2.0 Project Description

2.1 Applicant Information

FSM Management Group Inc.

FSM Management Group Inc. (FSM Group) was established in 2001 to provide project management services at airports in Western Canada. FSM Group was awarded a contract in 2005 to provide administrative, technical and project management services at all major airports in Canada. Since 2005, FSM has expanded to provide strategic and innovative solutions for fuel management at Canadian airports.

FSM Group, an affiliate of FSM Group LLC and Apron Fuel Services Inc., is a multidisciplinary professional services firm that provides airport fuel consortium administration, fuel infrastructure project and construction management, engineering and environmental management, business consulting, and structured finance solutions for aviation fuel and ground fuel facilities at major airports in North America. We also provide niche solutions for fuel system management at smaller and mid-size airports.

Operating from offices in Montréal, Orlando, Toronto and Vancouver, FSM Group is currently managing several airport fuel facility construction projects, either under way or in the planning stage, which combined are valued in excess of $350 million.

For more than a decade, FSM Group has managed the design and construction of large-scale jet fuel offloading, storage and distribution systems at international airports in North America. We have also structured multi-million dollar long-term financing programs at the Toronto, Montréal and Vancouver international airports, in addition to managing the accounting, legal, and borrowing requirements of getting large-scale projects off the ground.

2.2 Tenant Information

Introduction and Background

Vancouver Airport Fuel Facilities Corporation (VAFFC) (the Proponent) is a not-for-profit company owned by a consortium of international and domestic commercial airlines that operate at the Vancouver International Airport (YVR). Currently, there are twenty-five consortium members. VAFFC owns and operates fuel storage and distribution facilities at YVR, and has over twenty years of experience in fuel handling activities at the airport. Similar fuel facility corporations operate at all of the major international airports across Canada. VAFFC contracts the management, construction and operation of its facilities to qualified organizations, and draws expertise from a network of experienced engineering and environmental consultants specializing in fuel infrastructure.

The consortium structure provides efficient sharing of costs and risks between member airlines. Although membership may vary with the airlines serving YVR, the VAFFC structure remains stable over time. VAFFC has invested over $60 million in fuelling infrastructure at YVR over the

last fifteen years, and capital financing of over $100 million is attainable within VAFFC's financial structure.

Responsibilities

VAFFC's fuel facilities at YVR include two 4-tank storage facilities and tanker truck offloading rack systems, an airside tanker truck loading compound, an extensive underground pipeline hydrant system to transfer fuel from VAFFC's tanks to airside fuelling aprons, and a maintenance and administration facility. The VAFFC fuel storage tanks receive fuel from two separate upstream delivery modes: a pipeline and storage delivery system owned and operated by Trans Mountain (Jet Fuel) Inc.; and from daily tanker truck deliveries from the Cherry Point Refinery, located in Washington State.

VAFFC operates the only fuel facility system servicing YVR's main domestic and international terminals and, therefore, provides fuel delivery service to all airlines using those terminals. Non-member airlines receive fuel delivery service from VAFFC on a fee-for-service basis. Each member airline purchases fuel for its own use and arranges delivery to the VAFFC fuel facilities at YVR, either through the existing Trans Mountain (Jet Fuel) Inc. delivery pipeline system or via tanker trucks. VAFFC manages the storage and handling of each airline's fuel and ensures its delivery to the airline's respective aircraft. On behalf of its member airlines, VAFFC is responsible for:

- Operating and maintaining its fuel facility system at YVR;
- Working with the Vancouver Airport Authority and Transport Canada to develop fuel demand forecasts;
- Directing new investment, maintaining insurance, and structuring debt;
- Planning, constructing and operating safe, reliable and cost-effective fuel infrastructure to meet near and long-term demand projections; and
- Obtaining regulatory permits, approvals and authorizations as they relate to fuel system expansion and/or development.

Project Representatives

The Project is managed by FSM Group. FSM Group is responsible for administrating the day-to-day operation of VAFFC's activities and facilities at YVR. FSM Group specializes in the planning and management of fuel-related projects and infrastructure at airports across Canada. FSM Group is the Proponent contact for the Project.

2.2.1 BC Certificate of Registration

THIS PAGE IS INTENTIONALLY LEFT BLANK

2.2.2 Corporate Profile

THIS PAGE IS INTENTIONALLY LEFT BLANK

2.3 Project Rationale

2.3.1 Rationale

YVR has experienced tremendous growth over the last two decades, driving an increase in the demand for aviation fuel. Over the same period of time, local fuel refining capacity has declined from four refineries to one, and is at the point where international sources now supply the majority of fuel for YVR.

Aviation fuel forecasts are an important component of airport planning as well as fuel facility planning and design. In planning for the future, VAFFC bases its fuel forecasts on Vancouver Airport Authority and Transport Canada high-range passenger forecasts to predict long-term fuel demand growth because passenger traffic is strongly correlated to fuel consumption at YVR.

To remain competitive on the West Coast and maintain YVR's position as Canada's Pacific Gateway, it is critical that airlines operating out of YVR have access to globally competitive and secure fuel supply sources. YVR is Canada's second largest airport, with well in excess of one million passengers relying on aircraft operations each month. The airport is also a significant employment generator (approximately 360 employers and 26,700 direct jobs) and economic contributor to the City of Richmond, Metro Vancouver, British Columbia, and Canada. According to a 2005 independent study of YVR's economic impact, direct and indirect employment contributes approximately $3.1 billion in total Gross Domestic Product value to the province.

