available throughout all hours of the day at this parking area. Even at its peak (Saturday afternoon), 19-24 parking stalls remained unoccupied. It is noted that during the parking survey period no boats were observed to be parked in this lot.

As shown, the parking areas that are planned to be replaced with the project (Lots "A" through "D") are at peak occupancy during the Saturday afternoon period. Even during the peak parking demand period (187 stalls Saturday at 6pm), there were 29 stalls vacant (83% occupancy). It is important to note that Bunt was directed (by District staff) to perform the parking counts on a non-Holiday Summer weekend. Based on discussions with Sewell's staff and neighbouring residents, the existing on-site parking is typically over 100% occupied, particularly during a Holiday weekend (e.g. Mother's Day) or when Special Events are held at the bay.



Exhibit 2-5
Existing Parking Areas

Sewell's Landing Transportation Study
4241.43 October 2015 Scale NTS

FRIDAY					
Time	ON-SITE				Subtotal A to D
	A	B	C	D	
Supply	10	28	27	161	226
7:00	10	8	4	77	99
8:00	10	8	5	71	94
9:00	10	8	6	74	98
10:00	10	8	8	69	95
11:00	10	8	9	74	101
12:00	10	8	15	80	113
13:00	10	8	18	85	121
14:00	10	9	18	83	120
15:00	10	9	18	80	117
16:00	10	9	13	93	125
17:00	10	8	17	83	118
18:00	10	8	25	92	135
Peak Demand	10	9	25	93	135

SATURDAY					
Time	ON-SITE				Subtotal A to D
	A	B	C	D	
Supply	10	28	27	161	226
7:00	10	8	3	95	116
8:00	10	8	5	102	125
9:00	10	8	6	104	128
10:00	10	8	8	113	139
11:00	10	9	10	119	148
12:00	10	10	13	131	164
13:00	10	10	21	137	178
14:00	10	9	22	139	180
15:00	10	10	23	142	185
16:00	10	11	22	140	183
17:00	10	10	21	142	183
18:00	10	11	27	139	187
Peak Demand	10	11	27	142	187

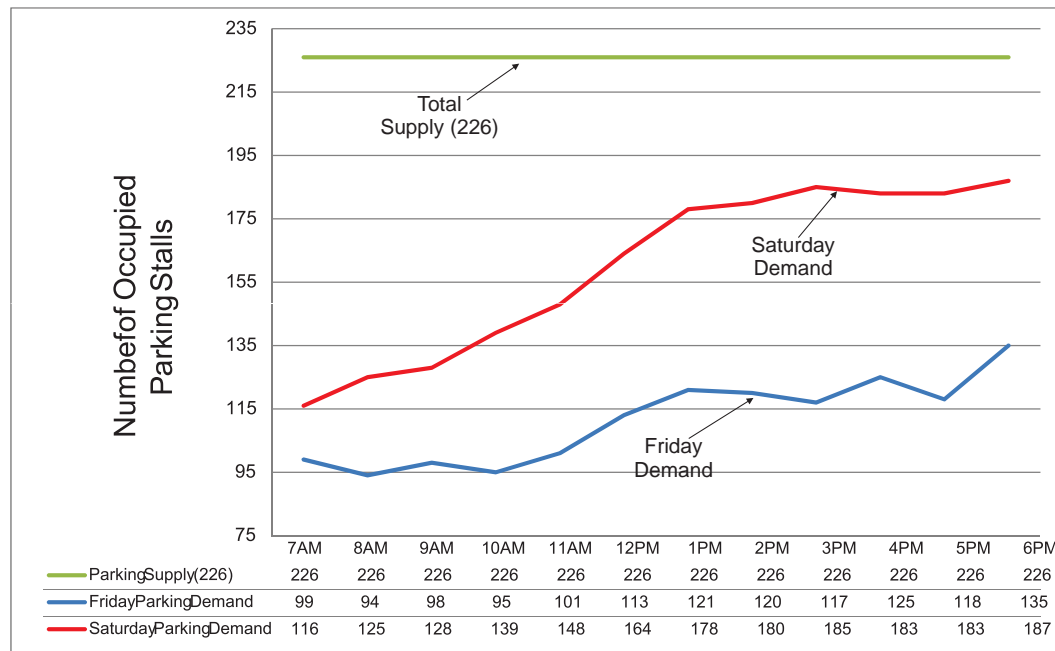


Exhibit 2-6
On-Site Areas “A” to “D”
Parking Supply & Demand

Sewell's Landing Transportation Study
4241.43 October 2015 Scale NTS



Parking Areas “E” and “F”, which are time-limited, free parking areas, were also included in the parking survey per request by District staff. The count data for “E” and “F” is graphically presented in Exhibit 2-7. As shown, these parking areas provide a total of 63 parking stalls.

- Parking Area “E” represents the on-street parking areas along Nelson Avenue that fronts the project site and Horseshoe Bay Park. This area provides 17 parking stalls. These areas are frequently used for loading / unloading activities associated with the adjacent Government Wharf. This parking area is generally vacant during the morning period and mostly occupied during the afternoon period.
- Lot “F” provides 46 parking stalls and primarily serves Horseshoe Bay Park and the existing commercial uses fronting Bay Street. Similar to Parking Area “E”, Parking Area “F” is generally vacant during the morning and mostly occupied during the afternoon hours.

2.5 Public Transit

The site is located within 400 metres (5 minute walking distance) of the Horseshoe Bay Ferry Terminal. Additionally, the site is conveniently located across the street from Bus Station #54557 (Southeast corner of Nelson Street at Bay Avenue). Table 2-4 summarizes the various bus routes that stop at this station.

Table 2-4 Bus Route Headways

Route	Approximate Headways (minutes)		
	AM	PM	Weekend Mid-Day
250 Vancouver	14	30	30
250A Vancouver	30	20	30
257 Express Vancouver	30	20	30
257 Express Vancouver (Summer)	30	25	30
259 Lions Bay (peak hours only)	60	60	--
C12 Caulfield	60	60	60
C12 Lions Bay - Brunswick	60	60	60

As shown, Route 250 (Vancouver) is the most frequent bus route with approximate headways of 14 to 30 minutes. Additionally, the 257 Express route has varying headways depending on the time of the year with the more frequent headways during the Summer afternoon period.

The number and frequency of these bus transit routes located within a 5 minute walk of the proposed development ensures that public transit is a viable transportation option for the future residents, visitors and customers.

FRIDAY			
Time	ADJACENT TO SITE		Survey Area Total
	E	F	
Supply	17	46	63
7:00	1	8	9
8:00	0	15	15
9:00	0	17	17
10:00	0	25	25
11:00	1	30	31
12:00	7	42	49
13:00	16	44	60
14:00	10	42	52
15:00	15	45	60
16:00	7	36	43
17:00	10	36	46
18:00	14	40	54
Peak Demand	16	45	61

SATURDAY			
Time	ADJACENT TO SITE		Survey Area Total
	E	F	
Supply	17	46	63
7:00	1	7	7
8:00	2	9	9
9:00	1	14	14
10:00	4	26	26
11:00	6	35	35
12:00	10	40	40
13:00	13	46	46
14:00	16	45	45
15:00	13	43	43
16:00	4	38	38
17:00	7	31	31
18:00	11	41	41
Peak Demand	16	46	46

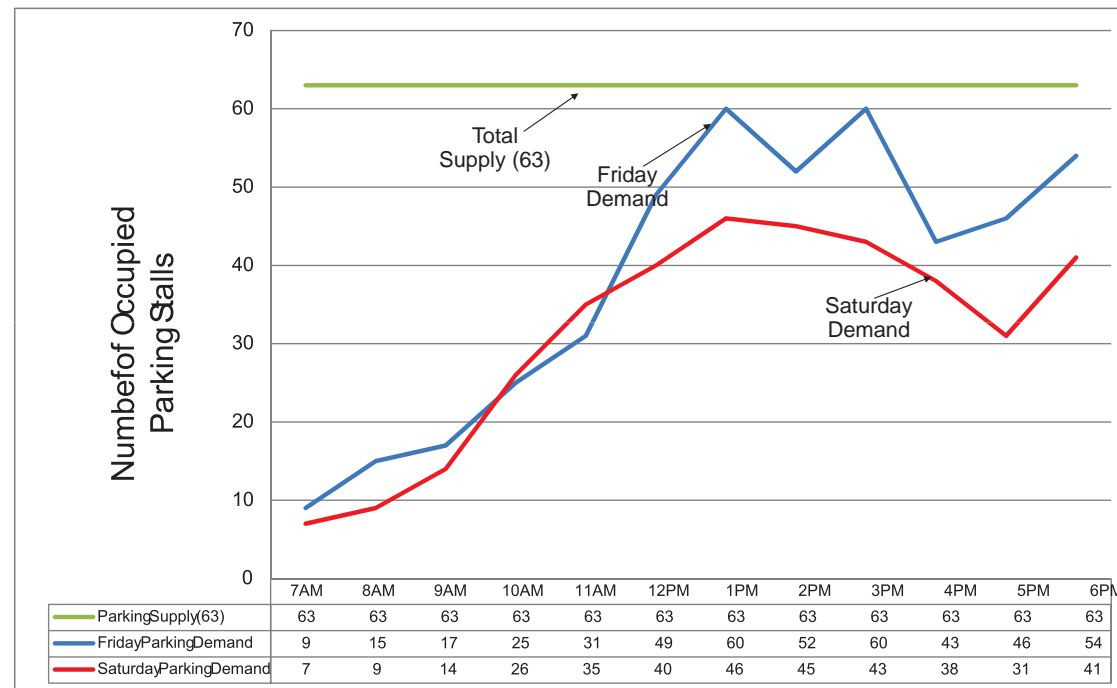


Exhibit 2-7
Areas “E” and Area “F”
Parking Supply & Demand

Sewell’s Landing Transportation Study
4241.43 October 2015 Scale NTS



2.6 Pedestrian Facilities / Hiking Trails

Street edge sidewalks and paved pathways extend throughout the Horseshoe Bay area. Additionally, many trails (such as the Baden Powell Trail, Trans Canada Trail, and future Spirit Trail connection) are accessible from Horseshoe Bay. The planned portion of the Spirit Trail from Gleneagles Elementary School to/from Chatham Street is currently the subject of public consultation. The second planned segment of the Spirit Trail from Chatham Street to the Horseshoe Bay waterfront (Bay Street) is also the subject of public consultation, but is still in its conceptual planning stages. Ultimately, the Spirit Trail is expected to be an excellent route for future residents of the project that intend on accessing Gleneagles Elementary by walking.

Exhibit 2-8 illustrates the location of another trail that currently encroaches on private property directly west of the project site. As shown, due to the proximity of this trail to the project site, this trail head will need to be relocated (likely to the end of the Wolseley Street) to ensure the trail is in the public domain and secure for future generations.

Exhibit 2-8 Existing Hillside Trail Location Map



2.7 Cycling Network

Exhibit 2-9 illustrates the bike routes adjacent to the site. As shown, cyclists are able to access the site via cycling routes along Marine Drive, Nelson Avenue, Bay Street, Royal Avenue, and Highway 1. As discussed in Section 2.6, the portion of the Spirit Trail connecting Seaview Walk with Horseshoe Bay is currently the subject of a public consultation process. Although the details of the future Spirit Trail (e.g. design plans, completion year, etc) are not yet available, it can be concluded this future connection will enhance the future bicycle network infrastructure for existing and future cyclists accessing Horseshoe Bay.



2.8 BC Ferries Master Plan

BC Ferries has indicated the terminal master plan for Horseshoe Bay is being delayed until the Major Routes Strategy is complete. The Major Routes Strategy will likely be finished in mid-2017, after which the terminal plan for Horseshoe Bay will begin. As such, the Horseshoe Bay Terminal will likely begin at the end of 2017 or beginning of 2018, and the inclusion of any BC Ferries planning data is premature at this time.

Exhibit 2-9
West Vancouver Bike Routes

Sewell's Landing Transportation Study
4241.43 October 2015 Scale NTS



3. DEVELOPMENT PLAN

3.1 Proposed Development

The project is proposed to include:

- Approximately 240,000 sf of Townhomes/Condos providing 159 suites; and,
- A 5,000 sf net increase of marina-commercial uses.

It is noted that the development estimates (above) are approximate only, and are subject to change over the course of the planning study. It is also important to note the majority of additional traffic that will be generated by the project is associated with the proposed residential suites. The commercial component of the project involves only a reorganization of the existing marina-commercial uses with a limited increase of commercial uses. As such, the commercial component of the project is not anticipated to generate a significant amount of new traffic.

Traffic and parking will be key planning considerations for the project with its location at the core of the Horseshoe Bay community and adjacency to Horseshoe Bay Park. The nearby BC Ferries terminal, the existing array of neighbourhood shops and restaurants along Bay Street, the existing marina operation and visitors to the park collectively contribute to this area being quite active with vehicle, pedestrian and cyclist traffic. While the addition of the proposed development traffic may be relatively modest in comparison to existing traffic levels, the addition of any new traffic or parking activity has nonetheless been evaluated to identify the project’s traffic impacts (if any).

As part of the project, four levels of pedestrian plazas shall be provided. The plazas on the proposed terraces are generally intended for pedestrian use, but shall also be designed to accommodate low vehicular traffic.

3.2 Parking

3.2.1 Marina Commercial Parking Plan

The relevant parking bylaws for the added marina-commercial uses of the site are shown below:

Bylaw Section 352.10 Off-Street Parking 1(a): Minimum of 1 parking space for every 37.5 square metres (404 square feet) of commercial gross floor area.

Table 3-1 (next page) presents the required number of parking stalls for the added marina-commercial uses of the site.

Table 3-1 Minimum Parking Requirements for Added Commercial

Proposed Use	Density	No. of Required Parking Spaces
		Minimum
Added Commercial Space	5,000 sf	12

Per the District’s parking bylaws, the 5,000sf increase of added commercial use requires a minimum of 12 additional parking stalls. The project intends on providing an additional 24 stalls for the added marina-commercial uses. Thus, the proposed commercial parking supply will significantly exceed the minimum parking supply requirement of the District of West Vancouver’s Zoning Bylaw.

Table 3-2 (below) summarizes the parking supply strategy for the commercial components of the project. Commentary is also provided on Table 3-2 to provide clarification on how the stalls are allocated in regards to the existing and future uses of the site.

Table 3-2 Proposed Parking Supply for Added Commercial

Land Use	Existing Number of On-Site Parking Stalls	Future Number of Parking Stalls	Commentary
Marina and Boathouse	209	209	The existing Marina and Boathouse parking of 209 stalls shall continue to be provided.
Commercial	17	17	The existing Commercial parking of 17 stalls shall continue to be provided.
Added Commercial	NA	24	The parking supply for “added commercial space” exceeds the West Vancouver parking bylaw (minimum of 12 stalls).
Nelson Replacement Stalls	NA	3	Loss of stalls along Nelson will be placed on-site.
Potential Car Share	NA	2	Car share stalls shall be publicly accessible.
Marina and Commercial Total	226	255	Increase of 29 stalls

Per Table 3-2, the Marina and Commercial parking area shall provide 255 stalls to accommodate the parking needs of the site and the site’s surrounding uses (e.g. working waterfront, Horseshoe Bay Park, short term BC Ferries traffic, etc). Though the parking counts have indicated existing on-site parking areas are only 82% occupied (per Chapter 2 of this report), Sewell’s staff have indicated the existing on-site parking areas regularly experience **over 100% occupancy**. This is especially true during Holiday weekends (such as Mother’s Day) and during days where Special Events are held at the bay. Feedback from the community has also indicated BC Ferries traffic presents an anecdotal impact on parking

availability during the busy Summer months. Therefore, although the existing parking counts demonstrate that parking is generally available on-site during non-Holiday weekends, there are regular instances in the Summer when parking is unavailable.

As previously discussed, the parking counts were performed during a non-Holiday weekend to evaluate average Summer conditions at the site. Although it is important to provide sufficient parking to accommodate the parking demands of a non-Holiday weekend, it is the project's intent to accommodate the parking demands experienced during a Holiday weekend and days with Special Events at the bay. This provision would minimize the potential for parking-related issues in the bay and also address parking-related feedback provided by the community.

District staff has also indicated some concern regarding the loss of 2-3 existing parking stalls along Nelson Avenue (north of Bay) with the construction of the planned access driveways for the new development. As shown, additional parking has been provided on-site to account for the loss of 2-3 stalls along Nelson.

Furthermore, the option of providing 2 publicly accessible car share stalls will be discussed with District staff.

3.2.2 Residential Parking

The relevant parking supply requirement of the Zoning Bylaw for the proposed residential uses of the site is set out below:

Bylaw Section 352.10 Off-Street Parking 1(b) 1 parking space for every dwelling, or (c) 1 parking space for every 83.6 square metres (900sf) of gross residential floor area, whichever is the greater, provided no more than 2 residential parking spaces per dwelling need be provided.

Table 3-3 presents the required number of parking stalls for the proposed residential uses of the site.

Table 3-3 Minimum Parking Requirements for Residential

Proposed Use	Density	Rate	No. of Required Parking Stalls	
		Minimum	Minimum	Proposed
Residential	240,000sf	1 per 900 sf	267	238

Per the District's Zoning Bylaw, the 159-unit residential component of the project (240,000sf) shall require a minimum of 267 parking stalls. The project is proposing 238 residential parking stalls which would be in deficit by 29 stalls (per the bylaw). However, the residential parking provision of 238 stalls equates to

1.50 parking stalls per unit. Although the residential parking is in deficit by 29 stalls (per the bylaw), it is our opinion this parking supply rate (1.50 per unit) is appropriate for the development.

