Executive Summary

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Executive Summary

The Centerm Container Terminal (Centerm) on the south shore of Vancouver's Inner Harbour is one of three primary container terminals in the Vancouver area. The Vancouver Fraser Port Authority (port authority) is proposing to concurrently deliver two projects (referred to collectively as "the proposed Project") to increase goods movement through the south shore of Vancouver's Inner Harbour: the Centerm Expansion Project (CEP), a set of improvements to Centerm to increase container handling capacity and accommodate larger vessels (Terminal improvements); and the South Shore Access Project (SSAP), which will improve the adjacent road and rail networks to accommodate the predicted increases in containerized goods movement (Off-Terminal improvements).

The port authority, established by the Government of Canada, is responsible for the stewardship of federal port lands in and around Vancouver, BC. The mandate of the port authority is to facilitate Canada's trade objectives, ensuring goods are moved safely while protecting the environment and considering local communities. Centerm is within federal lands and waters managed by the port authority.

The Centerm Expansion Project Team (Project Team) consists of port authority staff and subject matter experts. The Project Team includes engineers, environmental scientists, project managers and communications and engagement specialists. The Project Team is working closely with DP World Vancouver (DPWV), the operator of Centerm, to deliver this project. The port authority intends to deliver the proposed Project under a single Design-Build (DB) contract by which the selected DB Contractor develops and constructs the final design of the proposed Project based on the performance requirements and details established by the Project Team.

Project Rationale

Two trends are influencing the need to expand both short-term and long-term containerized shipping/handling capacity in the Port of Vancouver. Trade of containerized goods shipped through Canada's west coast is increasing. In 2015, container terminals on the west coast of Canada (including Vancouver and Prince Rupert) handled more than 3.8 million TEUs, with nearly 3.1 million TEUs handled by container terminals in the Port of Vancouver. The Port of Vancouver's container terminals (Vanterm, Deltaport, Fraser Surrey Docks, and Centerm) are currently able to handle an estimated 3.9 million TEU/year.

Independent forecasts completed for the port authority by international experts in transportation and trade indicate that container traffic through the west coast of Canada will increase by approximately 3.5 million TEUs by 2035. This growth is driven primarily by the growing demand between Canada and Asian markets for imported products such as clothing, food, electronics and manufacturing inputs, such as car parts, and exports of Canadian products such as pulp, paper, lumber, and specialty grains.

Increasing the capacity and efficiency of existing container terminals like Centerm will ensure timely delivery of required marine and land-based infrastructure to meet the predicted growth in the container sector. Sustainable capacity is when the terminal is operating efficiently at high throughput and under ideal operating conditions. Maximum capacity is when the terminal achieves maximum throughput; however, it stretches the effectiveness of operations and equipment and is generally only achieved for short periods of time. Terminal operating volumes vary widely depending on the goods moving through the terminal. Larger terminals attract larger ships, which in turn exchange larger volumes of containers.

The proposed Project has been developed using the proposed sustainable annual capacity (considered to be 85 percent of maximum annual capacity), as this represents the typical peak operating conditions. The current sustainable container capacity at Centerm is approximately 750,000 TEU/year (maximum capacity 900,000 TEU/year) and its 646 metre (m) berth can accommodate two small- or medium-sized vessels simultaneously (i.e., two vessels of up to 6,000 TEUs or a single vessel 9,000 TEUs or larger). The proposed Project would increase Centerm's container capacity by approximately two-thirds to a sustainable capacity of 1.3 million TEU/year (maximum capacity of 1.5 million TEU/year) and continue to accommodate larger vessels of up to 14,000 TEU.

Project Overview

The proposed Project consists of improvements to the existing Terminal Site and operations (Terminal improvements) to accommodate the newer container ships and to provide additional room to store and transfer containers. Improvements would also be required to the supporting rail and road infrastructure (Off-Terminal improvements) to improve connectivity and the movement of vehicles on the south shore and containers in and out of Centerm.

Terminal improvements include expanding the land area at both the west and east ends of the existing Terminal. Approximately 4.2 hectares (ha) of marine area will be infilled on the west and 4 ha on the east. In-water marine works will include dredging to remove unstable substrates, constructing new rock dykes, and infilling open water areas within the dykes. Dreding will also be conducted to enhance a navigational turning basin for the cruise ship berth in the area between the westward extension of Centerm and the SeaBus Terminal.

Works on land include removing the warehouse structures and rehabilitating the Ballantyne Pier (while retaining the Ballantyne Pier heritage building), reconfiguring the Intermodal Yard to extend the existing tracks, removing the Heatley Avenue Overpass, reconfiguring the Container Yard, consolidating existing buildings into one Container Operations Facility, establishing new storage facilities, increasing Terminal Operations parking near the Container Operations Facility, reconfiguring the Terminal entrance area, upgrading terminal control systems and yard equipment, installing one new quay crane and replacing one quay crane, installing up to five new electrified rail-mounted gantry cranes, and adding up to 20 new diesel-powered internal transfer vehicles.

The proposed Project will allow completion of DP World's internal lighting upgrade project to exchange the existing high pressure sodium light fixtures to energy efficient light-emitting diode fixtures.

Off-Terminal improvements proposed include constructing an overpass to the entrance of the Terminal, removal of the Southern Railway rail crossing at Centennial Road, constructing Centennial Road Overpass east of the Terminal, and an extension to Waterfront Road.

