Royal Vancouver Yacht Club

Coal Harbour Marina Expansion Project: Aquatic Effects Assessment

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

BC	British Columbia
BMP(s)	Best Management Practices
CDC	Conservation Data Centre
CEMP	Construction Environmental Management Plan
CRA	Commercial, Recreational or Aboriginal
CRIMS	Coastal Resources Information System
DFO	Department of Fisheries and Oceans Canada
EM	Environmental Monitor
HWM	High Water Mark
LLW	Low Low Water
MOE	Ministry of Environment
MTBE	Methyl Tertiary-Butyl Ether
MVRD	Metro Vancouver Regional District
MWLAP	Ministry of Water, Land and Air Protection
PAH(s)	Polycyclic Aromatic Hydrocarbons
PCB(s)	Polychlorinated Biphenyls
QEP	Qualified Environmental Professional
RPBio	Registered Professional Biologist
RVYC	Royal Vancouver Yacht Club
SARA	*Species at Risk Act*
SCUBA	Self-Contained Underwater Breathing Apparatus
TSS	Total Suspended Solids
Port authority	Vancouver Fraser Port Authority

UNITS

dB	Decibel
km	Kilometer
kPa	Kilopascal
m^2	Square metre
NTU	Nephelometric Turbidity Unit
ppt	Parts per Thousand
µg/g	Micrograms per gram

1.0 INTRODUCTION

The Royal Vancouver Yacht Club (RVYC) is proposing the expansion and improvement of the Coal Harbour Marina facilities, Vancouver, British Columbia (**Figure 1**). The following Aquatic Effects Assessment was conducted to determine if a Section 35 *Fisheries Act* Authorization for 'serious harm to fish' may be required for the Coal Harbour Marina Expansion Project (the project). The assessment also supports the guidelines established by the Vancouver Fraser Port Authority for Habitat Assessment (port authority, 2015), as part of the Project and Environmental Review process.

1.1 Objectives

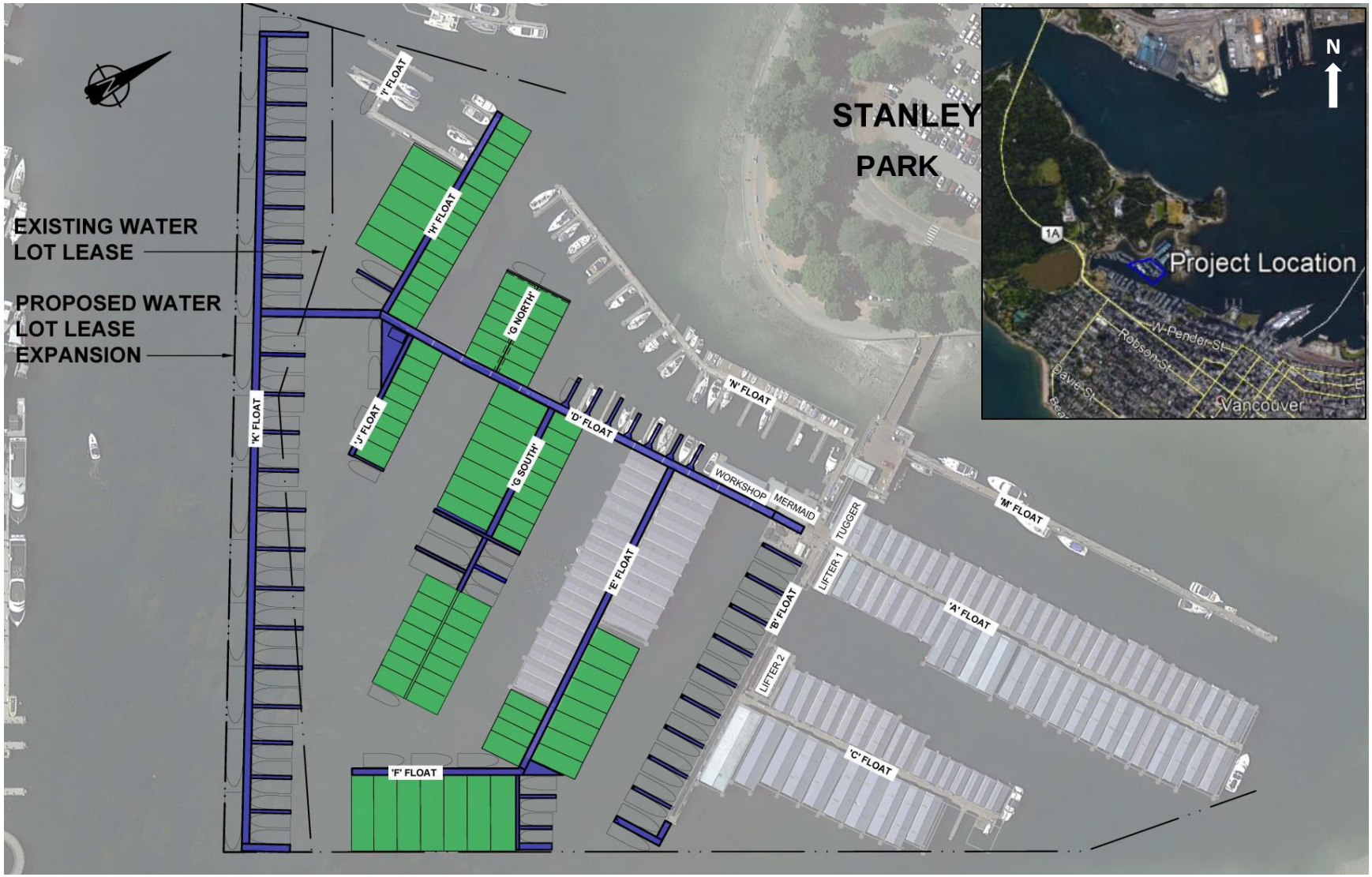
The objectives of the Aquatic Effects Assessment are to:

- Characterize the marine habitats in the project location, and identify resources, sensitive habitat and species of concern that may be affected by project activities;
- Assess potential for adverse effects to fish and fish habitat that may result from the project;
- Identify measures to avoid and/or mitigate potential adverse effects to fish and fish habitat; and,
- Assess potential residual serious harm to fish (i.e., following the implementation of mitigation).