The following section discusses the rationale for the parking variance:

In order to determine the appropriateness of the residential parking supply (as it relates to the bylaw variance), statistics from the Metro Vancouver Apartment Parking Study (dated September 2012) and the 2009 Canadian Vehicle Survey were investigated. The key findings that are applicable to this project are highlighted below:

- Per the Canadian Vehicle Survey:
 - In Canada, there are an estimated 1.47 vehicles per household; and,
 - In British Columbia, there are approximately 1.43 vehicles per household.
- Per the Metro Vancouver Apartment Parking Study, the average number of vehicles for larger units (ie. greater 1,200 square feet) is approximately 1.50-1.60 per unit.

As shown, the parking supply rate of 1.50 per unit generally falls in line with the survey findings from the Metro Vancouver Parking Study. Additionally, the 1.50 per unit provision is still more than Canada's average number of vehicles per household (1.47) and is also more than British Columbia's average number of vehicles per household (1.43). Furthermore, the site is excellently served by a variety of transit routes, particularly Route 240 which provides service to Vancouver with headways of 14-30 minutes. Although the residential parking is in deficit by 29 stalls, the proposed 1.50 stalls per suite is expected to appropriately accommodate the parking demands of a 159-unit residential development and avoid a parking oversupply.

Westbank is willing to explore the option of providing 2 publicly accessible car share stalls to offset the parking variance (if required by the District).

3.2.3 Total Development Parking

Table 3-4 (next page) summarizes the overall parking supply count for the development.

Table 3-4: Total Development Parking

Land Use	Future Number of Parking Stalls
Marina, Commercial and Boathouse	226
Added Commercial	24
Nelson Replacement Stalls	3
Potential Car Share	2
Future Residential	238
Development Total	493

Per Table 3-4, the total parking for the development shall consist of 493 stalls. A total of 493 parking stalls are planned for the site - This parking supply consists of 226 for the existing commercial uses, 24 stalls for the added commercial use, 3 stalls to replace the loss of stalls along Nelson, 2 stalls for a potential car share system and 238 spaces for resident use. Based on the aforementioned data and discussion, this parking supply is anticipated to excellently accommodate the parking demands of the proposed development.

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3.3 Loading Facilities

The project will provide a sufficient number of loading bays to accommodate the anticipated loading activities for the development. The loading supply strategy shall be evaluated in a separate technical document in the future.

3.4 Bicycle Facilities

The project is expected to provide bicycle storage areas to suitably accommodate the development. Bicycle storage facilities shall be addressed in a separate technical document in the future.

4. TRAFFIC IMPACT ASSESSMENT

The first iteration of the Traffic Impact Assessment for this project previously evaluated a residential density of 171 suites. As the planning process continued, the quantity of residential units has decreased from 171 suites to 159 suites. **For conservative purposes**, the analysis presented in this section of the report has been unchanged to evaluate 171 suites, rather than 159 suites.

4.1 Trip Generation

4.1.1 Trip Rates

To evaluate the impact of the traffic generated from the proposed development, future traffic conditions were assessed for the weekday morning peak hour, weekday afternoon peak hour, and Saturday mid-day periods. Trip generation rates from the Institute of Transportation Engineers' (ITE) Trip Generation Handbook (9th Edition) for the proposed land use categories have been utilized in this report. **Table 4-1** presents the trip rates for the proposed development.

Table 4-1 Trip Generation Rates

Description	ITE Code	Qty.	Unit	AM PEAK HOUR			PM PEAK HOUR			SAT PEAK HOUR		
				In	Out	Total	In	Out	Total	In	Out	Total
High Rise Residential Condo/Townhouse (3+ floors)	232	171	Suites	0.07	0.28	0.34	0.24	0.14	0.38	0.16	0.22	0.38
Specialty Retail	826	5.00	TSF	0.60	0.37	0.96	1.19	1.52	2.71	1.67	0.90	2.57

4.1.2 Vehicle Trip Generation

Using the trip rates summarized above, **Table 4-2** provides a summary of the added vehicle trips likely to be generated by the development.

Table 4-2: Added Vehicle Trips

Description	ITE Code	Qty.	Unit	AM PEAK HOUR			PM PEAK HOUR			SAT PEAK HOUR		
				In	Out	Total	In	Out	Total	In	Out	Total
High Rise Residential Condo/Townhouse	232	171	Suites	11	47	58	40	25	65	28	37	65
Specialty Retail	826	5.0	TSF	3	2	5	6	8	14	8	5	13
TOTAL				14	49	63	46	33	79	36	42	78

As shown in Table 4-2, the proposed development is anticipated to generate a net additional 63 two-way vehicles per hour (vph) during the weekday morning peak hour, 79 vph during the weekday afternoon peak period, and 78 vph during the Saturday mid-day peak hour. Even during the busier traffic periods, the net traffic increase associated with the proposed development is limited to an average of between one to two vehicles per minute.

4.2 Trip Distribution and Assignment

Trip distribution represents the directional orientation of traffic to and from the project site. Trip distribution is heavily influenced by the geographical location of the site, the location of employment, commercial and recreational opportunities and the proximity to the regional highway system. The trip distribution for the project was estimated based on all the aforementioned components, and further refined with input provided by District staff.

Exhibit 4-1 illustrates the trip distribution assumptions utilized in the analysis. The majority (80%) of motorists headed toward the project site are expected to access the area using Highway 1 via the signalized intersection of Keith Road/Douglas Street at Highway 1. Additionally, for outbound traffic destined to Highway 1, project related traffic has been assumed to be split between Bay Avenue (40%) and Marine Drive (40%). Some traffic has also been conservatively assigned to Nelson Avenue, south of Marine Drive (5%).

Using the vehicle trip generation established in the previous section, the overall traffic assignment (i.e. "Project Only" traffic volumes) for the development site for the AM, PM, and Saturday peak periods are presented in **Exhibit 4-2**, **Exhibit 4-3**, and **Exhibit 4-4**, respectively.

4.3 Opening Day (2019) Traffic Volumes and Operations

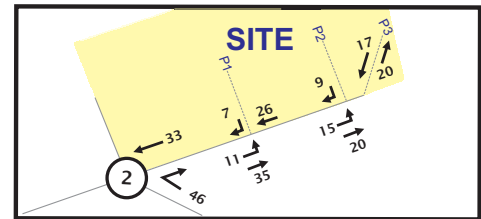
4.3.1 Traffic Forecasting Methodology

In order to develop Year 2019 Total (development traffic included) traffic volumes, the traffic forecasts have utilized a Background traffic (general increase in area traffic) growth rate of 0.5% per annum. This overall growth factor was applied to the Existing (2015) intersection volumes to develop Baseline 2019 volumes. The last step in the forecasting methodology is to superimpose the project's new traffic volumes on the Baseline 2019 volumes to develop the Opening Day (2019) Total or "With Project" traffic volumes.

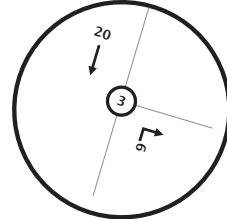
The resulting Opening Year 2019 With Project traffic volumes are illustrated in **Exhibit 4-5**, **Exhibit 4-6**, **Exhibit 4-7** for the Weekday AM, Weekday PM, and Saturday Mid-Day peak-hour periods, respectively.

4.3.2 Intersection Operations

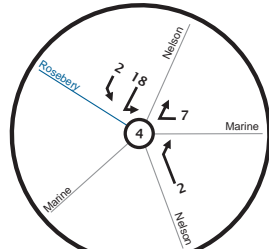
The Opening Day 2019 With Project traffic analyses have been conducted using the Synchro traffic analysis tool. The output pages from the Synchro traffic analyses are included in **Appendix C** of this report, and the traffic analyses for the study area intersections are summarized in **Table 4-3**.



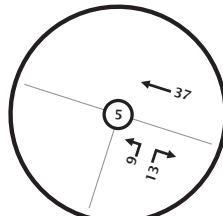
- 1. Nelson Avenue at Existing Site Driveways
- 2. Nelson Avenue at Bay Street



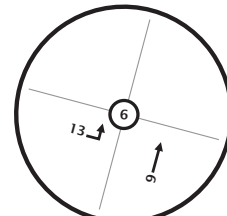
- 3. Nelson Avenue at Chatham Street



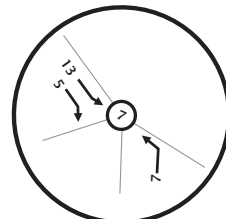
- 4. Nelson Avenue at Marine/Rosebery Drive



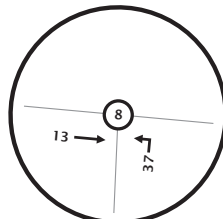
- 5. Royal Avenue at Bay Street



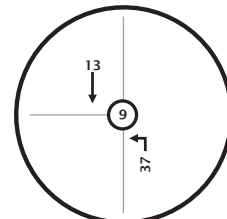
- 6. Royal Avenue at Bruce Street



- 7. Keith Road at Marine Drive



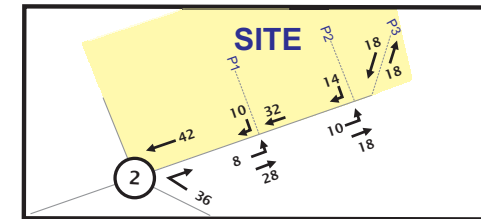
- 8. Keith Road at Bay Street



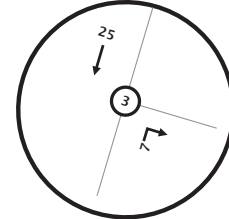
- 9. Highway 1 at Douglas Street

Exhibit 4-3
Project Only/ New Traffic
PM Peak Hour Volumes

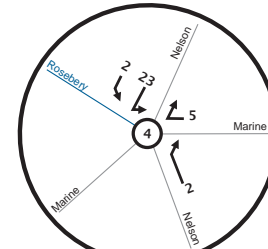
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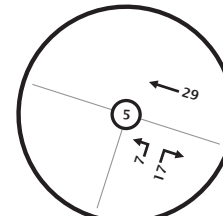
- 1. Nelson Avenue at Existing Site Driveways
- 2. Nelson Avenue at Bay Street



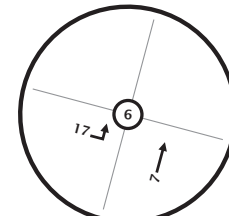
- 3. Nelson Avenue at Chatham Street



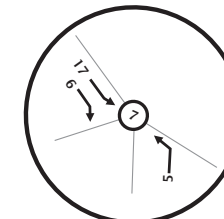
- 4. Nelson Avenue at Marine/Rosebery Drive



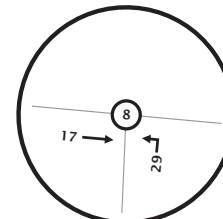
- 5. Royal Avenue at Bay Street



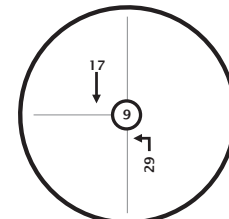
- 6. Royal Avenue at Bruce Street



- 7. Keith Road at Marine Drive



- 8. Keith Road at Bay Street

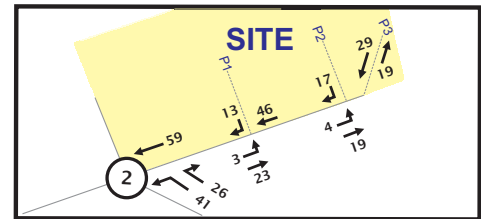


- 9. Highway 1 at Douglas Street

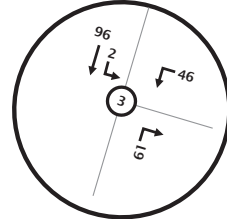
Exhibit 4-4
Project Only / New Traffic
Saturday Mid-Day Peak Hour Volumes

Sewell's Landing Transportation Study
 4241.43 October 2015 Scale NTS

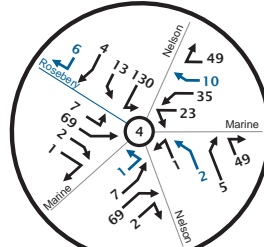




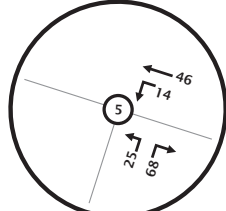
1. Nelson Avenue at Existing Site Driveways
2. Nelson Avenue at Bay Street



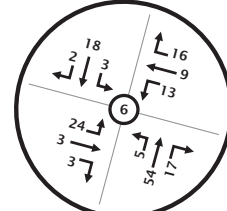
3. Nelson Avenue at Chatham Street



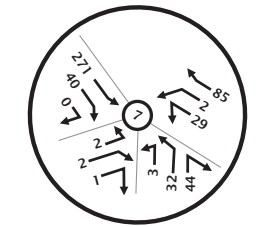
4. Nelson Avenue at Marine/Rosebery Drive



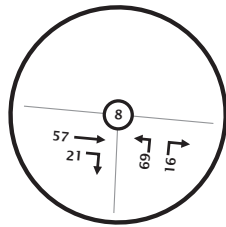
5. Royal Avenue at Bay Street



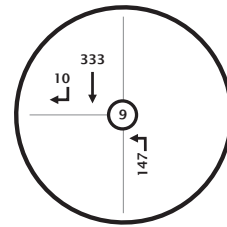
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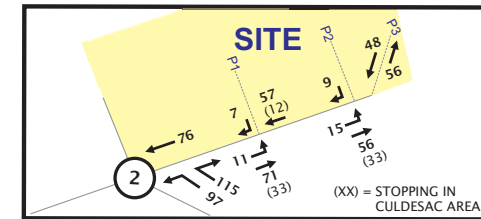
7. Keith Road at Marine Drive



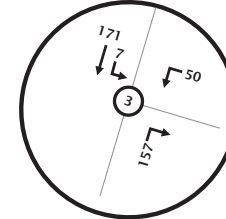
8. Keith Road at Bay Street



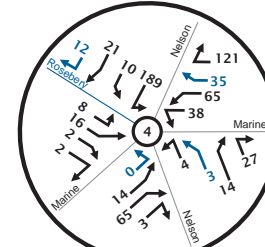
9. Highway 1 at Douglas Street



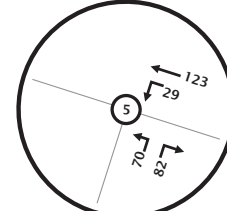
1. Nelson Avenue at Existing Site Driveways
2. Nelson Avenue at Bay Street



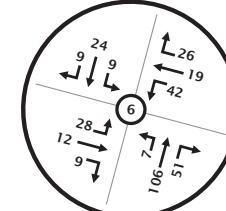
3. Nelson Avenue at Chatham Street



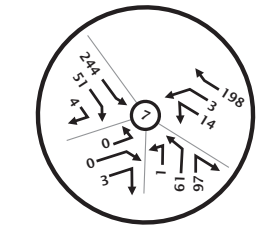
4. Nelson Avenue at Marine/Rosebery Drive