The proposed Project is expected to be delivered using the design-build procurement model where the Design-Build Contractor provides the final design and construction based on the preliminary design and performance criteria. Works covering the supply and installation of the new cranes, technology for the new truck gate, plus the final fit out of the Container Operations Facility will be coordinated by DPWV and are anticipated to be procured through design-bid-build procurement methods.

Environmental Study Report Purpose and Context

The proposed Project is subject to review and approval by the port authority under the Project and Environmental Review (PER) Process before it can proceed.

The proposed Project does not trigger an Environmental Assessment under *Canadian Environmental Assessment Act* (CEAA) 2012 and is not subject to review by the Canadian Environmental Assessment Agency. Canadian Port Authorities have responsibility under section 67 of CEAA 2012 to conduct an environmental review and determine that projects will not likely cause significant adverse environmental effects (or, if a project is likely to cause significant adverse environmental effects, requires the Governor in Council to decide whether those effects are justified in the circumstances).

This Environmental Study Report (Report) contains the results of environmental studies and the identification and characterization of environmental effects associated with the proposed Project.

The Report has been written to meet the project-specific PER Application Submission Requirements (Submission Requirements) issued by the port authority on October 21, 2016, following the PER Team's review of the Preliminary Comment Period Summary Report (Kirk & Co. Consulting Ltd. 2016)[1].

The environmental studies and characterization of effects focus on impacts directly produced as a result of the physical works and activities associated with the proposed Project on the following Environmental Components:

- Acoustic Environment
- Air Quality
- Greenhouse Gas (GHG) Emissions
- Marine Water and Sediment Quality
- Marine Resources (Fish, Fish Habitat, Marine Birds, and Marine Mammals)
- Terrestrial Resources (Vegetation and Wildlife)
- Archaeological Resources
- Heritage Resources

Environmental Components were selected by AECOM based on the PER Application Submission Requirements and their potential interaction with the proposed Project.

The characterization of effects considers environmental and other impacts associated with physical works and project activities from the date construction is initiated to the time the proposed Project is expected to achieve full operating capacity. The characterization of environmental effects relies on determining the degree of change to an Environmental Component from existing conditions to predicted conditions as a result of effects from the proposed Project after mitigation measures are put into place. Determining the severity of that change will normally rely on comparison against accepted thresholds or limits. This Report relies on thresholds or limits drawn from guidelines and performance standards from multiple sources even though they may not be legally binding on federal lands. The Report draws on Guidelines from the Canadian Council of Ministers of the Environment (CCME), provincial regulations, and local bylaws.

Pursuant to section 67 of CEAA 2012, the port authority must determine whether the proposed Project is likely to result in significant adverse environmental effects. That determination will be made by the port authority in relation to any adverse residual effects that are predicted to remain after the implementation of technically and economically feasible measures to mitigate the potential effects is taken into account. This report characterizes predicted residual effects in terms of magnitude, geographic extent, duration, frequency, reversibility, and resilience (or vulnerability). The port authority will take this information, as well as other information gathered during the PER process, into account when making their determination.

Environmental Studies and Characterization of Effects

Acoustic Environment

Project activities with the potential to increase noise in the surrounding community include increased road traffic, rail operations, marine vessels hoteling and in transit, and use of mobile equipment to move containers during operation of the proposed Project. The effects of construction noise are addressed through mitigation measures incorporated into the Construction Environmental Management Plan (CEMP) (AECOM 2016a)[2].

[1] Kirk & Co. Consulting Ltd. 2016. *Preliminary Comment Period Summary Report: Centerm Expansion Project*. Prepared for Port Metro Vancouver's Centerm Expansion Project Team by Kirk & Co. Consulting Ltd. March 2016.

[2] AECOM. 2016a. *Construction Environmental Management Plan*.

To understand the effects the proposed Project would have on noise levels a Noise Assessment was conducted to determine the degree of change in noise from existing conditions at sensitive receptors within a 1.5 kilometre (km) radius of the proposed Project. Sensitive receptors are areas of frequent human use that are susceptible to the adverse effects of noise level change and include residential areas, public buildings (e.g., schools, hospitals, daycare facilities, elderly housing), and public spaces (e.g. CRAB Park at Portside).

The Noise Assessment work comprised:

- determining the existing background noise at sensitive receptors
- determining the level of noise attributable to existing Centerm operations
- modelling the predicted noise from the proposed Project at full operating capacity and then comparing the change between existing conditions and predicted conditions

Noise levels from the existing Centerm operations and the proposed Project were modelled using noise levels for equipment and activities derived from published data, manufacturer's data, and monitoring data from other ports of similar activities.

Noise levels (peak day, evening, and night) as a result of operation of the proposed Project are expected to increase no more than 1.3 dB above existing conditions at all sensitive receptors. Noise level increases below 3 dB are considered to not likely be perceived by the human ear (ISO R1996-1971E).

The port authority *Project and Environmental Review Guidelines – Environmental Noise Assessment* (PMV 2015b)[3] (Noise Guidelines) stipulate that mitigation measures should be considered when project noise is expected to exceed a Day-Evening-Night noise level (L_{den}) of 75 dBA. The noise modelling predicts that L_{den} noise levels are predicted to be below the port authority 75 dBA limit at all receptors.