1.2 Statement of Limitations

This Aquatic Effects Assessment was prepared by a qualified environmental professional (QEP), based on the project description provided by TyPlan Planning and Management, information provided in the *Biophysical Survey of Subtidal Habitat at Royal Vancouver Yacht Club's, Coal Harbour Proposed Marina Reconfiguration* report (Seacology, 2018) and relevant historical information available for the project area. This work was performed to current industry standard practice for similar environmental work, within the relevant jurisdiction and same locale. The conclusions and recommendations contained in this report are based upon the applicable guidelines, regulations, and legislation existing at the time the report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

Figure 1 Project Location



2.0 BACKGROUND

2.1 Project Location

The Royal Vancouver Yacht Club Coal Harbour Marina (the project site) is located in Coal Harbour, west of Deadman's Island (site of HMCS Discovery Naval Reserve Division) and east of the Vancouver Rowing Club, Vancouver, BC (**Figure 1**). It is bounded by Stanley Park to the north (including the Seawall pedestrian walkway and Stanley Park Drive), and by the Coal Harbour Navigation Channel to the south (and beyond, a section of the city's waterfront). The marina provides 326 slips, along with other mooring amenities and services. Refer to *Coal Harbour Marina Expansion Project: Project Description* (TyPlan, 2018) for a detailed description of the site and current marina facilities. Construction will be limited to the area west of the "B" float (**Figure 1**); total project area is approximately 43,000 m^2 (including the water lot expansion area of 8,553 m^2). The existing marina and lease expansion area are located within the port authority's jurisdictional boundaries. The geographical coordinates at the project's approximate centre are 49°17'41" North and 123°07'40" West.

2.2 Proposed Timeline

The project is expected to commence August 2020 (subject to regulatory approval) and be completed by August 2022. Where practical, in-water work will take place during the fisheries work window of least risk for Burrard Inlet (Area 28 – Vancouver); August 16 to February 28 (DFO, 2014a).

2.3 Project Description

The project will retrofit and improve the marina's floats, replace older float and boat sheds, remove 89 old creosote-treated wooden piles and upgrade utilities. The proposed Lease Expansion Area represents 8,553 m^2 and was defined based on the available Water Lot Area Navigational Channel Design (TyPlan, 2018). The expansion will allow 46 additional slips, improve the current layout, and allow facilities upgrade. The added slips and boat sheds will increase shading of the sea floor by an estimated total area of approximately 10,075 m^2. The project will proceed in eight (8) phases: detailed plans for each project phase are presented in TyPlan (2018). All activities in relation to the project will be conducted from the water, with no intertidal footprint, and no upland staging/ laydown area (a support barge will serve that purpose). The following activities are associated with the various phases of the project:

Demolition - float/boat shed removal: Dismantling of old floats and boat sheds to be replaced. Removed structures will be loaded unto a support barge for subsequent off-site disposal (see below).

Demolition - pile removal: A total of 89 old creosote-treated wooden piles will be removed either by vibratory extraction or direct pull. Removed piles will be loaded unto a support barge for subsequent off-site disposal. A total of 24 cylindrical steel piles will be removed either by vibratory extraction or direct pull and stored on a support barge for subsequent on-site reuse.

Pile driving: All new/reused piles will be driven with either a vibratory or drop hammer, from a barge. A total of 134 piles will be installed (detailed plan in TyPlan, 2018):

- 24 12-inch cylindrical steel (reused)
- 62 12-inch steel pipes
- 48 16-inch steel pipes

Shifting of float/finger/boat shed: Shifting (i.e., repositioning) of existing components will involve only limited movement of each component to its new/proposed location.

Installation of concrete float/finger/corner: All new concrete floats, fingers and corners will be constructed off-site and brought to the project site by barge (**Figure 2**) to be installed at their proposed locations. No concrete works will be conducted on-site. Dock float design is available in TyPlan (2018).

Installation of boat shed: All new boat sheds will be constructed off-site and brought to the project site by barge (**Figure 2**) to be assembled at their proposed locations. The boathouses will be constructed by CCY Marine in Richmond, to BC Float Home Standards (Province of BC, 2003), and detailed design is available in TyPlan (2018).

Upgrading of dock utilities and safety features: These include upgrades to plumbing, electrical and lighting systems. The upgrading/reconfiguration of dock facilities will be phased in with dock construction. Detailed design plans are available in TyPlan (2018).