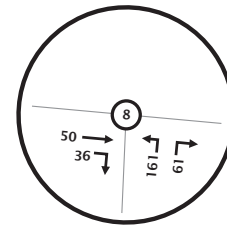
5. Royal Avenue at Bay Street



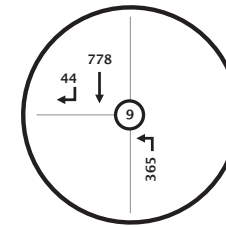
6. Royal Avenue at Bruce Street



7. Keith Road at Marine Drive



8. Keith Road at Bay Street



9. Highway 1 at Douglas Street

Exhibit 4-5
2019 With Project Conditions
AM Peak Hour Volumes

Sewell's Landing Transportation Study
4241.43 October 2015 Scale NTS



Exhibit 4-6
2019 With Project Conditions
PM Peak Hour Volumes

Sewell's Landing Transportation Study
4241.43 October 2015 Scale NTS



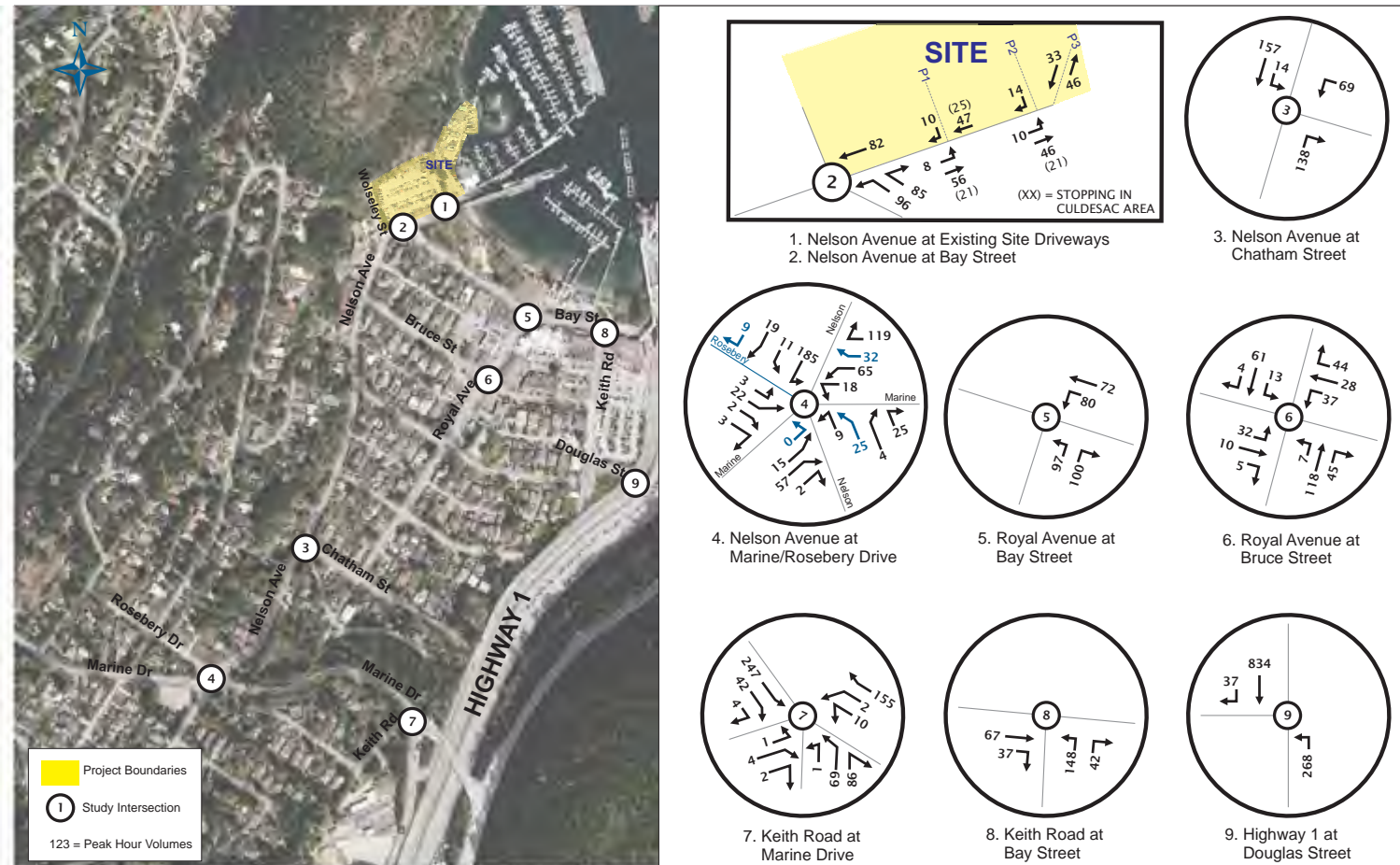


Exhibit 4-7
2019 With Project Conditions
Saturday Mid-day Peak Hour Volumes

Sewell's Landing Transportation Study
 4241.43 October 2015 Scale NTS



Table 4-3 Opening Day 2019 With Project Traffic Analysis

Intersection	Movement	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
		V/C	HCM LOS	V/C	HCM LOS	V/C	HCM LOS
Nelson Avenue (NS) at Bay Street/Wolseley Street (EW)	SBT	0.08	B	0.14	B	0.15	B
	WBL	0.03	A	0.06	A	0.06	A
Nelson Avenue (NS) at Chatham Street (EW)	WBL/R	0.03	A	0.06	A	0.06	A
	NBR	0.04	A	0.11	A	0.09	A
Roundabout - Nelson Avenue, Marine Drive, Rosebery Avenue	SBL/T	0.00	A	0.01	A	0.01	A
	WBL	0.06	A	0.07	A	0.10	B
	Nelson NB	0.06	A	0.05	A	0.07	A
	Nelson SB	0.13	A	0.22	A	0.21	A
	Marine EB	0.08	A	0.09	A	0.08	A
Royal Avenue (NS) at Bay Street (EW)	Marine WB	0.09	A	0.20	A	0.19	A
	Rosebery	0.08	A	0.03	A	0.03	A
Royal Avenue (NS) at Bruce Street (EW)	Overall	0.13	A	0.22	A	0.21	A
	NBL/R	0.10	A	0.20	A	0.25	A
Roundabout - Keith Road, Marine Drive	WBL/T	0.08	A	0.19	A	0.21	A
	NBL/T/R	0.00	A	0.00	A	0.00	A
	SBL/T/R	0.00	A	0.01	A	0.01	A
	EBL/T/R	0.04	A	0.08	B	0.08	B
Keith Road (NS) at Bay Street (EW)	WBL/T/R	0.05	A	0.13	B	0.16	B
	Marine NB	0.08	A	0.16	A	0.16	A
	Marine SB	0.23	A	0.21	A	0.20	A
Highway 1 (NS) at Keith Road/Douglas Street (EW)	Keith EB	0.01	A	0.01	A	0.01	A
	Marine WB	0.09	A	0.17	A	0.14	A
Highway 1 (NS) at Keith Road/Douglas Street (EW)	Overall	0.23	A	0.21	A	0.20	A
	NBL/R	0.11	A	0.28	A	0.24	A
	EBT/R	0.09	A	0.11	A	0.13	A
Highway 1 (NS) at Keith Road/Douglas Street (EW)	NBL	0.28	B	0.44	B	0.44	B
	SBT	0.11	A	0.32	A	0.29	A
	Overall	0.15	B	0.36	A	0.33	A

As shown on Table 4-3, the study area intersections are predicted to operate at LOS “A” and LOS “B” for 2019 With Project conditions. Furthermore, the very satisfactory levels of service that currently occur in the study area today are expected to continue even with full occupancy of the proposed project.

District staff has also requested the HCM analysis include each of the three (3) driveways proposed for the site. This analysis is shown on **Table 4-4** below. As shown, the proposed driveways are predicted to operate at very satisfactory LOS.

Table 4-4 Intersection Analysis for Project Driveways

Intersection	Movement	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
		V/C	HCM LOS	V/C	HCM LOS	V/C	HCM LOS
Nelson Avenue (NS) at P3 Access (EW)	NBL	0.01	A	0.04	A	0.03	A
	EBR	0.03	A	0.05	A	0.03	A
Nelson Avenue (NS) at P2 Access (EW)	NBL/T	0.00	A	0.01	A	0.01	A
	SBT	0.02	A	0.04	A	0.04	A
	EBR	0.02	A	0.01	A	0.02	A
Nelson Avenue (NS) at P1 Access (EW)	NBL/T	0.00	A	0.01	A	0.01	A
	SBT	0.03	A	0.04	A	0.05	A
	EBR	0.01	A	0.01	A	0.01	A

Lastly, based on public input provided during the District-led Open House events (in September 2015), a few neighbours have inquired about the number of added vehicles to the segment of Nelson Avenue, south of Marine Drive. As previously shown on Exhibits 4-2 to 4-4, the project is expected to add approximately 2 vph (in each direction) along this segment of Nelson Avenue; this equates to a nominal amount of 1 added vehicle every 30 minutes (in each direction). As shown on Table 4-3 (page 34), each leg of the Marine Drive/Nelson Avenue roundabout is expected to operate at LOS “A” during any peak hour. This demonstrates the added traffic from the project is *not* expected to cause unsatisfactory traffic operations in the study area, particularly Nelson Avenue, south of Marine.

4.4 Non-Summer Weekday – Sensitivity Analysis

As an industry standard, transportation planners and traffic engineers typically evaluate traffic operations during the peak times of vehicular activity to evaluate worst-case traffic operations scenarios. During the scoping process for this Transportation Impact Assessment (in June/July 2015), Bunt & Associates, Sewell’s staff, and District of West Vancouver staff all agreed the Summer boating season was the appropriate time to evaluate peak traffic activity for the Horseshoe Bay community.

Based on public input provided during the District-led Open House events, many neighbours have inquired about the project’s potential impact during the Non-Summer season to account for school traffic. In particular, neighbours expressed concern for the project’s potential impact to the weekday traffic operations at the existing Marine Drive roundabouts (intersections #4 and #7 of this report). As such, Bunt & Associates has performed a supplemental set of intersection counts for the Marine Drive roundabouts in October 2015 when Gleneagles Elementary School was in session.

The supplemental counts (included at the end of Appendix A) were then further evaluated to determine how the Non-Summer traffic counts compare to the Summer traffic counts. **Table 4-5** summarizes the Non-Summer vs. Summer traffic volumes for the Marine Drive roundabouts.

Table 4-5 Non-Summer vs. Summer Count Comparison

Intersection	Count Collection Period	Peak Hour Traffic Volumes	
		AM	PM
Roundabout - #4. Marine Drive at Nelson Avenue	Summer	442	605
	Non-Summer	452	516
	<i>Delta</i>	10	-89
	<i>% Delta</i>	2%	-15%
Roundabout - #7. Marine Drive at Keith Avenue	Summer	471	638
	Non-Summer	595	588
	<i>Delta</i>	124	-50
	<i>% Delta</i>	26%	-8%

As shown, the weekday morning traffic volumes at the Marine Drive at Nelson Avenue roundabout (intersection #4) are generally the same during either the Summer or Non-Summer season; review of the traffic volumes indicate only a +2% change. However, the traffic volumes for intersection #7 are higher (+26%) during the Non-Summer weekday mornings. This is attributable to the traffic associated with the Gleneagles Elementary School (which was not in session during the Summer count program).

To evaluate the project’s impact along Marine Drive (if any), additional HCM analysis has been performed for these two roundabouts utilizing the Non-Summer weekday morning traffic volumes and the project’s added traffic volumes. The results of this analysis are presented below on **Table 4-6** (next page).

Table 4-6: 2019 With Project Non-Summer Weekday AM Intersection Operations

Intersection	Movement	AM Peak Hour	
		V/C	HCM LOS
Roundabout - Nelson Avenue, Marine Drive, Rosebery Avenue	Nelson NB	0.06	A
	Nelson SB	0.15	A
	Marine EB	0.10	A
	Marine WB	0.09	A
	Rosebery	0.06	A
	Overall	0.15	A
Roundabout - Keith Road, Marine Drive	Marine NB	0.09	A
	Marine SB	0.27	A
	Keith EB	0.06	A
	Marine WB	0.13	A
	Overall	0.27	A

As shown on Table 4-6, the roundabouts shall continue to operate at very satisfactory levels of service even when during the Non-Summer time periods, particularly when the Gleneagles Elementary School is in session.

During the weekday afternoon, the traffic volumes for the Marine Drive at Keith Avenue roundabout (intersection #7) are actually *higher* during the Summer boating season. Therefore, it can be concluded the weekday PM operations analysis in Section 4.3 of this report evaluates the higher traffic volume condition.

4.5 Bay Street – Two Way Traffic Operation Analysis

The section of Bay Street (between Nelson Avenue and Royal Avenue) is presently a one-way westbound street operating with two travel lanes. A number of area residents attending the September 2015 Open House events for this project queried whether Bay Street could be converted to a two way traffic operation to provide a more direct exit route from the proposed development to Highway 1, thereby reducing traffic activity on Nelson. Due to the proximity of the project site to this segment of Bay Street, District staff have requested that this transportation study evaluate the future traffic operations of intersections along the Horseshoe Bay waterfront assuming a reconfigured two-way traffic operation on this section of Bay Street.

Currently, vehicles departing the site or the Government Wharf must travel southbound along Nelson Avenue → to Bruce Street → to Royal Avenue → to Bay Street → towards Highway 1. Alternatively, vehicles can route southbound along Nelson Avenue → to Marine Drive → to Highway 1. Reconfiguring

the section of Bay Street between Nelson and Royal to a two-way traffic operation will provide for a more direct route to Highway 1.

To determine the traffic impact of this potential roadway modification, the Opening Year 2019 With Project traffic volumes were adjusted to assume two-way traffic was allowed within this segment of Bay Street. Project-related traffic headed towards Highway 1 was assumed to turn left from southbound Nelson onto eastbound Bay rather than the existing available routes described above. **Table 4-7** presents the findings of this analysis. The supporting analysis worksheets are included in **Appendix E**. *It is important to note the 2-way Bay Street analysis is presented for informational purposes only, and Bunt & Associates does not advocate for the one-way or two-way alternative of Bay Street.*

Table 4-7: Two-Way Bay Street Intersection Operations

Intersection	Movement	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
		V/C	HCM LOS	V/C	HCM LOS	V/C	HCM LOS
Nelson Avenue (NS) at Bay Street/Wolseley Street (EW)	SBT (added stop sign)	0.08	A	0.10	A	0.11	A
	WBL/R (added stop sign)	0.08	A	0.25	A	0.22	A
Royal Avenue (NS) at Bay Street (EW)	NBL/R	0.08	A	0.16	A	0.21	A
	EBT/R	0.05	A	0.05	A	0.07	A
	WBL/T	0.08	A	0.20	A	0.21	A
Royal Avenue (NS) at Bruce Street (EW)	NBL/T/R	0.00	A	0.00	A	0.00	A
	SBL/T/R	0.00	A	0.01	A	0.01	A
	EBL/T/R	0.01	A	0.03	A	0.02	B
	WBL/T/R	0.05	A	0.13	B	0.16	B
Keith Road (NS) at Bay Street (EW)	NBL/R	0.11	A	0.28	A	0.24	A
	EBT/R	0.12	A	0.13	A	0.15	A
Highway 1 (NS) at Keith Road/Douglas Street (EW)	NBL	0.28	B	0.44	B	0.44	B
	SBT	0.11	A	0.32	A	0.29	A
	Overall	0.15	A	0.37	A	0.33	A

As shown, all of the evaluated intersections in this sensitivity analysis are still expected to operate at very satisfactory Levels of Service. Highlights of the operational analysis are listed below:

- Nelson Avenue (NS) at Bay Street / Wolseley Street (EW) – The westbound approach V/C ratios are predicted to increase slightly with the installation of a stop sign. However, the traffic volumes are

anticipated to remain relatively low at this intersection, and LOS "A" traffic operations are anticipated to continue even with the subject Bay Street modification.

- Royal Avenue (NS) at Bay Street (EW) - The primary traffic operation change at this intersection is the introduction of the eastbound movement which is assumed to be controlled by a future stop sign (i.e., stop sign control on all three approaches to the intersection). The analysis indicates all approaches of this intersection would operate at ideal LOS "A" conditions.
- Royal Avenue (NS) at Bruce Street (EW) - The assumption of two-way traffic flow on Bay Street will reduce the traffic volumes at this intersection, particularly for the eastbound approach; this results in improve the V/C ratios for the eastbound approach and generally the same V/C ratios for the other approaches.
- Keith Road (NS) at Bay Street (EW) - Eastbound V/C ratios are predicted to increase with the increased eastbound traffic movement at this intersection (traffic directed out toward the Highway 1 entry access) though ideal LOS "A" traffic operations are maintained.
- Highway 1 (NS) at Keith Road/Douglas Street (EW) - Reconfiguring Bay Street is not anticipated to have any significant change to traffic operations at this intersection.

The reconfiguration of Bay Street (between Nelson Avenue and Royal Avenue) to provide for two-way traffic flow rather than the current one-way westbound flow is expected to only *slightly increase* the V/C ratios for all study area intersections along the Horseshoe Bay waterfront. However, the increased V/C ratios are still well within capacity and traffic operations remain at very satisfactory LOS "A" to LOS "B" conditions.

By allowing 2-way traffic along Bay Street (between Nelson Avenue and Royal Avenue), priority is given to traffic connectivity and traffic capacity rather than improving the pedestrian experience along Horseshoe Bay. Furthermore, this potential configuration may require the loss of on-street parking along Bay Street. Although the traffic analysis indicates this potential reconfiguration shall continue to provide LOS "A" and LOS "B" operations, Bunt recommends the District continue to assess this alternative via the Horseshoe Bay Streetscape Study efforts.

It is noted that BC Ferries staff has provided feedback regarding this potential reconfiguration of Bay Street. Their concern is regarding the increase of traffic on Bay Street between Keith Road and the terminal (as a result of the reconfiguration), as this is where the baggage handlers must cross. In regards to potentially modifying Bay Street as a 2-way street (in conjunction with the Streetscape Plan), BC Ferries has indicated they would prefer that Bay Street remain one way between Royal Avenue and Nelson Avenue in order to minimize traffic growth along Bay Street.

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5. CONCLUSIONS AND RECOMMENDATIONS

Westbank Projects Corp. is proposing a mixed-use residential and commercial development along the Horseshoe Bay waterfront in the District of West Vancouver. The development will feature approximately 159 residential townhome/condominium units and an increase of approximately 5,000 square feet of marina-commercial uses. Pending municipal approvals, the project is planned with a construction start in mid-September 2016 with completion targeted for mid-October 2018. Sewell's marina and the existing Boathouse Restaurant will remain and be integrated with the proposed new development.

A total of 493 parking stalls are planned for the site - This parking supply consists of 226 for the existing commercial uses, 24 stalls for the added commercial use, 3 stalls to replace the loss of stalls along Nelson, 2 stalls for a potential car share system and 238 spaces for resident use. Parking is proposed on four levels of parking underneath the buildings, all layered into the sloping terrain of the site. All parking access will be via Nelson Avenue with separate driveway connections to the Level 1 (P1) parking (highest up), the Level 2 (P2) parking, and to Level 3 (P3) closest to the water's edge. An internal parking ramp will connect the P3 parking to the Level 4 (P4) parking below. Existing parking data indicates sufficient off-street parking within the development shall be provided to accommodate the anticipated parking needs for the marina and existing Boathouse Restaurant.

Based on consultation and coordination with District staff, the counts were conducted during a "non-holiday" Summer Friday and Saturday when Horseshoe Bay vehicular traffic is typically at its peak (during the boating season). Traffic operations analyses indicate all of the study area intersections currently operate at very satisfactory Levels-of-Service (LOS) for Existing (2015) peak period conditions.

The proposed development is anticipated to generate a net additional total of 63 two-way vehicles per hour (vph) during the weekday morning peak hour, 79 vph during the weekday afternoon peak period, and 78 vph during the Saturday mid-day peak hour. Even during the busier traffic periods, the net traffic increase associated with the proposed development is limited to approximately 1.3 vehicles per minute. The analysis herein concludes that the projected impacts of the new development, net of existing and proposed added uses on the site, will not have a material impact on the capacity of service levels of the existing road network. In fact, the future traffic operations analysis indicates all of the study area intersections shall continue to operate at very satisfactory LOS even with full occupancy of the proposed project.