Noise mitigation is incorporated into aspects of the design, including expanding an existing Terminal that is already part of a larger industrialized environment and geographically removed from dense communities, and using electric rail-mounted gantry cranes that will generate less noise than non-electric equipment currently in use. In addition, a Noise Management Plan will be developed that will identify operational practices that can be used to minimize disturbance to surrounding neighbourhoods.

Underwater noise is discussed in the Marine Mammals section below.

Air Quality

Increased road traffic, rail operations, marine vessels hoteling and in transit, use of mobile equipment on site to move containers and diesel power generation during operation of the proposed Project will contribute to increases in emissions of criteria air contaminants (CACs) and volatile organic compounds (VOCs) that have the potential to deteriorate air quality. To understand the effects the proposed Project would have on air quality an Air Assessment was conducted to predict the degree of change from existing conditions.

The Air Assessment followed the approach for Level 1 and Level 2 assessments as directed in the port authority *Project and Environmental Review Guidelines – Environmental Air Assessment* (PMV 2015c)[4] (Air Guidelines) for evaluating the potential impact of the proposed Project on ambient air quality. Level 1 involves a quantification of total (annual) emissions; Level 2 involves developing a computational model to predict the dispersion of contaminants. The Air Assessment considers both emissions from Terminal operations (Terminal Emissions) and emissions associated with container movement to the Terminal (Supply Chain Emissions).

[3] PMV. 2015b. *Project & Environmental Review Guidelines – Environmental Noise Assessment*. July 2015.

[4] PMV. 2015c. *Project & Environmental Review Guidelines – Environmental Air Assessment*. July 2015

The Level 1 and 2 assessments quantified and then modelled emissions under three scenarios:

- **Base Case**: Emissions from the existing operations operating under normal conditions.
- **Project Case**: Emissions associated with the increase of equipment and throughput from the proposed Project under normal operations.
- **No-Project Case**: Emissions associated with future increases in throughput without the proposed expansion. The No-Project Case considers anticipated changes to equipment and throughput expected in 2019 and assumes operation at a sustainable maximum level.

The Level 1 assessment also included a fourth scenario, the Best Available Techniques Case. This case accounts for increase in equipment and throughput associated with the proposed Project and incorporates the use of best available technology not entailing excessive cost.

Overall, there will be an increase of estimated emissions from the Base Case to the proposed Project Case. However, while the overall annual emissions are higher in the Project Case, the overall intensity of emissions per container processed are lower.

Model results show that the estimated maximum ground-level concentrations of all contaminant indicators (SO2, CO, PM10, and PM2.5) except (NO2) meet the most stringent Air Quality Objectives. The analysis shows that predicted concentrations of all contaminants fall to background levels within 5 km of the Terminal.

Exceedances of NO_2 occur under the Base Case, Project Case and No-Project Case and there is little difference in the frequency or level of exceedance between the Base Case and the Project Case. Predicted exceedance events are short-lived and would last only for the duration of the activities that give rise to the “worst case” hour emissions levels, in this case two ships at berth and 16 of 19 rubber tire gantry cranes all lifting a container in the same hour. This concurrence of activities would be rare and would not last more than a few hours at most. Exceedances are predicted in a small area of approximately 0.064 km2 over water or on industrial-zoned areas and do not occur over any Sensitive Receptors.

A number of factors in the assessments lead to an overall conservative (over-estimate) of emissions and dispersion. In both the Level 1 and Level 2 assessments, where there was uncertainty in a particular equipment type or emission factor, the more polluting option was used in the assessment. In the Level 2 assessment, the scenarios were designed to consider the “worst case” concurrence of activities and meteorological conditions, a combination that would occur extremely infrequently. The air assessments also did not take into account mitigation from shore power at berth 5 or reduction in future emissions as a result of replacement of equipment or MARPOL Annex VI emission standards (which require new vessels to phase in more stringent emission requirements).

Greenhouse Gas (GHG) Emissions

The increased capacity for container throughput has the potential to increase atmospheric GHGs. Sources of GHG emissions include diesel fuel combustion, gasoline fuel combustion, purchased electricity consumption, and, to a smaller extent, refrigerant leakage from these operational activities: road traffic, rail operations, marine vessels hoteling and in transit, use of mobile equipment on site to move containers, diesel power generation, and air conditioning/refrigeration.

To understand the effects the proposed Project would have on GHG emissions, a GHG Study was estimated to predict the degree of change from existing conditions. The GHG Study calculated annual emission inventory estimates for the following scenarios:

- **Base Case**: Existing facility and supply chain (e.g., rail, truck, and marine vessels) operating at normal operating level.
- **Project Case**: Proposed Project, including base case and increased operation associated with the expansion, resulting in an increase of equipment and capacity, normal operation.
- **No-Project Case**: Changes that would occur to the existing facility in the future should the proposed Project not proceed. This case allows a comparison to be made between the proponent proceeding with the project or managing future increases in throughput without the proposed expansion. The No-Project Case considers

anticipated changes to equipment and throughput expected in 2020 and assumes that the project operates at a sustainable maximum level.