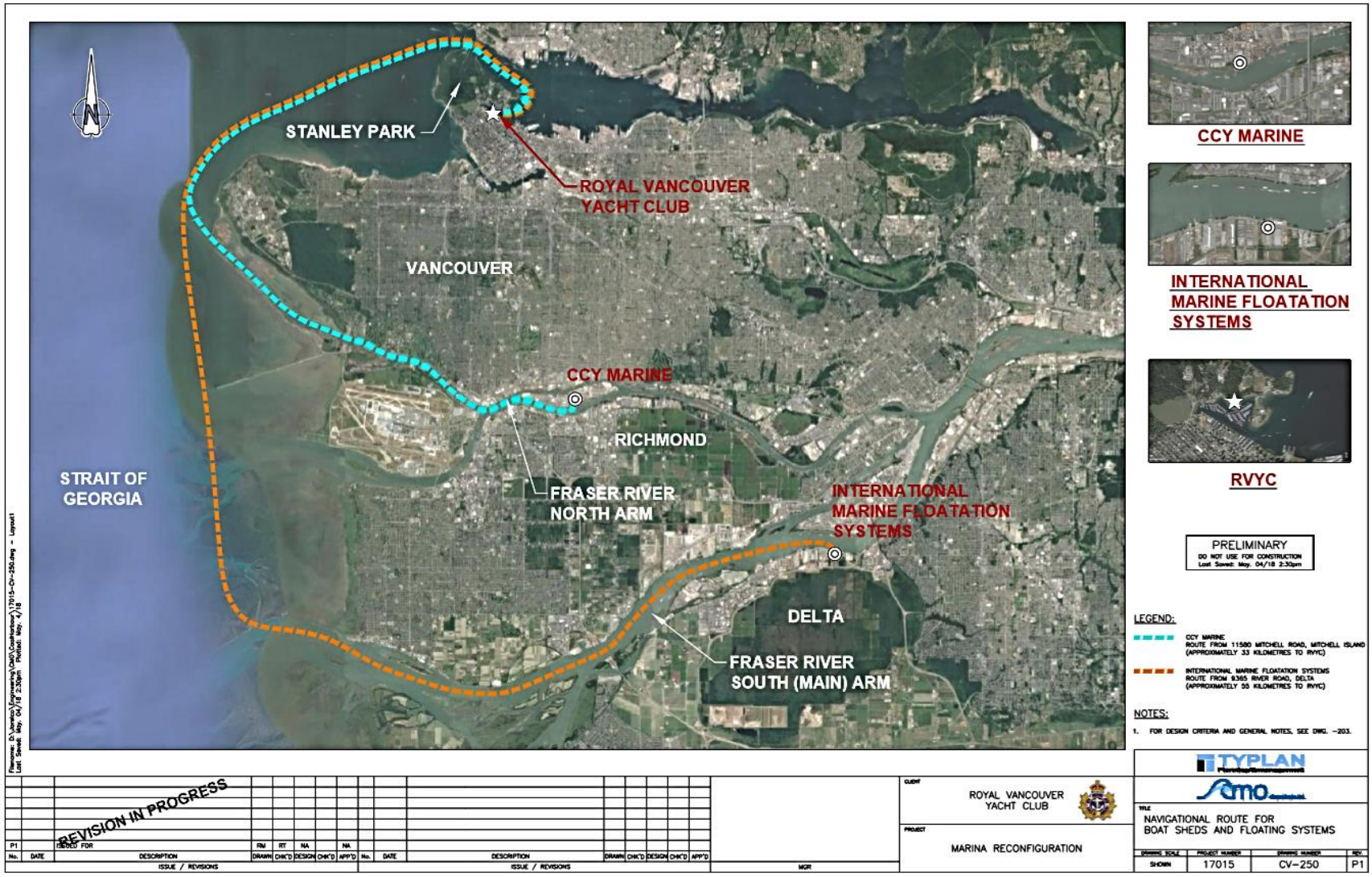
Off-site disposal: All removed creosote-treated piles, old floats and boat sheds will be barged from the project site and delivered to an approved disposal site.

Most of the works will occur within the boundaries of the current water lot lease and/or proposed expansion area (i.e., internal to RVYC Coal Harbour Operations); however, some activities such as barge access/staging and boat shed towing may occur outside these boundaries. Pile driving is expected to be conducted throughout the project phases.

2.4 Project Rationale

The project will allow for 46 additional slips to accommodate present and future growth at the Coal Harbour Marina, while promoting environmental sustainability. The reconfiguration will significantly improve the marina's layout, making it more functional and operational for its members (TyPlan, 2018). The project also includes the removal of 89 creosote-treated piles (to be replaced by steel pipe piles), as well as the replacement of old docks and boat sheds by newer components that meet current environmental standards. Finally, dock utilities and safety features will be upgraded to provide improved services and safer facilities.

Figure 2 Proposed Navigational Route for Boat Sheds and Floating Systems



3.0 EXISTING ENVIRONMENTAL CONDITIONS

3.1 Methods

The Aquatic Effects Assessment was developed based on the results of a desktop review and marine biophysical survey (Seacology, 2018).

3.1.1 Desktop Review

A review of available literature and web-based information was conducted to identify documented and potential aquatic resources in the project area, along with any knowledge gaps. Resources reviewed included, but were not limited to:

- BC Coastal Resource Information Management System (CRIMS database)
- BC Species and Ecosystem Explorer, Conservation Data Centre (BC CDC)
- EcoCat Ecological Reports Catalogue, Ministry of Environment (MOE)
- BC Marine Ecological Classification (BCMEC) system
- Sensitive Habitat Inventory and Mapping (SHIM)
- Habitat Wizard (MOE)
- Available government reports, and scientific and grey literature (published and unpublished)

3.1.2 Marine Biophysical Survey

A marine survey was conducted by Seacology, over a period of two days, on March 6 and 7, 2018. A combination of visual observation from a survey vessel and underwater survey (via SCUBA diving) was conducted to assess the shoreline, intertidal and subtidal habitats at the project site. The underwater survey was conducted to characterize the physical and biological conditions in the project area and identify sensitive habitat and resources of interest. A total of eight transects were surveyed: substrate, flora and fauna were characterized via passive quadrat sampling, fish presence was recorded, and features documented via photo and video. Photos and video footage were subsequently reviewed by a biologist experienced in marine taxonomy, to supplement quadrat data recorded in the field. Two additional transects were conducted parallel to shore, to assess the presence of eelgrass in the project site and adjacent areas. Incidental observations (e.g., organisms seen outside the quadrats, seabirds or marine mammals observed from the survey vessel) were also recorded. Detailed survey methods are described in Seacology (2018).