Based on public input provided during the District-led Open House events (in September 2015), many neighbours have inquired about the project's potential impact during the Non-Summer season to account for school traffic. In particular, neighbours expressed concern for the project's potential impact to the weekday traffic operations at the existing Marine Drive roundabouts (intersections #4 and #7 of this report). As such, Bunt & Associates has performed a supplemental set of intersection counts for the Marine Drive roundabouts in October 2015 when Gleneagles Elementary School was in session. Based on the analysis presented in this report, the roundabouts are expected to operate at very satisfactory levels of

service during the Non-Summer time periods, particularly when the Gleneagles Elementary School is in session.

District staff has also requested that this Transportation Impact Assessment evaluate the future traffic operations of intersections along the Horseshoe Bay waterfront assuming a reconfigured two-way traffic operation along Bay Street between Nelson Avenue and Royal Avenue. This reconfiguration is currently being considered as part of the District's Horseshoe Bay Streetscape Study efforts. Based on the analysis presented in this report, the reconfiguration is expected to only *slightly increase* the V/C ratios for all study area intersections along the Horseshoe Bay waterfront. The slight increase is attributable to the redistribution of existing and future project traffic directly to Highway 1 via Bay Street, rather than Nelson Avenue. Please note the volume of both existing and future project traffic diverted from Nelson Avenue is fairly minor at less than 1 car a minute in any peak hour. Thus, this two-way reconfiguration is not imperative to providing satisfactory levels of traffic flow along Nelson Avenue.

Consistent with the current off-season (i.e. Non-Summer) operations of the site, the on-site marina parking areas are proposed to store boats. Based on our review of the site plan, the commercial parking areas are expected to provide sufficient turning radii to accommodate the towing of these boats along the parkade's "P3" drive aisles.

The project is expected to provide a sufficient amount of loading bays to suitably accommodate the loading activities expected for the site. *However, the loading supply provisions are still being incorporated into the final design of the site and are not complete at this time. Therefore, the loading supply strategy shall be evaluated in a separate technical document in the future.*

The project is expected to provide bicycle storage areas to suitably accommodate the development. *However, the bicycle storage area plans are still being refined and incorporated in to the final design of the site and are not complete at this time. Therefore, bicycle storage facilities shall be addressed in a separate technical document in the future.*

Based on the analysis outlined in this study, it is concluded that the proposed form and density of the proposed development can be supported from a transportation perspective.

FINAL BALANCED ENVIRONMENTAL REPORT

AQUATIC EFFECTS ASSESSMENT

SEWELL'S LANDING SHORELINE IMPROVEMENTS
HORSESHOE BAY, WEST VANCOUVER,
BRITISH COLUMBIA

Report Date: February 6, 2016
Report Number: 5623-R-01.1

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EXECUTIVE SUMMARY

This report represents an Aquatic Effects Assessment (AEA) of proposed shoreline works associated with the Westbank Projects Corp. (Westbank) Sewell's Landing Project at Horseshoe Bay, West Vancouver, British Columbia. The proposed shoreline works assessed include:

- replacement of existing marginal wharf and pier structures,
- stabilization of existing rip rap slopes,
- construction of a temporary barge ramp facility,
- installation of a foot bridge and public park amenity,
- ocean loop energy transfer system, and,
- habitat enhancement works related to shoreline restoration.

As a result of mitigation measures applied to project design and construction practices this AEA has determined that the Sewell's Landing shoreline works will result in no significant temporary or permanent harm to fish and/or fish habitat. If constructed as proposed the shoreline works will result in improved habitat function and increased productive capacity.

CLARIFICATIONS REGARDING SERVICES/FINDINGS

The intent of this assessment report is to provide technical information on behalf of Westbank in support of a decision as to whether the project requires review under the DFO Fisheries Protection Program (FPP) and *Fisheries Act*. This report has been prepared by Balanced Environmental Consultants Inc. (Balanced) in accordance with generally accepted Qualified Environmental Professional (QEP) practices and is intended for the exclusive use of Westbank. The contents, implied or written, of this document and its' related media may not be utilized in part or in whole by parties other than Westbank without the signed written authorization of Balanced. The information contained within this report reflects Balanced's best judgment in light of the information available to it at the time of preparation and has been developed in a manner consistent with that level of care normally exercised by QEPs currently practicing under similar conditions. This report represents the opinion of Balanced. This report does not constitute approval under any municipal, provincial or federal legislation.

This report has been prepared by Balanced Environmental Services Inc.

REVIEWED BY



Scott Christie, R.P.Bio
Principal, Senior Biologist

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APPENDIX 2 ENVIRONMENTAL MANAGEMENT PLAN

**AQUATIC EFFECTS ASSESSMENT OF
 SEWELL’S LANDING SHORELINE IMPROVEMENTS,
 HORSESHOE BAY, WEST VANCOUVER, BRITISH COLUMBIA**

SECTION 1 INTRODUCTION

1.1 Summary of Project Scope

Balanced Environmental Services Inc. (Balanced) has been secured by Westbank Projects Corp. (Westbank) to perform an AEA to determine if the Sewell’s Landing project requires Review or Authorization under the Department of Fisheries and Oceans Canada (DFO) Fish Protection Program (FPP). The scope of this work includes:

- description of the shoreline project elements and existing biophysical conditions,
- discussion of anticipated environmental impacts on fisheries resources,
- mitigation measures to minimize temporal and residual impacts, and,
- proposed management plans and best management practices.

1.2 Project Overview

The Sewell’s Landing Project (SLP) is an upland residential development that includes the restoration/repair of existing commercial marine facilities and degraded foreshore areas including:

- replacement of a concrete marginal wharf and timber pier structures,
- stabilization of existing rip rap slopes,
- construction of a temporary barge ramp facility,
- installation of a foot bridge and establishment of a public park amenity,
- an ocean loop energy transfer system, and,
- habitat enhancement works related to shoreline restoration.

For an overall project description see the June 10, 2015 “Sewell’s Landing at Horseshoe Bay Application for Rezoning” found at <https://westvancouver.ca/sites/default/files/dwv/council-agendas/2015/jul/20/15jul20-10.1%20plans.pdf>.

1.3 Project Location

The SLP is located in the southwest corner of Horseshoe Bay, a 22 kilometre drive along Highway 1 northeast of Vancouver, British Columbia. The SLP site is fronted by Sewell’s Marina and Madrona Island (750 m²). A 125 metre long government wharf and B.C. Ferry terminal are located east of the SLP site. Horseshoe Bay also contains a waterfront park and a commercial area including coffee shops and restaurants. The UTM and latitude/longitude coordinates for the site are generally:

Easting:	480008.26 m E	Latitude:	49°22'35.68"N
Northing:	5469356.91 m N	Longitude:	123°16'31.48"W
Zone:	10 U		

For additional detail on the project’s location, see *Drawing 5623-D-01.1 Sewell’s Landing Project* in Appendix 1.

SECTION 2 DESCRIPTION OF THE WORK

2.1 General

The SLP shoreline works will involve approximately 2,700 square metres of waterfront structures and shoreline. The primary elements of the SLP include:

- removal of timber and concrete pile supported wharf and building structures,
- replacement of existing float and gangways,
- construction of a floating private amenity yacht club and access gangway,
- installation of a temporary barge loading facility ,
- stabilization of the existing rip rap shoreline,
- replacement of concrete roadway and parking surfaces with paving stones,
- erosion protection along sections of Madrona Island,
- creation of an intertidal stream estuary,
- installation of an seawater loop cooling/heating system
- construction of a pedestrian bridge to Madrona Island that transitions to an elevated walkway,
- invasive species removal on Madrona Island, and,
- installation of public education elements regarding foreshore habitat values.

For additional detail on project elements see the following drawings in Appendix 1:

- *PFS Studio Drawing L5.02 Grading Plan Area 2*
- *Kerr Wood Leidel Horseshoe Bay Seawater Heating/Cooling System Concept Schematic.*

2.2 Construction Methodology*Demolition of Existing Structures*

Removal of existing fixed timber and concrete wharves will be performed by a combination of land based equipment and crane equipped floating barge. Piles will be pulled where possible. In the event a pile breaks off or is not able to be removed it will be cut off at the mudline. The amount of water based demolition will be a function of available tide windows and general site access. Land based operations are preferred. During the process, timbers and waste concrete will be recycled, repurposed or disposed of at an appropriate upland facility.

Shoreline Protection

The existing rip rap shoreline will be armoured with one meter or larger angular rock at a slope of 1.5 to 1 (horizontal to vertical). Rip rap and filter rock will be made up of appropriate materials excavated from the upland project areas or imported to the site by barge and placed by excavator.

Temporary Barge Ramp

Construction of the temporary barge facility, used to bring project materials to and from the site, will require a limited amount of dredging and filling of the existing barge ramp area. A long reach excavator working from the shore during periods of low tide will be employed to lower the existing seabed elevations to -1.5m Chart

Datum (CD) over a 551 m² area. The volume of mud/sand dredgeate is estimated 375 m³. Dredge materials will be used to establish riparian areas associated with the proposed stream feature.

Private Amenity Yacht Club

A floating private amenity yacht club will replace the existing creosote treated timber pile supported travel lift. The boat house will be held in place using driven steel pipe piles. Construction will be executed using a combination of land based equipment and crane equipped floating barge.

Promenade

The existing paved parking lot and roadway adjacent to the waterfront will be removed and replaced with a public waterfront promenade surfaced with stone pavers. A set of stone seating plinths will be installed in sections along the eastern and northern edges of the promenade above the intertidal zone from 6.9m CD down to 5.6m CD.

Floats

Pre-fabricated floats (125 m²) will be towed into place and anchored using the steel pipe piles employed during the construction phase of the project to anchor barges during unloading and loading. The floats will be anchored in depths sufficient to prevent impacts to the seabed.

Ocean Loop

The seawater loop intakes will be suspended mid water column from the existing marina floats. Outfall location is yet to be confirmed. All intakes and outfalls will conform to DFO guidelines for the protection of fish.

Madrona Island

A pedestrian bridge will be built to Madrona Island as part of a public amenity. The structure will be supported by bulkheads at either end with a single bridge support pile located within the span. Bridge will be metal grate with 60% transparency and wood detailing for handrails. The bridge will transition to a low lying elevated walkway on the island and include some rock work to provide access to the viewing area and educational component of the public amenity.

Riparian works on the island include the removal of invasive species, such as Himalayan Blackberry and English Ivy, as well as the installation of native trees and shrubs to improve habitat function. Erosion protection in the form of high intertidal rip rap will be placed at two locations on the island (southern and northwestern sides) to prevent further loss of island riparian vegetation.

2.3 Materials

The works will require the use of clean materials free of contaminants. Final specifications for all construction materials will be identified upon completion of detailed project design.

2.4 Timeline

The proposed works are still subject to regulatory approval but are planned to occur during the time period of 2016 to 2018.

SECTION 3 BIOPHYSICAL CONDITIONS

3.1 Biophysical Survey Methodology

The survey was conducted the week of May 20, 2015 by a survey team including a biologist with knowledge and experience of the local aquatic biology and ecology. Confirmatory site condition visits were made in August and September 2015. The surveying included mapping of elevations, identification of substrate and vegetation type and density, as well as identification of any fish and/or invertebrate species observed within the project area.

The above water survey included the area from the top of bank to the lowest available point on the shore that tide level at the time of survey permitted. Topographic elevations, boundaries between different substrate types and the location and elevation ranges of aquatic organisms were mapped using a Total Station. Photographs illustrating typical biophysical conditions were recorded.

The underwater biophysical survey was conducted using SCUBA. Detailed biophysical information, including underwater photographs were collected over the entire survey area. A hydrographic survey of the seabed was completed using a differential global positioning system (dGPS) and digital sounder operated from a boat, see *Drawing 5623-D-2.1 Existing Hydrographic Conditions* in Appendix 1.

3.2 Physical Conditions

The upland area adjacent to the shoreline consisted of a concrete decked marginal wharf and paved asphalt roadway and parking areas. A less than one metre wide band of soil substrate was noted running along the northern edge of the parking lot at the top of bank. The bank supporting the parking consisted of stable and unstable areas of angular rock (rip rap) ranging in size from 0.1m to greater than 1m in dimension. The toe of the rip rap slope varied from 0m CD to above +2.5m CD.

From the toe of the rip rap slope down into the subtidal zone the substrate consisted of mud/sand. Trace amounts of woody debris and anthropogenic materials common to marina operations were observed at random throughout the survey area.

For additional details on substrate conditions see *Drawing 5623-D-04.1 Substrate Conditions* in Appendix 1

3.2 Biological Conditions

There is a less than one metre wide fringe of short grass and shrubs running in patches above the rip rap slope along the northern edge of the parking area. The upper intertidal zone (5.5m to 4.0m CD) consisted of bare rip rap. Observed aquatic vegetation on the rip rap slope below 4.0m CD included green sea lettuce and rockweed with percent areal coverage ranging from 50% to 75%. Invertebrate species observed on the riprap slope included barnacles (greater than 50% coverage) and mussels (less than 50% coverage). Beyond the toe of the riprap slope and along the bedrock outcropping of Madrona Island a variety of algae, fish and invertebrates were observed, see Table 1 for a list of species and their abundance observed.

For more details on biological conditions see *Drawing 5623-D-03.1 Biological Conditions* and *5623-D-31.1 Existing Shoreline Habitat Areas and Conditions* in Appendix 1

Table 1: Observed Marine Biota Species and Abundance

Common Name	Scientific Name	Chart Datum Range (m)		Abundance*	
		Upper	Lower	Description	Method
Barnacles					
Acorn	<i>Balanus glandula</i>	4.0	-4.0	Common	PAC
Bivalves					
Bay Mussel	<i>Mytilus trossulus</i>	3.0	1.0	Few	PAC
Pacific Oyster	<i>Crassostrea gigas</i>	0.0	-1.0	Rare	IOT
Brown Algae					
Brown Rock Fuzz	<i>Sphacelaria sp.</i>	1.5	-3.0	Abundant	PAC
Japanese Weed	<i>Sargassum muticum</i>	0.0	-2.0	Sparse	IOT
Rockweed	<i>Fucus gardneri</i>	3.8	1.3	Common	PAC
Sugar Wrack Kelp	<i>Saccharina latissima</i>	-1.0	-4.0	Few	PAC
Crabs					
Dungeness	<i>Metacarcinus magister</i>	0.0	-2.5	Rare	IOT
Graceful	<i>Metacarcinus gracilis</i>	-1.0	-4.0	Rare	IOT
Red Rock	<i>Cancer productus</i>	-2.0	-4.0	Few	IOT
Echinoderms					
Leather Star	<i>Dermasterias imbricata</i>	0.0	-3.0	Few	IOT
Mottled Star	<i>Evasterias troschelii</i>	-1.0	-4.0	Rare	IOT
Ochre Star	<i>Pisaster ochraceus</i>	1.5	-2.0	Common	IOT
California Cucumber	<i>Parastichopus californicus</i>	-1.0	-2.0	Rare	IOT
Pink Star	<i>Pisaster brevispinus</i>	-2.5	-2.5	Rare	IOT
Sunflower Star	<i>Pycnopodia helianthoides</i>	0.0	-2.0	Rare	IOT
Fish					
Bay Pipefish	<i>Sygnathus leptorhynchus</i>	-1.5	-2.0	Rare	IOT
Kelp Greenling	<i>Hexagrammos</i>	-3.0	-3.0	Rare	IOT
Northern Ronquil	<i>Ronquilus jordani</i>	0.0	-2.5	Sparse	IOT
Pile Perch	<i>Rhacochius vacca</i>	1.0	-3.0	Common	IOT
Rock Sole	<i>Pleuronectes bilineatus</i>	-2.0	-4.0	Rare	IOT
Striped Perch	<i>Embiotoca lateralis</i>	1.0	-3.0	Abundant	IOT
Tidepool Sculpin	<i>Oligocoitus maculosus</i>	-1.0	-2.5	Sparse	IOT
Saddleback Gunnel	<i>Pholis ornata</i>	-2.0	-2.5	Sparse	IOT
Green Algae					
Sea Lettuce	<i>Ulva fenestrata</i>	3.0	-4.0	Common	PAC
Red Algae					
Filamentous	<i>Polysiphonia spp.</i>	-1.0	-4.0	Rare	PAC
Purple Laver	<i>Porphyra sp.</i>	0.0	-1.0	Rare	PAC
Rainbow Leaf	<i>Mazaella sp.</i>	-2.0	-4.0	Rare	PAC
Red Ribbon	<i>Palmaria mollis</i>	-1.0	-4.0	Sparse	PAC
Staghorn Felt	<i>Ceramium sp.</i>	-1.0	-4.0	Rare	PAC
Turkish Washcloth	<i>Mastocarpus papillatus</i>	-2.0	-4.0	Sparse	PAC
Sea Anemones					
Giant Plumose	<i>Metridium farcimen</i>	-2.0	-4.0	Sparse	IOT

The biophysical survey of Madrona Island revealed a variety of plants, see Table 2 for a list of the species observed and their abundance. No birds or mammals were observed on the island during the survey. A number of bird houses were noted.