The quantity of GHG emissions correlates to the amount of fuel and electricity consumed by the various equipment used in operations and activity level (level of use) (e.g., number of hours, distance). The proposed Project would result in an increase in GHG emissions of 19,299 tonnes CO_2e/year from the Base Case that cannot be practically mitigated. To provide context for the magnitude of the increase, GHG emissions for the proposed Project are compared to existing provincial, national, and global GHG emission totals. Total GHG emissions after expansion would be less than 0.1 percent of provincial totals, less than 0.01 percent of national totals, and less than 0.0001 percent of global levels. Based on efficiency for numbers of containers processed, the Project Case emissions intensity represents a 3 percent improvement to GHG emissions performance.

Marine Water and Sediment Quality

Dredging and infilling are the main activities that have the potential to affect the marine environment. Infilling of the eastern and western ends of the existing Centerm Site is required to expand the existing terminal. To prepare a solid foundation for infilling, these areas first need to be dredged. Also, the western expansion will affect how cruise ships manoeuvre and berth at the Canada Place terminal, so navigational dredging is required south of the cruise ship terminal in the area of the Sea Bus terminal. Dredging will be temporary and limited to approximately three months.

Dredging of sediments may affect water quality as a result of increased turbidity, total suspended solids, and any associated bound contaminants. Dredging of sediments also has the potential to affect marine sediment quality as a result of settling of dispersed sediments to the nearfield existing sediment bed. Compaction of sediments during infilling may result in expulsion of contaminated water bound in the existing sediments (pore water). Infilling of the western expansion has the potential to alter tidal circulation in the embayment between Centerm and the cruise ship terminal.

Stormwater discharges from the Centerm site during operations and construction, if not controlled, also have potential to affect marine water quality.

The work conducted to characterize the effects of proposed Project activities on marine water and sediment quality comprised:

- Field sampling and chemical characterization of existing surficial sediment and pore water, and deeper sediments
- Field sampling and chemical characterization of marine water column
- Computer modelling of tidal flushing within the embayment
- Computer modelling of dredged sediment dispersion (turbidity modelling)
- Computer modelling of pore water dispersion

Review of historical data indicates sediments peripheral to the proposed Project display anthropogenic chemistry that is typical of active ports and harbours, which are not pristine in nature. This is demonstrated by elevated metal and polycyclic aromatic hydrocarbon (PAH) content of sediments that often exceed regulatory guideline values.

Chemical characterization of sediments and sediment pore water confirmed that the surficial sediments within the areas proposed for dredging and infilling are contaminated relative to regulatory guideline values for both PAHs and various metals. These conditions were likely created as a result of historical and ongoing human activity typical of an active large marine port city. Deeper sediments, typically over 1 m, display more benign conditions. Chemical characterization of the marine water column indicated good water quality, with results compliant with the Canadian Water Quality Guidelines for Protection of Aquatic Life.

Modelling studies of the dispersion of the bottom sediment during dredging at the three proposed dredge locations indicate that the longer term turbidity guideline of an incremental 5 mg/L above background can be achieved most of the time without mitigation. The modelling results provide good confidence that when mitigation measures are

employed, the federal turbidity guidelines can be achieved within a mixing zone of 100 m. Mitigation measures will include the type of dredging equipment to be used, management of fugitive dredgeate through the use of sediment booms or semi-permeable enclosures; safe handling procedures to prevent release of dredgeate from receiving barges, controlled release of dredge water; and construction supervision and environmental monitoring. While there is potential for dredging to deteriorate marine water quality by increasing turbidity, mitigation measures will limit turbidity. No residual effects of dredging on marine water quality are expected beyond the construction mixing zone.

A water mixing model (CORMIX) was used to predict how expelled pore water mixes with overlying water. This model helped determine the distance of the mixing zone that would allow substances dissolved in the pore water to dilute to levels compliant with federal and provincial marine water quality guidelines. The model predicted mixing and dilutions to federal guidelines would occur within less than 1 m of the pore water expulsion. Given the conservative assumptions on which the modelling is based it is likely to be less than 10 cm.

The western expansion footprint would affect tidal flushing of the embayment by increasing residence time by 2 to 3 hours from the current residence time, which ranges from 5 hours to 11 hours. The increase in embayment residence time, however, does not preclude embayment flushing. The slightly reduced current velocity will continue to flush and replenish new water mass through natural tidal cycles.

Stormwater discharge from the Terminal to the marine environment during either the construction phase or operation phase, if uncontrolled, could cause deterioration of water quality. Centerm has an existing stormwater management system that includes remote controlled outfalls on each side of the Terminal (north, east, south and west) with oil/water separators to prevent any contaminated run-off from entering the marine environment. The existing systems will be maintained and expanded to handle the surface flow from all new land surfaces. All outfalls will continue to be equipped with remote controlled oil/water separators to minimize the potential for stormwater to affect the water quality around the Terminal.

Marine Resources

Project activities that could interact with Marine Resources (fish and fish habitat, marine birds, and marine mammals) during construction and operation include dredging, infilling, terminal operations, stormwater discharge and vessel traffic.

Fish and Fish Habitat

In-water construction of the Terminal expansion and Ballantyne Pier removal and rehabilitation have the potential to result in serious harm to fish, loss of fish habitat, and deterioration of habitat quality from increased noise, degraded water quality, increased light levels, and deposition of contaminated sediment.