3.2 Results of Desktop Review

3.2.1 General Description

Coal Harbour Marina (established at its current location since 1903) is bounded by Stanley Park to the north (presenting an armoured shoreline), the Vancouver Rowing Club to the west, the Coal Harbour Navigation Channel to the south, and Deadman's Island, Vancouver Harbour and Burrard Inlet to the east. The marina is well-protected from wave action. The project site is limited to the subtidal area, west of the "B" float (**Figure 1**).

The Coal Harbour area, historically inhabited by members of the Squamish Nation, developed rapidly in the mid-19th century. Coal (subsequently determined to be low-grade) was discovered in the area, in 1859, leading to minor exploration (Davis, 2011). Clay suitable for brickmaking was also present, but never extracted. In 1882, a floating fish oil plant and cannery was established in Coal Harbour. The Pacific Lumber Mill Company was also located in Coal Harbour in the late 19th century (until the 1920s; City of Vancouver, 2018). A shipbuilding yard was constructed in the early 1900's, which later became Boeing's first seaplane factory and testing site (Jordan, 2013). The Canadian Pacific Steamships passenger terminal and dock were also located in Coal Harbour.

3.2.2 Water and Sediment Quality

An extensive study was conducted in 2000, investigating water and sediment quality throughout Burrard Inlet, including sites in Coal Harbour (Phippen, 2001). One water sample was collected in Coal Harbour and analyzed for general chemical parameters (chlorophenols, polychlorinated biphenyls [PCBs], metals, nutrients and total suspended solids [TSS]), as well as methyl tertiary-butyl ether (MTBE). All parameters were below detection limits and/or below established water quality objectives (Phippen, 2001).

Core sediment samples collected at two sites in Coal Harbour were analyzed for polycyclic aromatic hydrocarbons (PAHs) and metals. One Ponar grab (surface sediment) sample was also collected and analyzed for PCBs, chlorophenols, PAHs, and metals. Sediment composition was mainly silt, with clay and sand (Phippen, 2001). Concentrations of dibenz(a,h)anthracene in two core samples (0.01 and 0.14 µg/g) exceeded the sediment quality value of 0.06 µg/g. Copper concentration in one core sample (239 µg/g, in the deeper portion of the core) exceeded the long-term total copper sediment concentration objective of 100 µg/g dry weight for Burrard Inlet. Total PCBs concentrations (up to 0.101 µg/g) exceeded the Burrard Inlet objective of 0.03 µg/g (Phippen, 2001).

3.2.3 Aquatic Resources

The natural environment in Coal Harbour has been extensively altered over the last two centuries; an estimated 80% of Burrard Inlet's Inner Harbour shoreline has been modified (Haggarty, 2001). Activities such as industrial and urban development, shoreline armouring and dredging have transformed the upland, intertidal and subtidal habitats.

Coal Harbour and Burrard Inlet lie within the Strait of Georgia Marine Ecosection (MSRM, 2002). The area is characterised as presenting shallow (0-20 m), warm (9-15 °C) and polyhaline waters (18-28 ppt), with flat slopes (0-5%), soft (mud) substrate and low bottom roughness (CRIMS, 2018). It is classified as very protected from wave exposure and presenting low current (<3 knots). No visible biobands have been identified at the project site; however, continuous barnacle, patchy rockweed (*Fucus* sp.), patchy sea lettuce (*Ulva* sp.) and continuous bull kelp (*Nereocystis luetkeana*) have been documented along the shore, east of Deadman's Island (CRIMS, 2018). No historical records of eelgrass (*Zostera* spp.), kelp beds or clam beds were found for the project site.

A total of 75 species of fish have been historically documented in Burrard Inlet, including economically and culturally important taxa such as rockfish, lingcod (*Ophiodon elongatus*), flounders, perches and forage fish (Hanrahan, 1994; Renyard, 1988). All five Pacific salmon species, as well as steelhead trout (*Oncorhynchus mykiss*) and cutthroat trout (*O. clarki*) are known to utilize nearshore habitat in Burrard Inlet (Naito and Hwang, 2000). A total of 23 invertebrate species were identified during a subtidal survey of soft-bottom habitat near the Westridge Marine Terminal, in Burnaby, approximately 12 km from the project site (Trans Mountain Pipeline ULC, 2017). Dominant species included Dungeness crab (*Cancer*

magister), sunflower stars (*Pycnopodia helianthoides*), ochre stars (*Pisaster ochraceus*), giant plumose anemones (*Metridium farcimen*) and sea pens (*Ptilosarcus gurneyi*). Macroalgae diversity and abundance in the study area were characterised as "relatively low" and the marine flora was mainly associated with hard substrate, such as riprap (Trans Mountain Pipeline ULC, 2017).

Coal Harbour is part of Fisheries Management Area 28-10 (DFO, 2016a). No commercial fisheries are conducted in the area and only a moderate recreational crab fishery may occur (CRIMS, 2018). The area has been permanently closed to bivalve shellfish harvesting due to sanitary contamination (DFO, 2017). No Pacific salmon (*Oncorhynchus* spp.) or Pacific herring (*Clupea pallasii*) holding areas have been identified in the area (CRIMS, 2018). The closest designated Rockfish Conservation Area is located in eastern Burrard Inlet (approximately 12 km from the project site; DFO, 2015).

3.2.4 Species at Risk

A total of five provincially and/or federally listed animal species with the potential to occur near the project area were identified in the BC Conservation Data Centre (**Table 1**; BC CDC, 2018). Green sturgeon (*Acipenser medirostris*), northern abalone (*Haliotis kamtschatkana*) and marbled murrelet (*Brachyramphus marmoratus*) have been reported within the Metro Vancouver regional district; however, no site-specific report of these species was found, and the likelihood of their occurrence in Coal Harbour is suspected to be very low, based on their respective known habitats (BC CDC, 2018).