Table 2: Observed Plants, Madrona Island, Sewell’s Marina

Common Name	Scientific Name	Chart Datum Range (m)		Abundance*	
		Upper	Lower	Description	Method
Trees					
Grand Fir	<i>Abies grandis</i>	7.5	6.0	Sparse	PAC
Arbutus	<i>Arbutus menziesii</i>	7.5	5.0	Common	PAC
Western Red Cedar	<i>Thuja plicata</i>	6.5	5.5	Sparse	PAC
Shrubs					
Dull Oregon Grape	<i>Mahonia nervosa</i>	7.0	5.5	Rare	PAC
Himalayan Blackberry	<i>Rubus discolor</i>	6.5	5.0	Rare	PAC
Oceanspray	<i>Holodiscus discolor</i>	7.5	5.0	Rare	PAC
Rhododendron	<i>Rhododendron sp.</i>	7.5	5.5	Sparse	PAC
Sitka Mountain Ash	<i>Sorbus sitchensis</i>	7.5	6.0	Rare	PAC
Flowering Plants					
Common Silverweed	<i>Argentina anserina</i>	7.0	5.0	Rare	PAC
English Ivy	<i>Hedera helix</i>	7.5	6.0	Sparse	PAC
Nootka Rose	<i>Rosa nutkana</i>	7.5	5.5	Sparse	PAC
Spreading Plox	<i>Phlox Diffusa</i>	7.0	5.5	Rare	PAC

The abundance descriptions utilized in Tables 1 and 2 are based on the following definitions and criteria.

Abundance Category	Percent Areal Coverage (PAC)	Individuals On or Along Transect (IOT)	Individuals per Square Metre (IPM)
Rare	<5%	1	1
Sparse	5% to 25%	2 to 5	2 to 5
Few	26% to 50%	6 to 10	6 to 10
Common	51% to 75%	11 to 30	11 to 30
Abundant	>75%	> 30	> 30

3.4 Species of Concern

No species of concern or at risk were observed during the survey. Refer to the Environmental Management Plan in Appendix 2 for further details on species of concern.

SECTION 4 POTENTIAL IMPACTS, PATHWAYS OF EFFECTS AND MITIGATION

4.1 Project Pathways of Effects

Potential temporary and permanent impacts to fish, fish habitat resulting from dock demolition, pile driving, marine intakes/exhausts and shore stabilization works are well known and include:

- noise above and below water caused by construction equipment,
- exhaust of equipment used during the work,

- the disturbance and release of excess sediment and elevated turbidity,
- pressure waves during pile driving,
- increased water temperatures or injury from suction pumps and intake flows,
- contamination of water, sediments and marine life with oil or gas pollution, and,
- loss or changes in habitat.

These impacts have the potential to create significant physical changes and stressors to wildlife and habitat values of an area. Table 3 below provides a list of project potential effects, their associated stressors, proposed mitigation and the magnitude of their residual effects.

Table 3: Pathways of Effects, Mitigation and Residual Effects

Effect	Stressor	Mitigation	Residual Effect
disturbance of intertidal sediments and or site runoff	increased turbidity or change in substrate	employment of best management practices (BMPs) for placement of material and sediment erosion control plans	insignificant and temporary
change in contaminant concentrations	release of hydrocarbons from equipment and construction debris	use BMPs to reduce risk of event and have provisions in place to address any accidental release of contaminants	insignificant and temporary
change in channel morphology or shoreline morphology	shoreline will have steeper side slopes.	works will be carried out with known technologies and methodologies in order to maintain stable side slopes	none
hydraulics	removal of timber structures will increase water movement along foreshore and could release sediment into water column	perform pile removal in dry, employ silt curtains to isolate work environment, increased water flow will improve habitat	none
fish passage	installation of piles and floating structures can restrict marine life passage	project will minimize the use of piles in order to maintain fish passage opportunities and floats will have sufficient draught to allow marine life free passage	insignificant
channel stability	sloughing of shoreline damages and smothers habitat	shoreline works are designed to improve shoreline stability and habitat values	none
substrates	changes in substrate can limit species colonization	proposed substrate change are a habitat enhancement	none
food supply	shoreline works will result in disturbance of benthos resulting in temporary losses and gains in food supply depending on species; loss of food resulting from covering over of epibenthic layer	benthic habitat values are marginalized by current shoreline physical features and activities; project results in improved habitat and benthic opportunities; losses in food supply are temporary; significant alternative resources and supplies are available in close	insignificant and temporary

		proximity to the work site; improved habitat conditions will recolonize naturally from adjacent habitats in a short period of time.	
habitat structure and covers	exposes species to predation or physical impacts from the environment	habitat structure improved by proposed works	none
aquatic macrophytes (vegetation)	loss of protective cover and associated food source when new materials placed over existing	current habitat values marginalized by poor substrate stability and size; new materials will significantly improve opportunities for macrophytes	insignificant and temporary
nutrient concentrations	nutrient concentration can increase significantly with suspension of sediments and diminish post project	fluctuation in nutrient levels during works are not anticipated; nutrient levels will be higher after construction due to improved habitat conditions	none
direct and indirect injury	mechanical impact and pressure wave injuries to marine life by equipment	use of BMPs to ensure pressure waves are below 30 kpa during pile driving. Stop works when marine life is in proximity to operation and at risk of injury	none
Increase water temperatures and direct injury	ocean loop systems can increase water temperatures to harmful levels for marine life; intakes can cause injury to marine life	while ocean loop exhaust design and location are pending they will be located where their temperature effects will be mitigated by tidal flushing and ferry propeller wash; ocean loop intakes will be screened in accordance with DFO guidelines to prevent physical harm to marine life	none
above water noise and exhaust from equipment	disrupt wildlife behaviour	noise and exhaust associated with the works will not be significant in comparison to those generated by the day to day operation of the harbour. The proposed work does not represent a significant cumulative effect as it will be of short duration.	insignificant and temporary

4.2 Project Planning and Design Mitigation

The existing habitat values found within the project footprint are primarily impacted by the:

- commercial activities currently taking place along the foreshore including the barge loading facility and the boat maintenance operations,
- instability and size of rip rap slopes,
- erosion of Madrona Island shoreline and loss of riparian vegetation, and,
- lack of diversity in shoreline physical elements (slope, substrate, freshwater influences, and vegetated riparian areas.

With these limiting factors in mind the project has undergone several stages of design to reduce the project’s environmental footprint and increase productive capacities including;

- reduce shading impacts to intertidal and shallow subtidal algae,
- maximize colonization opportunities through the use of larger stable angular rip rap to increase shoreline relief and available attachment surfaces for algae and invertebrates,
- installation of erosion protection for Madrona Island,
- eliminate the use of treated materials including creosote protected piles and superstructure timbers employed in the current wharf structures,
- attachment of ocean loop systems to existing float infrastructure to avoid impacts to the seabed,
- selection of durable materials to reduce future disturbances to habitat that may be associated with repairs or maintenance,
- providing public amenities and access along the project shoreline and Madrona Island that educate the value and importance of marine habitats,
- relocate commercial barging activities and establish a more natural and diverse beach zone in its place, and,
- creation of a foreshore stream feature that utilizes project site drainage to provide freshwater habitat benefits to marine and riparian wildlife.

4.3 Environmental Management Plan

During construction an Environmental Management Plan, shown in Appendix 2, will be followed in order to prevent and mitigate project impacts. The plan contains a variety of BMPs, guidelines, requirements and strategies including:

- measures to prevent deleterious materials from entering the marine environment,
- prescription of testable criteria to ensure works are performed in an environmentally responsible manner, and,
- recommendations for responses in the event of unforeseen events such as petroleum product spills or the unlikely arrival of a species at risk.

SECTION 5 RESIDUAL EFFECTS

The SLP will result in a number of substrate changes and impacts to habitat areas, see *Drawing 5623-D-30.1 Pre and Post Construction Habitat Areas* in Appendix 1. Each pre and post construction area has a unique productive capacity based on a wide variety of factors. For pre and post construction comparison purposes two factors have been assessed;

- Relief Factor (RF) is a relative measure of a substrate’s stability increased surface area available for colonization associated with its’ “relief”.
- Habitat Factor (HF) is a relative measure of the habitat opportunity represented by a substrate for species normally anticipated to be present in an area.

The relative habitat values of the impacted areas shown on *Drawing 5623-D-30.1 Pre and Post Construction Habitat Areas* in Appendix 1 are summarized in Table 4 below.

Table 4: Relative Habitat Values of Existing and Proposed Habitat Areas

Description of Habitat Type		Relative Habitat Value			
Area	Habitat Type	Area (m2)	RF ¹	HF ²	Value ³
Existing	Riparian	-130	1.5	3.0	-585
Existing	Sand/Silt	-957	1.0	1.5	-1,436
Existing	Rip Rap	-567	2.5	2.5	-3,544
Existing	Asphalt Paving	-280	1.0	0.1	-28
Existing	Shaded Rip Rap	-56	2.5	1.2	-168
Existing	Shaded Stacked Concrete	-200	1.2	1.5	-360
Existing	Shaded Sand/Silt	-315	1.0	1.4	-441
Existing	Eroding Shoreline	-105	1.0	0.2	-21
Proposed	Riparian/Stream Feature	271	1.5	3.0	1,220
Proposed	Sand/Silt	214	1.0	1.5	321
Proposed	Rip Rap	737	2.5	2.5	4,606
Proposed	Stone Pavers	634	1.0	0.2	127
Proposed	Shaded Rip Rap	177	2.5	1.2	531
Proposed	Shaded Sand/Silt	270	1.0	1.4	378
Proposed	Cobble/Sand Beach	153	1.5	1.5	344
Proposed	Concrete Steps	54	1.0	0.3	16
Net =					961

Notes:

1. “RF” is a Relative measure of the stability and relief associated with a substrate.
2. “HF” is a relative measure of Habitat opportunity represented by the substrate for the species normally anticipated to be present in the area.
3. “Value” is the relative value of a habitat which is a product of the “RF” and “HF” factors.

The net positive habitat “Value” gain of 961 shown in Table 4 demonstrates that the SLP impacts, relative to existing habitat conditions, are mitigated through design. The magnitude of the “Value” indicates a significant improvement in habitat conditions.

The primary mitigating factors of the SLP design result from the legacy features of the temporary barge loading facility, see *Drawing 5623-D-33.1 Temporary Barge Loading Site Conditions During and Post Construction*, including the:

- low intertidal/shallow subtidal rip rap slope from 4.0m CD down to -1.5m CD,
- upper intertidal sand/cobble beach from 5.5m to 4.0m CD, and,
- the freshwater and riparian influences of the intertidal stream feature.

The low intertidal/shallow subtidal rip rap slope is located in the primary habitat zone for algae and encrusting invertebrates in the SLP area, see Photographs 1 and 2 below.



Photograph 1. Dense mussel, rockweed and barnacle growth is common where stable hard substrates are present below 4.0m CD.



Photograph 2. Healthy algae and barnacle cover on stable rip rap surfaces provide excellent habit for red rock crabs and other species dependent on these primary colonizers.

The new upper intertidal cobble/sand beach and stream feature will improve local biodiversity and productive capacity by increasing riparian values and opportunities for forage fish and local wildlife.

SECTION 6 CONCLUSIONS

This assessment has demonstrated that if the SLP design is implemented utilizing the best management practices, environmental monitoring and mitigation measures identified in the Environmental Management Plan (EMP), see Appendix 2, the SLP will improve habitat conditions and productive capacities within the harbour and result in no significant temporary or permanent harm to fish or fish habitat.

SECTION 7 SIGNATURES

This report has been duly prepared by qualified environmental professionals with knowledge and experience in performing marine AEAs. The information presented in this report is accurate and complete to the best of Balanced’s knowledge. This assessment does not alleviate the Westbank from their obligation to comply with the requirements of the Fisheries Act or any other municipal, provincial, or federal rules or regulations.

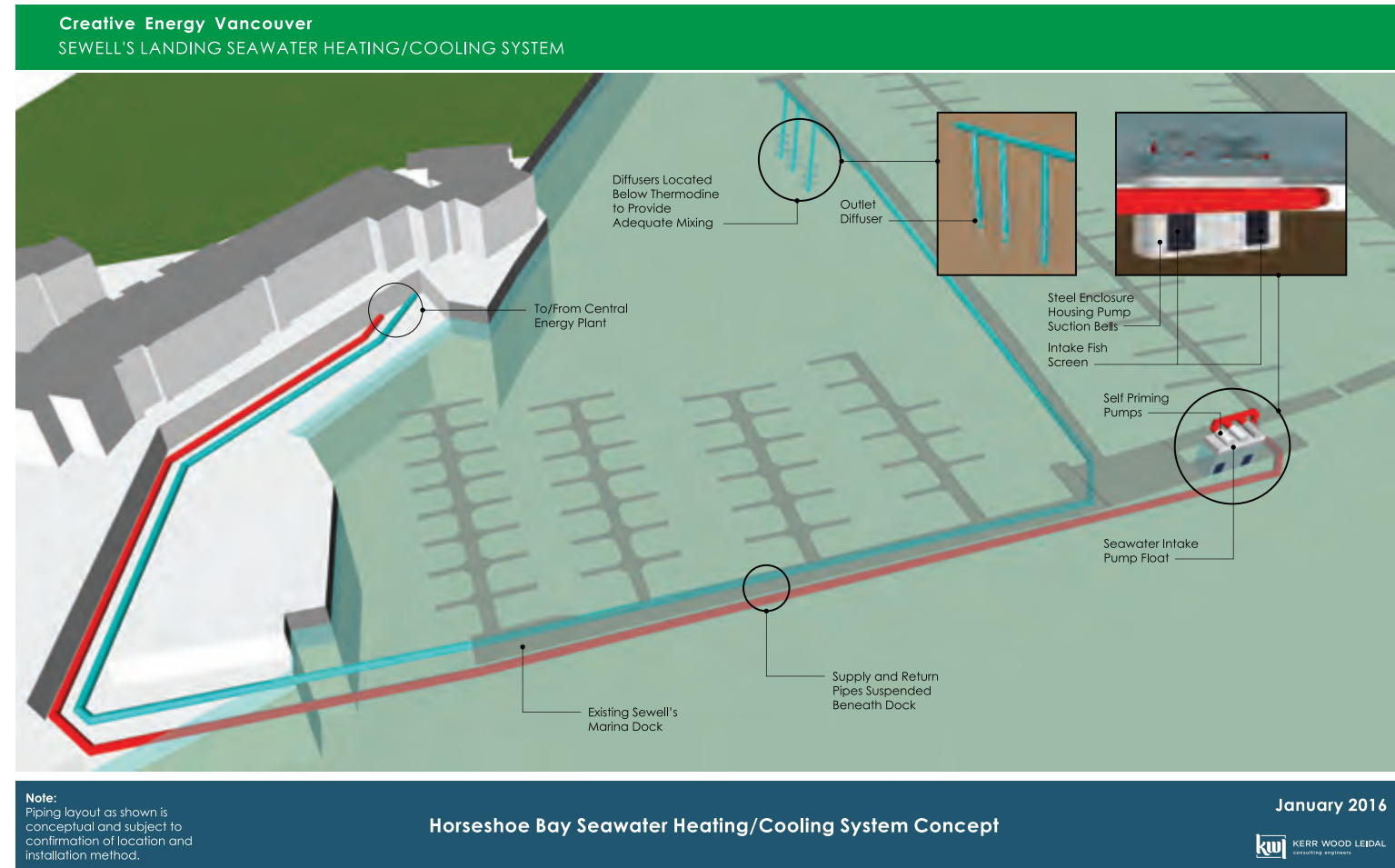
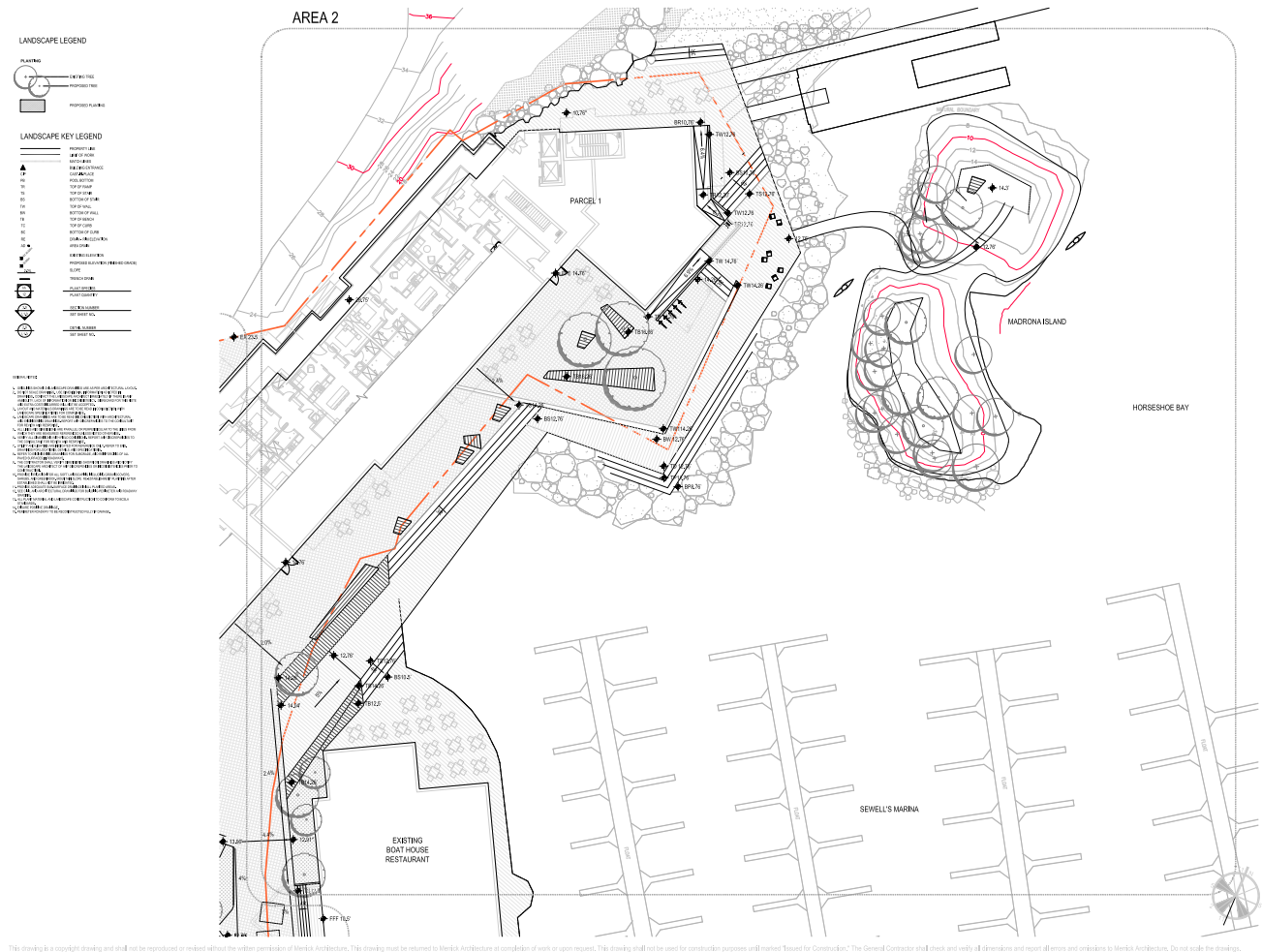
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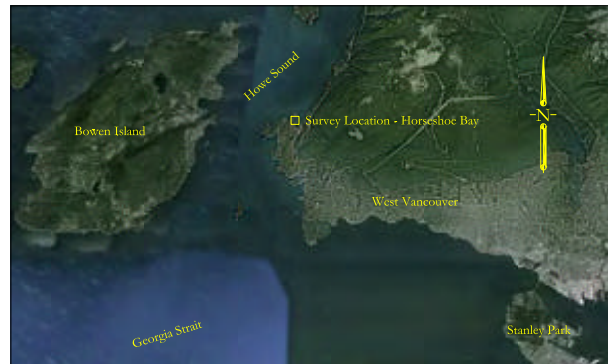