To understand the effects of the proposed Project on fish and fish habitat, existing literature was reviewed and a Marine Resources Study was conducted in accordance with the port authority *Project and Environmental Review Guidelines – Habitat Assessment* (PMV 2015d)[5] (Habitat Guidelines). The marine fish and fish habitat study was based on data collected by Foreshore Technologies Inc. through dive surveys (Appendix G). Transects were established around the west and east ends of Centerm. Observational and semi-quantitative data were collected by divers as they surveyed the transects.

The area around Centerm supports a diverse marine environment ranging from mud/silt substrates with a low diversity of plants and animals to areas of boulder and cobble that support diverse assemblages of algae, invertebrates, and fishes. While there is no active fishery in the area around Centerm, fish and invertebrates such as ling cod, Dungeness crab, and sea cucumbers have been observed in the area and they are often part of commercial, recreational, and Aboriginal fishery in other areas of Burrard Inlet. Salmon smolts also likely pass through the Centerm area on their way to the open ocean where they will be part of a fishery as adults.

[5] PMV. 2015d. *Project & Environmental Review Guidelines – Habitat Assessment*. June 2015.

The potential residual effect for fish and fish habitat includes the temporary loss of productive habitat and harm to fish or fish habitat from the dredging and placement of fill and the effects of degraded water quality on fish health. Habitat lost due to the new project footprint of 72,070 Habitat Units (HUs) would be replaced with an estimated 146,200 HUs provided along the slopes of the dykes that will be built to contain the soils used to infill and expand the terminal footprint. The new habitat is expected to support fish that are part of a commercial, recreational, or aboriginal fishery or fish or habitat that support such a fish. Measures to create new fish habitat would, however, take up to 3 years to achieve similar productivity to the habitat that would be affected, resulting in a temporary loss of productivity.

Water quality effects as a result of dredging and infilling were described above. Mitigation measures that will be established to limit effects on water and sediment quality will also limit serious harm to fish.

Marine Birds

On-water construction and marine shipping activities have the potential to disrupt feeding and nesting of marine birds. To understand the effects of the proposed Project on marine birds a desktop Marine Birds Study was conducted using data from marine bird surveys in Burrard Inlet.

Butler et al. (2015)[6] reported that various species are regularly observed in the area of Centerm; however, the area was not a primary area for any bird except for the Glaucous-winged Gull, which is well known to tolerate human activity.

The area where construction activities would take place is already currently affected by vessel movement and noise and light effects from the existing Centerm operations. Also, nearby facilities, including the cruise ship terminal and Vanterm, create disturbance on the water. During the operational phase, the increased vessel activity as a result of the proposed Project would be minor in relation to the existing vessel traffic in the Inner Harbour. The additional activities associated with construction and operation of the proposed Project are unlikely to have a noticeable effect on the marine birds that use the Inner Harbour.

Marine Mammals

The on- and in-water activity associated with construction of the Project could affect marine mammals through interaction with vessels and underwater noise from construction. During the operational phase, the increased vessel traffic could lead to an increase of marine mammal/vessel interactions. To understand the effects of the proposed Project on marine mammals, a desktop Marine Mammal Study was conducted from existing reports with information on the occurrences and observed effects of marine activities on marine mammals around the Port of Vancouver.

The most common marine mammal in Burrard Inlet is the harbour seal (*Phoca vitulina*) with an estimated population of 300 animals (TWN 2005). The nearest known congregation of harbour seals is on log booms near Port Moody approximately 15 km east of Centerm (Butler et al. 2015). Other marine mammals are infrequent visitors to the Inner Harbour. From 1990 to 2014, the BC Cetacean Sightings Network reported only six sightings (three grey whales, two killer whales, and one harbour porpoise) in the Inner Harbour (KWL 2015)[7]. However, a review of news stories in local papers found five reports of killer whale sightings in Burrard Inlet between 2011 and June 2016.

[6] Butler, R.W., A.R. Couturier, and E. Dickson. 2015. Status and Distribution of Marine Birds and Mammals in Burrard Inlet and Indian Arm, British Columbia 2011-13. Pacific Wildlife Foundation & Bird Studies Canada. Unpublished Report. Port Moody, BC and Port Rowan, Ontario.

[7] KWL. 2015. *Burrard Inlet Action Plan: A Tsleil-Waututh Perspective*. Public Review Draft.

The assessment indicates that the construction and operational phase of the Project is unlikely to have any damaging or long term effects, particularly in the context of the number of marine mammals reported to use Vancouver Harbour and minor increase of shipping activity associated with the proposed Project.

The level of underwater noise associated with construction and operation is unlikely to cause physical injury to marine mammals. Slow start-up procedures will be implemented for dredging, infilling, and vibro-densification in-water work to allow marine mammals in the vicinity of the activity to leave the area.

In 2012 the large vessel traffic (cargo vessels, passenger vessels, and tankers) transiting Burrard Inlet was reported to be 336 vessels per month (Kinder Morgan 2013)[8]. During operation the additional ship activity of one extra vessel per week represents a 1 percent increase in vessel activity, which is unlikely to result in a measureable change in marine mammal activity in the area or increase the probability of vessel strikes for the marine mammals that occasionally enter Burrard Inlet. Vessels are required to travel at a safe speed (PMV 2016e)[9], which mitigates the potential for vessel strikes and provides navigational safety.