The great blue heron (*Ardea herodias fannini*) is designated Schedule 1, "Special Concern" under the federal *Species at Risk Act* (SARA) and the double-crested cormorant (*Phalacrocorax auratus*) is Blue-listed (i.e., Special Concern) under the provincial Red and Blue lists (BC CDC, 2018). Stanley Park is "home to one of the largest urban great blue heron colonies in North America" (Stanley Park Ecology Society, 2018); the intertidal and subtidal zones provide food resources for these birds.

No listed marine mammals were documented for the area.

Table 1 Species at Risk with the Potential to Occur Near the Project Area (BC CDC, 2018)

English Name	Scientific Name	BC List[1]	COSEWIC Status[2]	SARA Status
Marine Fish				
Green sturgeon	*Acipenser medirostris*	Red	SC	SC
Marine Invertebrates				
Northern abalone	*Haliotis kamtschatkana*	Red	E	E
Seabirds				
Double-crested cormorant	*Phalacrocorax auritus*	Blue	-	-
Great Blue Heron	*Ardea herodias fannini*	Blue	SC	SC
Marbled murrelet	*Brachyramphus marmoratus*	Blue	T	T

Search Criteria: Animal AND Regional District Metro Vancouver AND Habitat Types: Ocean AND BC Conservation Status: Red or Blue OR SARA Schedule 1 Status: true.

1 Red: indigenous species considered Endangered or Threatened (definitions as below). Blue: indigenous species considered of Special Concern in BC and which are particularly sensitive or vulnerable to human activities or natural events.

2 SC: Special Concern – A species whose characteristics make it particularly sensitive to human activities or natural events. E: Endangered – A species facing imminent extirpation or extinction. T: Threatened - Likely to become endangered if limiting factors are not reversed.

3.2.5 Sensitive Habitats

No historical records of sensitive fish habitats (e.g., eelgrass meadow, canopy-forming kelp bed or clam bed) were found for the project site. Bull kelp was documented along the east side of Deadman's Island (CRIMS, 2018).

3.3 Summary of Marine Biophysical Survey

As all project activities will occur on the water – below the Low Low Water (LLW) mark - and none are expected to affect upland areas, a backshore survey was not conducted. The following sections provide a summary of the observations made during the marine biophysical survey performed in March 2018 at the project site (methods in **Section 3.1.2**; details in Seacology, 2018).

3.3.1 Marine Substrate

The marine environment observed in the project area was typical of protected basins, with low species diversity and abundance (Seacology, 2018). Substrate was dominated by unconsolidated fine-grained sediments (i.e., silt/mud/clay), representing 73% of the observed substrate. Limited boulder and cobble were seen throughout the site. Anthropogenic debris was also limited.

3.3.2 Marine Flora

Diatoms were abundant throughout the site (representing >70% average cover), forming a thin layer on the sediment (Seacology, 2018). Macroalgae (i.e., seaweeds) were observed in limited abundance and were mainly restricted to hard substrates, with the exception of the unattached red spaghetti alga (Family Gracilariaciae), which was seen throughout the site (average of 1.4% cover/m^2). No canopy-forming kelps were observed. No eelgrass (*Zostera* sp.) beds were observed inside the project area; a single shoot was seen during the marine survey (between floats E and G south). A small patch of eelgrass (approximately 25 m^2 in size) was observed at the northwest boundary of the project site, outside the project area (Seacology, 2018).

3.3.3 Marine Fauna

Few marine invertebrates were observed in the project area during the marine survey (Seacology, 2018). Dungeness and red rock crabs (*C. productus*) were present throughout the site (0.2/m^2 and 0.01/m^2 average abundance, respectively), along with a few California sea cucumbers (*Parastichopus californicus*) and mottled sea stars (*Evasterias troschelii*). Other invertebrates included: hermit crabs (*Pagarus* spp.), barnacle shells (Cirripedia – with few live specimens), chitons (*Mopalia* spp.), limpets (*Tectura* spp.), hydroids (Class Hydrozoa), and a few giant plumose anemones. Observed bivalve molluscs included: fat and Pacific gapers (*Tresus capax* and *T. nutallii*), Washinton butter clams (*Saxidomus gigantea*), softshell clams (*Mya arenaria*), cockles (*Clinocardium* sp.) and Pacific blue mussels (*Mytilus trossulus*; dislodged from float and pile structures). Average infaunal bivalve density for the entire site - based on siphon count- was 0.5/m^2, with the highest density observed along the "B" float (1.5/m^2). An invasive tunicate species, the harbour star ascidian (*Botryllus schlosseri*), was also observed on wooden piles.

Only a few fish were observed during the marine assessment: a single juvenile left-eyed flounder (Family Paralichthyidae), an adult flounder, and two unidentified sculpins (probably padded sculpin [*Artedius fenestralis*]). Two small fish egg clusters (probably from padded sculpins) were also noted (Seacology, 2018).

3.3.4 Incidental Observations

A few sea birds were noted, including: bufflehead (*Bucephala albeola*), goldeneye (either *Bucephala clangula* or *B. islandica*), and mallard (*Anas platyrhynchos*) ducks, as well as double-crested cormorants and a single great blue heron. Double-crested cormorants and great blue herons are listed species (**Section 3.2.4**). No marine mammals were observed within the project site or adjacent areas during the marine assessment. No other listed marine species were observed within the project site or adjacent areas during the marine assessment (Seacology, 2018).

3.3.5 Habitat Value in the Project Area

The project area can be characterized by the following habitat types, based on biophysical conditions observed during the survey:

- *Moderate* to *low* value, where hard substrate (i.e., boulder, cobble and anthropogenic components) was present (representing only a few spatially-limited areas within the project site).
- *Low* habitat value, in areas of fine sediments (representing the majority of available habitat within the project site).