Development of a new fuel delivery system is essential to secure access to flexible and competitive offshore fuel supply sources and address the critical needs of current and future fuel demand at YVR. Marine transportation offers the most economic means to access a broad range of flexible, competitively priced and secure fuel supply sources. Since YVR is located in an international port, marine transport represents a key component in VAFFC's long-term planning of fuel delivery to YVR.

2.3.2 Project Overview

VAFFC is developing a new aviation fuel delivery system that will serve YVR's fuel requirements over the long-term. The Project is located in the City of Richmond, Metro Vancouver, British Columbia, and consists of the following component infrastructure:

- Upgrades to an existing marine terminal wharf on the South Arm of the Fraser River (Fraser River or river) to accommodate a range of aviation fuel cargo vessel types and sizes;

- Construction and operation of facilities at the marine terminal to off-load and transfer fuel from vessels;

- Construction and operation of a new fuel receiving facility located on land near to the marine terminal;

- Construction and operation of a new pipeline to transfer off-loaded fuel from the marine terminal to the new fuel receiving facility; and

- Construction and operation of a new pipeline to deliver fuel from the new fuel receiving facility to VAFFC's fuel facilities at YVR.

The Project underwent a robust multiyear environmental assessment review process subject to the *BC Environmental Assessment Act* and *Canadian Environmental Assessment Act*, culminating in December 2013 with the issuance of a provincial Environmental Assessment Certificate (EAC) and federal Environmental Assessment Decision Statement, with conditions.

The Fuel Receiving Facility will be construction in compliance with the Certified Project Description issued in response to the Environmental Assessment application, with the following minor exceptions:

1. Location. The fuel receiving facility will be located on approximately 13.6 acres of PMV land instead of approximately 12 acres as identified in the CPD. The site was reconfigured during the final lease negotiation in 2015 as part of an optimization of the overall land parcel, Lot 1. PMV will retain some access rights which may, in time, reduce the VAFFC lease area to closer to 12 acres.

2. Delivery Pipeline. The delivery pipeline to YVR will now leave the VAFFC leased area and travel west across private land and then north on Savage Road before entering Francis Road. The CPD approved route travels north on PMV land prior to entering Francis Road at its easternmost extent. The net result is less pipeline infrastructure on PMV land, and no additional land lease, easement, or service right of way will be necessary in addition to the leased area.

3. Delivery Pipeline. The delivery pipeline size will be increased from 300mm diameter to 350mm diameter to improve pump performance and power efficiency over the life of the project. It will also lower the operating pressure. This change includes the short section of pipeline on PMV land prior to leaving the leased area.

Due to the addition of Savage Road and the private property crossing adjacent to the PMV lands, and the small increase in pipeline diameter, the Environmental Assessment Office has confirmed that an amendment to the Environmental Assessment Certificate will be required. In addition to these items, VAFFC will be making a route change in north Richmond and YVR that will also require an amendment VAFFC will be submitting an application for an amendment to the EAC once the routing change in north Richmond is confirmed.

2.3.2.1 Marine Terminal

VAFFC owns a waterfront property and wharf on the Fraser River. The wharf will be upgraded to meet current seismic design criteria, spill prevention, containment and response measures, improve structural capacity and accommodate fuel cargo off-loading and transfer facilities for vessels ranging in size from barges up to Panamax-class. Minor dredging of the riverbed around the existing perimeter wall and installation of new pipe-pile breasting dolphins, re-grading of rip-rap, and land-based ground improvements, are among the activities VAFFC will undertake.

2.3.2.2 Fuel Receiving Facility

The location for the development of a new fuel receiving facility has been identified within a parcel of Port-owned lands adjacent and northeast of VAFFC's marine terminal property. VAFFC intends to lease this parcel of land from the Port. The fuel receiving facility will include six aboveground tanks capable of providing a total capacity of approximately 80 million litres (e.g., 500,000 barrels).

The Project is comprised of the following infrastructure, as relevant to this permit application:

- A new fuel receiving facility, consisting of six storage tanks, filtration, and pumping systems control structures, all to be located on Port Metro Vancouver land; and

- Sections of new transfer and delivery pipeline that will be located on Port Metro Vancouver land.

Because of the requirement to conduct ground improvements before construction of the fuel receiving facility can start, a phased approach to this component of project construction is proposed whereby pre-construction early works would be undertaken on the land to be leased from Port Metro Vancouver for the purposes of providing suitable ground conditions for the future construction of the new fuel receiving facility. These pre-construction early works will involve removal of overburden material and excavation and replacement of below surface materials. The subsequent construction phase for these project components, for which the detailed design engineering works are underway, will include construction of the new fuel receiving facility, sections of piping, road access, containment areas and the associated ancillary facilities

2.3.2.3 Fuel Delivery Pipeline

A short pipeline (e.g., approximately 0.5 kilometres long) will be constructed to transfer fuel from vessels at the marine terminal to the fuel receiving facility. A longer pipeline (approximately 15 kilometres) will be constructed to deliver fuel from the fuel receiving facility to YVR.

A preferred route has been identified by VAFFC for the delivery pipeline which is expected to utilize existing transportation and/or utility corridors in the City of Richmond.

