



# COAL HARBOUR MARINA EXPANSION PROJECT PROJECT DESCRIPTION

## VANCOUVER FRASER PORT AUTHORITY: PROJECT AND ENVIRONMENTAL REVIEW

*Prepared for:*

Royal Vancouver Yacht Club  
3811 Point Grey Road  
Vancouver, BC  
V6R 1B3

Tel: (604) 224-1344

*Prepared by:*

**TyPlan Planning and Management**

1461 Ioco Road  
Port Moody, BC  
V3H 2X3  
Tel: (604) 461-6664 Fax: (604) 461 6668

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## EXECUTIVE SUMMARY

The Royal Vancouver Yacht Club (RVYC) has proposed to the Vancouver Fraser Port Authority (port authority) a project to expand the marina and upgrade the marina and facilities based on improving the design and introducing best in class environmentally sustainable practices and materials. The Coal Harbour Marina is situated within Coal Harbour, immediately to the west of Deadman's Island and east of the Vancouver Rowing Club. Stanley Park is immediately north of the marina. The proposed project is primarily to expand the marina and increase the water lot lease area by 13.3% to accommodate an additional 47 slips.

The total project area is 76,930 m<sup>2</sup> / 828,068 sq. ft., which includes the water lot expansion area of 9,040 m<sup>2</sup> / 97,306 sq. ft. and the existing water lot of 67,890 m<sup>2</sup> / 730,762 sq. ft. This project description and the supporting appendices have been prepared to satisfy the port authority's requirements under the Project and Environmental Review (PER) process for a category "C" project review (Project permit 17-113).

Using B.O. Tobiasson and R.C. Kollmeyer (T&K), *Marinas and Small Craft Harbors*, 2<sup>nd</sup> edition, 2000, design manual, a revised marina plan has been designed to meet best practices:

Project activities include:

- Dismantling of old floats and boat sheds;
- Removal of 85 old creosote-treated wooden piles (by vibratory extraction or direct pull);
- Removal of 23 H steel piles;
- Removal of 24 cylindrical steel piles (that will be reused on site) by either vibratory extraction or direct pull;
- Installation of 129 piles driven with either a vibratory or drop hammer from a barge:
  - 48 16-inch cylindrical steel (new)
  - 24 12.75-inch cylindrical steel (reused)
  - 35 12.75-inch cylindrical steel (new)
  - 22 10.75-inch cylindrical steel (new)
- Repositioning of existing floats, fingers and boat sheds;
- Relocation of existing boat sheds via towing;
- Installation of new concrete floats, fingers and corners that are to be constructed off-site and brought to site by barge (no concrete works will be conducted on-site);
- Removal of 37 existing boat sheds and installation of 37 new prefabricated boat sheds that will be constructed off-site and brought to site by barge; and
- Upgrading of float utilities and safety features including upgrades to plumbing, electrical and lighting systems.

The proposed construction period consists of off-site construction of floats and boat sheds (2020-2022) and approximate on-site construction phases 1 through 8 between August 16, 2020–February 28, 2021 and August 16, 2021–February 28, 2022 (to be confirmed). All in-water works will be conducted outside of most-risk timing windows (March 1 to August 15) as defined by the Department of Fisheries and Oceans.

All attempts to minimize disruption during construction to the neighbourhood and its residents, commercial operators, tourists, and users of the waterway are being implemented. Construction activities within Coal Harbour predominantly focus on attaching floats to piles and boat sheds to floats, all of which are benign in terms of impacts to the neighbourhood and users of the waterway.

The key source of noise and disruption will result from the pile driving activities necessary to realign the marina and secure the floats and boat sheds. The nearest residential or commercial operation is approximately 300 m from the centre of the marina. All best management practices will be utilized to minimize potential noise and other nuisance effects during pile driving activities.

An eight-phase project construction plan has been proposed in which Phase 1 (i.e. the construction of K float, that occurs within the proposed expansion area), has the greatest potential impact on marine stakeholders, as works will be undertaken in proximity to, but not within, the navigational channel. The remaining phases (2-8) are internal to the marina's reconfiguration, will not impact external marine users.

Pile driving will occur throughout the construction period and will be restricted to daytime hours. No work will take place on weekends or statutory holidays.

The port authority PER process also defines additional studies to be undertaken to identify and mitigate any potential effects the proposed project might have on marine stakeholders, commercial operators, tourists and residents. This application contains assessments of the potential effects of view and shade, noise, lighting, multiuse of the waterway, aquatic habitat, etc.

The studies confirmed limited impacts would result from the proposed projects construction and on-going operations.

The channel design was accepted by the port authority in November of 2017, and the application for expansion of Coal Harbour was deemed complete by the port authority on December 12, 2018.

	Existing	Proposed New	TOTAL AFTER EXPANSION
Vessel Slips with Boat Sheds - removed, replaced, and relocated)	37		
Vessel Slips with Boat Sheds – Relocated	52		
Total – Removed and/or Replaced	89		
Total Vessel Slips with Boat Sheds – not relocated	103		
Total Vessel Slips with Boat Sheds	192		192
Total Vessel Slips without Boat Sheds	128	47	175
<b>TOTAL VESSEL SLIPS</b>	<b>320</b>	<b>47</b>	<b>367</b>

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# 1 GENERAL SCOPE

## 1.1 Applicant Information

The Royal Vancouver Yacht Club was formed in 1903, seventeen (17) years after the City of Vancouver was incorporated. The Club had as its first headquarters a small rented house at the foot of Thurlow Street in Coal Harbour. The Club soon built a two-storey floating clubhouse on a leased water lot just west of the foot of Bute Street. In 1905 it was towed to a new site in the shelter of Deadman's Island, close to our present Coal Harbour location. Between 1960 and 1993 the Club acquired seven Offshore Stations:

- 28-acre Tugboat Island in Silva Bay on Gabriola Island purchased in 1960
- Alexandra Island in Centre Bay on Gambier Island in 1965
- 400 feet of waterfront at Secret Cove in 1972
- RVYC bought a 'complete' marina at Scott Point on Salt Spring Island in 1977
- Wigwam Inn at the head of Indian Arm was purchased in 1985
- in 1989 the Club took possession of a second 'full service' marina at Garden Bay in Pender Harbour
- In 1993 the Club purchased 18 acres with 1,400 feet of waterfront in Cortes Bay on Cortes Island

The search continues for a second Offshore Station in Howe Sound.

At present there are 1,918 Active Members, 245 Intermediate Members, 80 Post-Secondary Members, and 371 Junior Members. In addition, there are 625 Non-Resident Members, 1,403 Joint members, and 540 Special, Honorary, Honorary Life and Life Members. The fleet numbers over 465 sailboats and 848 power boats berthed at Jericho and Coal Harbour Stations or moored elsewhere.

## 1.2 Description of Project Setting

Coal Harbour Marina is sited within Coal Harbour immediately to the west of Deadman's Island and east of the Vancouver Rowing Club. Immediately north is Stanley Park. Refer to Exhibit 1 Location Plan for context. The exhibit illustrates the existing water lot lease and the proposed expansion area. The exhibit also illustrates the proposed reconfiguration and expansion from a navigational and real estate perspective. Surrounding land uses are also identified.



Exhibit 1: Location Plan





The RVYC Coal Harbour location has served as a second home port for the members of the Royal Vancouver Yacht Club since 1905. The marina is currently equipped with:

- two boat lifts
- a small café open daily for breakfast and lunch
- a pump out station
- a workshop
- recycling bins paired with every garbage bin in the marina
- Slips are available for reciprocal visitors from around the world to stay and enjoy the facilities
- rotating staff of approximately 18 people, with at least one staff member onsite in the evenings, and one staff member overnight for security and emergency response
- other locations, including the main Clubhouse in Jericho as well as the seven (7) outstations owned by the club have Clean Marine Certifications, and the Coal Harbour location was recently awarded 4-anchor Clean Marine Certification to further the Club's continuous endeavour to be environmentally responsible.

Of the 320 vessels currently moored at RVYC – Coal Harbour:

- 192 vessels are in boat sheds
- 128 vessels are in open slips

With the proposed expansion of 97,306 sq. ft. (9,040 m<sup>2</sup>), the number of boat sheds would remain the same, and 47 new slips would be created consisting of a distribution of:

- 40' / 12.2 m slips with a 17' / 5.2 m water beam
- 50' / 15.2 slips with a 19' - 20' / 5.8 m - 6.1 m water beam
- 55' / 16.8 m slips with a 20' / 6.1 m water beam
- 60' / 18.2 m slips with a 22' / 6.7 m water beam
- 78' / 23.8 m linear slips
- 88' / 26.8 m linear slips

### 1.3 Potential Impacts to Land, Water, Air and Adjacent Communities and Businesses

The existing marina is sited within the jurisdictional boundaries of the port authority. The proposed expansion of the water lot and associated marina reconfiguration is wholly located within the port authority jurisdictional boundaries. Stanley Park resides to the north, the City of Vancouver to the south and to the west.

The Project comprises an expansion of the existing water lot (by 13.3%). A key objective of the application is to expand and upgrade existing facilities, services and utilities based on worldwide best management practices, as well as promoting, and creating one of the most environmentally sustainable marinas on the west coast. The expansion and renewal retrofits and improves the marina's floats, replaces older boat sheds with new ones, removes the older ecologically unfriendly creosote timber piles, and upgrades utilities.

The potential to expand the marina by a small margin was contingent upon whether current and future navigation could be accommodated for within Coal Harbour. In 2012, RVYC prepared the Coal Harbour Marina Expansion

Project Master Plan (refer to Appendix A) that confirmed that such an expansion was feasible, and that navigation would not be impacted. The determination was based on being able to satisfy navigational channel design in accordance with The World Association for Waterborne Transport Infrastructure (PIANC) *Harbour Approach Channels – Design Guidelines*, 2014 (updated guidelines from 1997), as well as support the continuation of rowing. The channel design defined the extents of available water lot while at the same time incorporating rowing lane requirements in accordance with international rowing lane guidelines:

- Channel design was based on the PIANC *Harbour Approach Channels – Design Guidelines* (2014) and was reviewed by the port authority, who agreed in principle to the channel design in 2016.
- The rowing lanes were designed based on the International Rowing Federation (FISA) guidelines (the governing association for rowing) for the width of rowing lanes.

Initial consultation with stakeholders was undertaken (refer to Appendix C and D regarding the expansion project (HMCS Discovery) and the replacement of seven boat sheds (Vancouver Parks Board)), however, as part of the consultation process currently being undertaken as of the port authority's PER process review, all stakeholders will be receiving referral letters as part of the application review process.

During construction, the installation of the new float (K float) and the reconfiguration of the internal floats require pile driving. Pile driving has been identified as a key source of noise in which other stakeholders and users may be temporarily impacted. A review of construction staging presented herewith as Appendix G (which has been discussed with local contractors) confirms that much of the construction disruption itself will be restricted to the RVYC membership and not the navigational channel users, which remains functional to local stakeholders. RVYC notes that potential noise to residents and local businesses located further away than 984' / 300 m from the centre of the marina) must be managed effectively, specifically noting pile driving activities. To address potential noise the *Best Management Practices for Pile Driving and Related Operations* (BMPPDRO) (BC Marine and Pile Driving Contractors, March 2003), will be referenced and adhered to. Vibratory hammer will be used for this project. Bubble curtains will be used to reduce noise resulting from pile driving if noise exceeds 30 kPa. Monitoring will occur during the entire tenure of pile driving and additional mitigation measures will be deployed if necessary. Only daytime pile driving will be permitted; no pile driving will be allowed on statutory holidays or weekends. Fisheries windows will be observed. Lighting will not be an issue during construction activities as all works will be restricted to daylight hours. Please refer to the Construction Environmental Management Plan (Appendix R).

## 1.4 List of Studies Completed to Support the Application

The RVYC, in preparing this project permit application for the port authority, has assembled a team of highly skilled professionals, well-known to the port in relation to the technical studies needed to plan, design, and construct the proposed Marina. This document has been prepared to address and meet the requirements outlined in the port authority Draft Checklist RVYC Marina Application Submission Checklist issued November 23, 2017 (PER 17-113).

The application has been prepared under the guidance from the following RVYC representatives:

- David Doig; RVYC, Commodore 2020
- Carmen Derricott; RVYC, General Manager
- Chris Barnett; RVYC Marine Asset Manager, Project Manager
- Craig McKeen; RVYC Coal Harbour Rear Commodore
- Jack Wood; RVYC, Coal Harbour Steering Committee
- Robbie Hausch; RVYC, Coal Harbour Steering Committee
- Wally Eggleton; RVYC, Coal Harbour Steering Committee
- Peter Powers; RVYC, Coal Harbour Steering Committee
- Ron Jupp; RVYC, Coal Harbour Steering Committee
- David Brind; RVYC, Coal Harbour Steering Committee

The list of studies and corresponding reports appended to this document include:

- Coal Harbour Marina Expansion Project Master Plan (Appendix A)
- RVYC Proposed Expansion Project Navigation Channel Design (Appendix B)
- HMCS Discovery Letter of Support (Appendix C)
- Vancouver Parks Board Letter (Appendix D)
- Marina Design (Appendix E)
- Marine Seismic Refraction, Bathymetry and Sub-Bottom Acoustic Profiling Survey Report (Appendix F)
- Detailed Construction Staging Memorandum (Appendix G)
- Rowing Technical Memorandum (Appendix H)
- Dock/Float Design (Appendix I)
- Boat Shed Design (Appendix J)
- View and Shade Technical Memorandum (Appendix K)
- Royal Vancouver Yacht Club Emergency Response Plan (Appendix L)
- Fire and Life Safety Report (Appendix M)
- Water Supply and Fire Protection Drawings (Appendix N)
- New Electrical Distribution Layout Drawings (Appendix O)
- Lighting Plan (Appendix P)
- Biophysical Survey of Subtidal Habitat at Royal Vancouver Yacht Club's Coal Harbour Proposed Marina Reconfiguration (Appendix Q)
- Construction Environmental Management Plan (CEMP) (Appendix R)
- Environmental Noise Assessment (Appendix S)



## 2 OPERATIONS

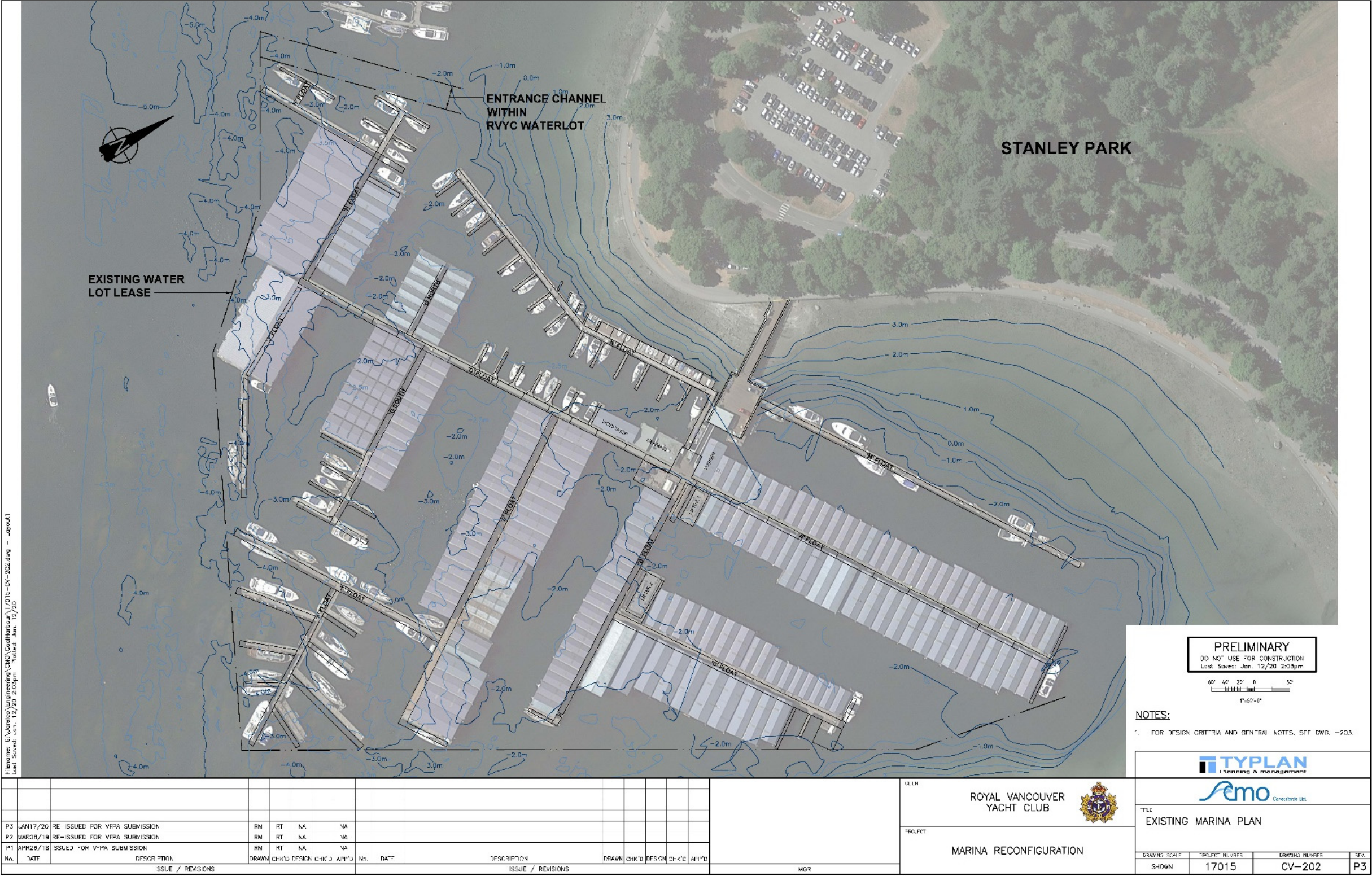
### 2.1 Description of Coal Harbour Marina Operations

The existing Coal Harbour Marina consists of 320 vessels providing moorage for vessels ranging from 20' to 160'. There is a total of 192 boat sheds (of which 52 are being relocated and a further 37 replaced in situ or relocated because of the expansion project, as identified in Exhibits 21 and 22), and an upgraded series of floats and fingers. The boat mix and parameters for the marina berth geometry is provided in Section 2.3 and identified in Exhibit 3, Proposed Marina Plan. Design criteria and notes are also identified and are detailed in Appendix E. The Design Criteria is supported by the Marine Seismic Refraction, Bathymetry and Sub-Bottom Acoustic Profiling Survey Report (refer to Appendix F) that was undertaken to support design.