Most of the assemblages of marine organisms occur on the hard surfaces, which provide suitable attachment surfaces for algal and sessile invertebrate species, as well as structure for fish refuge and invertebrate use. Overall, species diversity and abundance observed in the project site were classified as low for both macroalgae and marine epifauna.

No critical and/or sensitive fish habitat was observed within the project site.

4.0 ASSESSMENT OF POTENITAL ENVIRONMENTAL EFFECTS

Potential impacts of project activities to fish species that are part of a commercial, recreational or Aboriginal (CRA) fisheries, to fishes that support such a fishery, and to at-risk species were assessed, along with impacts to aquatic habitat (including water and sediment quality). Where applicable, Pathways of Effects (DFO, 2014b) were also considered.

4.1 Potential Project Effects on the Environment

The following potential impacts to the environment may occur as a result of the Coal Harbour Marina Expansion activities during project's construction and operational phases.

4.1.1 Air Quality

Air quality may be negatively affected by the project through:

- Exhaust emissions from machinery (vessels and equipment) may cause temporary disturbance of wildlife (e.g., sea birds and seals).

4.1.2 Light

Lights used during night work (if required) and/or additional marina lights (associated with the expansion) may result in the disturbance to fish and wildlife in the project area.

4.1.3 Noise and Sound Pressure

Underwater and air noise generated during project activities may affect fish and other wildlife through:

- Pile removal/driving is not expected to result in sound pressure in excess of 30 kilopascal (kPa, which could result in injury to or death of fish present in the area during the works), however the resulting air and underwater noise may cause temporary disturbance to fish and wildlife (e.g., birds and marine mammals) present in the area; and,
- Temporary disturbance of fish and wildlife from air and underwater noise resulting from vessels and other machinery.

4.1.4 Water and Sediment Quality

Water and sediment quality at the project site and adjacent areas may be affected through:

- Introduction of deleterious substances (e.g., PAHs) to Coal Harbour and/or components mobilization routes (**Section 2.3** and **Figure 2**), due to accidental release from on-site heavy machinery and/or vessels (DFO, 2014b);
- Temporary increase in TSS from pile removal and pile driving activities can result in stress to fish due to abrasion and clogging of gills, and in the smothering of sessile organisms (Birtwell 1999);
- Temporary increased water turbidity from pile removal/driving and propeller wash can disrupt feeding behaviour in fish, and reduce photosynthesis in algae and seagrass;
- Release of contaminants, such as PCBs (Section 3.2.2), via re-suspended sediments during pile removal/driving, and creosote from pile removal could temporarily affect water quality; and,

- Contamination of water and/or sediment via leaching from components introduced to the harbour (e.g., removed creosote piles, floats, boat sheds).

4.1.5 Water Flow

No potential impact on local water flow is anticipated as a result of project activities.

4.1.6 Shading

Shading of the sea bed from additional floats, boat sheds and boats associated with the marina's expansion is unlikely to result in negative impacts to fish and fish habitat, as no macroalgae beds are present below the proposed structures and slips (due to lack of hard substrates; **Section 3.3.1**).

4.1.7 Direct Loss of Habitat

No permanent changes to shoreline or water depths are anticipated as a result of the project activities (**Section 2.3**). The direct footprint on the sea bed, created by additional piles associated with the expansion, will be limited spatially. As the lack of hard substrates is a limiting factor in the Coal Harbour marine ecosystem (**Section 3.3.1**), the addition of hard surfaces (i.e., the steel pipe piles) could result in a positive effect on fish habitat (providing increased attachment surfaces for algae and sessile invertebrates, as well as foraging sites and cover for invertebrates and fish).

4.1.8 Other

Other potential effects on the surrounding environment and wildlife in the project area and/or associated project areas include:

- Animal strike by work vessels in the harbour, and by vessels bringing new components to site (**Figure 2**) or taking old components off-site (Section 2.3); and,
- The disposal of old creosote-treated piles and other removed components could result in the contamination of soil and water at the disposal site.

4.2 Potential Serious Harm to Fish

Although the Federal Government has introduced proposed amendments to the *Fisheries Act* with Bill C- 68 (February 6, 2018), these amendments have not yet been passed into law, and therefore, the current Act (last amended on April 5, 2016) remains in effect.

"Serious harm to fish" is defined in Subsection 2(2) of the *Fisheries Act* and means "the death of fish or any permanent alteration to, or destruction of, fish habitat." Project activities and associated potential effects (identified in **Section 4.1**) which could result in serious harm to fish that are part of or support commercial, recreational or Aboriginal fisheries are:

- The introduction of deleterious substances in the water, either through a pulse event (such as a spill) or gradual contamination (such as leaching of contaminants), could result in fish kill (in the immediate vicinity) and/or reduction of productive capacity as a result of habitat destruction; and,
- Elevated TSS levels, resulting from pile removal/driving activities and/or propeller wash, may lead to loss of productivity in fish and/or death.

Serious harm to fish may be prevented through project design, and the implementation of mitigation strategies and best management practices (BMPs; **Section 5.0**).

5.0 PROPOSED MITIGRATION MEASURES

Prevention measures for project potential environmental effects were considered prior to the development of mitigation strategies. Where effect avoidance was not possible or practical, mitigation measures and BMPs were identified for each of the project potential effects. The recommendations presented below are intended to be used as a guide to mitigate potential adverse effects to marine life and habitat.

The development and implementation of a Construction Environmental Management Plan (CEMP) and Environmental Monitoring Plan will clearly define the procedures and controls to achieve mitigation of potential project effects, and objectives to maintain environmental performance.

A qualified Environmental Monitor (EM) will be present at the site during construction activities that may result in harm to fish and fish habitat (**Section 4.0**). The EM will be responsible for communicating the mitigation measures and BMPs to be implemented by the construction crew, and for ensuring developed objectives and standards of both the CEMP and Environmental Monitoring Plan are achieved. Where possible, practices described in DFO's *Measures to avoid causing harm to fish and fish habitat including aquatic species at risk* (DFO, 2016b) will be applied. The following measures are proposed to mitigate potential project effects on fish and fish habitat.