2.3.3 Project Benefits

The Project will result in significant economic, social and environmental benefits to the region. Some of the key benefits include:

- Access to more dependable, diverse and competitive offshore fuel supply sources to meet YVR's long-term fuel requirements.
- Enhanced global competitiveness of YVR for airlines and travelers which will assist YVR in continuing its important economic contribution to the region and the Province.
- Economic contribution during construction and operation.
- Modernization of the fuel receiving, storage and delivery infrastructure to YVR, which will enhance the performance of fuel delivery in all respects, including: operational, maintenance, reliability, safety and environmental.

Greatly reduce or eliminate the use of tanker trucks to transport aviation fuel along Highway 99 and city streets, with a corresponding reduction in the related safety and environmental impacts.

2.4 Project Scope and Schedule

For the purposes of this application for a Project Permit, this section and subsequent sections focus on the Fuel Receiving Facility component of the Project. The scope of the Project Permit is limited to the development of Project infrastructure on leased land administered by Port Metro Vancouver. This includes primarily the fuel storage tanks and associated piping, processing, and emergency/backup equipment. In addition, several small buildings and sections of underground fuel pipelines will also be located on the leased premises. Construction of the facilities on the leased land is categorized in two phases. The first phase is a heavy earth moving and backfilling operation and the second phase is the main elements of facility construction including utilities, foundations, and visible components of the fuel receiving facility.

2.4.1 Phase One – Ground Improvements

Upon occupancy of the site, a number of processes must be undertaken to prepare and strengthen the ground below and surrounding the proposed structures in order to meet settlement and seismic performance parameters. This involves:

1. Site Preparation: set up staging areas, drainage systems, and construction security measures. Also includes removal, disposal and replacement of unsuitable sub-base materials to varying depths depending on the surface structures.

2. Ground Improvement: densification using stone columns in areas of critical infrastructure such as tanks and processing areas.

These works are anticipated to require up to 12 months to complete before any significant foundation or utility work can commence in Phase 2.

Site Preparation

This work will involve leveling the site to a working elevation typically around the base elevation of the future containment area. Site preparation will also include sand base installation as a working surface for ground improvement, perimeter drainage and sediment control system, temporary power, lighting, fencing, and other services.

Once the site is leveled to the working surface, the site will be over-excavated to mitigate settlement of the shallow clayey silts underlying the tank and process area locations.

Over-excavation of the soft clayey silts and peat will generate enormous quantity of unwanted spoil material (up to 150,000 cubic meters), however is easily replaced with dredged river sand as quality backfill material not subject to settlement. Over excavation could take as little as three months or as much as six months depending on weather and the ability to use off-road equipment for material transfer.

Most of the excavated material is expected to be accepted by a neighbouring development as fill material and will not be transported on public roads. Up to 20% of the material will be transported out of the site along Williams Road, No. 6 Road and Steveston Highway to Highway 99. This amounts to an anticipated traffic density of up to 50 trucks per day over a period of 90 days.

Wheel wash facilities and sweepers will maintain roads in a clean and tidy state. Drainage of the site will be controlled and filtered through silt bags and gravel beds prior to entering adjacent ditches. Ditches will be lined with silt fences and monitored for water quality by the environmental monitor.

Ground Densification

Ground densification is required to provide the facility the stability to withstand a major seismic event. Operations and the Vancouver International Airport will depend on the function of the fuel receiving facility in a post-disaster scenario and therefore the seismic performance target is a 1:2475 year event.

Typical to the deltaic soils of Richmond, ground densification will consist of increasing the strength and density of the ground below the heavy tanks to a depth of up to 20 meters. The method expected to be used is vibro replacement, or stone columns, whereby columns of native soils are replaced with columns of dense, compacted granular fill. A crane mounted system injects water to effectively drill a hole down through the layers of soft clays, silts and sands, and coarse gravel is poured down the

hole and collects at the bottom. The column is slowly compacted back to the surface leaving an almost uniform column of coarse gravel 20 meters deep.

This process will be repeated over an area of approximately 20,000 square meters to cover the area necessary to support the future tanks. During the entire process, surface water and silty soils are completely contained within the ground densification zone in cells which allow moisture to reabsorb into the ground after the columns are completed. At the end of the process, some quantities of spoil material area expected to be disposed of off-site as unsuitable for remaining construction. This volume of material is low, and therefore traffic during this process is limited to daily mobilization of work crews, with period low volumes (five trucks/day) of material leaving the site.

Granular materials to be used for the columns are expected to be received by marine barge at the adjacent VAFFC marine terminal. Road trucks (or off-road trucks if permitted) will transfer material directly across Williams Road will little or no traffic management issues other than a flag person to control the crossing area.

Wheel wash facilities and sweepers will maintain roads in a clean and tidy state. Drainage of the site will be controlled and filtered through silt bags and gravel beds prior to entering adjacent ditches. Ditches will be lined with silt fences and monitored for water quality by the environmental monitor.

The ground densification process requires up to six months to complete. In order to meet with the overall project schedule this work must commence the beginning of summer 2015 and be complete prior to the end of 2015.

2.4.2 Phase Two – Facilities Construction

Following the Ground Improvements phase, construction of the fuel receiving facility will consist of underground utilities, pipeline sections, foundations, six receiving tanks, secondary containment, transfer pump system, filtration system, storm water management systems, emergency/backup systems and operations building.