Exhibit 2 below provides an outline of the existing marina layout. Exhibit 3, as noted above and follows Exhibit 2, presents the proposed reconfigured and expanded marina.



Exhibit 2: Existing Coal Harbour Marina Layout





1.1 THE ADDITIONAL WATER LOT AREA IS 97.305<sup>12</sup> (9,040m<sup>2</sup>), 0.904 HECTARES OR 2.234 ACRES, PROVIDED BY AN EXTENSION OF THE CORNERS OF THE WATER LOT TOWARDS THE NAVIGATION CHANNEL, AS SHOWN ON THE DRAWINGS:

- 112'-6" (34.3m) FROM THE EAST CORNER OF THE WATER LOT, AND;
- 119'-5" (36.4m) FROM THE WEST CORNER OF THE WATER LOT.

- 1.2 THE PROPOSED WATER LOT LEASE EXPANSION WAS REVISED BY UTILIZING AN UPDATED NAVIGATION CHANNEL PROVIDED BY THE PORT AUTHORITY ON NOVEMBER 9, 2018. AN AUTOCAD FILE "CHANNEL - COAL HARBOUR - FINAL - 2019.DWG" WAS RECEIVED ON JUNE 10, 2019 CONFIRMING THE CHANNEL DESIGN DESIGN AND LOCATION AS PROVIDED ON NOVEMBER 9, 2018 BY THE PORT AUTHORITY.

- 2.0 NEW BOAT SLIPS ARE OPEN AND THE NUMBER OF BOAT SHEDS HAS NOT CHANGED IN THE EXPANSION.

- ### 3.0 WATER LEVELS

- 3.1 TIDAL ELEVATIONS ARE TO CHART DATUM (CD), DEFINED AS THE LOWEST NORMAL TIDE, USING THE CANADIAN TIDE AND CURRENT TABLES, CANADIAN HYDROGRAPHIC SERVICES, 2018 EDITION, FOR VANCOUVER, AS PROVIDED IN THE FOLLOWING TABLE:

RECORDED EXTREME HIGH WATER LEVEL, (EHWL)	5.6m	CD
HIGHER HIGH WATER LEVEL, LARGE TIDE (HHWL)	5.0m	CD
HIGH WATER LEVEL, MEAN TIDE (HWL)	4.5m	CD
MEAN WATER LEVEL (MWL)	3.1m	CD
LOW WATER LEVEL, MEAN TIDE (LWL)	1.2m	CD
LOWER LOW WATER LEVEL, LARGE TIDE (LLWL)	0.1m	CD
RECORDED EXTREME LOW WATER LEVEL, (ELWL)	-0.4m	CD

- 3.2 THE INCREASE IN WATER LEVELS BY 2100 DUE TO CLIMATE CHANGE IS APPROXIMATELY 0.6m USING THE AVERAGE PROJECTED SEA-LEVEL CHANGE FOR REPRESENTATIVE CONCENTRATION PATHWAY (RCP) SCENARIO 8.5 (RCP8.5) IN JAMES ET AL GEOLOGICAL SURVEY OF CANADA OPEN FILE 7942 REPORT "TABULATED VALUES OF RELATIVE SEA-LEVEL PROJECTIONS IN CANADA AND THE ADJACENT MAINLAND UNITED STATES", 2015.

- 3.3 THE PROJECTIONS FOR SEA-LEVEL CHANGE DUE TO WEST ANTARCTIC ICE SHEET MELTING ARE FOR A FURTHER INCREASE OF 0.65m BY 2100 (JAMES, 2015).

- 3.4 PILE CUT-OFF ELEVATIONS WILL INCLUDE AN ADDITIONAL 1.25m FOR SEA-LEVEL RISE, AND WILL BE ABOVE THE FLOAT FREEBOARD AT EHWL PLUS A 0.3m SAFETY ALLOWANCE.

- #### 4.0 WINDS

- 4.1 WIND RECORDS FROM 1976 TO 1988 ARE AVAILABLE FROM A RECORDING STATION ON DEADMAN ISLAND ENTITLED VANCOUVER HARBOUR BY ATMOSPHERIC ENVIRONMENT SERVICE, ENVIRONMENT CANADA.

- 4.2 THE NATIONAL BUILDING CODE OF CANADA (NBCC) PROVIDES THE 1 IN 50 YEAR WIND PRESSURE FOR VANCOUVER AS 0.45 KPA, WHICH CONVERTS TO A WIND SPEED OF 95 KPH FOR ALL DIRECTIONS.

- 4.3 THE 1 IN 50 YEAR WIND SPEED FOR GENERATING WAVES OVER THE OPEN WATER FETCH TO THE EAST OF THE SITE IS 86 KPH, WHICH IS DETERMINED BY SCALING UP THE VANCOUVER HARBOUR WIND SPEEDS TO MATCH THE NBCC VALUE OF 95 KPH FOR ALL DIRECTIONS.

- 4.4 THE 1 IN 50 YEAR WIND SPEED FROM THE NW, FOR APPLYING TO K-FLOAT FOR WINDS FROM THE DIRECTION OF LOST LAGOON IS 91 KPH, WHICH IS DETERMINED BY SCALING UP THE VANCOUVER HARBOUR WIND SPEEDS TO MATCH THE NBCC VALUE OF 95 KPH FOR ALL DIRECTIONS.

- 4.5 THE WIND SPEED FOR ALL OTHER DIRECTIONS IS 70 KPH BASED ON THE VANCOUVER HARBOUR WIND RECORDS.

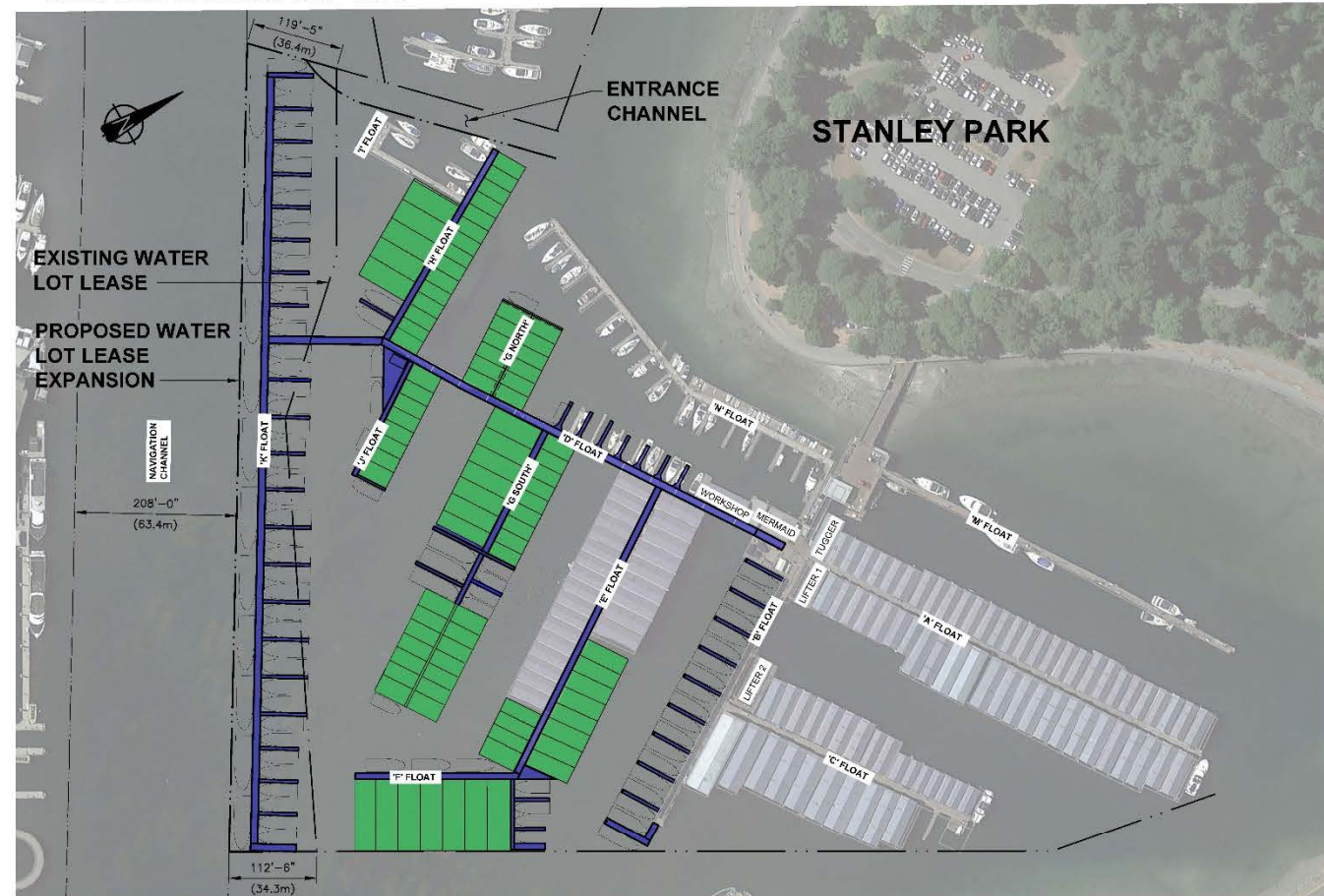
- 4.6 THE WIND SPEED FOR CHECKING THAT THE MARINA IS A "CLASS A" MARINA ACCORDING TO THE GUIDELINES OF HARBOUR ACCOMMODATION BY SMALL CRAFT HARBOURS DIRECTORATE, FISHERIES AND OCEANS CANADA, 1985, IS 51 KPH, WHICH IS THE 0.17% EXCEEDANCE WIND SPEED FROM THE EAST AND WHICH IS DETERMINED BY SCALING UP THE VANCOUVER HARBOUR WIND SPEEDS TO MATCH THE NBCC VALUE OF 95 KPH FOR ALL DIRECTIONS.

- 4.7 WIND SPEEDS ARE ONE HOUR AVERAGES AND ARE AT A HEIGHT OF 10 M ABOVE THE WATER SURFACE.

- ## 5.0 WAVES

- 5.1 THE 1 IN 50 YEAR WIND WAVES GENERATED BY THE EAST DIRECTION WINDS HAS A SIGNIFICANT WAVE HEIGHT (HS) OF 0.8 M AND A PEAK SPECTRAL WAVE PERIOD (TP) OF 4.2 SECONDS AT THE SOUTH END OF K-FLOAT.

- 5.2 THE 0.17% EXCEEDANCE WAVES ARE HS = 0.25 M AND TP = 3.0 SECONDS AT THE SOUTH END OF K-FLOAT WHICH INDICATES THAT THE MARINA IS GENERALLY CLASS A.



5.3 HS IS DEFINED AS THE AVERAGE OF THE HIGHEST 33% OF THE WAVES, WHERE THE WAVE HEIGHT IS THE VERTICAL DISTANCE FROM THE TROUGH TO THE CREST OF THE WAVES. TP IS DEFINED AS THE PERIOD OF THE MOST ENERGETIC WAVES IN THE SEA STATE, WHERE WAVE PERIOD IS THE TIME BETWEEN SUCCESSIVE WAVE CRESTS AT A STATIONARY POINT.

- 5.4 WAVE HEIGHTS AND PERIODS ARE CALCULATED USING THE PROFESSIONAL COMPUTER PROGRAM MIKE 21 SW DEVELOPED BY DHI.

- 6.0 BERTH WIDTHS AND VESSEL BEAM AND EFFECTIVE HEIGHT FOR CALCULATING WIND LOADS IS PROVIDED IN B. TOBIASSON AND R. KOLLMMEYER "MARINAS AND SMALL CRAFT HARBOURS", 2ND EDITION, 2000 (T&K).

- 7.0 THE BOAT MIX AND PARAMETERS FOR MARINA BERTH GEOMETRY ARE GIVEN IN THE FOLLOWING TABLE FOR GENERAL GUIDANCE (N/A = NOT APPLICABLE), BASED ON TABLE 10-2 AND FIGURE 10-1 OF T&K.

BOAT LENGTH L (FT)	BOAT BEETH B (FT)	DOUBLE BEETH WIDTH M (IN. FT)	SINGLE BEETH B (FT)	MIN. FAIRWAY WIDTH FOR A CALM MARINA 1.25xL (FT)	MIN. FINGER WIDTH FOR (10% RULE)
70 (2x3.6)	22' (6.8m)	N/A	N/A	N/A	N/A
80 (21.3')	21' (6.4m)	N/A	N/A	N/A	N/A
65 (19.8')	20' (6.1m)	46' (14m)	24' (7.3')	81' (24.7m)	6' (1.8m)
60 (18.3')	19' (5.8m)	44' (13.4m)	23' (7m)	75' (22.8m)	6' (1.8m)
55 (16.8')	18' (5.5m)	42' (12.8m)	22' (6.7m)	69' (21.0m)	6' (1.8m)
50 (15.2')	17' (5.2m)	40' (12.2m)	21' (6.4m)	63' (19.2m)	6' (1.8m)
48 (14.6')	16.5 (5.0m)	37' (11.3m)	19' (5.8m)	60' (18.3m)	5' (1.5m)
40 (12.2')	15' (4.6m)	34' (10.4m)	18' (5.5m)	50' (15.2')	4' (1.2m)
30 (9.1')	13' (4.0m)	27' (8.2m)	15' (4.6m)	38' (11.6m)	3' (1.0m)

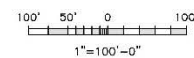
- ## 8.0 BOAT SIZES FOR CALCULATING WIND LOADED AREAS

BOAT LENGTH L FT (m)	AVERAGE PROFILE HEIGHT, FT (m)
80 <sup>3</sup> (24.4m)	14 <sup>1</sup> (4.3m)
70 <sup>3</sup> (21.3m)	13 <sup>1</sup> (4m)
60 <sup>3</sup> (18.3m)	12 <sup>1</sup> (3.7m)
50 <sup>3</sup> (15.2m)	11 <sup>1</sup> (3.4m)
40 <sup>3</sup> (12.2m)	9 <sup>1</sup> (2.7m)
30 <sup>3</sup> (9.1m)	7 <sup>1</sup> (2.1m)

- 8.1 THE WIND LOADS ON K-FLOAT BOATS AND PILES ARE CHECKED FOR VESSELS WITH HIGHER FREEBOARDS AS PROVIDED IN FIGURE 10-7 OF T&K ENTITLED MOTORYACHT AND MEGAYACHT LOA VERSUS VERTICAL HEIGHT FOR WINDS FROM THE NW.

- 9.0 BOAT SIZES AND DRAFT BASED ON TABLE 12-1 AND FIGURE 10-6 OF T&K:

BOAT LENGTH L FT (m)	DRAFT FT (m)	
	POWER BOATS	SAIL BOATS
80' (24.4m)	7.5' (2.3m)	14' (4.3m)
70' (21.3m)	7' (2.1m)	13' (4m)
60' (18.3m)	6' (1.8m)	11.5' (3.5m)
50' (15.2m)	5.5' (1.7m)	10' (3m)
40' (12.2m)	5' (1.5m)	8' (2.4m)
30' (9.1m)	4' (1.2m)	6' (1.8m)




**PRELIMINARY**  
DO NOT USE FOR CONSTRUCTION  
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CLIENT	<p>ROYAL VANCOUVER YACHT CLUB</p> 
PROJECT	MARINA RECONFIGURATION

**LEGEND:**

 UPGRADED DOCK

 NEW AND RELOCATED BOAT SHEDS



TITLE			
PROPOSED MARINA PLAN DESIGN CRITERIA AND GENERAL NOTES			
DRAWING SCALE	PROJECT NUMBER	DRAWING NUMBER	REV.
SHOWN	17015	CV-203	P8

## 2.2 Hours of Operation

The marina is accessible to members 24/7, 365 days per year.

## 2.3 Increase in Capacity

The proposed expansion facilitates 47 new slips. It is noted that the reconfiguration significantly improves the current layout and meets best practices for marina layout designs, making it more functional and operational for members as well as create a navigational passage at the western end of the marina to separate the RVYC and VRC water lots. The slip design configuration presented below reflects the noted boat mix and parameters for marina berth geometry required for such vessels, which is based on Table 10-2 and Figure 10-1 of B.O. Tobiasson and R.C. Kollmeyer (T&K) *Marinas and Small Craft Harbors*, 2<sup>nd</sup> edition, 2000. The (T&K) design guidelines which have been utilized in the marina's reconfiguration.

**Table 1: Additional Slip Design Requirements**

BOAT LENGTH (L)	BOAT BEAM	DOUBLE BERTH WIDTH, MIN	SINGLE BERTH WIDTH	MIN. FAIRWAY WIDTH FOR A CALM MARINA, 1.25 x L*	MIN. FINGER WIDTH (10% RULE)	AVERAGE TOTAL OF SLIPS**
80' / 24.4 m	22' / 6.7 m	N/A	N/A	N/A	N/A	2
70' / 21.3 m	21' / 6.4 m	N/A	N/A	N/A	N/A	2
65' / 19.8 m	20' / 6.1 m	46' / 14 m	24' / 7.3 m	81' / 24.7 m	6' / 1.8 m	0
60' / 18.3 m	19' / 5.8 m	44' / 13.4 m	23' / 7 m	75' / 22.9 m	6' / 1.8 m	5
55' / 16.8 m	18' / 5.5 m	42' / 12.8 m	22' / 6.7 m	69' / 21 m	6' / 1.8 m	5
50' / 15.2 m	17' / 5.2 m	38' / 11.6 m	20' / 6.1 m	63' / 19.2 m	5' / 1.5 m	22
48' / 14.6 m	16.5' / 5 m	37' / 11.2 m	19' / 5.8 m	60' / 18.3 m	5' / 1.5 m	6
40' / 12.2 m	15' / 4.6 m	34' / 10.4 m	18' / 5.5 m	50' / 15.2 m	4' / 1.2 m	4
30' / 9.1 m	12' / 3.7 m	27' / 8.2 m	15' / 4.6 m	38' / 11.6 m	3' / 1 m	1
<b>TOTAL</b>						<b>47</b>

\* N/A (Not Applicable) refers to the fact that the 80' and 70' vessels are not sited in double nor single berths and minimal fairways and finger widths do not apply.