Scott Christie, R.P.Bio
President

APPENDIX 1 – DRAWINGS, FIGURE AND PHOTOS

- Drawing 15014 L5.02 Grading Plan Waterfront
- Figure 3265016 Ocean Loop Schematic
- Drawing 5623-D-01.1 Survey Site Location Map
- Drawing 5623-D-02.1 Hydrographic Conditions
- Drawing 5623-D-03.1 Biological Conditions
- Drawing 5623-D-04.1 Physical Conditions
- Drawing 5623-D-30.1 Pre and Post Construction Habitat Areas
- Drawing 5623-D-31.1 Existing Habitat Conditions Images
- Drawing 5623-D-33.1 Temporary Barge Loading Site Conditions



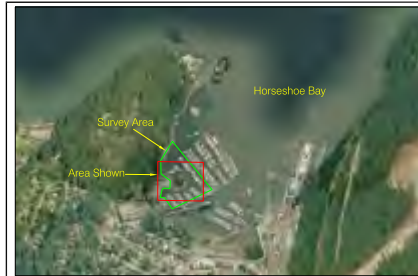


DRAWING NOTES

- Not an As-Built drawing. Not for Construction.
- Soundings collected by TopCon Total Station and calibrated to local tide chart (Point Atkinson - Tides and Currents Nobletec version 3.5.107.
- All elevations are in metres referred to local low water. Negative numbers indicate elevations below local low water (0.0 m Chart Datum).
- The information, including bathymetric and survey data, presented on the drawings may vary from current conditions due to the passage of time or seasonal changes.

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					Drawn by xib	
					Date 2015-12-10	
					Scale As Shown	
					Inspection	
					Paper 11 x 17	DWG. No. 5623-D-01.1

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					Drawn by xib	
					Date 2015-12-21	
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					Inspection	
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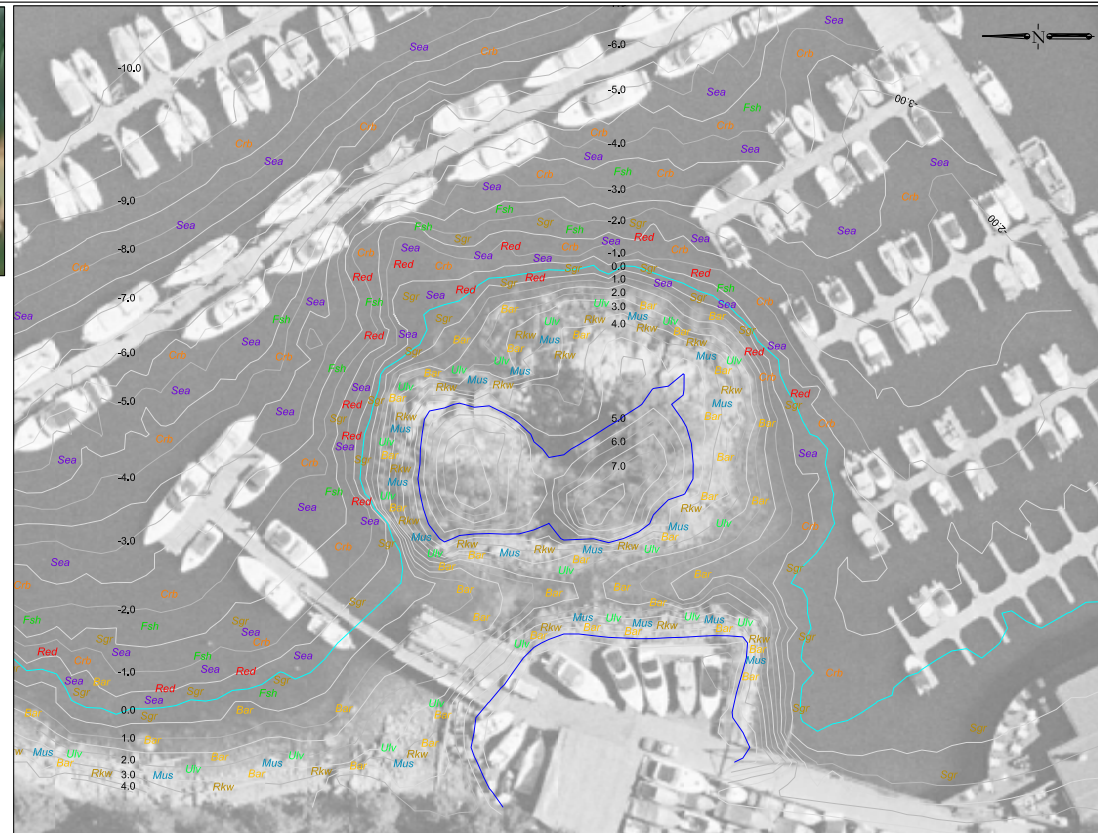
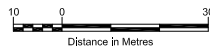


LEGEND

High Tide Elevation	Bar	Barnacles
Low Tide Elevation	Crb	Crabs
0.5 metre contours	Fsh	Fish
1.0 metre contours	Mus	Mussels
	Red	Red Algae
	Rkw	Rockweed
	Ulv	Ulva
	Sea	Sea Stars
	Sgr	Sugarwrack Kelp

DRAWING NOTES

- Not an As-Built drawing.
- Elevations are in metres (m) chart datum (CD).
- The information, including bathymetric and survey data, presented on the drawings may vary from current conditions due to the passage of time or seasonal changes in substrate and biota.
- Substrate and biota are mapped on the basis of "presence" (not density), however, the number of tags/symbols present in a given area can provide, in relative terms, an indication of abundance and uniformity.
- This survey was conducted by making a series of dives throughout the survey area to collect general information. Detailed information was collected along three transects.



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					XJE MT 28-MAY-15 As Shown WP, DB, MT 11 x 17	
Ref. No.	REFERENCE					

BALANCED ENVIRONMENTAL SERVICES INC.

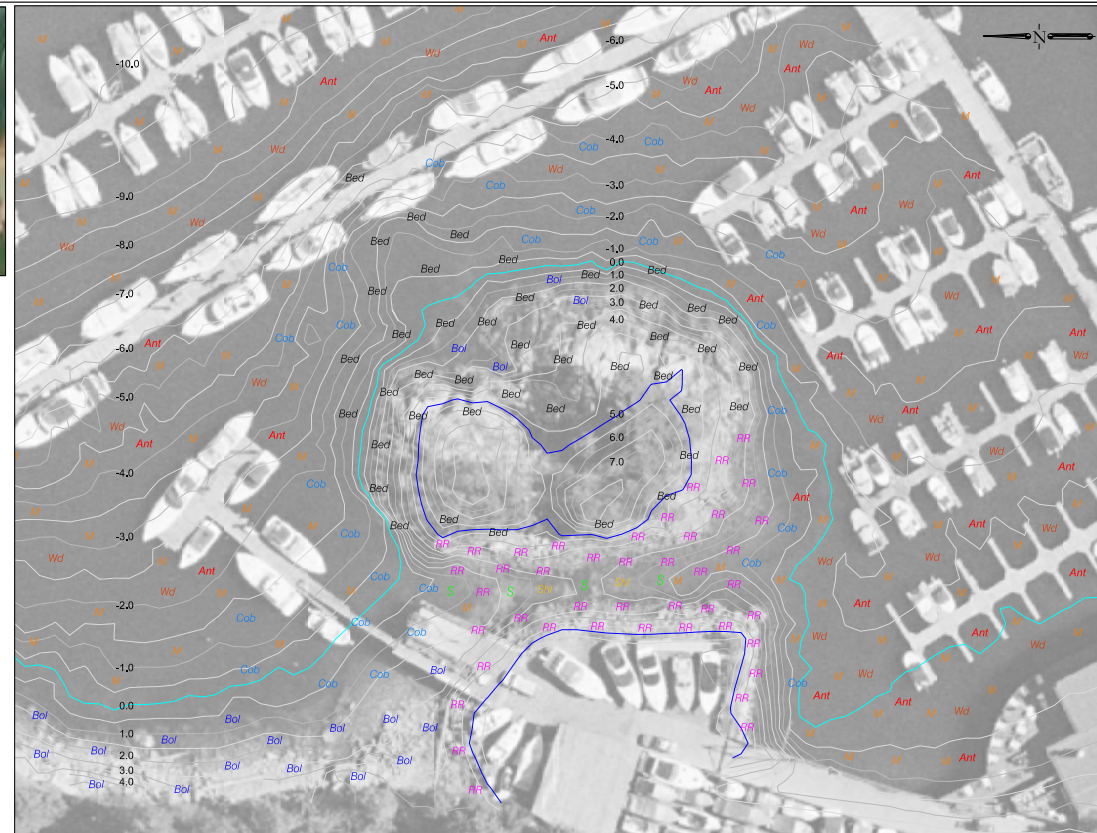
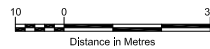


LEGEND

High Tide Elevation	Ant	Anthropogenic Debris
Low Tide Elevation	Bed	Bedrock
0.5 metre contours	RR	Rip Rap
1.0 metre contours	Bol	Boulders
	Cob	Cobble
	S	Sand
	M	Mud
	Shl	Shell Hash
	Wd	Wood Debris

DRAWING NOTES

- Not an As-Built drawing.
- Elevations are in metres (m) chart datum (CD).
- The information, including bathymetric and survey data, presented on the drawings may vary from current conditions due to the passage of time or seasonal changes in substrate and biota.
- Substrate and biota are mapped on the basis of "presence" (not density), however, the number of tags/symbols present in a given area can provide, in relative terms, an indication of abundance and uniformity.
- This survey was conducted by making a series of dives throughout the survey area to collect general information. Detailed information was collected along three transects.











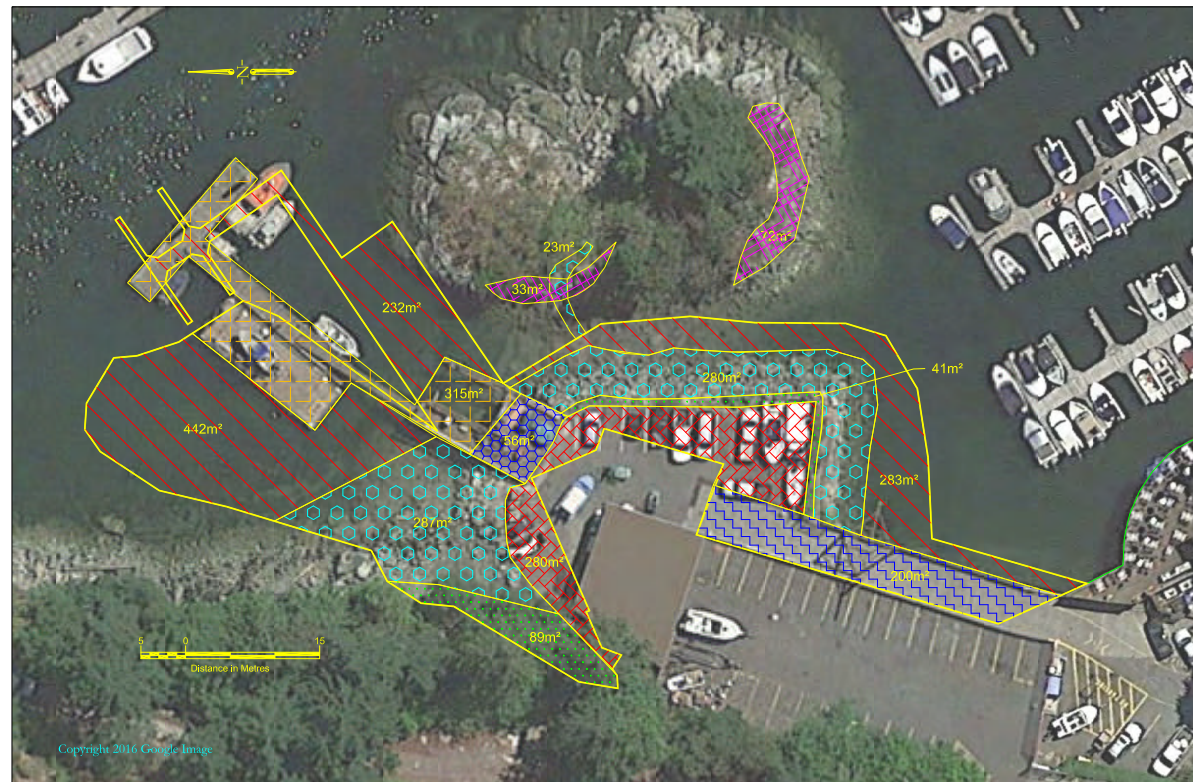
NOT FOR CONSTRUCTION

Client		<p>This document contains restricted and/or privileged information and has been prepared solely for use by the party with whom Balanced Environmental Services Inc. has entered into a contract. This document is to be used only for the purpose to which it refers and none of the information in this document may be used, reproduced or transmitted, in any form or by any means, electronic or mechanical, without written permission of Balanced Environmental Services Inc.</p>	Author	<p>BALANCED ENVIRONMENTAL 1118 GARDEN AVE, NORTH VANCOUVER BRITISH COLUMBIA, V7P 3H2 T: 604.988.3033 F: 604.988.3034 W: WWW.BALANCED.CA</p>	Checked by	<p>PROJECT SUBSTRATE CONDITIONS SEWELL'S MARINA HORSESHOE BAY, BRITISH COLUMBIA</p>
					XJE MT 28-MAY-15 As Shown WP, DB, MT 11 x 17	
Ref. No.	REFERENCE					

BALANCED ENVIRONMENTAL SERVICES INC.

HABITAT AREA TYPES

-  Riparian
-  Sand/Silt
-  Rip Rap
-  Asphalt Paving
-  Shaded Rip Rap
-  Shaded Stacked Concrete
-  Shaded Sand/Silt
-  Eroding Shoreline



DRAWING NOTES

Nor an As-Built drawing.
Not for construction.

Habitat areas positioned using a combination of photographic and survey data information.

The information, including bathymetric and survey data, presented on the drawings may vary from current conditions due to the passage of time or seasonal changes in substrate and biota.

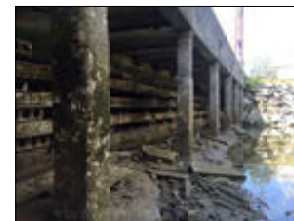


Image 1. Typical conditions under concrete marginal wharf with shaded stacked concrete habitat.



Image 2. Rip rap conditions found along northern face of parking area.

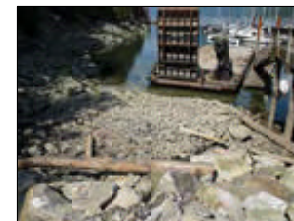


Image 3. Rip rap/boulder/cobble substrates found in the existing barge loading area west of the travel lift.

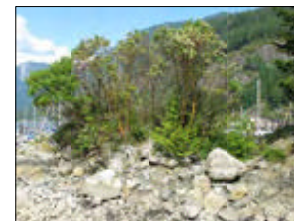


Image 4. Shoreline erosion on Madrona Island resulting in loss of vegetation.



Image 5. Substrate conditions under and adjacent to travel lift.



Image 6. Invasive Himalayan Blackberry on Madrona Island.



Image 7. Stable subtidal rip rap provides opportunities for encrusting plants and animals.



Image 8. Mud bottom common to subtidal areas of marina.