The six tanks will be above ground vertical carbon steel single wall tanks constructed per API 650, each approximately 35 metres in diameter and 14.6 metres high. The tanks will provide a combined total capacity of approximately 80 million litres (e.g., 500,000 barrels), and will sit atop concrete foundations and an impermeable dyke liner.

The tanks will:

- Be fitted with a primary and secondary level control system, which will include monitoring and overfill protection;
- Incorporate a pressure/vacuum venting system to control emissions;
- Incorporate foam dispensing system connected to the foam storage building;

- Be fitted with automatic motorized emergency valves to control the receiving and dispensing lines to each tank; and
- Be provided with a liner and leak detection

The fuel received from the marine terminal will go through an inbound filtration system prior to entering the tanks. The filtration system will be located on a concrete containment pad outside of the secondary containment area. On the tanks outbound system, three transfer pumps will transfer f fuel to the storage facilities at YVR, with one pump designed as an auxiliary back-up. The system will also include pump and filtration systems to allow additional filtration and tank to tank transfer operations. The pump systems will be installed on a concrete containment structure.

The operations building will house offices for facility operations staff, a control room for the facilities, first aid facilities and washrooms. Other buildings include a foam storage and incident command center, motor control center and maintenance/storage structure.

Other key elements of the facility include:

- Containment basin and lift station as part of oil/water separator system;
- Fire pump system and perimeter fire hydrants around the facility;
- Backup generator capable of running core functions and fire fighting systems.

Drainage from the secondary containment area around the tanks will be isolated using a normally closed valve. The valve will remain closed during normal operations and opened intermittently to release surface water that collects inside the secondary containment area. This feature actually reduces the free runoff calculation for the proposed site due to the large area of controlled drainage. Drainage from this area will run through an oil/water separator to process the runoff to local discharge standards. Other process areas will drain to the same system.

Construction of the fuel receiving facility is expected to take approximately 18 to 24 months depending on weather and construction. To meet with the overall project schedule this work must commence the fall of 2015 and be completed prior to the end of 2017.

Temporary facilities including a site office, washrooms and onsite kitchen will be required, along with portable or temporary connections to potable water, sewage and electrical power. Radio communications systems are expected to be used onsite. In addition, temporary fuel storage facilities and associated spill and fire prevention and response equipment, which will be detailed in the CEMP, are also expected to be onsite.

Initial trenching and excavation will be required to accommodate underground services and structures including electrical, water, telecommunication, sanitary sewer, surface water drainage, oil/water separator system, and the incoming and outgoing pipelines.

Facility Access Road

Paving will be required to provide an inner perimeter road for vehicle access, parking and walkways. A perimeter access road will be installed around the facility to provide vehicular access to fire hydrants and a ramp accessing the inside of the secondary containment area. Access road construction will require machine grading and compaction of the common fill or native base, and import and compaction of crushed gravel of varying grades in layers. Certain access roads may be covered with asphalt or concrete.

Preparation of Infrastructure Foundations

Seismic considerations require the tanks to be placed on solid concrete mat foundations placed above the soils previously densified during the ground improvement work. Each tank foundation will consist of a circular pan of concrete over one metre thick and one metre larger in diameter than the tank itself. The foundation will be reinforced with steel, and will include a raised ring wall foundation to allow for the installation of a liner and cathodic protection system between the sloping tank bottom and the top of the concrete mat foundation. Sand will be placed above the foundation and below the tank bottom to allow the tank bottom to drain to a center sump. The installation of concrete tank foundations is expected to take several months including curing of the concrete. Heavy trucks hauling forms, steel, and concrete will be required for the duration of this work.

Fuel Receiving Tanks

Each tank will be welded plate steel, which will be delivered to the site by truck or barge. The bottoms of the tanks will be constructed first, followed by up to five or six courses of rolled steel plate to form the cylindrical shape of the tanks. The tank roofs and various nozzles and connection points will be completed last. The tanks will be constructed and tested in accordance with API 650, Welded Steel Tanks for Oil Storage.

The tanks, once completed, will be strengthened and leak-tested by filling with water prior to sand-blasting and epoxy painting. Sand blasting and painting will be conducted in a manner to reduce or eliminate fugitive dust and vapour emissions.

Perimeter Dike and Secondary Containment System

Once the tanks and foundations are in place, perimeter drainage, impermeable liner, and dike structures will be installed around the tanks. The tank area will drain to a central storm line controlled with a valve. This line will run to an oil/water separator system which will collect all runoff from areas where fuel handling and transfer activities occur.

The secondary containment area will be designed to current seismic standards. Because the containment area will be exposed to rain, the capacity will also include a volume allowance for rain events as well as the defined minimum fuel containment.

Process, Transfer and Operations Areas

Areas outside of the tank and dike area are generally free-draining to perimeter storm or swale collection areas. All drainage will eventually lead to a new ditch adjacent to Dyke Road and flow southwest to the drainage ditch located along Williams Road. Alternatively, drainage can be directed to a proposed new storm outfall to be located on Williams Road as part of the Ecowaste development.

Controlled drainage areas consist of equipment and fuel handling areas with concrete pads and foundations with drainage directed to the oil/water separator. Fuel handling areas will be protected with a water/foam deluge system as well as automated shut-down systems detecting localized heat and/or fire.

2.5 Operational Overview

The Fuel Receiving Facility operations consists mostly of the movement of fuel through underground and aboveground pipelines and into and out of aboveground tanks. Visible activity on the site will be limited to the movement of crews and equipment during fuel transfer operations.