\*\* The distribution of vessel sizes represents the maximum size of vessel that can be accommodated based on design. Actual vessel size may vary.

Source: B.O. Tobiasson and R.C. Kollmeyer *Marinas and Small Craft Harbors*, 2<sup>nd</sup> edition 2000 (T&K).

## 2.4 Description of Potential Community and Environmental Impacts and Proposed Mitigation

### 2.4.1 Land Use Sensitive Receptors

Located within Coal Harbour, intensive land use activity occurs near the proposed project site. From a marine perspective the Project Scope has been discussed with the following groups:

- HMCS Discovery
- Vancouver Rowing Club
- Bayshore West Marina Centre
- Harbour Cruises

From a land perspective consultation with the following groups will be required:

- Vancouver Parks Board (boat sheds and parking)
- City of Vancouver (utilities)

From a sensitive receptor perspective, no schools, hospitals etc. will be affected by the proposed expansion. It is noted in the Master Plan for the project (Appendix A of this submission), consultation with the Vancouver Harbour Flight Centre seaplane base has been undertaken, flight paths mapped, and navigational approaches outlined, in which no effects on seaplane operations were noted. HMCS Discovery has stated they have no objections to the proposed project (refer to Appendix C). RVYC continue to work with the Vancouver Parks Board regarding parking issues, but in general were supportive of the recent replacement of 7 boat sheds (refer to Appendix D).

As part of the public consultation process associated with the application review by the port authority, the community will be invited to a Public Consultation where they can comment upon this proposal.



## 3 CONSTRUCTION PHASING

### 3.1 Proposed Construction/Removal Schedule

To facilitate the removal of older portions of the marina and reconfigure new portions of the marina (namely removal of old piles, floats, and boat sheds and their replacements), preliminary discussions with marine contractors were undertaken to ascertain the most suitable construction means and methods (specific to phasing schedule). These discussions resulted in the establishment of an eight (8) phased construction (and removal) schedule.

The phasing objective was to:

- Create minimal intrusion into the navigable channel (avoid impacting other stakeholders)
- Minimize intrusion to surrounding users (Vancouver Rowing Club, Bayshore West Marina, Harbour Cruises; Vancouver Rowing Club access to the channel)
- Manage internal disruption to members during expansion and reconfiguration
- Create additional space during construction and removal to internally relocate vessels
- Ease the replacement and or relocation of boat sheds

Most of the membership with vessels within the marina will be accommodated internally, but if situations arise where they cannot be relocated, available slips at the Club's offshore stations will be utilized on a temporary basis.

### 3.2 Construction Staging

The following table outlines the proposed construction/removal/relocation phases associated with the project providing a brief description of the activities, potential implications to other stakeholders using Coal Harbour or RVYC marina operations, and mitigation being proposed to address impacts.

While most activities associated with the expansion are internal to the existing marina, during Phase 1, construction of K float within the expansion area represents the key period in which stakeholders and users may potentially be impacted. The reason for this is that pile driving activities and location of the support barge(s) needed to drive the new piles for K float will be in proximity to, but outside of, the navigational channel.

Table 2 below provides a summary of key activities by phase followed by a series of exhibits (Exhibits 4 to 11) illustrating those activities spatially.

**Table 2: Construction and Demolition Phasing Implications and Mitigation\***

Construction/Demolition Phase	Key Activities	Mitigation and Implications
Phase 1 **	Installation of the new K float specific to the expansion of the marina into the new water lot.	Pile driving and construction activities will require equipment be in place in general, abutting the navigational channel. Detailed construction staging has been undertaken to locate such equipment within the existing or proposed water lot to limit encroachment upon the navigational channel. Marine communication newsletters will be circulated to all stakeholders and an overall marine communication plan (MCP) will be submitted to the port authority for approval. Internally, floats D and E will be replaced.
Phase 2	Removal of all the south side floats that do not meet today's current marina standards.	This is predominantly an internal activity in which poorly aligned floats will be removed, to enable works to be undertaken internally. Specifically, this will include the removal of the south portion of G Float as well as floats F and J. Internal membership communications will be key to this with limited external stakeholder impacts, as all work is internal.
Phase 3	Shift existing G float east. Install new G float. Add new concrete corner to the end of D float and two new concrete fingers at the end of G float. Relocate existing J boat sheds to the end of G float.	This will be predominantly an internal reconfiguration exercise impacting existing RVYC Coal Harbour operations. Limited impacts are anticipated in relation to the navigational channel although infrequent equipment movement will be required that may impact the navigational channel.
Phase 4	Add new concrete float to end of E float. Relocate existing H boat sheds to end of E float. Add new concrete fingers to the east of E float.	This will be an internal reconfiguration impacting existing RVYC Coal Harbour operations. Limited impact is anticipated in relation to the existing navigational channel although equipment will be required.
Phase 5	Remove old G boat sheds. Add new J float and tow in new replacement J boat sheds. Install new concrete fingers on east side of K float. Install new float to connect south end of D float to K float.	This will be predominantly an internal reconfiguration impacting RVYC Coal Harbour Operations. Limited impacts are anticipated to the existing navigational channel as all equipment will be placed within the expansion boundary.
Phase 6	Shift existing fingers east on D float. Tow in new replacement G boat sheds. Install new H float. Relocate existing B boat sheds to new H float.	This will be predominantly an internal reconfiguration impacting the marina. Limited impacts are anticipated to the existing navigational channel as all equipment will be placed within the expansion boundary.
Phase 7	Tow in new replacement H boat sheds and install new concrete finger on H float. Install new fingers.	This will be predominantly an internal reconfiguration impacting RVYC Coal Harbour Operations. Limited impacts are anticipated to the existing navigational channel.
Phase 8	Install new concrete fingers on the existing B float and add new one on the south end of B float. Tow in new replacement boat sheds on the south side of E float. Tow in new replacement	This will be predominantly an internal reconfiguration impacting RVYC Coal Harbour Operations. Limited impacts are anticipated to the existing navigational channel.

---

boat sheds on the north side of E  
float. Place new fingers on the  
expansion area

---

\* As the contractor has yet to be selected, the key activities outlined in Table 2 may change, but in general will follow what is being presented here. Refer to Exhibits 4-11 for Construction/Demolition Staging for actual removal/relocation/replacement of boat sheds and concrete fingers.

\*\* The placement of fingers along K float may occur during either Phase 1 or during Phases 5 and 7 pending the availability of space for barges.

To further support the construction of this proposed marina a detailed construction staging memorandum has been prepared that defines the phases, the location, and types of marine construction equipment that will be used throughout the estimated two-year construction period (refer to Appendix G).