Terrestrial Resources

During the construction phase, clearing and site preparation of the Project footprint have the potential to remove or disturb vegetation, introduce invasive plants and noxious weeds, and destroy or disrupt nests. During the operation phase, lighting and new buildings have the potential to affect wildlife. To understand the effects the proposed Project would have on terrestrial resources, a Terrestrial Resources Study was conducted. The study began with a review of existing information for the Terrestrial Resources Study Area followed by a field reconnaissance level survey of the proposed Project Site. Sources of existing information included the City of Vancouver online mapping layer, which identifies trees planted along the boulevards of city streets, including those within the 250 m study area. Aerial imagery was used to identify locations of vegetation on the Centerm site. A reconnaissance survey was conducted by professional biologists familiar with the wildlife and vegetation found in Vancouver. Information collected during the survey included:

- identification and location of plant species on the site
- wildlife observations, including locations of old bird nests
- photographic records of observations

The existing vegetation is limited and mostly invasive and non-native species. There are no rare or endangered plants recorded on the site that would require protection during project construction. The limited and weedy nature of vegetation reflects that the existing site is paved for industrial use. The most likely potential effect of clearing the existing vegetation would be to cause the spread of invasive and noxious weeds.

The habitat within the proposed Project footprint is limited to small pockets of mostly invasive plants and a few trees. During the reconnaissance survey no important bird nests were observed on the Site. Due to the high level of existing activity on site only those birds that become habituated to the ongoing movement of equipment and the associated noise would likely attempt to nest within the area (i.e., crows and pigeons). However, as a precaution, a nest survey will be conducted to determine whether there are any active nests prior to removal of trees, shrubs, buildings, or structures during the breeding bird window (March 15 to August 15). If an active nest is found then it would be left undisturbed until young have fledged and left the nest.

Given the limited extent of vegetation and presence of wildlife on the Site and taking into account mitigation measures to prevent and control the introduction and spread of invasive plants and protect nesting birds, no residual effects on terrestrial resources are anticipated. Mitigation measures include the implementation of a

[8] Kinder Morgan. 2013. *The Trans Mountain Expansion Project, an Application Pursuant to Section 52 of the National Energy Board Act*. Prepared by Trans Mountain Pipeline (ULC). December 2013.

[9] PMV. 2016e. *Port Information Guide*. Prepared by Harbour Master Port Metro Vancouver. August 2016.

vegetation management plan that describes how invasive plants are to be handled and disposed of and requiring searches of active bird nests if clearing or demolition is to take place in the bird breeding season.

Archaeological Resources

Clearing and site preparation for the proposed Project have the potential to disturb known and not yet recorded archaeological sites. The alteration of lands adjacent to historic buildings has the potential for direct physical effects on, or changes to, the surrounding environments of historic places. To understand the effects the proposed Project would have on heritage resources, an Archaeological Overview Assessment (AOA) and Heritage Impact Assessment were conducted. The AOA is a desktop review of pre-contact Coast Salish land activities, as identified through ethnographic, historic, ecological, geological, and archaeological literature. The AOA evaluates the risk that the proposed Project could affect recorded or currently unknown archaeological sites.

The AOA reports that any disturbances to the foreshore area and/or the removal of the pre-existing capping have the potential to disturb any existing (but currently unrecorded) subsurface archaeological deposits. This area would have had very high potential for archaeological sites, but this potential is now limited due to the past impacts of construction and ground disturbance since the establishment of the Hastings Saw Mill and the Canadian Pacific Railway. With the application of mitigation measures, including archaeological monitoring and implementation of a Chance Find Protocol during construction, there is low residual risk that archaeological sites could be disturbed by the proposed Project.

Heritage Resources

Archival records, including photographs, were used to describe the historic development and past use of the buildings included in this assessment. These records were also used to describe the heritage values and character-defining elements of the buildings. The residual effects of the proposed Project on these heritage values were characterized by using Parks Canada's *Standards and Guidelines for the Conservation of Historic Places in Canada* (2010)[10]. The assessment for each of the buildings is based on the following scope:

- **Mission to Seafarers building**: The assessment considers the potential effects on the building as a result of its location adjacent to the Terminal Site.
- **Shed One on Ballantyne Pier (existing Ballantyne Cruise Terminal building)**: The assessment considers the potential effects of adapting the current facility into an office building.
- **Rogers Sugar building**: The assessment considers the potential effects from the Centennial Road Overpass.

The proposed Project design does not require any alteration to the Mission to Seafarers building. While the building is adjacent to the Terminal, the proposed Project will involve only changes to the parking lot adjacent to the building, and this will not alter the physical context of the building in a way that would affect its historical values.

The existing Ballantyne Cruise Terminal heritage building will be retained, and stripped of current internal walls and fittings. The building will require structural and seismic retrofit works to enable its reuse as the new Container Operations Facility. The existing road network around the Ballantyne Cruise Terminal heritage building will be removed to make room for the new truck gates.

The proposed Project will not physically alter the Rogers Sugar building, which will remain *in situ*. However, the proposed Centennial Road Overpass will limit the public appearance of the primary façade by concealing major portions of the lower floors and will obscure the public view of many of the windows.

[10] Parks Canada. 2010. *Standards and Guidelines for the Conservation of Historic Places in Canada*. http://publications.gc.ca/collections/collection_2011/pc/R62-343-2010-eng.pdf.