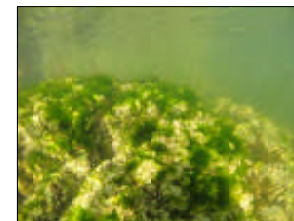
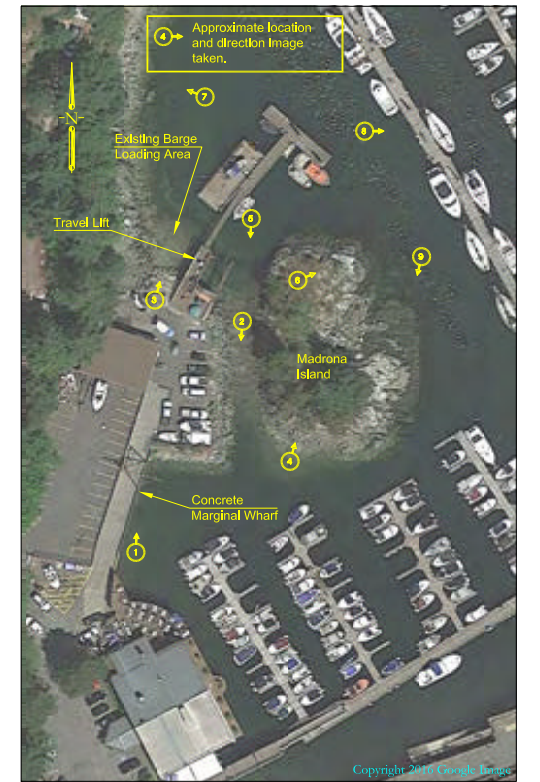


Image 9. Intertidal bedrock provides stable substrate for encrusting barnacles and green algae.



PLAN NO.	COMPANY - YEAR
	Not for Construction
Ref. No.	REFERENCE

Client	westbank
Westbank Projects Corp.	Suite 501, 1067 West Cordova Street Vancouver, British Columbia V6C 1C7
Author	BALANCED ENVIRONMENTAL
118 Garden Avenue, North Vancouver, B.C V7P 3H2	Tel: 604-988-3033 Fax: 604-983-3454 www.balanced.ca
Checked by	SC
Drawn by	xjb
Date	2016-01-22
Scale	As Shown
Inspectors	
Paper	11 x 17









PROJECT	EXISTING SHORELINE HABITAT AREAS AND CONDITIONS OBSERVED HORSESHOE BAY, BRITISH COLUMBIA
DWG. No.	5623-D-31.1

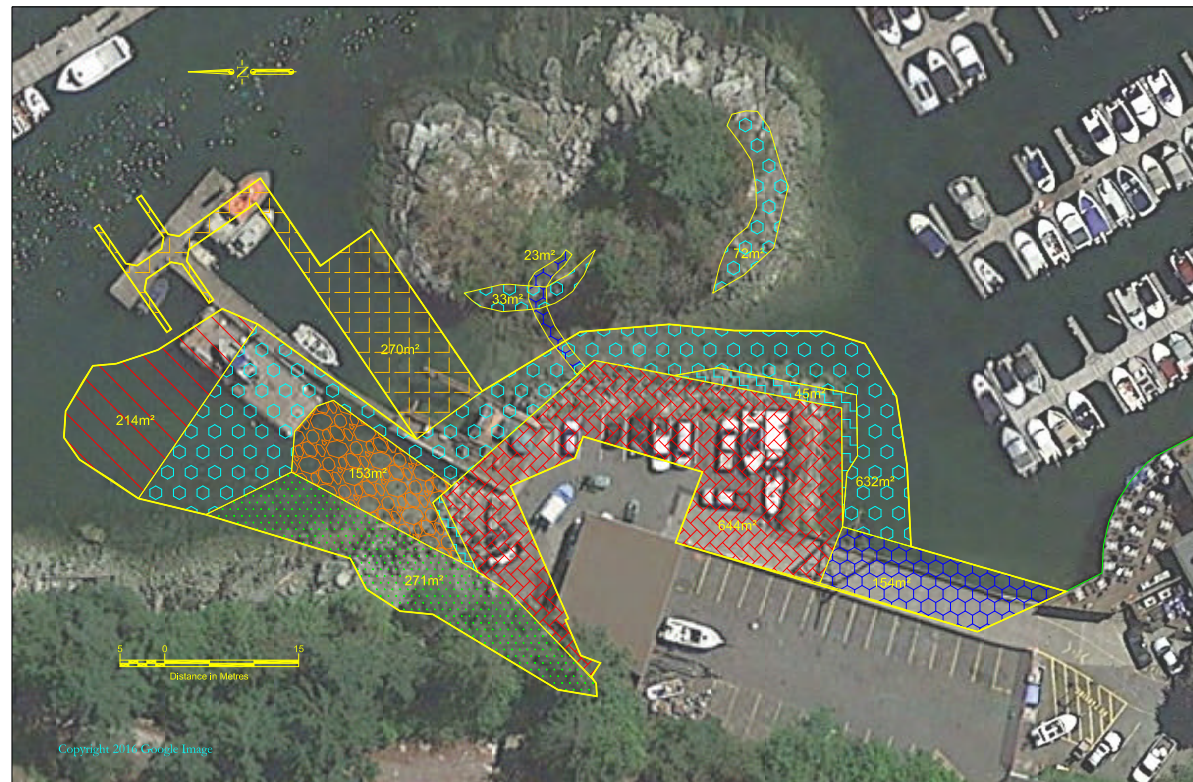
Client	westbank
Westbank Projects Corp.	Suite 501, 1067 West Cordova Street Vancouver, British Columbia V6C 1C7
Author	BALANCED ENVIRONMENTAL
118 Garden Avenue, North Vancouver, B.C V7P 3H2	Tel: 604-988-3033 Fax: 604-983-3454 www.balanced.ca
Checked by	SC
Drawn by	xjb
Date	2016-02-04
Scale	As Shown
Inspectors	
Paper	11 x 17

PROJECT	PRE-CONSTRUCTION PRIMARY HABITAT AREAS, HORSESHOE BAY, BRITISH COLUMBIA
DWG. No.	5623-D-30.1

Client	westbank
Westbank Projects Corp.	Suite 501, 1067 West Cordova Street Vancouver, British Columbia V6C 1C7
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118 Garden Avenue, North Vancouver, B.C V7P 3H2	Tel: 604-988-3033 Fax: 604-983-3454 www.balanced.ca
Checked by	SC
Drawn by	xjb
Date	2016-02-04
Scale	As Shown
Inspectors	
Paper	11 x 17

HABITAT AREA TYPES

-  Riparian/Stream Feature
-  Sand/Silt
-  Rip Rap
-  Stone Pavers
-  Shaded Rip Rap
-  Shaded Sand/Silt
-  Cobble/Sand Beach
-  Concrete Steps



DRAWING NOTES
Not an As-Built drawing.
Not for construction.

Habitat areas positioned using a combination of photographic and survey data information.

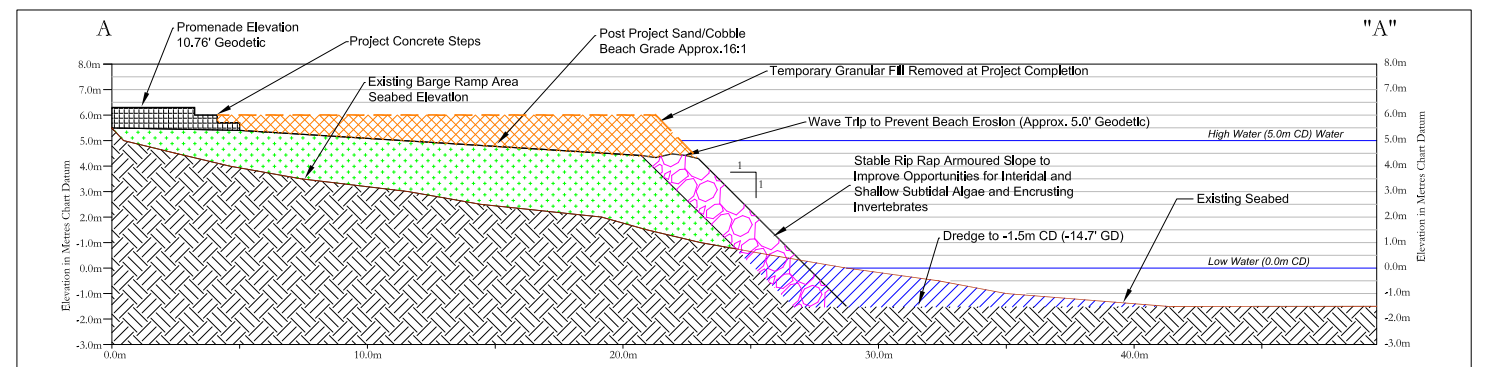
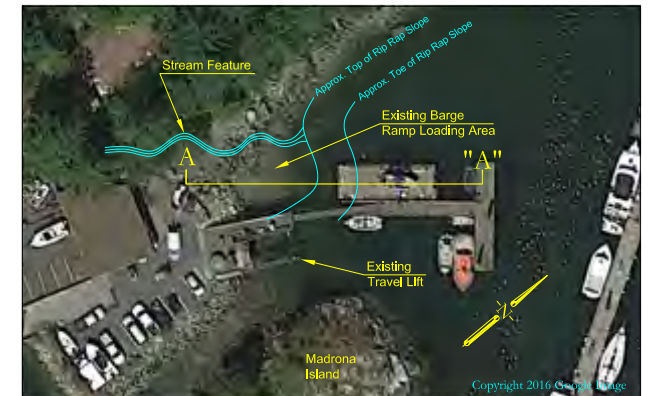
The information, including bathymetric and survey data, presented on the drawings may vary from current conditions due to the passage of time or seasonal changes in substrate and biota.

SUBSTRATE TYPES

-  Granular Fill to Establish Beach Grades
-  Temporary Granular Fill
-  New Concrete Stairs
-  Rip Rap (>1m Diameter Typical)
-  Existing Substrate/Seabed
-  Sand/Mud to be Dredged

DRAWING NOTES

- Not an As-Built drawing. Not for Construction.
- Soundings collected by TopCon Total Station and calibrated to local tide chart (Point Atkinson - Tides and Currents Nobletec version 3.5.107).
- All elevations are in metres referred to local low water. Negative numbers indicate elevations below local low water (0.0 m Chart Datum).
- The information, including bathymetric and survey data, presented on the drawings may vary from current conditions due to the passage of time or seasonal changes.



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		Drawn by	xjb	Date	2016-02-05	Scale	As Shown	Inspectors		DWG. No.

Ref. No.	REFERENCE	Client	westbank Westbank Projects Corp. Suite 501, 1067 West Cordova Street Vancouver, British Columbia V6C 1C7	This document contains sensitive and/or privileged information and has been prepared solely for use by the party with whom Balanced Environmental Services Inc. has entered into a contract. This document is to be used only for the purpose to which it refers and none of the information in this document may be used, reproduced or transmitted in any form or by any means, electronic or mechanical, without written permission of Balanced Environmental Services Inc.	Author	BALANCED ENVIRONMENTAL 118 Garden Avenue, North Vancouver, B.C V7P 3H2 Tel: 604-988-3033 Fax: 604-983-3454 www.balanced.ca	Checked by	SC	PROJECT	TEMPORARY BARGE LOADING SITE CONDITIONS DURING AND POST CONSTRUCTION, HORSESHOE BAY, BRITISH COLUMBIA
		Drawn by	xjb	Date	2016-02-06	Scale	As Shown	Inspectors		DWG. No.

APPENDIX 2 – ENVIRONMENTAL MANAGEMENT PLAN

ENVIRONMENTAL MANAGEMENT PLAN SEWELL'S LANDING PROJECT, HORSESHOE BAY, B.C.

1.0 GENERAL

1.1 PROJECT SCHEDULING

Juvenile salmon emerge from the local rivers and can be found along the shoreline in the spring. In addition, most Herring spawn between March 15th and May 1st. In late summer and early fall, adult salmon return to their native streams. For those reasons, DFO has identified August 16th to January 31st as a preferred window in which to carry out in-water works. It is therefore proposed that all in-water works be performed during this timing window.

The contractor shall provide 5 days notice to the environmental monitor prior to any in-water works or other works that occur below the high water mark or have the potential to harm fish or fish habitat.

Works generating exposed sediments shall not be scheduled during extreme rainfall events unless appropriate sediment erosion control systems are in place such that no release of sediment into the marine environment will occur.

1.2 SITE PREPARATION

During site preparation and construction, a number of materials may be removed from the site. These works may require the use of several hand tools like chain saws and heavy machinery such as excavators and dump trucks. Mitigation measures that will be employed during these works will include:

1. A containment boom will be placed around any areas to be demolished located above water to capture any debris.
2. All debris will be collected and removed from the site at an appropriate upland disposal facility.
3. The site shall be left in a clean condition.
4. Works shall be conducted in a safe manner to ensure the safety of both work crews and the public. The contractor must have a Safety Plan in place.
5. Proper marking of the site shall be in place to ensure that all areas being demolished are clearly visible.
6. No heavy machinery shall be permitted to enter the water.
7. A spill kit will be on site at all times.
8. The Contractor will have a Spill Management Plan and will carry out that plan in the event of a spill.
9. Water quality from these works shall not exceed water quality criteria in Section 1.5.
10. These works shall not generate any vibration that would exceed 30 kPa in the marine environment.
11. Saw dust and particles shall be cleaned up daily so as to prevent exposure to the marine environment.
12. The contractor shall create an Environmental Management Plan.

1.3 MATERIALS

1. All rip rap shall be inspected by the contractor to ensure that it is free of excess fines prior to use.
2. The contractor to ensure that any fill material used does not result in acid leachate or is not from a source that can reasonably be suspected of causing acid leachate.
3. The contractor shall only use fill material from sources that have not been used for Industrial or Commercial purposes unless a Phase I ESA has concluded that the materials are not likely to be contaminated.

1.4 CONSTRUCTION

1. Infill will be placed during periods of low tide wherever possible.
2. If the water quality standards in Section 1.5 cannot be met, a 4.5m tall silt curtain will be required around the area being filled.

3. The Contractor shall inspect equipment to ensure it is in good working order, clean and free of leaks.
4. Heavy equipment to be kept out of the water.
5. Perform all works within the project footprint only.
6. The contractor shall develop a Sediment and Erosion Control Plan to ensure any stock piled materials or exposed sediments do not generate unnecessary sediment laden waters.
7. Clearly survey and mark fill boundaries onsite prior to construction to ensure the correct areas are worked on.
8. Plan project to minimize exposure of fines to tide cycles which will generate plume during high tides.
9. Have an environmental monitor onsite when there is potential for harm to fish or fish habitat.
10. Where practical, remove any macro invertebrates from the project footprint to an adjacent site of like habitat conditions.
11. Following Best Management Practices for Pile Driving and Dredging.
12. Use a vibratory hammer if driving conditions permit.
13. Employ bubble curtain if required.
14. Prevent grounding of barges or equipment on foreshore.

1.5 WATER QUALITY

1. Turbidity at the site shall not exceed 8 NTU above background unless a silt curtain has been installed and is functioning as practically as possible as determined by an environmental monitor. Background readings shall be recorded at the nearest possible location not affected by the project works.

2.0 SPECIES AT RISK PROTECTION

2.1 OVERVIEW

The federal Species at Risk Act, the federal Migratory Birds Convention Act, and the provincial Wildlife Act all apply to the project and the project site. These Acts provide for the protection of species deemed to be of concern, and include specific prohibitions, including prohibitions against disturbing individual animals, disturbing their residences (including bird nests and nest trees), and disturbing critical habitat.

Westbank and their project team, including project environmental monitors, are aware of the provisions and prohibitions in place for the protection of species of concern. This environmental management plan (EMP) includes measures for the protection of species of concern. Project construction activities will adhere to the measures laid out in the EMP.

Some species of concern have been recorded within Howe Sound (i.e., the general vicinity of the project site), or have the potential to reside there, including marine mammals, fish, and migratory birds. However, it is unlikely that project construction activities will have any adverse effect on any species of concern.

The project site is located within Horseshoe Bay - a somewhat enclosed, busy, working harbour. The project site itself is inshore of a large working marina, in relatively shallow water. Project construction activities in-water and or at the shore include minor dredging to allow temporary barge access to the shore and backshore, installation of armour rock at a small area of the shore, and installation of two piles. These activities will be limited in physical extent and duration.

The various marine mammal species found in Howe Sound are typically found in open water, in waters much deeper than the project footprint. There are no apparent records of any marine mammal species of concern within Horseshoe Bay. No marine mammals of concern were observed during the onsite biophysical survey. It is unlikely that any marine mammal species of concern will be at the project site or in the vicinity of the site during project construction activities.

Some bird species of concern have been recorded within Howe Sound, including Pacific Great Blue Heron (PGBH) and Marbled Murrelet. However, there are no apparent records of any nests or nesting trees of species of concern in the vicinity of the project site. Marbled murrelet is typically found on open water, and is unlikely to be found in the vicinity of the project site, including Horseshoe Bay. PGBH is known to frequent Horseshoe Bay and the vicinity of the project site, foraging along the shore and from marina floats. However, PGBH is an opportunistic forager, not dependant on any one

type of food source, or foraging site. It is unlikely the PGBH will choose to forage at the project site, or in the immediate vicinity, during project construction activities. In any case, measures will be taken to prevent any disturbance of any bird species of concern due to project construction activities.

Given their respective habitat requirements and preferences, it is unlikely that any fish species of concern will be found in the vicinity of the project site.

An environmental monitor (EM) will be onsite whenever there is the potential for a project-related significant adverse environmental effect. The EM will advise workers involved in project construction activities of the measures for the protection of species of concern, and will engage workers in monitoring the presence of species of concern during construction activities.

2.2 MONITORING

An EM will be onsite whenever there is the potential for a project-related significant adverse environmental effect. This includes during pile driving whenever there is reasonable potential for in-water pressure waves in excess of 30 kPa; and during dredging and shore protection activities when there is reasonable potential for a significant plume of sediment-laden water and/or turbid water to move beyond the perimeter of the project water lot boundary.

When onsite, the EM will monitor the site and vicinity for the presence of wildlife, particularly species of concern. During daylight hours, the EM will scan the site and vicinity visually, using binoculars as necessary. When daytime visibility is limited, and at night (if works occur at night), the EM will use a hydrophone to check for the presence of marine mammals, particularly cetaceans.