The fuel storage tanks and lighting requirements of the fuel receiving facility will likely be visible from some of the condominiums on Riverport Way, as well as from vantage points across the Fraser River South Arm, including recreation areas. While these may be visible, the fuel storage tanks and other Project facilities will not significantly obstruct viewscapes from nearby properties. Mitigation strategies to reduce visual effects of the fuel storage tanks include on-site landscaping and lighting direction and technologies.

Operations at the Fuel Receiving Facility will be primarily linked to activities at the Marine Terminal during receipt of fuel from marine vessels. Traffic on public roads associated with these activities may move between the Marine Terminal and the Fuel Receiving Facility sites. Between fuel deliveries, traffic will be limited to the daily shift changes of a handful of operations personnel.

3.0 Project Design

3.1 Design and Consultation Team

On behalf of the VAFFC, FSM Management has strived to bring together the most relevant team of professionals to ensure that the highest level design is implemented to ensure the all stakeholder concerns are addressed.

The project team brings together some of the forest expertise relevant to the uniqueness of the project.

Engineering Team

Prime Consultant (Mechanical/ Electrical/ Controls):
Argus Consulting Inc.

Civil:
Tetra Tech EBA

Marine:
Moffatt & Nichol

Fire Suppression:
Novota Engineering

Geotechnical:
Golder Associates Ltd.

Hazard/Risk Assessment:
Sereca Consulting Inc.

Overview

Environmental:
Hatfield Consultants

Archaeology:
AMEC Foster Wheeler

First Nations:
Cornerstone Planning Group
Bennett Jones LLP

Public Relations:
National Public Relations

3.2 Design Compliance

3.2.1 Engineering Standards

American Petroleum Institute

- API 650 – Welded Tanks for Oil Storage, 12th Edition, 2013
- API 651 – Cathodic Protection of Aboveground Petroleum Storage Tanks, 3rd Edition, 2007
- STD. 1542 - Airport Equipment Marking for Fuel Identification
- API-653 – Tank Inspection, Repair, Alteration, and Reconstruction, 3rd Edition
- API-2000 – Venting Atmospheric and Low-Pressure Storage Tanks
- API-2550 - Measurement and Calibration of Upright Cylindrical Tanks

American National Standards Institute (ANSI)

- A13.1 – Scheme for the Identification of Piping Systems
- B16.9 – Factory Made Wrought Steel Butt Welding Fittings
- B16.11 – Forged Steel Fittings, Socket-Welding and Threaded
- B16.25 – Butt-welding Ends
- B16.5 – Pipe Flanges and Flanged Fittings
- B31.3 – Chemical Plant and Petroleum Refinery Piping

American Society of Mechanical Engineers

- ASME B31.3 Process Piping
- A13.1 – Scheme for the Identification of Piping System
- Z53.1 - Safety Color Code for Marking Physical hazards

American Society of Testing and Materials

- ASTM A53
  - ASTM A48 – Gray Iron Castings
  - ASTM C443 – Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
  - ASTM C478 – Precast Reinforced Concrete Manhole Sections
  - ASTM F714 – Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
  - ASTM D751 – Standard Test Method for Coated Fabrics
  - ASTM D 2136 - Standard Test Method for Coated Fabrics-Low-Temperature Bend Test
  - ASTM D4437 - Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes
  - ASTM D4759 – Standard Practice for Determining the Specification Conformance of Geosynthetics

  - ASTM 5199 - Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
  - ASTM D5641 – Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber
  - ASTM D6497 - Standard Guide for Mechanical Attachment of Geomembrane to Penetrations or Structures
  - ASTM 6693 - Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
- C31 – Making and Curing Concrete Test Specimens in the Field
- C33 – Standard Specification for Concrete Aggregates
- C39 – Compressive Strength on Cylindrical Concrete Specimens
- C88 – Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- C94 – Ready Mix Concrete
- C109 – Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 – inch or (50-mm) Cable Specimens)
- C117 – Materials Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing
- C131 – Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- C136 – Sieve Analysis of Fine and Coarse Aggregates
- C144 – Aggregate for Masonry Mortar
- C150 – Portland Cement
- C618 – Coal Fly Ash and Raw or Calcined Natural Pozzolans for Use as Mineral Admixture in Concrete
- D792 Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D1698 – Environmental Stress Cracking of Ethylene Plastics
- A36 - Structural Steel
- A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
- A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
- A283 - Standard Specification for Low - and Intermediate - Tensile Strength Carbon Steel Plates
- A285 - Pressure Vessel Plates, Carbon Steel, Low - and Intermediate - Tensile Strength
- D1655 - Standard Specification for Aviation Turbine Fuels
- D1241 – Materials for Soil-Aggregate Subbase, Base and Surface Courses
- D1556 – Density and Unit Weight of Soil in Place by the Sand-Cone Method
- D1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft. lbf/ft3 (2700 kN-m/mm3)

- D2487 – Classification of Soils for Engineering Purposes
- D2922 – Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- D3017 – Water Content of Soil and Rock in Place by Nuclear Method (Shallow Depth)
- D4253 – Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
- D4254 – Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
- D4318 – Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- D4429 – CBR (California Bearing Ration) of Soils in Place
- D4491 – Water Permeability of Geotextiles by Permittivity
- D4533 – Trapezoid Tearing Strength of Geotextiles
- D4546 – One-dimensional Swell or Settlement Potential of Cohesive Soils
- D4632 – Grab Breaking Load and Elongation of Geotextiles
- D4751 – Determining the Apparent Opening Size of a Geotextile
- D4832 – Preparation and Testing of Controlled Low Strength Material
- D4833 – Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