Summary of Environmental Mitigation

The following table is a compilation of the mitigation measures that were identified during the technical studies, and provides a list of relevant sections of the CEMP (AECOM 2016a). The CEMP provides Best Management Practices (BMPs) for environmental protection during Project construction, and is to be a “living document” subject to continuous improvement.

Summary of Mitigation Measures by Environmental Component

Environmental Component	Mitigation Measures and Relevant Management Plans
Acoustic Environment	**Design Mitigation Measures** ▪ Expanding an existing terminal that is already part of a larger industrialized environment and geographically separated from dense residential communities ▪ Using electric rail-mounted gantry cranes that will generate less noise than non-electric equipment currently in use **Operational Mitigation Measures** ▪ No additional project-specific measures are proposed to mitigate noise. A Noise Management Plan will be developed and implemented that will identify operational practices that can be used to minimize any disturbance of nearby neighbourhoods that arises. **Management Plans** ▪ CEMP Section 5.4 Noise, Vibration, and Light Management, Mitigation and Management Measures for Noise and Vibrations

Environmental Component	Mitigation Measures and Relevant Management Plans
Air Quality and GHG Emissions	**Design Mitigation Measures** ▪ Reconfiguration of the container yard will optimize container handling and minimize diesel consumption from the rubber-tired gantries and internal transfer vehicles. ▪ The additional track will reduce the number of train shunts and short trips needed to build unit trains of 3,658 m in length. Though overall emissions may increase due to higher throughput, efficiency will be improved. ▪ Though full electrification of the entire Terminal and proposed Project is not practical, equipment electrification was incorporated where feasible. ▪ Electrification of equipment will focus on areas where the change can be accommodated without compromising Terminal capacity. The existing diesel rubber-tired gantry and terminal vehicle operations are expected to remain in operation, with electrification focussed on the intermodal yard, where two diesel powered cranes will be replaced with five electric rail-mounted gantry cranes. The change from diesel fuel to electricity for rail loading will greatly improve productivity and GHG emissions intensity, considering purchased electricity has a lower GHG intensity than diesel combustion. ▪ Extension of the berth to allow simultaneous berthing of two large ships will reduce the need for vessel repositioning. ▪ The larger central operations and administration building will allow for consolidation (and removal) of various smaller buildings around the site, which leads to more efficient electrical, heating, and cooling systems. The detailed design phase will include an energy efficiency study and demonstration of Best Available Technology Not Entailing Excessive Cost. ▪ All new high-mast lighting will use the more energy efficient LED fixtures. **Operational Mitigation Measures** ▪ New equipment will meet the most stringent (Tier 4) emission standard as appropriate. ▪ As older equipment is retired it will be replaced by Tier 4 equipment. ▪ Vessels will adhere to International Maritime Organization engine regulations for mitigating NO_X emissions. ▪ While not specific to the proposed Project, the port authority is considering providing access to shore power for container ships, eliminating marine emissions from vessels at berth. The port authority is proposing shore power connections at berth 5 and 6 at Centerm. The shore power connection proposal for berth 5 is in the permitting phase, and studies are being conducted on the feasibility of shore power connection for berth 6. ▪ For marine operations, mitigation is provided through recent reductions in requirements for sulphur content in fuel, and through enforcing NO_x and VOC limits. These improvements are currently in place and will not change in the Project or No-Project cases. **Management Plans** ▪ CEMP Section 5.3 Air Quality (including dust control)

Environmental Component	Mitigation Measures and Relevant Management Plans
Marine Water and Sediment Quality	**Design Mitigation Measures** ▪ Centerm has an existing stormwater management system that includes remote-controlled outfalls on each side of the Terminal (north, east, south, and west) with oil/water separators to prevent any contaminated run-off from entering the marine environment. The existing systems will be maintained and will be expanded to handle the surface flow from all new land surfaces. All outfalls will continue to be equipped with remote-controlled oil/water separators. **Construction Mitigation Measures** ▪ For dredging, the Total Suspended Solids performance standard is not to exceed 5 mg/L for dredging events longer than 24 hours or 25 mg/L above background for events less than 24 hours beyond the construction mixing zone, or else temporary cessation of dredging activity will ensue to allow attenuation. ▪ For dredging, the methods that will be used to achieve turbidity performance levels will be finalized during the detailed design. Proven methods to reduce turbidity that could be adopted include choice of dredging technology (mechanical dredging with environmental bucket or cutter/suction dredging), management of fugitive dredgeate (i.e., sediment booms or permeable enclosures), coordination with optimal tidal conditions, and safe dredgeate handling/transfer procedures. **Operational Mitigation Measures** ▪ Centerm has an operations Spill Prevention and Emergency Response Plan in place that will be updated to reflect the new layout and expanded area of Centerm to maintain safe operations. The control systems and the management plan will prevent uncontrolled releases to the marine environment. Any discharges to the marine environment will meet federal regulatory water quality guidelines and therefore prevent deterioration of receiving water quality. **Management Plans** ▪ CEMP Section 5.7 Marine Works ▪ CEMP Section 5.9 Dredging ▪ CEMP Section 5.10 Fill Placement ▪ CEMP Section 5.11 Water Quality Monitoring ▪ CEMP Section 5.12 Stormwater Management ▪ CEMP Section 5.13 Erosion and Sediment Control ▪ CEMP Section 6.3 Spill Response Plan ▪ Spill Prevention and Emergency Response Plan ▪ Stormwater Pollution Prevention Plan