Exhibit 4: Construction/Demolition Staging Phase 1

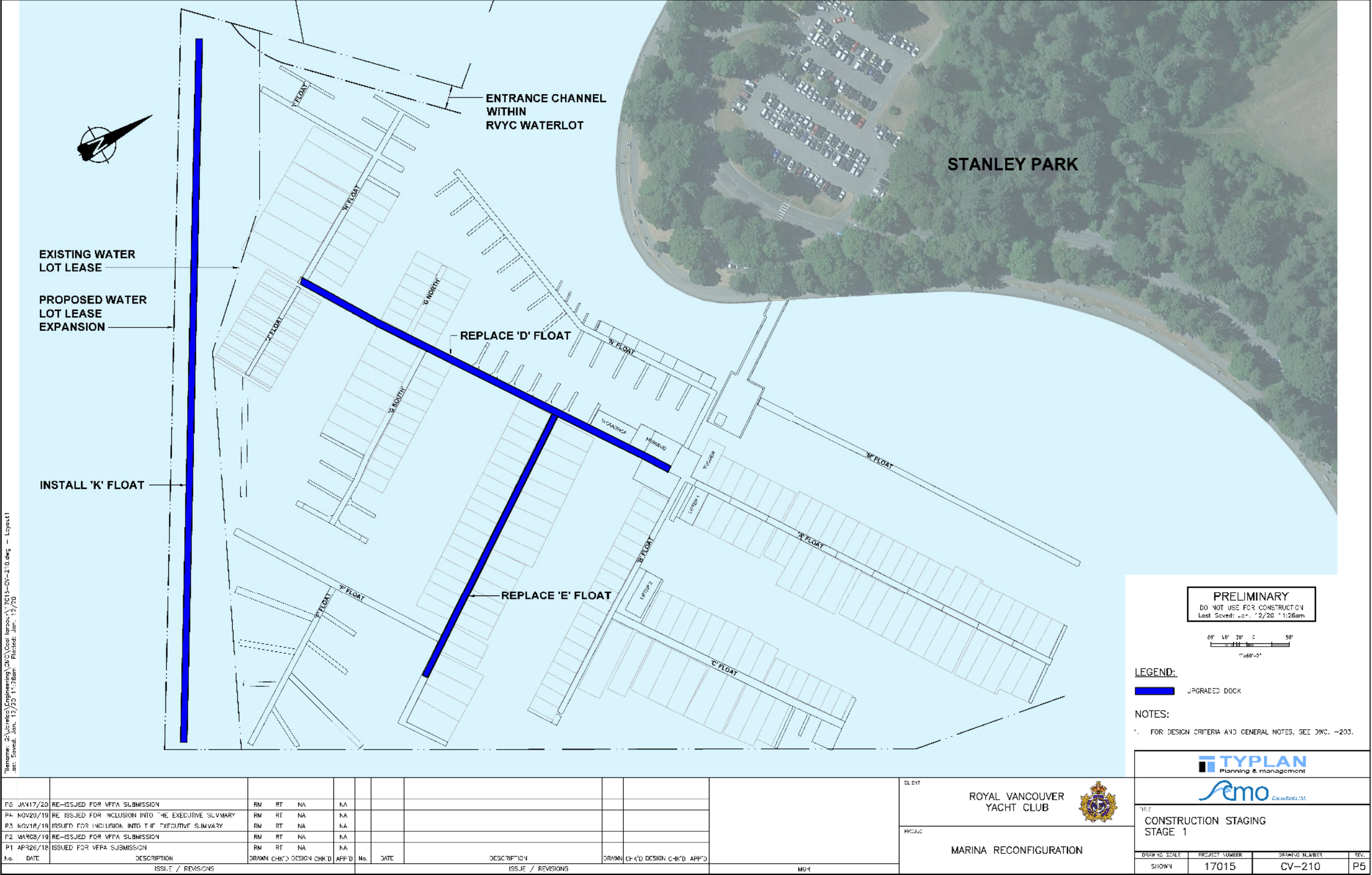








Exhibit 6: Construction/Demolition Staging Phase 3

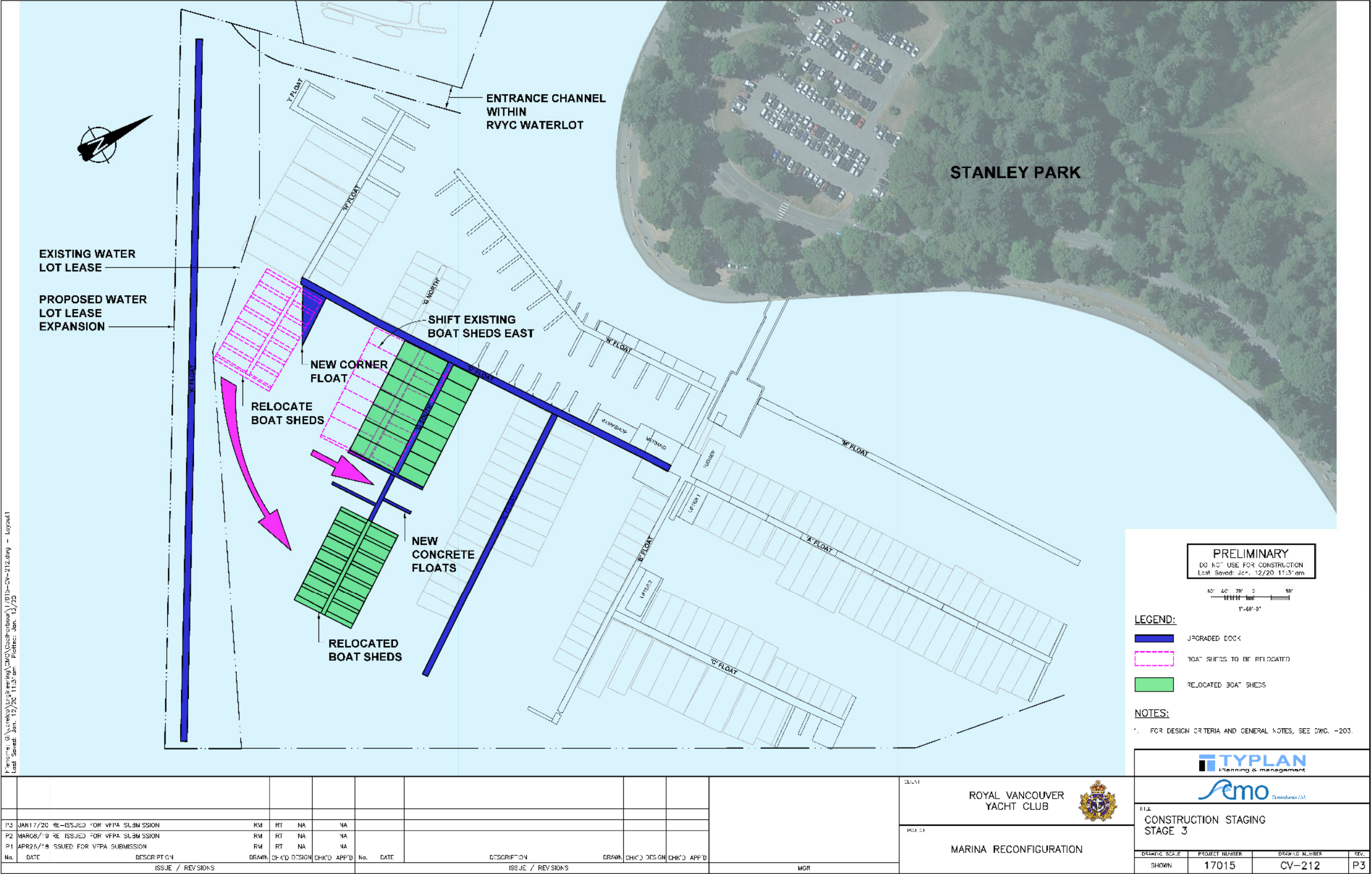




Exhibit 7: Construction/Demolition Staging Phase 4

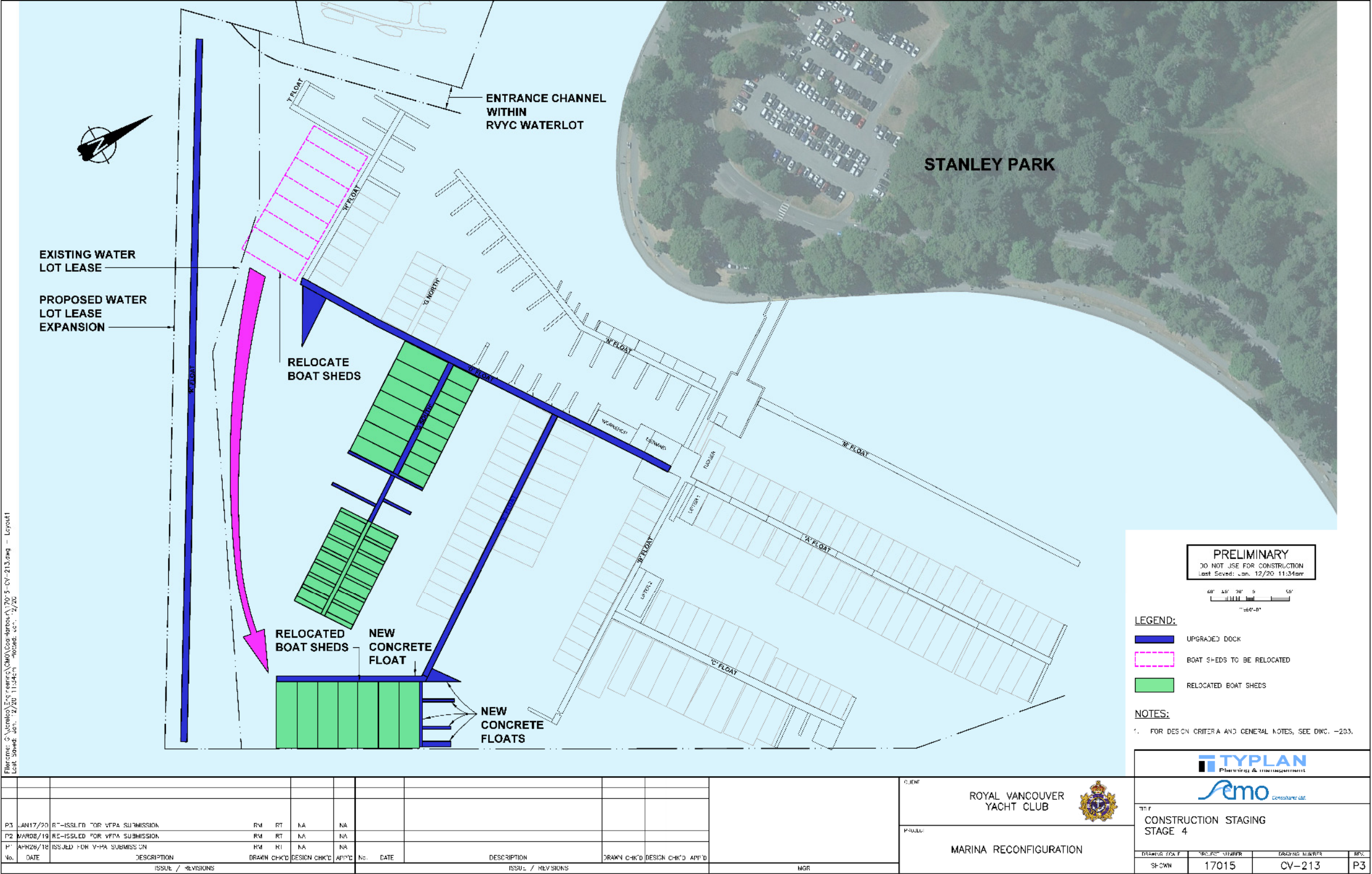




Exhibit 8: Construction/Demolition Staging Phase 5

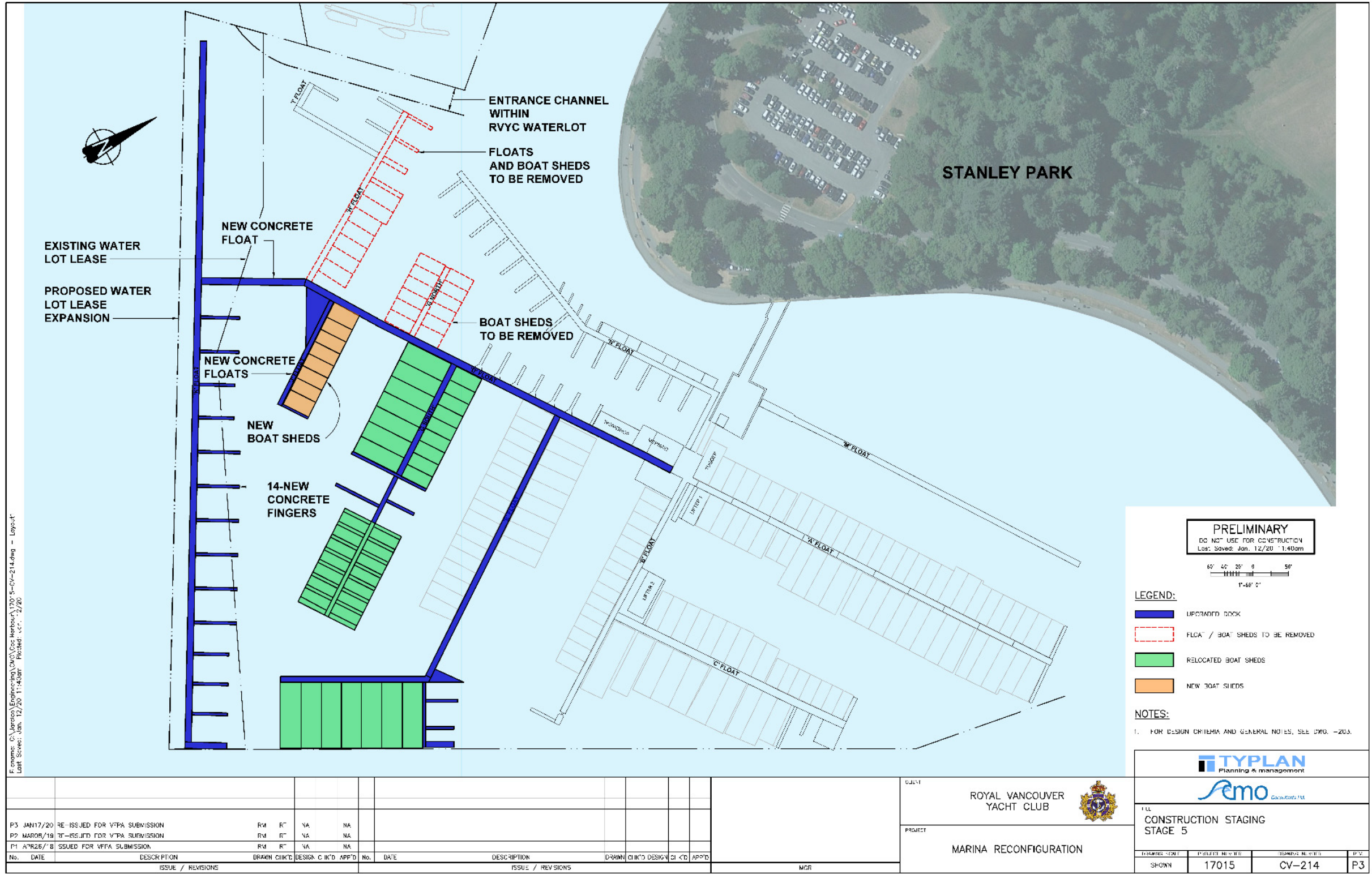




Exhibit 9: Construction/Demolition Staging Phase 6

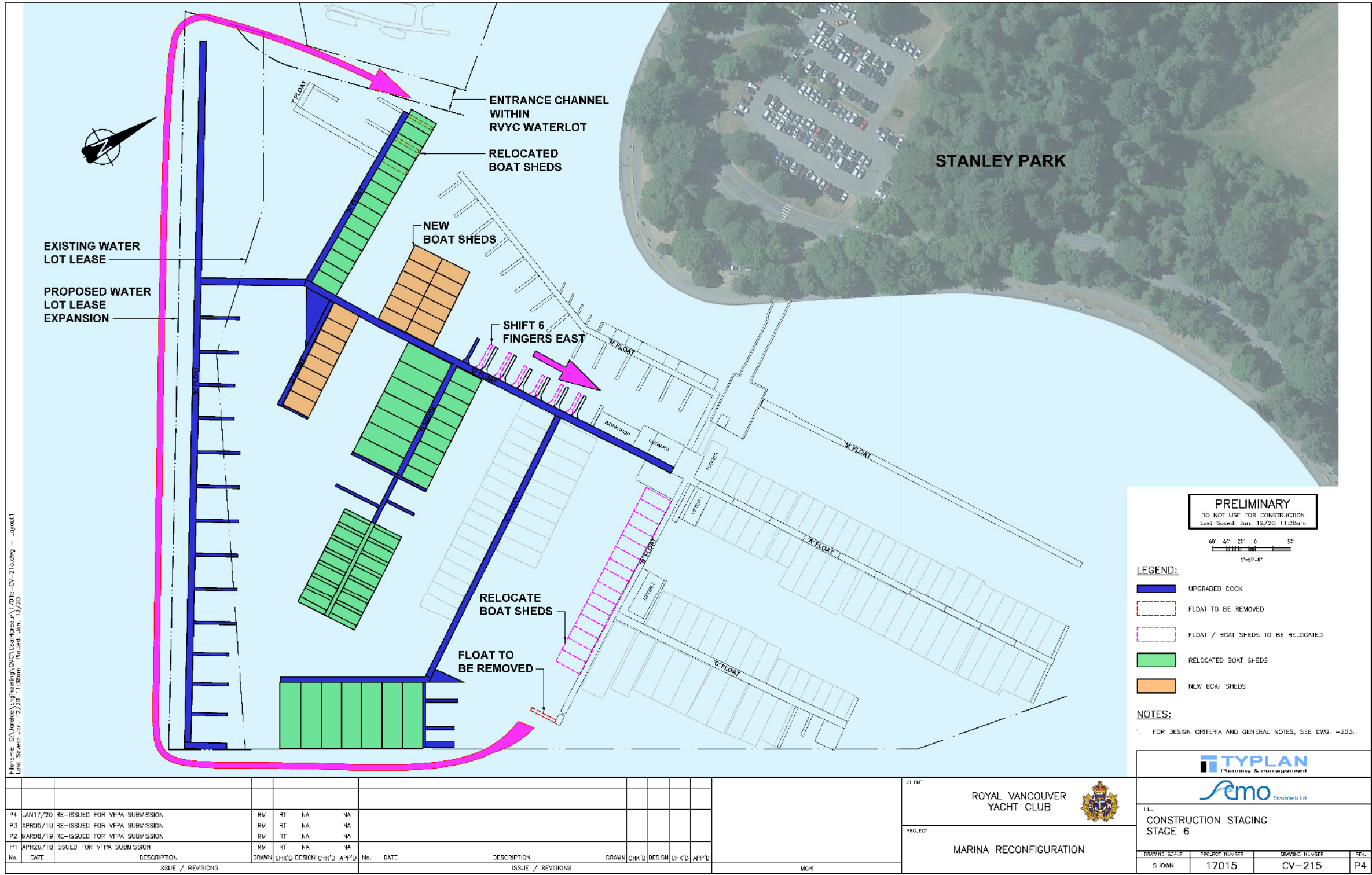
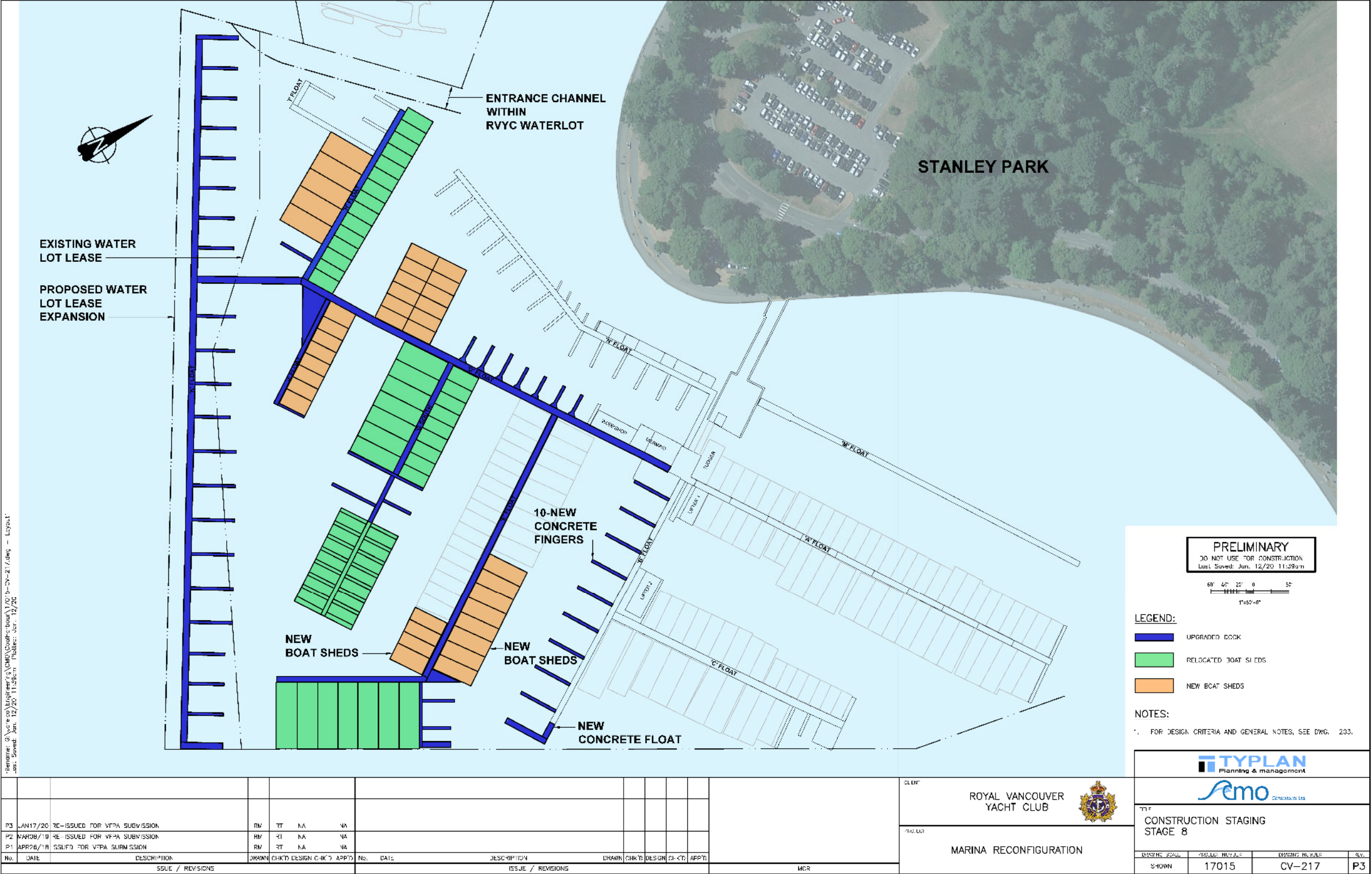








Exhibit 11: Construction/Demolition Staging Phase 8





## 4 PROPOSED MARINA DESIGN PLAN

### 4.1 Site Plan

The Revised Marina Design is based on B.O. Tobiasson and R.C. Kollmeyer, *Marinas and Small Craft Harbors*, 2<sup>nd</sup> edition, 2000 (T&K) design guidelines (refer to Appendix E). The design reflects the T&K guidelines referenced to ensure that adequate turning radii, finger widths and lengths, all satisfy the T&K guidelines that reflect the gold standard in relation to marina design.

The revised marina design inclusive of the reconfiguration of the marina, replacement, and relocation of boat sheds (and navigational design requirements) are illustrated on the exhibit below.

Detailed design notes regarding marina design are presented in Appendix E of this review, providing an outline of the technical work conducted to determine wave, current and wind, design criteria.

For this review the marina design includes the following components (i.e. design criteria refer to notes in the following exhibit), based on:

- Tidal criteria
- Navigational channels
- Speed
- Clearance between marina floats
- Wind speed design
- Wave heights
- Vessel mix and parameters
- Vessel sizes and water depth
- Vessel sizes and average profile heights
- Conceptual marina design
- Costs

1.0 ADDITIONAL WATER LOT AREA

1.1 THE ADDITIONAL WATER LOT AREA IS 97,305ft<sup>2</sup> (9,040ac). 0.904 HECTARES OR 2.21 ACRES, PROVIDED BY AN EXTENSION OF THE OWNER OF THE WATER LOT TOWARDS THE NAVIGATION CHANNEL, AS SHOWN ON THE DRAWINGS:

- 112'-6" (34.3m) FROM THE EAST CORNER OF THE WATER LOT, AND;
- 119'-5" (36.4m) FROM THE WEST CORNER OF THE WATER LOT.

1.2 THE PROPOSED WATER LOT LEASE EXPANSION WAS REVISED BY UTILIZING AN UPDATED NAVIGATION CHANNEL PROVIDED BY THE PORT AUTHORITY ON NOVEMBER 9, 2018. AN AUTOCAD FILE "CHANNEL - COAL HARBOUR - FINAL 2019.DWG" WAS RECEIVED ON 10 - 10 - 2019 CONFIRMING THE CHANNEL DESIGN DETAIL AND LOCATION AS PROVIDED ON NOVEMBER 9, 2018 BY THE PORT AUTHORITY.

2.0 NEW BOAT SLIPS ARE OPEN AND THE NUMBER OF BOAT SHEDS HAS NOT CHANGED IN THE EXPANSION.

### 3.0 WATER LEVELS

3.1 TIDAL ELEVATIONS ARE TO CHART DATUM (CD), DEFINED AS THE LOWEST NORMAL TIDE, USING THE CANADIAN TIDE AND CURRENT TABLES, CANADIAN HYDROGRAPHIC SERVICES, 2018 EDITION, FOR VANCOUVER, AS PROVIDED IN THE FOLLOWING TABLE:

RECORDED EXTREME HIGH WATER LEVEL, (EHWL)	5.6m	CD
HIGHER HIGH WATER LEVEL, LARGE TIDE (HHWL)	5.0m	CD
HIGH WATER LEVEL, MEAN TIDE (HWL)	4.5m	CD
MEAN WATER LEVEL (MWL)	3.1m	CD
LOW WATER LEVEL, MEAN TIDE (LWL)	1.2m	CD
LOWER LOW WATER LEVEL, LARGE TIDE (LLWL)	0.1m	CD
RECORDED EXTREME LOW WATER LEVEL, (ELWL)	-0.4m	CD

3.2 THE INCREASE IN WATER LEVELS BY 2100 DUE TO CLIMATE CHANGE IS APPROXIMATELY 0.6m USING THE AVERAGE PROJECTED SEA-LEVEL CHANGE FOR REPRESENTATIVE CONCENTRATION PATHWAY (RCP) SCENARIO 8.5 (RCP8.5) IN JAMES ET AL. GEOLOGICAL SURVEY OF CANADA OPEN FILE 7942 REPORT "TABULATED VALUES OF RELATIVE SEA-LEVEL PROJECTIONS IN CANADA AND THE ADJACENT MAINLAND UNITED STATES", 2015.

3.3 THE PROJECTIONS FOR SEA-LEVEL CHANGE DUE TO WEST ANTARCTIC ICE SHEET MELTING ARE FOR A FURTHER INCREASE OF 0.65m BY 2100 (JAMES, 2015).

3.4 PILE CUT-OFF ELEVATIONS WILL INCLUDE AN ADDITIONAL 1.25m FOR SEA-LEVEL RISE, AND WILL BE ABOVE THE FLOAT FREEBOARD AT EHWL PLUS A 0.3m SAFETY ALLOWANCE.

#### 4.0 WINDS

#### 4.0 WINDS

4.1 WIND RECORDS FROM 1976 TO 1988 ARE AVAILABLE FROM A RECORDING STATION ON DEADMAN ISLAND ENTITLED VANCOUVER HARBOUR BY ATMOSPHERIC ENVIRONMENT SERVICE, ENVIRONMENT CANADA.

4.2 THE NATIONAL BUILDING CODE OF CANADA (NBCC) PROVIDES THE 1 IN 50 YEAR WIND PRESSURE FOR VANCOUVER AS 0.45 KPA, WHICH CONVERTS TO A WIND SPEED OF 95 KPH FOR ALL DIRECTIONS.

4.3 THE 1 IN 50 YEAR WIND SPEED FOR GENERATING WAVES OVER THE OPEN WATER FETCH TO THE EAST OF THE SITE IS 86 KPH, WHICH IS DETERMINED BY SCALING UP THE VANCOUVER HARBOUR WIND SPEEDS TO MATCH THE NBCC VALUE OF 95 KPH FOR ALL DIRECTIONS.