5.1 Air Quality

The following measures are recommended to mitigate potential project effects to air quality:

- Land vehicles, vessels and equipment will be kept in good working condition and use low sulphur fuels when possible; and,
- Engines will be turned off when not in use or reduced to limited idle (or as appropriate to reduce air emissions).

5.2 Light

The following measures are recommended to mitigate potential project effects resulting from light:

- Where practical, night time activities shall be limited; and,
- Lighting spill (from construction work lights and/or marina lights) shall be reduced by pointing lights downward and placing task lighting as close to the work and/or target area as possible.

5.3 Noise and Sound Pressure

The following measures are recommended to mitigate potential project effects on fish and wildlife resulting from noise and sound pressure:

- All equipment will be properly maintained to limit noise emissions and fitted with functioning exhaust and muffler systems. Machinery covers, and equipment panels will be well fitted and remain in place to muffle noise. Bolts and fasteners will be tight to avoid rattling.
- Where practical, multiple concurrent underwater noise generating activities shall be limited; and

- All applicable BMPs concerning noise and sound pressure suggested in the *Best Management Practices for Pile Driving and Related Operations* (BC Marine and Pile Driving Contractors Association, 2003) should be implemented during pile removal/ driving works to maximize environmental protection and avoid contravention to the *Fisheries Act*.
- Piles shall be driven with a vibratory or drop hammer. Piles shall not be installed using a diesel or hydraulic hammer or other technology such as drilling without review and authorization by the port authority. When appropriate, ramp-up procedures (i.e., gradually increasing the sound intensity at the start of the operation) shall be used.
- Because of the small diameter of the piles to be driven (i.e., steel pipe piles less than 18 inch diameter; **Section 2.3**), the energy required to drive the pile to the final point of installation is not expected to result in shock waves in excess of 30 kPa or underwater sound exposure level exceeding 186 dB[1], therefore, protective measures to reduce shock waves are not expected to be required (BC Marine and Pile Driving Contractors Association, 2003).
- If distressed, injured or dead fish or marine mammals are observed following the initiation of pile driving, work will be halted immediately and measures to reduce the sound pressure waves will be implemented before the work is resumed. Appropriate mitigating measures would include the deployment a bubble curtain over the full length of the wetted pile. This technique should reduce the shock waves to an acceptable level (BC Marine and Pile Driving Contractors Association, 2003).
- If, despite the introduction of preventive measures, further visual/hydrophone monitoring reveals unacceptable conditions (fish kill or sound pressure over 30 kPa), then the work will stop immediately, and the methods will be reviewed and corrected.
- Visual monitoring for marine mammals should be maintained by on-site personnel during pile removal/driving and when operating work vessels to avoid potential disturbance/ injury to marine mammals in the project area.

5.4 Water and Sediment Quality

The following measures are recommended to mitigate potential project effects to water and sediment quality:

- Equipment and vessels shall be in good operating condition and maintained free of leaks, excess oil and grease, invasive species, and noxious weeds. Equipment shall be inspected daily for leaks or spills.
- Any hydraulic machinery used in water should use environmentally-friendly hydraulic fluids (i.e., non-toxic to aquatic life, and biodegradable);
- If storage of fuels is to occur on-Site, a 'Fuels, Chemicals and Materials Storage and Handling Plan' will be developed, in compliance to Ministry guidelines (Ministry of Water, Land and Air Protection; MWLAP 2002);

[1] Sound pressure level of 186 dB has been proposed as the standard threshold injury criteria for (in water) pinnipeds (e.g., harbour seals) exposed to multiple discrete noise events (such as those created by pile driving; Southall et al., 2007).

- Where possible, refueling of equipment shall occur on land at least 30 m from the water. Refueling areas will have spill containment kits immediately accessible and personnel should be knowledgeable in the use of these kits.
- A spill containment kit shall be readily accessible both on site and on each piece of equipment in the event of a release of a deleterious substance to the environment. All members of the construction team will be trained in the use of spill containment equipment/items. Any spill of a substance that is toxic, polluting, or deleterious to aquatic life of reportable quantities must immediately be reported.
- All materials to be used in and around water, should be certified clean (i.e., they will not present any risk of leaching contaminants or affecting water/sediment chemistry).
- Measures should be taken to provide 100% containment of all potentially deleterious materials; including fuel/ oil/ grease, chlorinated water, paint chips, cleaning products, coatings, or any other potentially deleterious materials.
- Barges or other vessels shall not ground on the foreshore or seabed, or otherwise disturb the foreshore or seabed (including disturbance as a result of vessel propeller wash), with the exception of such disturbance as is reasonably required resulting from the use of barge spuds.
- No equipment will operate on the intertidal foreshore and/or disturb the seabed outside the project site.
- Appropriate measures must be implemented to prevent sediment, sediment-laden waters, or other deleterious substances entering the water during the project.
- A support barge will be available for the temporary storage of removed components and materials. The barge shall have adequate containment protection to prevent removed materials and any associated runoffs (e.g. sediment-laden water) to leave the barge. All materials on the barge will be properly covered to avoid being blown off by winds.
- Piles should be removed by vibratory extraction (preferred method) or direct pull. Piles should be removed slowly to minimize turbidity in the water column, as well as sediment disturbance. Crane operator shall be experienced in pile removal (WADNR, 2017).
- During pile removal and pile driving, *in situ* water turbidity shall be monitored against water quality standards of 5 NTU when background is 8 to 50 NTU or 10% when background >50 NTU (MOE 2001). If necessary, floating silt/debris curtains should be deployed around the work area to minimize mobilization of potentially contaminated sediment and to further reduce turbidity to adjacent areas.
- A floating surface boom should be installed, prior to creosote-treated pile removal, to capture floating surface debris. The floating boom should be equipped with absorbent pads to contain any oil sheens (WADNR, 2017).
- Pulled piles shall be immediately placed in a containment basin to capture any adhering sediment. Piles removed from the water shall be transferred to the containment basin without leaving the boomed area to prevent creosote from dripping outside of the boom (WADNR, 2017).
- Removed creosote piles, and any associated waste materials (e.g., sediment, absorbent pads/boom, etc.) will be disposed of at an approved landfill. Creosote piles shall not be re-used.