American Water Works Association (AWWA)

- AWWA C500 – Gate Valves for Water and Sewerage System

BC Hydro

- BC Hydro Distribution Standards
- BC Hydro Advisory 2006111501: Transfer Switches for Emergency Standby Generators
- BC Hydro Engineering Technical Report ETR No. 20091201 – Requirements For Customer Owned Primary Services Supplied at 4 KV to 35 KV, Primary Guide June 2010
- BC Hydro Safety Practice Regulations
- BC Hydro Electric Tariff
- BC Hydro Requirements for Manually Read Primary Service Voltage Revenue Metering (4 KV to 35 KV)

Canadian Standards Association

- CSA B836 - Storage, handling, and dispensing of aviation fuels at aerodromes
- CSA Z662 - Oil and Gas Pipeline Systems
- CSA 47.1-03 Certification of Fusion Welding
- CSA W59-03 Welded Steel Construction (Metal Arc Welding)
- CSA W178.2 Latest Edition, Certification of Welding Inspectors

- CSA C22.1-15, Canadian Electrical Code Part 1 (23rd Edition) - Safety Standard for Electrical Installations
- CSA C22.2 No. 31 - Switchgear Assemblies

Underwriters Laboratory Canada

- ULC S601-07 Standard for Shop Fabricated Aboveground Horizontal Tanks for Flammable and Combustible Liquids
- ULC/ORD-C58.15-1992, Overfill Protection Devices for Flammable Liquid Storage Tanks
- ULC/ORD-C58.9 (1997) – Secondary Containment of Liners for Underground and Aboveground Flammable and Combustible Liquid Tanks.

Steel Structures Painting Council

- SP-1 - Solvent Cleaning
- SP-3 - Power Tool Cleaning
- SP-5 - White Metal Blast Cleaning
- SP-6 - Commercial Blast Cleaning
- SP-10 - Near White Blast Cleaning

Petroleum Equipment Institute (PEI)

- RP100-87 - Recommended Practices for Installation of Liquid Storage Systems

3.2.2 Code Compliance

- British Columbia Fire Code 2012
- National and Provincial Fire Codes
- Canadian Council of Ministers of the Environment
- Environmental Guidelines for Controlling Emissions of Volatile Organic Compounds from Aboveground Storage Tanks
- CCME PN1326 Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products
- SOR/2008-197 Storage Tank System for Petroleum Products and Allied Petroleum Product Regulations
- National Electric Code of Canada
- British Columbia Electrical Code
- National Building Code of Canada
- British Columbia Building Code
- BC Safety Authority
- Safety Standards Act
- Electrical Safety Regulation
- Directive No: D-E3 090313 1 High Voltage Installation
- Engineers and Geoscientists Act of BC
- WorkSafe BC - Electrical Safety
- City of Vancouver Bulletin 2007-03-EL
- BC Environmental Assessment Act
- City of Richmond
- The Corporation of Delta
- Transport Canada
- Environment Canada

3.2.3 Voluntary Compliance

- National Fire Protection Association
- NFPA 11 - Low Expansion Foam and Combined Agent Systems
- NFPA 30 – Flammable and Combustible Liquid Code
- NFPA 704 - Standard System for the Identification of the Fire Hazards of Materials for Emergency Response

3.3 Geotechnical Report

Golder Associates Ltd. (Golder) carried out a geotechnical investigation at the site of a proposed new jet fuel tank farm (TF-0) located near the northern bank of South Arm Fraser River, where Williams Road terminates at Fraser River in Richmond, British Columbia.

The project site has been subjected to a number of development/utilization activities such as peat mining, fill placement, staging, and stockpiling within the past several decades.

Geotechnical Investigation

The field investigation at the subject site was carried out between September 2 and October 11, 2014, during which the following geotechnical fieldwork tasks were completed:

- An onshore field investigation. The onshore drilling and testing included 4 mud rotary boreholes (BH14-02, -04, -07 and -12), 14 Cone Penetration Tests (CPT14-01 through CPT14-13, and CPT14-15), and 23 Sonic boreholes (SH14-01, -05, -06, -08 through -10, and -16 through -32). Shear wave velocity (V_s) measurements were carried out at 5 of the 14 onshore CPT locations. The onshore fieldwork was completed between September 2nd and 16th, 2014.

- An offshore field investigation. The offshore drilling and SCPT testing were carried at two locations, including BH/SCPT14-14 located in the offshore area east of the proposed new tank farm site, and BH/SCPT14-33 located in the offshore area of the proposed new jet fuel receiving terminal.

The approximate locations of the test holes are shown in Figure 1-1 in the geotechnical report.

Subsurface conditions

Based on the geotechnical information obtained from the field investigation and laboratory testing, the subsurface soils underlying the project site are inferred to consist of the following 5 key stratigraphic units:

1. Fill - highly heterogeneous, and generally consist of silty sand, sandy silt, clayey sand, clayey silt, and silty clay, with gravels, cobbles and boulders, as well as construction debris, wood and other organic matter.