4.4 THE 1 IN 50 YEAR WIND SPEED FROM THE NW, FOR APPLYING TO K-FLOAT FOR WINDS FROM THE DIRECTION OF LOST LAGOON IS 91 KPH, WHICH IS DETERMINED BY SCALING UP THE VANCOUVER HARBOUR WIND SPEEDS TO MATCH THE NBCC VALUE OF 95 KPH FOR ALL DIRECTIONS.

4.5 THE WIND SPEED FOR ALL OTHER DIRECTIONS IS 70 KPH BASED ON THE VANCOUVER HARBOUR WIND RECORDS.

4.6 THE WIND SPEED FOR CHECKING THAT THE MARINA IS A "CLASS A" MARINA ACCORDING TO THE GUIDELINES OF HARBOUR ACCOMMODATION BY SMALL CRAFT HARBOURS DIRECTORATE, FISHERIES AND OCEANS CANADA, 1985, IS 51 KPH, WHICH IS THE 0.17% EXCEEDANCE WIND SPEED FROM THE EAST AND WHICH IS DETERMINED BY SCALING UP THE VANCOUVER HARBOUR WIND SPEEDS TO MATCH THE NBCC VALUE OF 95 KPH FOR ALL DIRECTIONS.

4.7 WIND SPEEDS ARE ONE HOUR AVERAGES AND ARE AT A HEIGHT OF 10 M ABOVE THE WATER SURFACE.

## 5.0 WAVES

5.1 THE 1 IN 50 YEAR WIND WAVES GENERATED BY THE EAST DIRECTION WINDS HAS A SIGNIFICANT WAVE HEIGHT (HS) OF 0.8 M AND A PEAK SPECTRAL WAVE PERIOD (TP) OF 4.2 SECONDS AT THE SOUTH END OF K-FLOAT.

5.2 THE 0.17% EXCEEDANCE WAVES ARE HS = 0.25 M AND TP = 3.0 SECONDS AT THE SOUTH END OF K-FLOAT WHICH INDICATES THAT THE MARINA IS GENERALLY CLASS A.

5.3 HS IS DEFINED AS THE AVERAGE OF THE HIGHEST 33% OF THE WAVES, WHERE THE WAVE HEIGHT IS THE VERTICAL DISTANCE FROM THE TROUGH TO THE CREST OF THE WAVES. TP IS DEFINED AS THE PERIOD OF THE MOST ENERGETIC WAVES IN THE SEA STATE, WHERE WAVE PERIOD IS THE TIME BETWEEN SUCCESSIVE WAVE CRESTS AT A STATIONARY POINT.

5.4 WAVE HEIGHTS AND PERIODS ARE CALCULATED USING THE PROFESSIONAL COMPUTER PROGRAM MIKE 21 SW DEVELOPED BY DHI.

6.0 BERTH WIDTHS AND VESSEL BEAM AND EFFECTIVE HEIGHT FOR CALCULATING WIND LOADS IS PROVIDED IN B. TOBIASSON AND R. KOLLMEYER "MARINAS AND SMALL CRAFT HARBOURS", 2ND EDITION, 2000 (T&K).

7.0 THE BOAT MIX AND PARAMETERS FOR MARINA BERTH GEOMETRY ARE GIVEN IN THE FOLLOWING TABLE FOR GENERAL GUIDANCE (N/A = NOT APPLICABLE), BASED ON TABLE 10-2 AND FIGURE 10-1 OF T&K.

BOAT LENGTH L (FT)	BOAT BEAM B (FT)	DOUBLE BERTH WIDTH MIN. (FT)	SINGLE BERTH WIDTH MIN. (FT)	MIN. FAIRWAY WIDTH FOR A 12.5% MARINA	MIN. FINGER WIDTH FOR (10% TURN)
80' (24.42)	22' (6.70)	N/A	N/A	N/A	N/A
70' (21.30)	21' (6.40)	N/A	N/A	N/A	N/A
65' (19.80)	20' (6.10)	48' (14.63)	24.75 (7.53)	81' (24.70)	6' (1.83)
60' (18.29)	19' (5.79)	48' (14.63)	24.75 (7.53)	71' (21.63)	6' (1.83)
55' (16.76)	18' (5.49)	42' (12.80)	22' (6.70)	69' (21.03)	6' (1.83)
50' (15.24)	17' (5.18)	38' (11.58)	20' (6.10)	63' (19.20)	5' (1.52)
48' (14.63)	16.5 (5.00)	37' (11.28)	19' (5.79)	60' (18.30)	5' (1.52)
40' (12.20)	15' (4.57)	34' (10.36)	18' (5.49)	50' (15.24)	4' (1.22)
30' (9.14)	12' (3.70)	27' (8.23)	15' (4.57)	36' (11.00)	3' (0.91)

## 8.0 BOAT SIZES FOR CALCULATING WIND LOADED AREAS

BOAT LENGTH L FT (m)	AVERAGE PROFILE HEIGHT, FT (m)
80' (24.4m)	14' (4.3m)
70' (21.3m)	13' (4m)
60' (18.3m)	12' (3.7m)
50' (15.2m)	11' (3.4m)
40' (12.2m)	9' (2.7m)
30' (9.1m)	7' (2.1m)

8.1 THE WIND LOADS ON K-FLOAT BOATS AND PILES ARE CHECKED FOR VESSELS WITH HIGHER FREEBOARDS AS PROVIDED IN FIGURE 10-7 OF T&K ENTITLED MOTORYACHT AND MEGAYACHT LOA VERSUS VERTICAL HEIGHT FOR WINDS FROM THE NW.

9.0 BOAT SIZES AND DRAFT BASED ON TABLE 12-1 AND FIGURE 10-6 OF T&K:

BOAT LENGTH L FT (m)	DRAFT FT (m)	
	POWER BOATS	SAIL BOATS
80' (24.4m)	7.5' (2.3m)	14' (4.3m)
70' (21.3m)	7' (2.1m)	13' (4m)
60' (18.3m)	6' (1.8m)	11.5' (3.5m)
50' (15.2m)	5.5' (1.7m)	10' (3m)
40' (12.2m)	5' (1.5m)	8' (2.4m)
30' (9.1m)	4' (1.2m)	6' (1.8m)

100' 50' 0 100'

1'' = 100' - 0''

PRELIMINARY  
DO NOT USE FOR CONSTRUCTION  
Last Saved: Feb. 07/20 9:19am

LEGEND:

 UPGRADED DOCK

NEW AND RELOCATED BOAT SHEDS



TITLE  
PROPOSED MARINA PLAN  
DESIGN CRITERIA  
AND GENERAL NOTES

DRAWING SCALE	PROJECT NUMBER	DRAWING NUMBER	REV.
SHOWN	17015	CV-203	P8

P8	FEB07/20	RE--ISSUED FOR VFPA SUBMISSION	RM	RT	NA	NA									
P7	JAN17/20	RE--ISSUED FOR VFPA SUBMISSION	RM	RT	NA	NA									
P6	SEP17/19	RE--ISSUED FOR VFPA SUBMISSION	RM	RT	NA	NA									
P5	AUG20/19	RE--ISSUED FOR VFPA SUBMISSION	RM	RT	NA	NA									
P4	JUL19/19	RE--ISSUED FOR VFPA SUBMISSION	RM	RT	NA	NA									
P3	JUN11/19	RE--ISSUED FOR VFPA SUBMISSION	RM	RT	NA	NA									
P2	MAR08/19	RE--ISSUED FOR VFPA SUBMISSION	RM	RT	NA	NA									
No.	DATE	DESCRIPTION	DRAWN	CHK'D	DESIGN	CHK'D	APP'D	No.	DATE	DESCRIPTION	DRAWN	CHK'D	DESIGN	CHK'D	APP'D
ISSUE / REVISIONS							ISSUE / REVISIONS								

CLIENT

ROYAL VANCOUVER  
YACHT CLUB



MARINA RECONFIGURATION

## 4.2 Lease Expansion Area

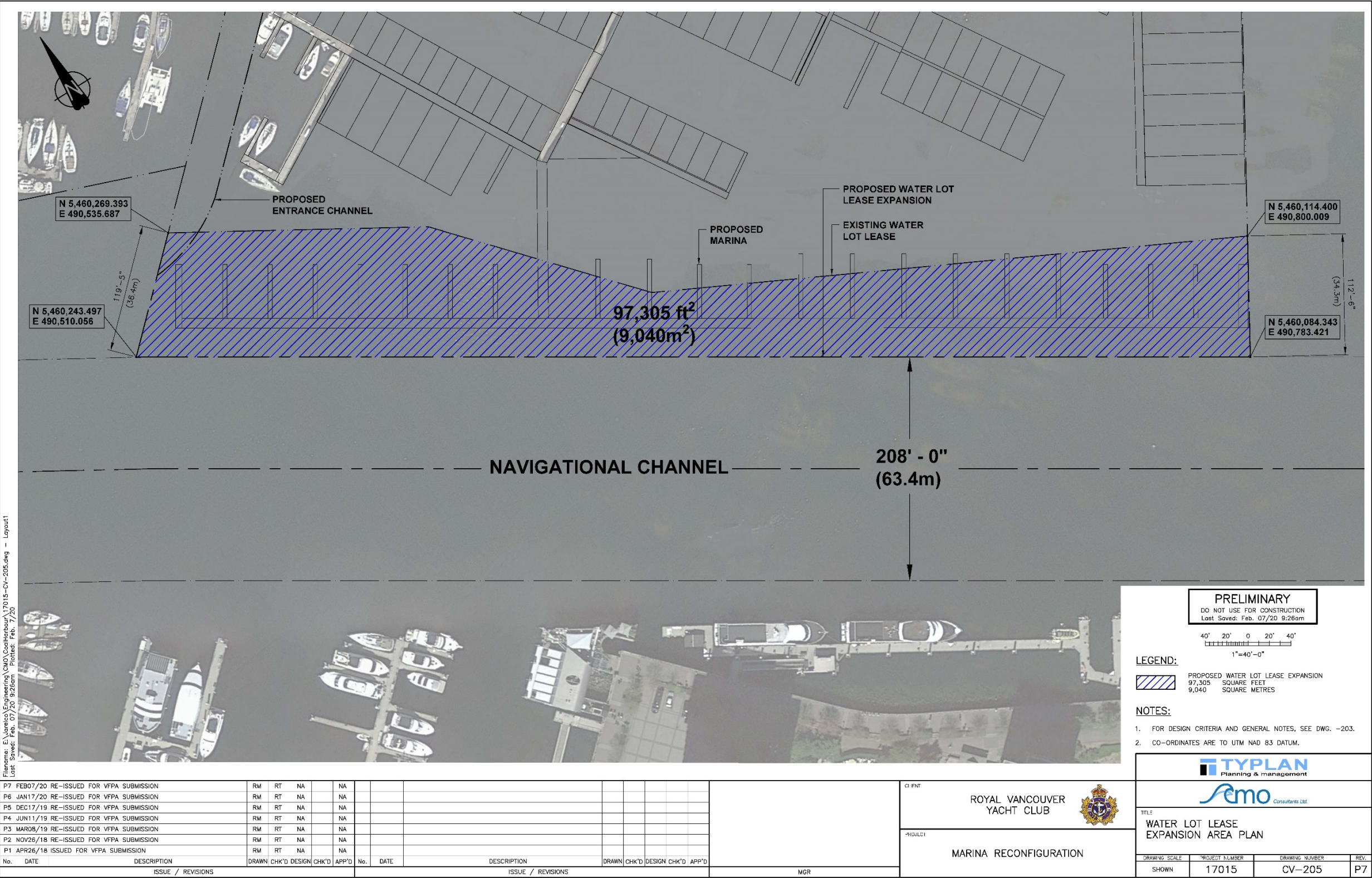
The existing water lot lease area is 730,762 sq. ft. / 67,890 m<sup>2</sup>, the proposed expansion area is 97,306 sq. ft. / 9,040 m<sup>2</sup> and the total expanded water lot area is 828,068 sq. ft. / 76,930 m<sup>2</sup>, representing an increase of 13.3%. The expansion area also defined the water lot area available in relation to the channel's design. Refer to Appendix A for the detail associated with the Coal Harbour Marina Expansion Project Master Plan and Appendix B for Proposed Expansion Project Navigation Channel Design.

The channel design was accepted by the port authority in November of 2017, and the application for expansion of Coal Harbour was deemed complete by the port authority on December 12, 2018.

The proposed lease area expansion as well as the recommended navigational channel design is illustrated on the exhibit below:



Exhibit 13: Coal Harbour Lease Area / Channel Design



### 4.3 Navigation Channel Design

The Coal Harbour navigational channel was accepted by the port to meet international standards, as set out in the 2014 World Association of Waterborne Transport Infrastructure (PIANC), *Harbour Approach Channels – Design Guidelines*. PIANC standards are international standards that the port authority uses when designing channels. Further, design of the Coal Harbour channel also incorporates standards for rowing as set out by the International Rowing Association (FISA). Channel designs help the port authority to determine areas for safe navigation and assists in considering proposed lease boundary amendments. Refer to Appendix A for the detail associated with the Coal Harbour Marina Expansion Project Master Plan and Appendix B for Proposed Expansion Project Navigational Channel Design, for details. The administrative navigational channel design is 63.4 m, as illustrated in Exhibit 14 below.



Exhibit 14: Coal Harbour Channel Design



For illustrative purposes only. Sourced from a Google Earth KMZ file, depicted from a 3D view.

## 4.4 Traffic Impact Assessment (Marine Vehicular Access/Egress)

The port authority has established guidelines for traffic impact studies as outlined in the PER process Guidelines for Transportation (December 2015).

Accordingly, the port authority's guidelines for traffic impact studies should assess existing and projected (hourly) traffic volumes (hourly projections) and how proposed volume will impact current road conditions, including traffic safety. Specific to the proposed expansion of the Coal Harbour Marina traffic impacts:

- marine access/egress to and from the proposed marina to the navigational channel.
- vehicular traffic increases projected based on the required increase in parking to support the expanded slips in the marina. The additional parking requirements were utilized to estimate the number of additional vehicular trips that would be generated. The number of vehicular trips is based on estimated recreational boating usage standards.

It is noted that a comprehensive Traffic Impact Assessment is not required in that the vehicular trips associated with expansion project is minimal, as outlined below.

### 4.4.1 Marine Access and Egress

The design considered the relationship between ingress and egress to and from the marina in relation to the navigational channel. To limit potential conflicts between vessel ingress and egress internally, and to minimize potential disruption to rowers, only two points of ingress and egress are proposed from the internal moorage at the marina. Internally, newsletters and information bulletins will be circulated to all members to ensure they are aware of the administrative rowing lanes and operational rules to protect rowers as well as no wake signs. Those vessels mooring on the outside of the new float will be provided specific mooring procedures to minimize conflict with rowers.

As part of the overall design, the reconfigured marina ensures that adequate turning radii and manoeuvring ability was accommodated for in accordance with the standards established by the T&K Guidebook. As illustrated on Exhibits 3 through 11, the overall marina design process, a navigational channel to support ingress and egress within the RVYC water lot has been created. The ingress and egress to and from the marina and the internal circulation patterns are illustrated on the following exhibit.







#### 4.4.2 Vehicular Access, Parking and Traffic Volumes

There are currently 320 slips in the marina that require 160 parking spaces (as per zoning bylaw requirements). Parking is currently accommodated in a lot abutting the marina (see Exhibit 16) and adjacent parking lots within Stanley Park. The resultant increase in 47 slips requires that 24 parking spaces (rounded up from 23.5) are required that are easily accommodated for within the existing and adjacent lots within Stanley Park.

RVYC requires members to taxi to the Club if they plan on extended cruises. Parking standards for marina is based on the following:

City of Vancouver Parking Bylaw Section 4.2.4.9 *"A minimum of one space for every two mooring slips"*.

B.O. Tobiasson and R.C. Kollmeyer, *Marinas and Small Craft Harbors*, 2nd edition, 2000, *"One car parking space for every two boat slips is quite adequate as a national guideline for most high use weekends."*

There are approximately 2,483 available parking spaces within Stanley Park and they currently operate at 25% capacity (source: Vancouver Parks Board). The additional parking does not impact capacity.

The 2011 National Recreational Boating Survey (NRBS), published by the United States Coast Guard, Boating Organization ([www.uscgboating.org](http://www.uscgboating.org)) represents the first in a series of reports that convey the results of the inaugural recreational boating survey. The 2011 NRBS report focuses on overall boating participation, boat ownership, the types of boats used, and the amount of time that boats are used (e.g., person-hours on recreational boats) for different regions of the US.

Key results presented in the report are utilized in this review as a proxy for boating habits associated with RVYC with the objective to estimate the number of vehicular trips that would be generated because of 47 additional moorage slips. Per Table 27 of the NRBS states the average number of days a power boat is used is 19.3.

Accordingly, with an additional 47 slips, the following calculation applies:

- **47 vessels x 19.3 trips x 2 vehicular trips (to and from the marina) = 1,814.2 vehicular trips.**

It is noted that the additional traffic generated by the 47 slips is not considered to cause an issue with traffic volumes nor parking.



## 4.5 Marine Structures

There are two construction activities required to support the proposed marina project that have implications for existing operations and include:

- a) Removal of piles and replacement with new steel piles to reconfigure the marina (new floats); and
- b) Removal and replacement of boat sheds.

The removal and replacement of piles (and installation of new floats) and the removal, replacement, and reconfiguration of boat sheds are discussed below. It is noted that the floats and the boat sheds are being constructed off site.

To support the detailed design required for pile driving and the design of the marina, a seismic refraction, bathymetry and sub bottom acoustic profiling survey was undertaken. Refer to Appendix F.

### 4.5.1 Removal and Replacement of Piles and New Floats

The existing pile plan and the proposed pile plan associated with the marina reconfiguration are provided on the following Exhibits 17 and 18. The table below provides a summary of the existing and proposed pile plan in relation to the number and type of piles that will be removed and replaced. It is noted that pursuant to the RVYC sustainability policy that 85 creosote piles will be removed from the existing marina being replaced by some form of steel pile. Old floats will be replaced with new ones and Appendix I provides design drawings for the typical floats.