5.5 Work window

Unless otherwise approved in writing by DFO or the port authority, all construction activities occurring below the high water mark (HWM) that may impact fish or fish habitat should be scheduled during the fisheries work window of least risk for Burrard Inlet: August 16 to February 28 (DFO, 2014a)[2]. The port authority shall be notified of any DFO exemptions allowing works within the fisheries sensitive period. In-water works that occur outside the least-risk work window should be monitored by a qualified environmental monitor. Prior to the commencement of any work, the contractor will complete and forward a "Notice of Project" to DFO.

5.6 Sensitive Habitat Features and Species

Although no sensitive habitat was identified inside the project boundaries, the following measures should be considered (in addition to the BMPs suggested in the above sections) to minimize potential negative impacts to fish and marine mammals in the project area during the construction activities, as well as to the eelgrass patch located northwest (outside) of project.

- Fish and marine mammals: All appropriate measures should be implemented to minimize water turbidity, including *in situ* monitored during activities that may cause increased suspended sediments. If a marine mammal is observed within 100 m of the pile driving site, work should be suspended until the animal has moved away again from the site boundary. Work shall be halted immediately if distressed, injured or dead fish or marine mammals are observed in the project site or adjacent areas. The work shall not resume until authorized by the EM and/or the port authority. Project-related vessel traffic shall reduce speed and/or stop to avoid collision with any observed marine mammal in it's trajectory.
- Eelgrass patch located northwest (outside) of project: Barges or other vessels shall not ground on the foreshore or seabed, or otherwise disturb the foreshore or seabed (including disturbance as a result of vessel propeller wash). If necessary, a marker could be deployed (Zone 10U 490596E 5460347N) to ensure protection of the eelgrass patch during low tides, for periods when work is conducted near the northwest end of the project site (**Figure 1**).

5.7 Other

- All applicable best practices suggested shall be implemented by the Sub-contractors during the mobilization of components from Delta and Richmond. The weather forecast should be consulted prior to component mobilization and all other precautions taken to ensure safe passage.
- Mobilization shall be planned to minimize the number of trips to and from the site.

[2] The *Best Management Practices for Pile Driving and Related Operations* (BC Marine and Pile Driving Contractors Association, 2003) indicates: "There will be no restriction of work during closure periods (the only exception being when spawning is present), provided the contractors employ an exclusion device (protective netting or geotextile material suspended in the water column around pile driving area) around the work area to prevent fish access or when required, an effective method of mitigating shock waves (bubble curtain)".

6.0 ASSESSMENT OF POTENTIAL RESIDUAL EFFECTS

Residual effects refer to those environmental effects predicted to remain after the application of recommended project BMPs and mitigation measures. The magnitude, and spatial and temporal extents of potential effects were evaluated, along with the significance of each effect for fish and fish habitat, and anticipated permanence of the effect.

Based on the identified potential environmental effects (**Section 4.0**) associated with the described project activities (**Section 2.3**), the occurrence of significant[3], long-term or short-term residual effects (i.e., after the implementation of all appropriate mitigations recommended in **Section 5.0**) is deemed unlikely. Limited short-term, non-significant residual effects, such as disturbance of fish and wildlife as a result of increased noise, turbidity and vessel traffic, may occur during construction phase.

The removal of 89 creosote-treated piles (to be replaced by steel pipe piles), as well as the replacement of old docks and boat sheds by newer components that meet current environmental standards may result in improved water and sediment quality. The addition of piles, associated with the expansion, may also create new habitat by increasing hard surface availability (a limiting factor in Coal harbour), for colonization by marine flora and fauna. No negative residual effects are predicted during the operational phase.

[3] Significant residual effects are considered those resulting in serious harm to fish.

7.0 CONCLUSION

The Royal Vancouver Yacht Club is committed to conducting its operations in a safe and environmentally responsible manner. Prevention measures for project potential environmental effects were considered prior to the development of mitigation strategies. The potential environmental impacts that may result from project activities can be avoided or minimized through implementation of environmental standards, guidelines, BMPs and site-specific mitigation measures.

Based on the results of the desktop review and biophysical assessment, the majority of habitat in the project area consisted of poorly colonized fine sediments (i.e., with low species diversity and abundance), and was characterized as low habitat value. With the exception of great blue herons and double-crested cormorants, no provincially and/or federally listed species was observed in the survey area or expected to occur in Coal Harbour, and no sensitive habitat was present within the project site.

Following the implementation of the recommended mitigation measures and BMPs, no adverse residual effects are expected to result from the project activities. Furthermore, it is suspected the removal of 89 old creosote-treated piles may result in improved environmental conditions in the project site, and consequently, contribute to greater fish habitat value in Coal Harbour.

Projects requiring authorization are those "likely to result in a localized effect to fish populations or fish habitat in the vicinity of the project" (DFO, 2013). Only when proponents are unable to completely avoid or mitigate serious harm to fish will projects require authorization under Section 35 of the *Fisheries Act* for the project to proceed.

The proposed Coal Harbour Marina Expansion Project is not expected to result in serious harm to fish that are part of a CRA fishery, or to fish that support such a fishery; therefore, it is assessed a *Fisheries Act* Authorization will not be required.

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