2. Peat/Organic Silt - generally fibrous to amorphous, brown to black, and inter-layered with organic silt at some locations. The organic silt is interlayered with clayey silt to clay sub-layers/zones, and is generally present underneath the peat.

3. Organic Silt/Clayey Silt to Clay - generally medium to high plasticity, brown grey to grey, and inter-bedded with organic silt and seams of fine silty sands at some locations

4. Fraser River Sand - grey to dark grey, mainly sand with thin sub-layers of silty sand/sandy silt/silt inter-beds. This unit was encountered at depths approximately 7.6 m to 12 m below

the existing ground surface with thicknesses ranging from approximately 15.7 m to 26 m, but generally in the range of 18 m to 20 m, in the area of the proposed tanks.

5. Inter-Bedded Silty Sand, Sandy Silt, Clayey Silt, and Silty Clay - a portion of the overall Fraser River deltaic deposits and extends beyond the maximum depth of the test holes.

Ground Densification Options

The soil units above e Fraser River Sand (Unit 4), i.e. Unit 1, 2 and 3, are not considered to be suitable for foundation support of jet fuel tanks or any other settlement sensitive or heavily loaded structures, and should either be removed or improved in-situ using appropriate engineering measures, within the zone of influence of all such structures.

Based on results of soil liquefaction assessment for the existing ground conditions, it is recommended that appropriate ground improvement measures be installed a sufficient depth into the Fraser River Sand deposits (Unit 4) in the area within and surrounding the foundations of the jet fuel tanks and associated deformation-sensitive structures to reduce the potentially severe negative impact of earthquake-induced soil liquefaction on the foundations of the tanks and associated facilities.

The following two options may be considered as potentially suitable ground improvement measures:

Option 1 –Stone Columns

This option will include sub-excavating all existing soils above Unit 4, replacing the excavated materials with suitable clean granular materials, and densifying the replacement soils as well as the underlying Fraser River sand using vibro-densification stone column installation technique within the influence zone of the tank and facility foundations.

The anticipated depths of sub-excavation will range approximately between 7.6 m and 12 m below the existing ground surface with the corresponding base elevations ranging from El.-4.6 m to El.-6.9 m.

The vibro-densification stone columns are recommended to be installed to approximately El.-17.5 m and the horizontal extension of soil densification zone is recommended to be approximately 15 m beyond the edge of tank foundations and other deformation sensitive facilities.

Option 2 – Deep Soil Mixing (DSM)

Alternatively, in-situ soil improvement technique such as deep soil mixing (DSM) method can be considered. This option will include excavation of the existing fill materials to a suitable elevation, such as El. +1.75 m, depending on the final design elevation of the tank foundations, and construction of a grid pattern of vertical cement-soil mixture walls extending into the Fraser River sand within and surrounding the area of tank and facility foundations.

The following table provides a summary of key construction tasks and the associated geotechnical challenges for each of these two potential ground improvement options.

	Key Construction Tasks	Key Geotechnical Challenges
Option 1	Sub-excavation Disposal of excavation spoil off site Dewatering Placement of imported granular materials Vibro-densification stone column installation	• Deep excavation immediately aside the Fraser River bank; • Large excavation, disposal and replacement volumes; • An appropriately designed and constructed dewatering system will be required to maintain the stability of the excavation slope; • Discharge of water back into Fraser River may require environmental approval; • Vertical excavation support measures may potentially be required, if open-cut operations are constrained by property boundaries or other restrictions. Design and construction of high vertical support will be a challenge due to the presence of very weak soils (Units 2 and 3) and the closeness to the river; • A certain level of compaction effort will be required during placement of the imported granular materials prior to commencement of vibro-densification stone column installation; and • Sub-excavation, disposal and dewatering operations may be affected by inclement conditions.
Option 2	Excavation Disposal of excavation spoil off site Construction of cement-soil mixture panels	• A cost effective design needs to be developed considering that cost of DSM could be quite high; • Suitable Q/A and Q/C measures will be required, especially during construction of the cement-soil mixture panels within the zone of Units 2 and 3; and • Presence of boulders and large size metal objects may obstruct the panel construction. Removal of obstructions by excavation may be required, when encountered.

THIS PAGE IS INTENTIONALLY LEFT BLANK

4.0 Studies and Reports

4.1 Project Setting

The project site is situated on a parcel of industrial-zoned land on the north shore of the South Arm of the Fraser River that the Applicant will lease from VFPA (PMV). This land is currently occupied by a tenant (ACME Landfill and Peat Ltd.) and has been significantly altered from its natural state after many years of industrial development (peat mining, landfilling and dredged material stockpiling).

The project site is bordered on the southeast side by Dyke Road, on the north and east by other areas of VFPA industrial-zoned land, and on the west by a railway right-of-way. Williams Road borders the site at the southern tip. The Ecowaste Richmond Landfill (current and future operations) is located next to the project site on the west side of the railway right-of-way. Dyke Road is a public road that separates the project site from the Fraser River and mostly provides access to these industrial areas for heavy truck traffic.

The project site is not on or directly adjacent to sensitive environmental or social receptors, or City of Richmond designated Environmentally Sensitive Areas. Nearby land uses other than industrial include, Agricultural Land Reserve lands (west of the landfill) and undeveloped City road right-of-ways (Savage Road), also west of the landfill. The Waterstone Pier Complex (commercial and residential) is more than 1.5 km west of the project site.