**Table 3: Total Number of Piles by Pile Type removed and re-used**

Pile Type	Number of Piles Removed	Total New/Reused
Creosote Timber	85	
H steel piles	23	
12.75-inch cylindrical steel (reused)	24	24
16-inch cylindrical steel (new)		48
12.75-inch cylindrical steel (new)		35
10.75-inch cylindrical steel (new)		22
<b>Total piles removed</b>	<b>132</b>	<b>Total new /reused piles 129</b>



Exhibit 17: Existing Pile Plan

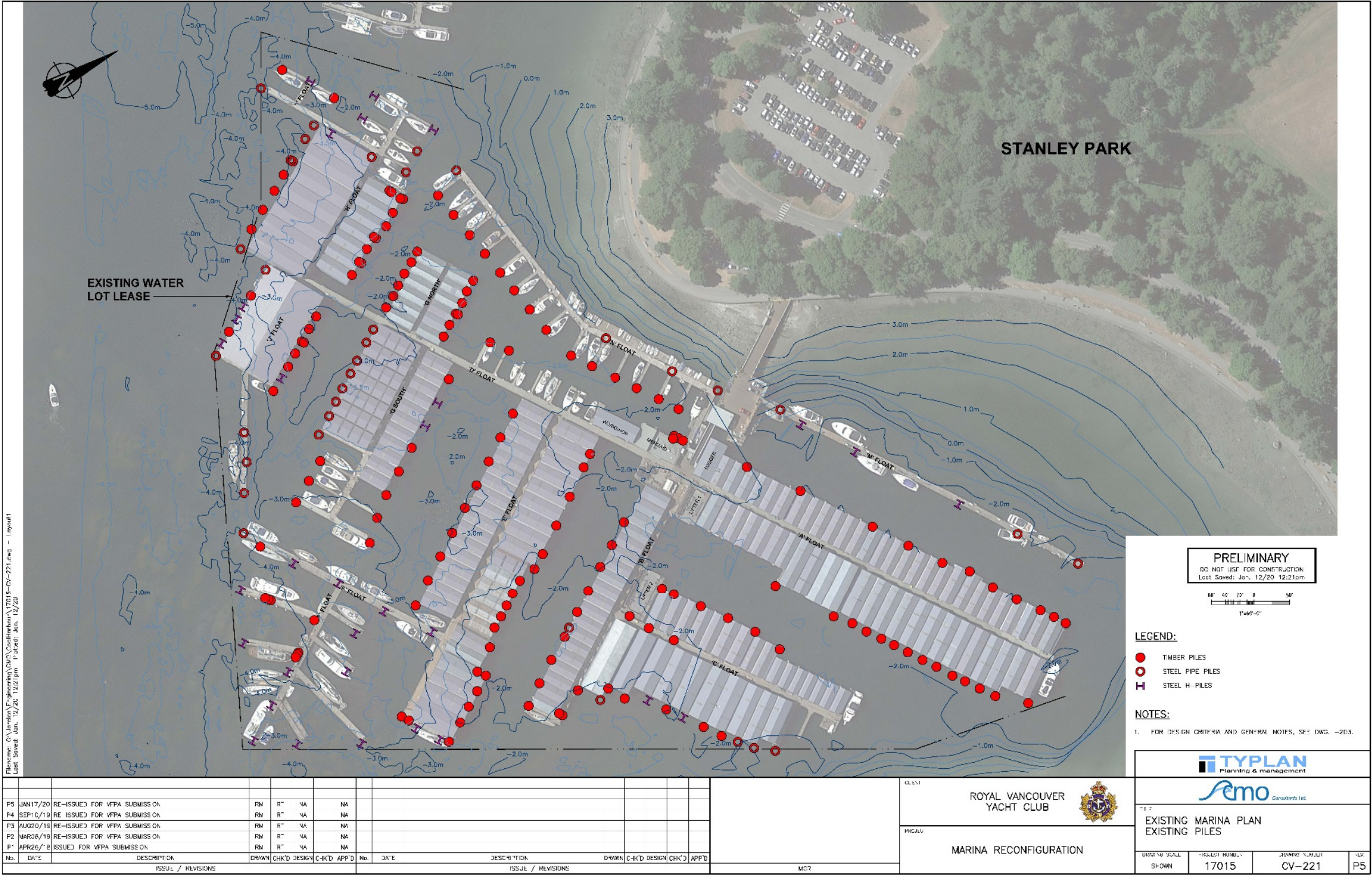
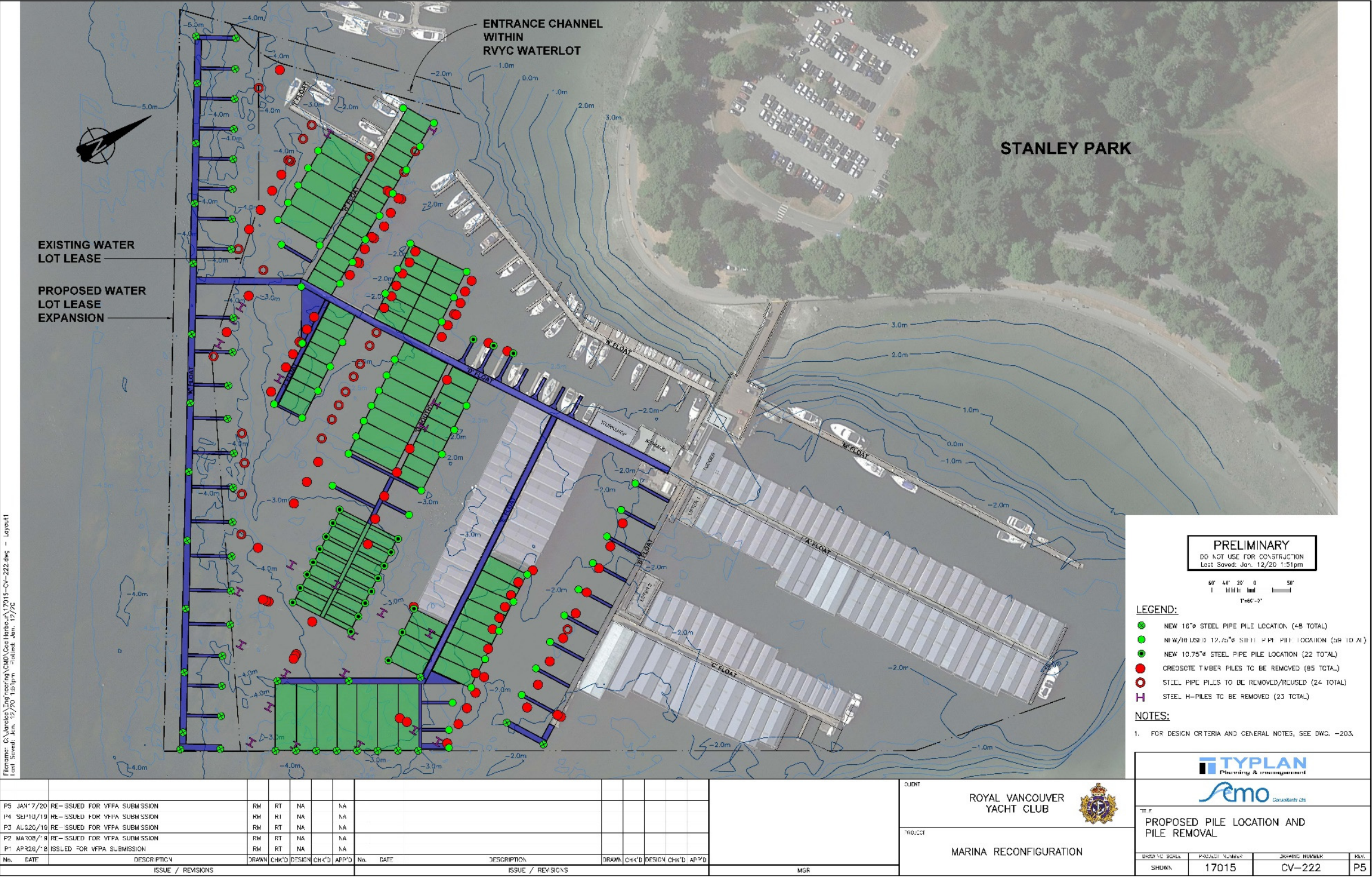




Exhibit 18: Proposed Pile Locations and Pile Removals





## 4.5.2 Removal and Replacement of Boat Sheds

This section provides a summary description of the removal and replacement of the boat sheds and illustrates spatially where those changes are to occur.

Today 192 boat sheds reside in the marina, 37 of which will be replaced (of the same design, colour, but varying heights), resulting in the same number of boat sheds post project construction.

This section also includes the applicants' assessment of the view corridor impacts resultant from the relocation of the boat sheds specific to views from Stanley Park Drive on the skyline of Vancouver. Provided is an illustration of the pre and post view corridor impacts considering the height of boat sheds in relation to the current vessel superstructures.

Appendix J provides design drawings based on the maximum boat shed height of 25' / 7.6 m for those boat sheds being replaced (as denoted in Appendix J). It is noted that the majority of proposed boat shed replacements range from 16.5' / 5.1 m in height to 25' / 7.6 m (refer to page 36 for actual heights by float). In comparison, the maximum height of an existing vessel superstructure in Coal Harbour is 24' / 7.2 m in height. However, the existing boat sheds on H float (31' / 9.4 m in height) will be relocated to the new F float in between G and E float. The relocated H float boat sheds to F float represent the highest boat sheds already existing in the marina. As such heights are already evident and accepted by the community, and as a result of the boat sheds being sited further away from Stanley Park, no noticeable impacts to view and shade will be evident. The natural massing of the Stanley Park treeline and the Vancouver skyline will further limit any view impacts. No impacts on shade will be evident. Sensitive land uses are more than 492' / 150 m away.

### 4.5.2.1 View Corridors and View and Shade Impacts

A key improvement and an integral part of the marina's renewal will be the removal of old, dilapidated boat sheds that are to be replaced by new ones. The plan is to remove and replace those boat sheds so that post construction the same number of boat sheds will be evident, albeit improved and with the most ecofriendly attributes.

The style of the boat sheds will remain consistent with the boat sheds within the existing marina to limit visual disruption. As part of the project submission marine boat sheds details and marine framing was provided to the port authority for approval. The removal and replacement of the boat sheds envisioned for this review are consistent with those as per applied in 2011 under PER 2011-70 and approved by the port authority.

As part of the design process view corridors from Stanley Park to downtown have been studied. Three view corridors have been identified based on those pedestrians, cyclists and motorists driving along Stanley Park Drive within Stanley Park, that enjoy the view of the Vancouver Skyline. The view corridors include between:

- floats J and G;
- floats E and G; and
- floats B and E.

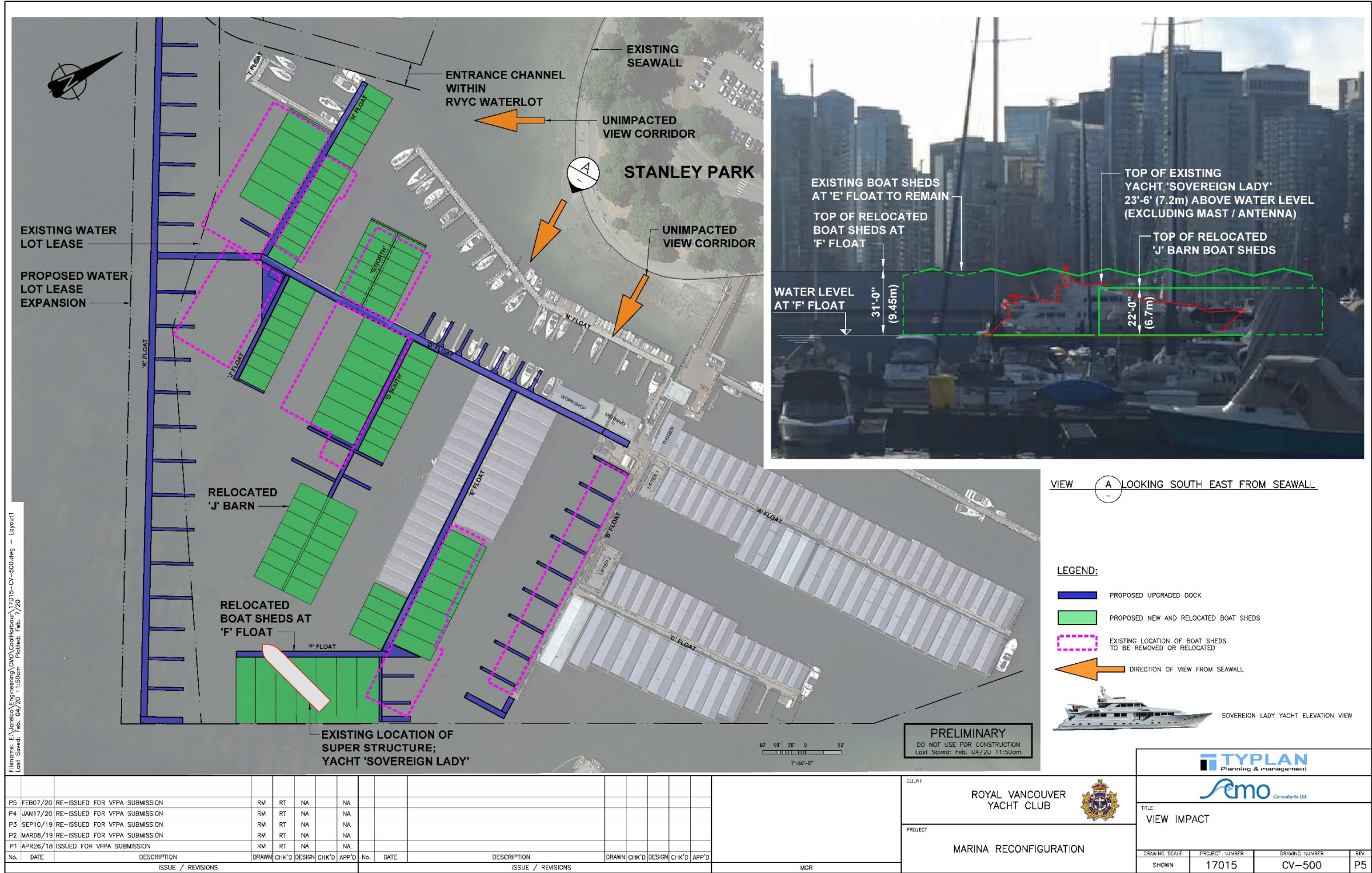
The heights of the replacement boat sheds by float are as follows:

- H Float (west): 25' (7.6 m)
- J Float: 16.5' (5.1 m)
- G Float (north): 16.5' (5.1 m)
- E Float (west): 17' (5.2 m)
- E Float (east): 22' (6.7 m)

The following exhibit illustrates the view corridors and the suggested view impacts associated with the relocation of the boat sheds between G and F floats.

A similar exhibit has been presented for views from the Vancouver waterfront or esplanade to the proposed marina expansion (refer to Exhibit 20). It is noted no impacts are anticipated.

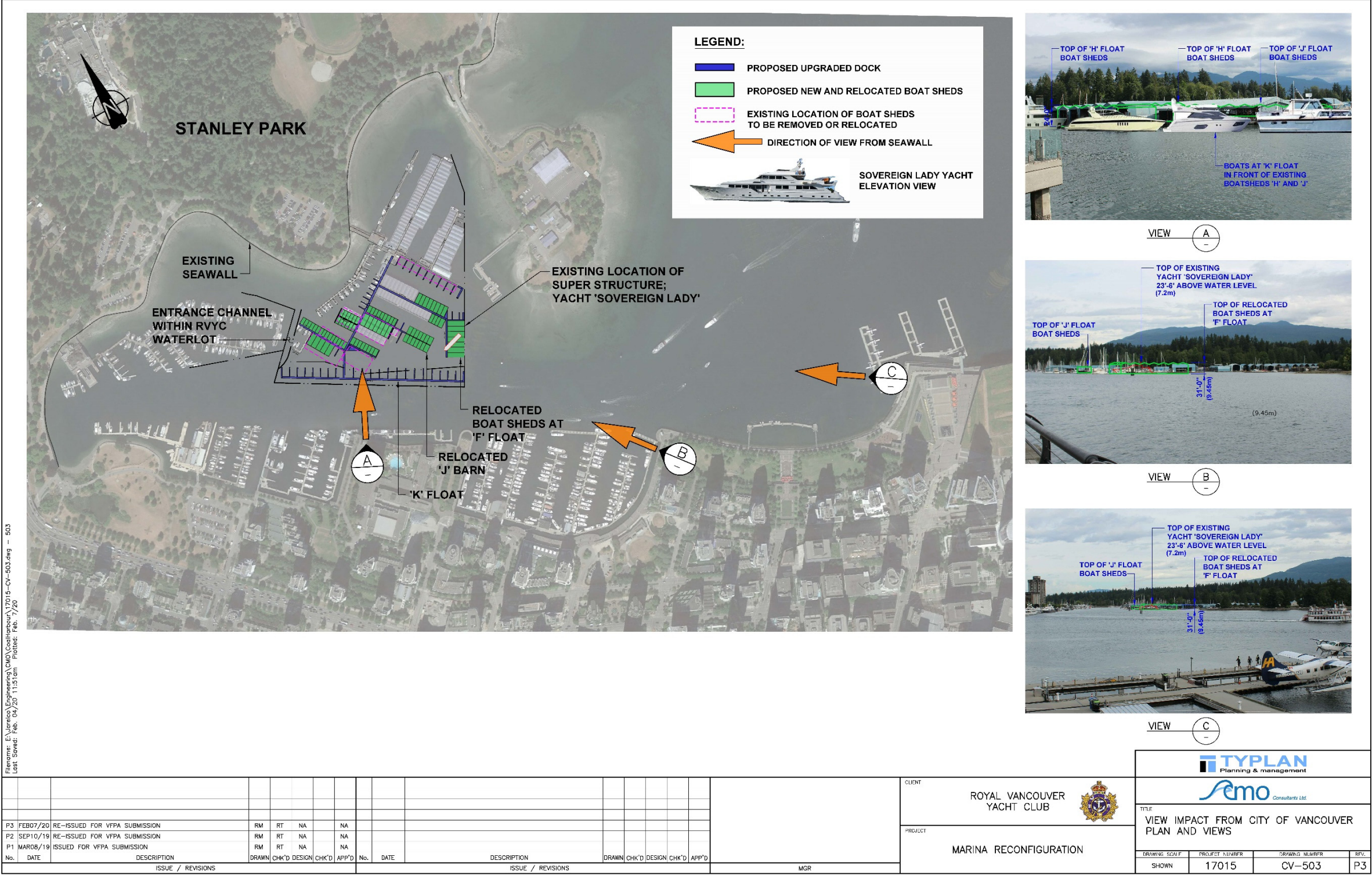
Exhibit 19: View Corridors and Sightlines from Stanley Park





In addition to potential views from Stanley Park, views from Vancouver towards Stanley Park have also been considered and are presented on the exhibit below (refer to Exhibit 20).