Environmental Component	Mitigation Measures and Relevant Management Plans
Marine Resources	**Design Mitigation Measures** ▪ The productivity of fish and fish habitat will be maintained around Centerm by finishing the rock dykes with a riprap face of rock ranging in diameter from 255 mm to 1,500 mm, similar to sizes currently on the existing dykes. **Construction and Operational Mitigation Measures** ▪ The potential for physical harm to fish during dredging, infilling, and demolition will be reduced by: o conducting a salvage of Dungeness crab prior to the start of dredging or deposition of sand for infilling and o using clean fill and size of fill that has limited potential for causing sediment plumes outside the construction area and causing elevated turbidity and TSS outside the construction area. ▪ To reduce potential effects of underwater construction noise on marine mammals and fish, slow start-up procedures will be implemented for dredging, infilling, and vibro-densification in-water work; this measure will alert mammals in the vicinity of the activity to leave the area. ▪ If the contractor decides to use construction methods that require pile-driving, wherever practical, vibratory driver should be used. The use of an impact hammer will require measurement of pressure levels in the water and additional mitigation measures including bubble curtains may be required to avoid harm to fish or marine mammals. ▪ The demolition of the pile-supported structures will be managed to prevent debris entering the water to the extent practicable. Booms will be used to contain fugitive floating debris. ▪ The Erosion and Sediment Control Plan will be developed to minimize risk of sedimentation during all phases of the project. The plan will, where applicable, include: o installation of effective and maintained erosion and sediment control measures and o site isolation measures such as silt curtains or silt booms for containing and managing suspended sediment where in-water work such as dredging is required. ▪ Machinery will be washed, refueled, and serviced and fuels and other materials will be stored at a sufficient distance from the water to prevent any deleterious substances from entering the water. ▪ Lighting effects will be reduced by adopting BMPs for lighting, as described in CEMP Section 5.4. ▪ The existing Stormwater Management Plan and related infrastructure will be expanded to control on-site runoff during construction and operation so that any discharges to the marine environment meet CCME water quality guidelines. ▪ To mitigate potential interactions between vessels and marine mammals, existing requirements for vessel speeds within Vancouver Harbour will be observed. **Management Plans** ▪ CEMP Chapter 5.4 Noise, Vibration, and Light Management ▪ CEMP Section 5.7 Marine Works ▪ CEMP Section 5.9 Dredging ▪ CEMP Section 5.10 Fill Placement ▪ CEMP Section 5.11 Water Quality Monitoring ▪ CEMP Section 5.12 Stormwater Management ▪ CEMP Section 5.13 Erosion and Sediment Control ▪ CEMP Section 5.15 Sensitive Habitat Features and Species ▪ CEMP Section 6.3 Spill Response

Environmental Component	Mitigation Measures and Relevant Management Plans
Terrestrial Resources	**Design Mitigation Measures** ▪ None applicable **Construction and Operational Mitigation Measures** ▪ Prevent and control the spread or introduction of invasive plants by: o cleaning earth-moving equipment to remove any foreign soil and vegetation prior to arriving at the construction site, o covering any surficial material taken from any areas infested with weeds and stockpiled on-site to avoid the spread of seeds, and o proper disposal of noxious weeds and invasive plants and soils where these plants were growing. ▪ Use native vegetation if any areas within the Project footprint are to be reclaimed through seeding or plantings (i.e., areas of exposed soils). ▪ If site preparation or demolition is to take place during the bird nesting and fledging season (March 15 to August 15) a nest survey will be conducted to determine whether there are any active nests in any trees, shrubs, buildings, or other structures that can be used for nesting. If an active nest is found, then it will be left undisturbed until young have fledged and left the nest. **Management Plans** ▪ CEMP Section 5.14 Vegetation and Wildlife Management ▪ CEMP Section 5.15 Sensitive Habitat Features and Species
Archaeological Resources	**Design Mitigation Measures** ▪ None applicable **Construction and Operational Mitigation Measures** ▪ Archaeological monitoring will be conducted during any work potentially affecting deposits below historic fill at the original shoreline. ▪ A Chance Find Protocol will be implemented in the unlikely event that archaeological materials are identified during construction and will include: o an archaeological monitor to be on site during any deep excavations upland of the original shoreline, o an archaeologist to provide awareness training to equipment operators so that they know what artifacts might look like, o a stop work and notification protocol if potential archaeological resources are identified. ▪ Personnel will be trained on how to recognize archaeological materials and how to implement the Chance Find Protocol. **Management Plans** ▪ CEMP Section 5.16 Archaeological Resources Management ▪ The Chance Find Protocol will be defined and agreed upon with the port authority prior to construction

Environmental Component	Mitigation Measures and Relevant Management Plans
Heritage Resources	**Design Mitigation Measures** ▪ Character-defining elements of the historic Ballantyne Pier will be retained and incorporated into the new Container Operations Facility. ▪ The Project layout avoids the Rogers Sugar building and the Mission to Seafarers building. **Construction and Operational Mitigation Measures** ▪ Damaged historical elements of the Ballantyne Pier will be carefully repaired, as necessary. **Management Plans** ▪ None applicable