2.3 SAFETY ZONES

A cetacean buffer zone will be established in the waters adjoining the project site. The buffer zone will extend 1 kilometre out from project construction activities. There will be no pile driving when any cetacean is observed within the buffer zone. If any cetaceans are observed within the buffer zone during pile driving, the EM will immediately stop the pile driving. Pile driving will not start until 30 minutes after the last observation of any cetacean within the buffer zone.

A marine mammal safety zone will be established in the waters adjoining the project site. The safety zone will extend 500 metres out from project activities. The EM will monitor all marine mammals that are observed within the safety zone. If the EM deems an animal to be possibly at risk or in distress as a result of project activities, the EM will immediately stop project activities until the animal has left the safety zone, or the EM deems the animal to be not at risk or in distress.

2.4 WORK STOPPAGE

All contractors working at the project site will be required to empower the EM in writing to stop work at the site in the event that the EM deems it necessary to stop work to protect a species of concern.

2.5 REPORTING

If a species of concern is observed at the project site or within the buffer zone or safety zone, during project construction activities, the EM will record that observation, including:

- the species and number of individual animals observed;
- the date, time, and duration of the observation;
- any special observation of behaviour of the animal(s) observed;
- the project activities underway at the time of the observation;
- comments on whether or not project activities appeared to have had any effect on the animal(s) observed, including comments on any apparent project-related adverse effect; and,
- comments on any action taken for the protection of the animal(s) observed, including the time and duration of any work stoppage, and or any other variation in project activities.

The EM will forward a record of the observation to relevant authorities as soon as practicable.

3.0 SEDIMENT EROSION CONTROL PLAN

3.1 PROJECT TIMING AND SCHEDULING

- Perform intertidal works in the dry during periods of low tide.
- Schedules works in a time effective manner.
- Provide the environmental monitor a minimum 5 days notice prior to performing works that may generate suspended sediments in marine waters.
- Avoid performing work during extreme rainfall.

3.2 CONSTRUCTION PRACTICES

- Keep heavy equipment out of the water. This is defined as the tracks of the machines out of the water itself.
- Minimize fill placement during extreme rainfall events.
- Clearly survey and mark fill boundaries onsite prior to construction to ensure the correct areas are worked on.
- All stockpiled materials shall be placed away from any drainage or the high water mark wherever possible.
- All stock piled materials shall remain covered with polyethylene or tarps during any rainfall event, or, after 3 days of dry weather if no rainfall has occurred.
- Public roadways must be kept clean. Daily cleaning will be required if any observed sedimentation has occurred.

3.3 SEDIMENT CONTROL DEVICES

- Based on water quality readings a silt curtain will be deployed at the discretion of the environmental monitor in consultation with Westbank and/or the project contractors responsible for the marine works.
- Gravel pads shall be placed where trucks pull out onto paved areas.
- Sand bags shall be placed beside catchment basins during the works to collect any sediment.
- Any upland works shall be isolated from the marine environment with the use of a silt fence if that surface slopes towards the High Water Mark.

3.4 WATER QUALITY TESTING

- Turbidity shall not exceed 8 NTU above background located at any point outside of the Horseshoe Bay Marina water lot as measured by the environmental monitor.

4.0 SPILL RESPONSE PLAN

4.1 EQUIPMENT AND SUPPLIES

At a minimum, the following equipment and supplies shall be onsite during any construction activities:

- Absorbent pads
- Spill booms
- Clearly marked spill kit
- Gloves
- Hard copy of this Spill Response Plan

4.2 TRAINING

All personnel on the project must have been trained to use the equipment and supplies listed above and be familiar with these spill response procedures to ensure a spill is avoided and immediate action is taken in the event of a spill.

4.3 PLANNING

The contractor shall ensure that when planning the project:

- Only equipment that is free of leaks are used on the project
- The equipment is of sufficient size and capable of performing the work without becoming overloaded.
- All equipment is inspected prior to daily use
- All equipment and work surfaces are in a clean condition.
- The location of the spill kit has clearly been communicated to all work crew members.
- Ensure that a skiff is available to perform cleanup.

4.4 CLEAN-UP PROCEDURE

In the event of a spill, the contractor shall perform the following immediately:

- Stop the source of the spill. If the spill is from a machine in or near the marine environment, remove it to a contained upland area.
- Contain the spill by deploying the spill booms from a skiff if in water.
- Use absorbent pads to collect the spilled material.
- Collect photographs of both the site impacted and the equipment that failed.
- Report the findings to a designate as determined by Westbank.
- Document the events, including:
 - your name and contact phone number;
 - name and telephone number of the person who caused the spill;
 - location and time of the spill;
 - type and quantity of the substance spilled;
 - cause and effect of the spill;
 - details of action taken or proposed;
 - description of the spill location and surrounding area;
 - names of agencies on scene; and
 - names of other persons or agencies advised concerning the spill.
- If the spill exceeds the values in B.C. Reg. 63/88 below, the following must be contacted:

B.C. Ministry of Environment Environmental Emergency:	1-800-663-3456
Marine Spill Reporting:	1-800-OILS-911
Canadian Coast Guard:	1-800-889-8852
Fisheries and Oceans Canada:	1-250-627-3499

4.5 SPILL REPORTING REGULATION

If the spill exceeds any of the following, it **must** be reported to the provincial government.

B.C. Reg. 63/88.

Item	Column 1 Substance spilled	Column 2 Specified amount
1	Class 1, Explosives as defined in section 2.9 of the Federal Regulations	Any quantity that could pose a danger to public safety or 50 kg
2	Class 2.1, Flammable Gases, other than natural gas, as defined in section 2.14 (a) of the Federal Regulations	10 kg
3	Class 2.2 Non-Flammable and Non-Toxic Gases as defined in section 2.14 (b) of the Federal Regulations	10 kg
4	Class 2.3, Toxic Gases as defined in section 2.14 (c) of the Federal Regulations	5 kg
5	Class 3, Flammable Liquids as defined in section 2.18 of the Federal Regulations	100 L
6	Class 4, Flammable Solids as defined in section 2.20 of the Federal Regulations	25 kg
7	Class 5.1, Oxidizing Substances as defined in section 2.24 (a) of the Federal Regulations	50 kg or 50 L
8	Class 5.2, Organic Peroxides as defined in section 2.24 (b) of the Federal Regulations	1 kg or 1 L
9	Class 6.1, Toxic Substances as defined in section 2.27 (a) of the Federal Regulations	5 kg or 5 L
10	Class 6.2, Infectious Substances as defined in section 2.27 (b) of the Federal Regulations	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
11	Class 7, Radioactive Materials as defined in section 2.37 of the Federal Regulations	Any quantity that could pose a danger to public safety and an emission level greater than the emission level established in section 20 of the "Packaging and Transport of Nuclear Substances Regulations"
12	Class 8, Corrosives as defined in section 2.40 of the Federal Regulations	5 kg or 5 L
13	Class 9, Miscellaneous Products, Substances or Organisms as defined in section 2.43 of the Federal Regulations	25 kg or 25 L
14	waste containing dioxin as defined in section 1 of the Hazardous Waste Regulation	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
15	leachable toxic waste as defined in section 1 of the Hazardous Waste Regulation	25 kg or 25 L
16	waste containing polycyclic aromatic hydrocarbons as defined in section 1 of the hazardous Waste Regulation	5 kg or 5 L
17	waste asbestos as defined in section 1 of the Hazardous Waste Regulation	50 kg
18	waste oil as defined in section 1 of the	100 L

	Hazardous Waste Regulation	
19	waste containing a pest control product as defined in section 1 of the Hazardous Waste Regulation	5 kg or 5 L
20	PCB Wastes as defined in section 1 of the Hazardous Waste Regulation	25 kg or 25 L
21	waste containing tetrachloroethylene as defined in section 1 of the Hazardous Waste Regulation	50 kg or 50 L
22	biomedical waste as defined in section 1 of the Hazardous Waste Regulation	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
23	A hazardous waste as defined in section 1 of the Hazardous Waste Regulation and not covered under items 1 – 22	25 kg or 25 L
24	A substance, not covered by items 1 to 23, that can cause pollution	200 kg or 200 L
25	Natural gas	10 kg, if there is a breakage in a pipeline or fitting operated above 100 psi that results in a sudden and uncontrolled release of natural gas

5.0 ENVIRONMENTAL MONITORING PLAN

5.1 Monitoring Objectives

The monitoring plan for the proposed Sewell’s Landing project includes works and activities during and after construction to:

- measure the effect of the works on the project environment to ensure that identified mitigation measures are followed correctly throughout the project,
- assess the effectiveness of the mitigation measures applied and confirm the project footprint and impacts, and,
- compliance with the mitigation measures, terms and conditions of the Fisheries Act authorization or aquatic effects assessment should DFO project review determine an authorization is not required.

5.2 Qualifications of the Environmental Monitor

Appropriate qualifications for the environmental monitor shall include knowledge and experience relating to:

- local marine biology and ecology,
- experience and background in the limitations and abilities of the equipment performing the project,
- the potential adverse environmental effects of the Project,
- measures that can be employed to mitigate known and unknown adverse environmental effects that are likely to occur, and,
- relevant legislation, guidelines, and best management practices.

5.3 Role of the Environmental Monitor

The environmental monitor will:

- have written authority from the Westbank to modify or halt any construction activity as required to minimize impacts to fish or fish habitat,
- explain the conditions of the authorization or aquatic effects assessment to each contractor prior to that contractor starting work at the project site,
- monitor the project for compliance with the conditions of the authorization or aquatic effects assessment, including compliance with the Fisheries Act, and all other applicable legislation, guidelines, and best management practices,
- direct project construction works as necessary to ensure compliance with the conditions of the authorization or aquatic effects assessment. This includes stopping or altering project works and directing works to avoid or mitigate adverse environmental effects, and
- provide written reports describing the findings of the monitoring program.

Note: the environmental monitor does not have the authority to change the Project or the terms or conditions of the authorization or aquatic effects assessment for the project.

5.4 Timing of Monitoring

The environmental monitor will be onsite at all times whenever there are:

- in-water works,
- works with the potential to adversely affect the aquatic environment,
- any time during the course of the project when there is the potential for adverse impacts to fish or fish habitat or
- the potential deposit of a deleterious substance into the aquatic environment.

5.5 Monitoring Specifics

The monitoring will include the following:

- the works undertaken each day and wildlife present;
- assessment of the effect of the project on the project environment, including observation, photography and physical measurements;
- assessment of compliance with the conditions of the authorization or aquatic effects assessment, including compliance with the Fisheries Act, applicable legislation, guidelines, and best management practices; and
- identification of any significant environmental issues and impacts and details of specific mitigation measures put in place to address those issues and impacts.

5.6 Mitigation Monitoring

If required mitigation monitoring of the stabilized rip rap slope shall be for a period of three (3) annual growing seasons (i.e., three years), following the completion of the project and include the following requirements:

- monitoring shall be conducted by an appropriately qualified expert or experts,
- an annual assessment of the colonization of the rip rap using suitable methods such as site inspection, photography and ground elevation survey.
- assessment of the square area of the rip rap,
- evaluation of the survival and growth of encrusting invertebrates and algae using suitable methods such as ground cover measurement, plant density and growth parameters such percent cover.
- identification of remedial works required to be implemented to enable the mitigation measures to function as intended.

5.7 Construction Monitoring

The monitor will create written daily monitoring reports describing the findings for each day the monitor is onsite including :

- a summary of the works and activities carried out or undertaken that day,
- commentary on the works and activities conducted from a fish and fish habitat perspective,
- identification of any potential issues or impacts to fish or fish habitat that arose or occurred, and details of specific mitigatory measures put in place to address these issues and impacts.

The monitor will keep the daily reports on file to be provided upon request. In addition to the daily monitoring reports, the monitor will provide a written summary monitoring report for the project works.

5.8 Reporting

If required, a written annual report for each of the three years following completion of the Project works. The report shall include an as-built plan, and any other relevant documents and photographs to illustrate the function of the rip rap slope.

6.0 PILE DRIVING BEST MANAGEMENT PRACTICES

- Have a preconstruction meeting to go over environmental requirements.
- Machinery is to arrive on site in a clean, washed condition and be free of fluid leaks.
- All equipment is maintained in good proper running order to prevent leaking or spilling of potentially hazardous or toxic products.
- Wash, refuel and service machinery and store fuel and other materials for the machinery at least 30 metres away from the water in order to prevent any deleterious substance from entering the water.
- Any water-based equipment or machinery (for example, clamshell dredge or pile driver on a barge) moored or used during the Project must not ground on the intertidal foreshore or subtidal seabed. The only exception to this condition is that use may be made of vertical spuds or other anchors to hold the water-based machinery or equipment in place.
- Storage of fuels and petroleum products will comply with safe operating procedures, including containment facilities in case of a spill.
- Pile cut-offs, waste or any miscellaneous unused materials must be recovered for either disposal in a designated facility or placed in storage.
- On site emergency spill equipment available whenever working near or on the water.
- Position water borne equipment in a manner that will prevent damage to identified fish habitat.
- Report any incidents of habitat damage to the Environmental Monitor or DFO to ensure that appropriate action (restoration) is taken.
- If fish spawn in the area or on equipment all work should stop and the Environmental Monitor or DFO notified.
- Work in least risk timing windows for fish and employ silt or bubble curtains to prevent harm to fish or fish habitat.
- Environmental monitoring of pressure waves is not required if appropriate vibratory hammer equipment is employed.
- For any extraction of existing piles, reasonable efforts are to be applied to remove the entire length of the pile from the intertidal foreshore or subtidal seabed.
- If pile driving is results in pressure waves above 30 kpa bubble curtains or other mitigation measures should be employed to reduce or pressure wave values or maintain marine life at a distance where pressure waves do not exceed 30 kpa.
- Follow any project plans including Environmental Management, Water Quality Monitoring, Environmental Monitoring, Spill Prevention and Emergency Response. Plan
- Best Management Practices are guidelines only.
- All permits, authorizations, laws and regulations take precedence over this document.

7.0 PILE REMOVAL BEST PRACTICES

- Measures should be implemented to control turbidity and sediments re-entering the water column during pile removal, and to dispose of removed piles and debris.
- Existing pilings within the project footprint should be extracted using direct pull and/or vibratory techniques in accordance with the following resource protection measures.
- Vibratory extraction is the preferred method of piling removal and should be used where available and feasible depending on piling condition and substrate type. Vibration reduces friction between the pile and substrate to avoid disturbing large amounts of sediment. Typically little or no sediment remains attached to the pile during vibratory withdrawal.
- When appropriate for the substrate type and structural integrity of the piling, a crane or excavator may be used to pull the pilings out of the sediment. To the extent practicable, pilings should be removed in their entirety; however, no jetting, excavation, or other significant disturbance of the sediment should occur to facilitate piling removal.
- Work should be done during periods of lower water (lower tides) to the extent possible. Individual piles should be removed slowly to ensure sediment disturbance and resulting turbidity in the water column is minimized. All sediment and contaminants associated with removed piles should be contained during handling and transport to prevent re-introduction to the water. No effort should be made to remove sediment or other material from chemically treated piles, either in or over the water.
- In the event that the pile breaks at or near the existing mudline and cannot be removed, the pile should be cut off at least 1 foot below the mudline. For creosote treated piles, the remaining stump should be covered with clean sediment. Any other holes remaining after piling removal should not be filled.
- All floating surface debris should be collected and disposed of along with the piling. All wooden piling treated with preservatives, together with associated sediments, and debris from piling removal should be permanently removed from the water and disposed of at a facility approved for collection of hazardous waste.
- Extracted piles and debris should be placed in a lined stockpile area or directly loaded into transport container or vehicle.
- Appropriate controls should be used to prevent runoff from leaving the stockpile and entering surface water or ground water. Steel pipe piling may be recycled or reused if the piling condition is suitable for reuse.
- Best Management Practices are guidelines only.
- All permits, authorizations, laws and regulations take precedence over this document.

7.0 DREDGING BEST PRACTICES

The following mitigation measures, conditions, and dredging practices were developed through consultation with DFO and will be followed during the project:

1. Dredging will be conducted as efficiently as possible and the duration of dredging shall be minimized.
2. If clamshell dredging is used to side cast dredged material, the clamshell dredge shall place the dredged material as close as possible to the existing seabed or ground line. Material will not be released from above the water surface or within the upper portion of the water column.
3. Any water based equipment or machinery moored or used during the construction or operation of the project will not be allowed to ground on the intertidal foreshore or subtidal seabed. The only exception to this condition is that use may be made of vertical spuds or anchors to hold the water based equipment or machinery in place.

4. Works will be carried out in a way that prevents any adverse impact to fish or fish habitat. If the proposed works or subsequent activities result in any such impact, the DFO Triage & Planning Unit of the Fisheries Protection Program will immediately be notified. Work may be suspended or altered and compensatory or remedial works may need to be undertaken at the expense of the Westbank, and to the satisfaction of the DFO Fisheries Protection Program, to ensure that the project does not result in a net loss of productive fish capacity.
5. Westbank and its' project team will comply at all times with Section 36 of the Fisheries Act, which specifically prohibits the deposit of a deleterious substance into fish bearing waters.
6. Upon completion of the dredging, a report will be created that summarizes the dredging activities undertaken. Information in the report will include dredge dates, approximate dredge volumes, hours spent dredging, as well as any problems encountered or observations that may be of interest to the DFO Fisheries Protection Program. This report shall be kept on file by Westbank to be made available to DFO upon request.
7. Dredging will be planned where possible to coincide with periods of low tide between the period from August 16th to January 31st in any calendar year. The actual work dates and times will be confirmed after the completion of project tendering. If dredging is required outside this timing window additional mitigation measures may be required.