Exhibit 20: Views from the City of Vancouver



Details of the view and shade impacts in accordance with the port authority's guidelines are presented in Appendix K.

In terms of the 37 boat sheds being removed, the locations, length, width, and height, are presented in the following table.

**Table 4: Existing Boat Sheds to be removed**

Location	Length	Width	Height	Number of Sheds
H Float (east)	50.5' / 15.4 m	20.5' / 6.3 m	25' / 7.6 m	7
G Float (north)	40' / 12.2 m	18' / 5.5 m	16.5' / 5.1 m	12
G Float (east)	40.5' / 12.4 m	18' / 5.5 m	16.5' / 5.1 m	2
E Float (east)	50.5' / 15.4 m	20' / 6.1 m	17' / 5.2 m	8
E Float (east)	69' / 21 m	18' / 5.5 m	22' / 6.7 m	4
B Float (west)	40' / 12.2 m	18' / 5.5 m	17' / 5.2 m	4
<b>Total</b>				<b>37</b>

Based on the information provided above and the stated heights of the proposed replacement boat sheds, it is our observation that the existing view corridors between Stanley Park and downtown Vancouver will not be impacted as a result of the boat shed configuration and subsequent replacement of 37 boat sheds.

From a port authority view and shade guideline perspective, limited impacts will be noted namely due to the linear distances between the marina to either Stanley Park or downtown Vancouver. It is concluded that view and shade guidelines do not apply in context to the expansion project.

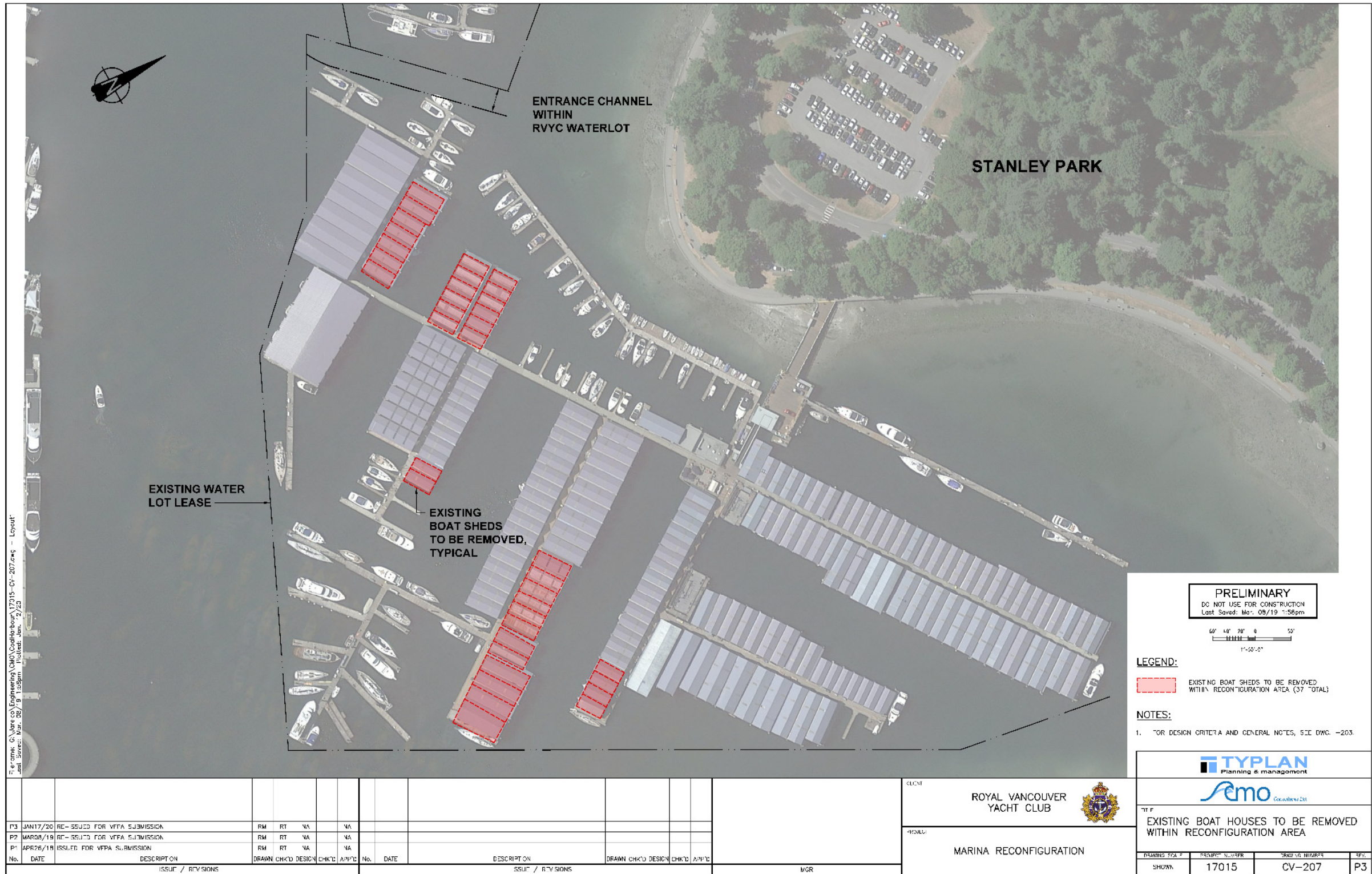
The next two exhibits illustrate the boat sheds affected as a result of the proposed expansion and the boat sheds being removed based on the existing site plan.







Exhibit 22: Existing Boat Sheds to be removed within the Reconfiguration Area





## 5 UTILITIES

RVYC has prepared, based on the revised layout and the accompanying mechanical, water, fire protection, and electrical design drawings:

- an Emergency Response Plan; and
- a Fire and Life Safety Report.

Please refer to Appendix L (Emergency Response Plan) and Appendix M (Fire and Life Safety Report) respectively for details.

### 5.1 Mechanical: Existing Water Supply and Fire Protection

As part of project feasibility, the existing water supply and fire protection plan was assessed and subsequently upgraded to satisfy current regulations established by the City of Vancouver.

Domestic water and fire protection pipe:

- a) There is an existing 4-inch diameter water line which serves both domestic water and fire protection. The distribution currently is a combined system where the water is drained when the temperature drops below freezing.
- b) The marina floats are being upgraded to concrete floats. Additional boat slips are added. TAG Engineering calculations show the existing 4-inch diameter connection from the City of Vancouver is adequate to accommodate increased capacity.
- c) The incoming 4-inch combined fire and water line will remain unchanged. The backflow prevention devices will be changed and reconfigured to bifurcate the system in the water entry/mechanical room to allow for separation of domestic water and fire prevention. The plan is to separate the domestic water and fire in phased construction.

Sanitary piping:

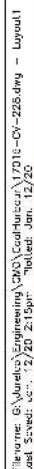
- a) Existing sanitary is pumped to the city mains.
- b) Sanitary lines in general will remain unchanged. A barrier free washroom is being added to meet current Marina building codes. All work will meet the 2015 National Building Code requirements.
- c) The current sanitary system is adequate to handle the addition of one washroom.

The water supply and fire protection design drawings are presented in Appendix N.

Exhibit 23: Mechanical: Existing Water Supply and Fire Protection







## 5.2 Electrical

The existing and proposed electrical plans are presented below. In 2011 RVYC undertook a comprehensive upgrade (which was approved by the port authority) upon which the following existing and proposed electrical systems have been prepared.

RVYC's Coal Harbour marina was originally serviced from a BC Hydro transformer located near the Seawall close to the access ramp to the Club. Over the years, as the vessels became larger and the electrical requirements increased, RVYC was faced with localized brownouts during colder winter nights due to the limitation of the Hydro transformer. Hydro would not increase the size of this transformer as the regulations indicated a maximum size of 500KVA. RVYC opted to pay for the increase in transformer size with the result that the BC Hydro transformer was removed and a new RVYC-owned transformer was installed. The size of the new transformer is 1250 KV based on a future estimate of electrical growth. Original marina design was based on 320 slips. These slips are a combination with enclosed shelters and open areas with electrical services based on the individual requirements of the members. The new configuration increases the number of slips by 47. This increase requires a complete reconfiguration of the marina with new dock facilities and associated electrical facilities as outlined on the drawings.

The reconfiguration of the marina will utilize illuminated pedestals for the open slips and miniature panels for the enclosed boat sheds. The wiring of the slips will be upgraded to current electrical standards as outlined by the 2015 Canadian Electrical Code.

Appendix O provides details on the new electrical distribution layout plan.











### 5.3 Lighting Plan

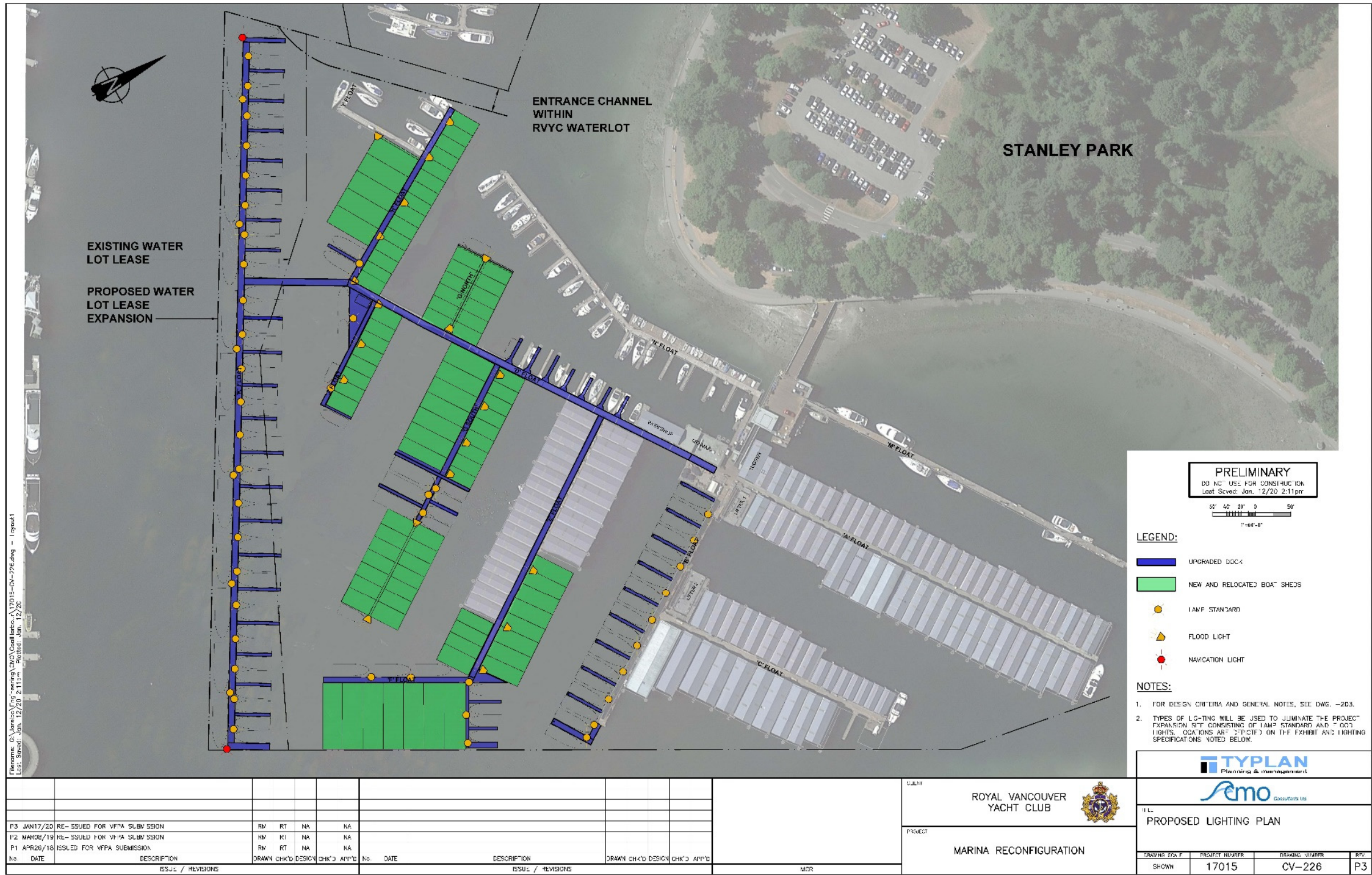
The Lighting Plan is illustrated on the following exhibit, specifications associated with the overall lighting types and specifications are presented in Appendix P of this review.

The port authority's Project and Environmental Review (PER) process has established Guidelines for Lighting (July 2015), which are intended to assist applicants to determine outdoor lighting requirements and/or provide direction regarding whether a comprehensive Outdoor Lighting Plan is required to be submitted by a proponent. The port authority has concerns that poorly designed or installed outdoor lighting may cause concerns with residents and or community groups, create unsafe and unpleasant conditions, impair the productive use of port authority property and tenants' facilities, or may result in unnecessary use of electric power. The guidelines provide information and guidance relating to the design, installation and operation of lighting proposed through the port authority's PER process.

The Lighting Plan is illustrated on the following exhibit, specifications associated with the overall lighting types and specifications are presented in Appendix P of this review. The existing marina has been illuminated with various sources that have appeared to have been popular during the various development stages in this facility's development. In some cases, wall mounted flood lights have been utilized with some glare. The incorporation of blue light stations for security has mandated that newer lighting systems utilize hidden light sources with lower level illumination to soften the transition from the surrounding darkness of the water to the lighted floats. This will be achieved with lower level lights located in the bollards and wall mounted lighting units that incorporate hidden sources to eliminate glare to the surrounding areas.

The lighting installation will be phased in with the float construction and will incorporate integral photocells, where feasible, to illuminate the floats during low lighting periods.

Exhibit 27: Lighting Plan





## 6 AQUATIC IMPACT ASSESSMENT

An aquatic assessment has been prepared to satisfy the requirements outlined in the port authority Habitat Assessment Guidelines (July 2015). The detailed habitat assessment (entitled Biophysical Survey of Subtidal Habitat at RVYC's Coal Harbour Proposed Marina Reconfiguration) is included as Appendix Q of this review and was undertaken by Seacology Environmental Consulting (Seacology). As noted in the port authority PER Habitat Assessment guidelines for Category C and D reviews, the appropriate format for presenting the habitat assessment will be determined by the port authority in consultation with the applicant during the preliminary review phase. Seacology has been in discussion with port authority staff regarding the technical requirements associated with the habitat assessment.

Seacology conducted substrate and biota survey of the area in and around the RVYC Coal Harbour Marina in Vancouver Harbour between March 6 and 7, 2018. Work was completed in anticipation of a proposed float realignment. Eight transects were positioned and deployed to best survey sites that are proposed to be covered with the newly positioned boat sheds and floats to accommodate infrastructure. Two additional meandering transects were completed at depths where eelgrass was discovered close to the shallow end of transect T2W. The eelgrass is located outside of the existing and proposed water lot. One eelgrass shoot was discovered near transect T5 and is not impacted. No endangered marine biota was observed during the survey. Diatom brown colorization was observed covering 90% of the substrate. Other marine biota observed was typical of the primarily soft bottom habitat at the time of year of the survey. Time of year and lack of suitable substrate limited macro algae presence. An invasive tunicate was observed on piles supporting the existing float and replacement.

Commercial and ceremonial biota was observed, including flounders, a green urchin, California sea cucumbers, dungeness and red rock crabs, bivalves, and chitons and anemones. Anthropogenic debris on the substrate included: glass jars, glass bottles, plastic including containers and small metal object corrugated aluminum, steel beams, and creosote preserved wooden piles (broken piles).

The following provides an overview of the findings illustrating Bivalve Siphon Density, combined Algae Cover and boulders and debris. Refer to Appendix Q for a detailed report.

A Construction and Environmental Management Plan (CEMP) has been prepared to address construction and environmental practices associated with the project. Refer to Appendix R.

Exhibit 28: Bivalve Siphon Density

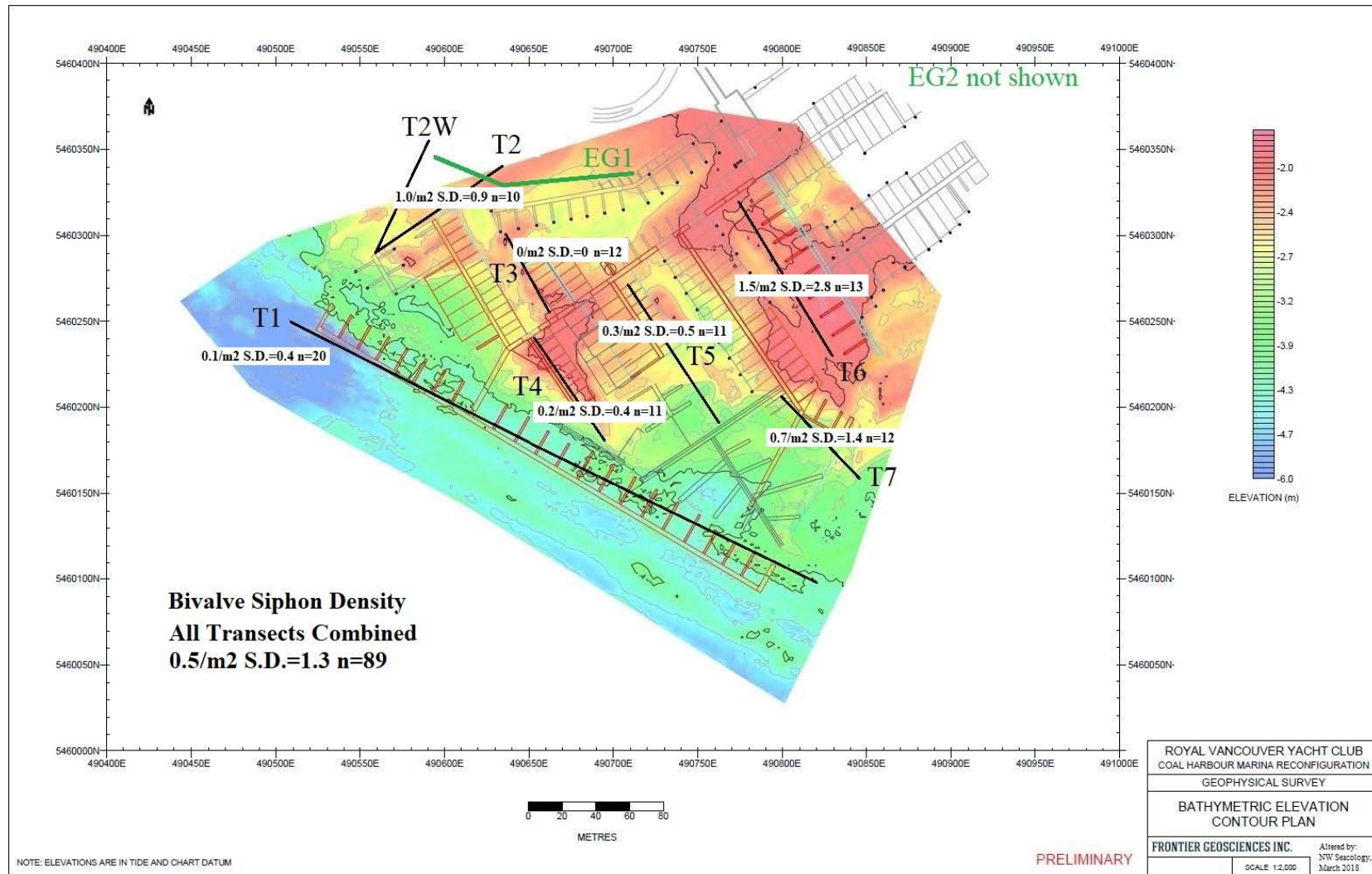




Exhibit 29: Combined Algae Cover

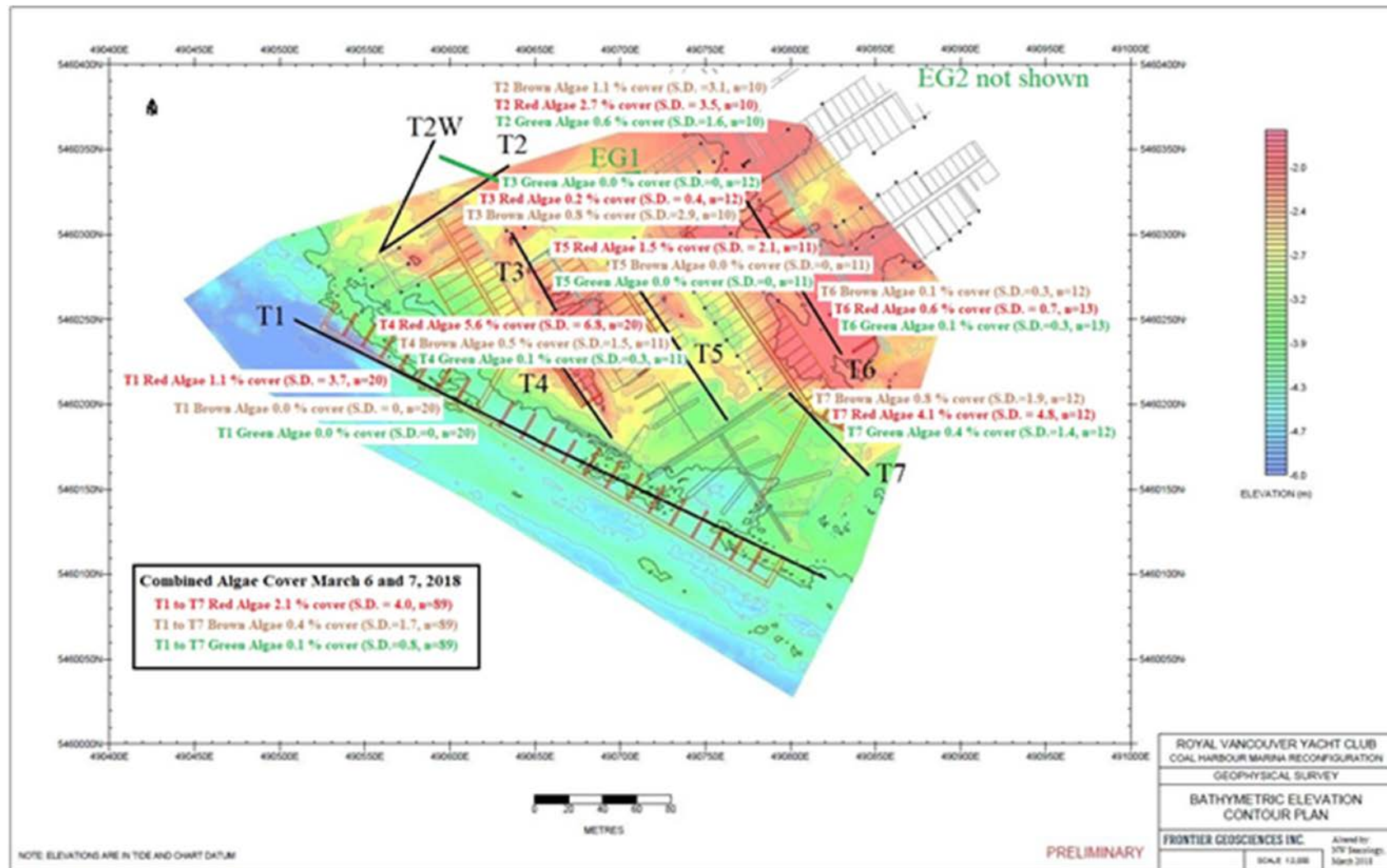
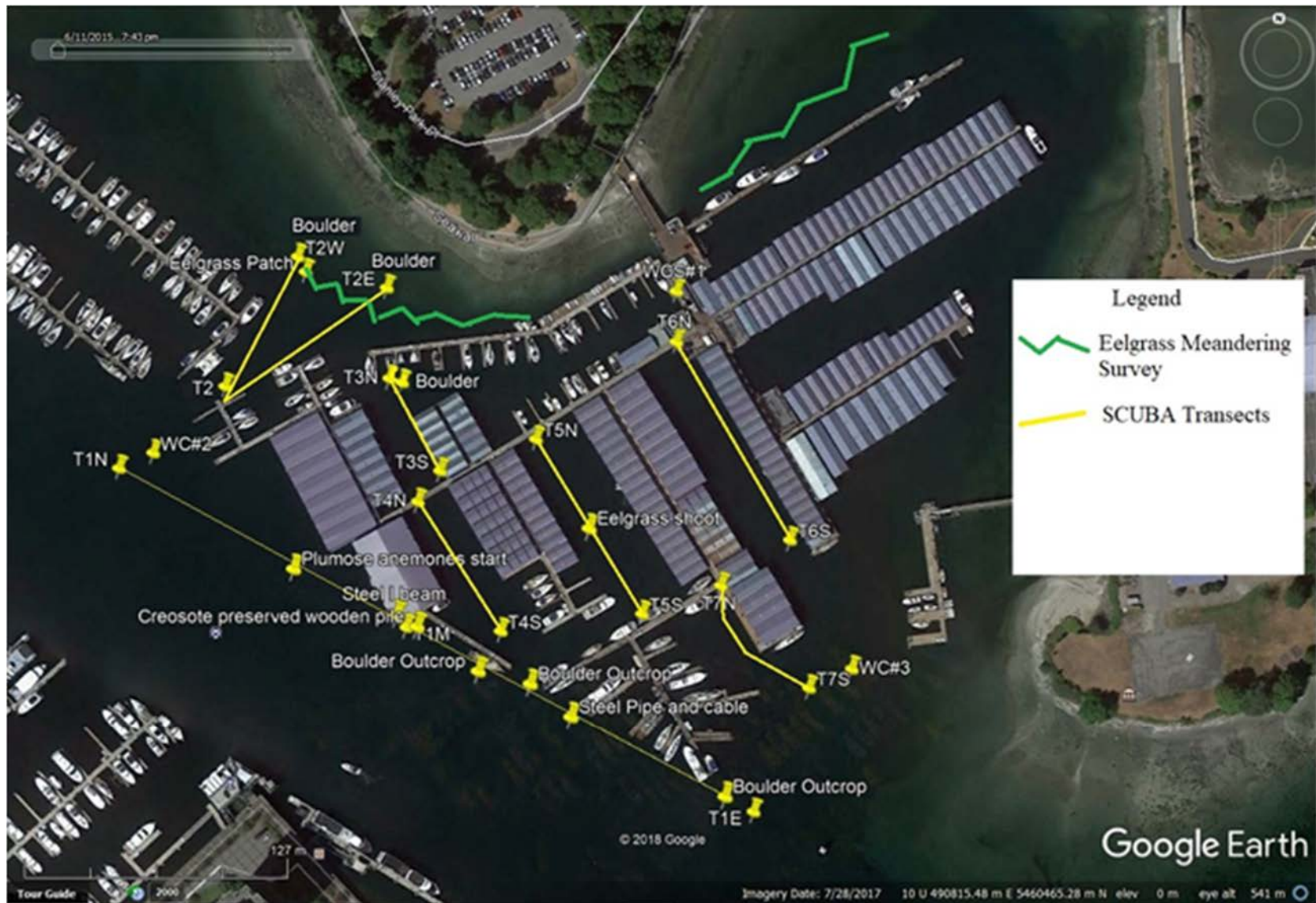


Exhibit 30: Boulders and Anthropogenic Debris





## 7 ENVIRONMENTAL NOISE ASSESSMENT

The port authority requires that the project applicant undertake an Environmental Noise Assessment Screening Study, that may lead to a more detailed technical study associated with the port authority PER. Category C and D projects should consider reflecting and be in accordance with the Environmental Noise Assessment (ENA) Guidelines (ENA) (July 2015), specifically completing Appendix i and ii of the guidelines. The ENA is provided in Appendix S of this report.

### 7.1 Port Authority Environmental Noise Assessment Guidelines: Appendix i and Appendix ii Worksheet Assessment

The ENA has been submitted herewith as part of the Coal Harbour Marina Expansion Project, Project Application documentation, following the general outline presented in the ENA document for Category C projects as part of a PER Application Guide. It is noted that the preliminary noise screening procedures (following Appendix I and Appendix II of the ENA) as well as a summary of record of community consultation related to noise complaints has been provided. The table below presents the results of the ENA worksheet project score.

**Table 5: Environmental Noise Assessment Project Score**

No	Attribute of Project or Project Setting	Questionnaire Score	Importance Weighting	Weighted Score
1	New Activity	1	1.2	1.2
2	Noise Levels Expected on Project Site	1	1.8	1.8
3	Presence of Undesirable Characteristics	0	1.6	0
4	Presence of High Energy Impulsive Noise	0	1.6	0
5	Hours/days of Operation	1	1.2	1.2
6	Proximity to Noise Sensitive Areas	3	1.6	4.8
7	Presence or Noise Shielding for Reflection	2	1.8	3.6
8	Baseline Noise environment	4	1.6	6.4
9	Population Potentially Exposed to Project Noise	5	1.0	5
10	Level of Community Concern	1	1.2	1.2
<b>Total Weighted Project Score</b>				<b>25.2</b>

The total weighted average score as defined by the ENA guidelines is 25.2 therefore in accordance with the ENA (refer to Table 1 of the ENA Guidelines) no further action is required as part of this project permit submission.

## 7.2 South Australia Environmental Protection Agency (EPA) Assessment of small-scale marinas and boating facilities

To further support the review of this project from a noise (nuisance) perspective we have referenced the Australian EPA guidelines related to the assessment of small-scale marinas and boating facilities and provided a spatial map to clarify distance separations according the EPA:

*“A separation distance of 100 m is recommended for marina and boating facilities for fewer than 5 vessels and 200 m for facilities with between 5-50 vessels. A vessel separation distance of 300 m is recommended where works for the repair of maintenance or vessels with the capability to handle fewer than five vessels of less than 12 m in length.”*

It is noted that the key noise source is the machinery associated with the boat lift which is only utilized for cleaning and minor maintenance. The exhibit below (Exhibit 31) illustrates for context.

## 7.3 Community Complaints

Consultation with both RVYC’s Marine Asset Manager and RVYC’s Harbour Master at Coal Harbour, confirmed that there have been no community complaints regarding noise at the Coal Harbour Marina.





## 8 STAKEHOLDER AND COMMUNITY CONSULTATION PLANS

This section outlines the existing and proposed consultation activities and plans being undertaken by RVYC for the following:

- Stakeholders
- Community

### 8.1 Stakeholders

Key stakeholders that will be consulted regarding the proposed Marina Project include but will not be limited to:

- Deadman's Island Vancouver's Naval Reserve Division, HMCS Discovery
- Vancouver Rowing Club
- Harbour Cruises
- Vancouver Parks Board
- Vancouver Harbour Flight Centre, previously Vancouver Harbour Water Airport or Vancouver Coal Harbour Seaplane Base (IATA: CXH, ICAO: CYHC)

Based on consultation undertaken as part of the Coal Harbour Master Plan process, we have a clear understanding of the issues the various stakeholders identified, and these are presented in the table below.

**Table 6: Key Stakeholders**

Key Stakeholder	Issue	Comments and Follow Up
Vancouver Naval Reserve Division HMCS Discovery	Potential impact on HMCS Discovery and other naval operations.	No concerns regarding project expansion were identified. Requested being consulted during construction.
Vancouver Rowing Club	VRC opposes the marina expansion as it was felt rowing was not being accommodated despite the inclusion of two 13.5 m rowing lanes as per FISA guidelines.	RVYC met with VRC three times during the planning phase of project development to discuss expansion and identify mitigative measures such as a rowing traffic scheme and awareness plan. VRC continues to oppose the project.
Harbour Cruises	Concern regarding the ability of Harbour Cruise vessels to manoeuvre in the channel.	The proposed expansion does not impede the ability of Harbour Cruises to manoeuvre in the channel as it is located immediately east of the manoeuvring basin Harbour Cruises use.
Vancouver Parks Board (VPB)	Parking.	Based on the availability of parking throughout Stanley Park and current utilization patterns, parking was not a concern to the VPB. RVYC has initiated programs to limit member parking requirements by promoting drop-off service, taxi service, and off-site parking at other city locations.
Vancouver Harbour Flight Centre	Impact to operations.	A meeting confirmed that the expansion project would not impact flight operations. No additional follow up required.



## 8.2 Community

A public consultation period of 15 business days will be undertaken for the proposed project in accordance with the port authority's Public Consultation Guidelines. During the comment period an in-person meeting will be undertaken. This will provide an opportunity for the public to learn more and ask project specific questions. All project materials, including application documents and material posted for the in-person session will be available via the RVYC website. Additional comments from the public can be submitted via online questionnaire on the RVYC website.

Following the close of the public consultation period a consultation summary and consideration report will be drafted and presented to the port authority for review and approval. Once approved, this document will also be posted on the RVYC website.

## 9 APPENDICES

Appendix A	Coal Harbour Marina Expansion Project Master Plan
Appendix B	RVYC Proposed Expansion Project Navigation Channel Design
Appendix C	HMCS Discovery Letter of Support
Appendix D	Vancouver Parks Board Letter
Appendix E	Marina Design
Appendix F	Marine Seismic Refraction, Bathymetry and Sub-Bottom Acoustic Profiling Survey Report
Appendix G	Detailed Construction Staging Memorandum
Appendix H	Rowing Technical Memorandum
Appendix I	Dock and Float Design
Appendix J	Boat Shed Design
Appendix K	View and Shade Technical Memorandum
Appendix L	Royal Vancouver Yacht Club Emergency Response Plan
Appendix M	Fire and Life Safety Report
Appendix N	Water Supply and Fire Protection Drawings
Appendix O	New Electrical Distribution Layout Drawings
Appendix P	Lighting Plan
Appendix Q	Biophysical Survey of Subtidal Habitat
Appendix R	Construction Environmental Management Plan (CEMP)
Appendix S	Environmental Noise Assessment



# APPENDIX A

## Coal Harbour Marina Expansion Project Master Plan

## **APPENDIX B**

### **RVYC Proposed Expansion Project Navigation Channel Design**

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## **APPENDIX C**

### **HMCS Discovery Letter of Support**

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## **APPENDIX D**

### **Vancouver Parks Board Letter**

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## **APPENDIX E**

### **Marina Design**

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## **APPENDIX F**

### **Marine Seismic Refraction, Bathymetry and Sub-Bottom Acoustic Profiling Survey Report**

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## **APPENDIX G**

### **Detailed Construction Staging Memorandum**

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## **APPENDIX H**

### **Rowing Technical Memorandum**

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# APPENDIX I

## Dock and Float Design

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## **APPENDIX J**

### **Boat Shed Design**

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## **APPENDIX K**

### **View and Shade Technical Memorandum**

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## **APPENDIX L**

### **Royal Vancouver Yacht Club Emergency Response Plan**

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## **APPENDIX M**

### **Fire and Life Safety Report**

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## **APPENDIX N**

### **Water Supply and Fire Protection Drawings**

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## **APPENDIX O**

### **New Electrical Distribution Layout Drawings**

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## APPENDIX P

### Lighting Plan

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## **APPENDIX Q**

### **Biophysical Survey of Subtidal Habitat**

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## **APPENDIX R**

### **Construction Environmental Management Plan (CEMP)**

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## **APPENDIX S**

### **Environmental Noise Assessment**

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