4.2 Impact Overview

The Project has recently been through a comprehensive five-year coordinated provincial and federal environmental assessment review process, which involved all relevant stakeholders, and public and Aboriginal consultations. That process concluded in December 2013 with the issuance of a joint provincial and federal Assessment Report, provincial Environmental Assessment Certificate with conditions, and a federal Environmental Decision Statement also with conditions. Taking into account the potential for environmental, social, economic, heritage and health effects, cumulative effects, and potential accidents and malfunctions, as well as the mitigation measures proposed and the conditions to be implemented, these provincial and federal approvals concluded that the project is not likely to cause significant adverse environmental effects.

Building on this robust foundation of assessment and consultation work, potential effects during construction shall be managed through implementation of a construction environmental management plan (CEMP). The CEMP, enclosed, identifies the potential effects of constructing the fuel receiving facility and sections of pipeline to be located on PMV land, and describes the mitigation measures to avoid or reduce effects.

4.2.1 General

Potential impacts of construction of the fuel receiving facility and sections of pipeline to be located on PMV land (and mitigation) are identified and described in detail in the CEMP and subcomponent management plans. These plans include:

- accidents or malfunctions
    - Potential accidents or malfunctions that could reasonably occur during construction and the recommended mitigation for avoiding or minimizing accidents or malfunctions is described in detail in Attachment 6.7: CEMP Appendix A3)
- air quality and dust control
    - Potential impacts on air quality during construction and the recommended mitigation for avoiding or minimizing impacts is described in detail in Attachment 6.7: CEMP Appendix A4)
- archaeology
    - Potential impacts on archaeological resources during construction and the recommended mitigation for avoiding or minimizing impacts is described in detail in Attachment 6.7: CEMP Appendix A5)
- contaminated sites
    - Potential impacts caused by contamination during construction and the recommended mitigation for avoiding or minimizing impacts is described in detail in Attachment 6.7: CEMP Appendix A6)
- fuels, chemicals and materials storage and handling
    - Potential impacts from improper handling and storage of fuels, chemicals and other materials during construction and the recommended mitigation for avoiding or minimizing impacts is described in detail in Attachment 6.7: CEMP Appendix A7)
- noise
    - Potential noise impacts during construction and the recommended mitigation for avoiding or minimizing impacts is described in detail in Attachment 6.7: CEMP Appendix A8)
- spill prevention and emergency response
    - Potential spills and other emergency situations that could reasonably occur during construction and the recommended mitigation for avoiding or minimizing such events is described in detail in Attachment 6.7: CEMP Appendix A9)

- surface water quality, fisheries protection and erosion and sediment control
    - Potential impacts to surface water quality and fish during construction and the recommended mitigation for avoiding or minimizing impacts is described in detail in Attachment 6.7: CEMP Appendix A10)
- vegetation and wildlife
    - Potential impacts to vegetation or wildlife during construction and the recommended mitigation for avoiding or minimizing impacts is described in detail in Attachment 6.7: CEMP Appendix A11)
- Wastes
    - Potential wastes that could be generated during construction and the recommended mitigation for avoiding, reducing, reusing or otherwise managing wastes is described in detail in Attachment 6.7: CEMP Appendix A12)
- Groundwater
    - Potential impacts to groundwater during construction and the recommended mitigation for avoiding impacts, including groundwater management, is described in detail in Attachment 6.7: CEMP Appendix A13)
- traffic
    - Potential traffic-related impacts during construction and the recommended mitigation for avoiding or minimizing impacts is described in detail in Attachment 6.7: CEMP Appendix A14)

Refer to Section 4.5 below for a summary of the CEMP and subcomponent plans, and to Attachment 6.7 for details of all plans including further information on potential effects during construction and how these shall be mitigated.

Potential impacts of project operations shall be managed through engineering design and implementation of operating plans to be developed at a future stage of the project. Potential environmental impacts during operations shall be managed through an operations environmental management plan (OEMP) which shall include subcomponent plans to address, at minimum, accidents or malfunctions, air quality, and noise and nuisance management. Refer to Section 4.6 below for further details on the nature of environmental issues anticipated during operations and the recommended mitigation to avoid or minimize the potential impacts.

4.2.2 Operations

Refer to Section 4.6.

4.2.3 Construction and/or Demolition

Potential construction impacts will be avoided or mitigated through design and the implementation of a construction environmental management Plan (CEMP), including several subcomponent plans. A draft CEMP is provided in this application.

4.3 Landscape

Because of the historical and current industrial use and condition of the project site, existing trees and vegetation on the site are limited. However, a site specific rare/at-risk plant survey will be conducted (see Section 4.4).

A Vegetation and Wildlife Management Plan has been prepared as a subcomponent plan to the CEMP (see Section 4.5.8). This Plan describes mitigation measures to prevent adverse effects to vegetation and wildlife during clearing and site preparation, identifies protocols for invasive species management and outlines monitoring and reporting requirements.

4.4 Environmental Assessment Certificate Studies

All EAC studies/surveys will be conducted and reported on as described and required in the EAC conditions.

EAC Condition No. 19

EAC Condition No. 19 requires the Holder (i.e., permit Applicant) to complete site specific rare/at-risk plant surveys. A rare/at-risk plant walkover survey will be conducted to address this condition.

EAC Condition No. 20

EAC Condition No. 20 requires the Holder (i.e., permit Applicant) to follow Best Management Practices Guidelines for Pacific Water Shrew in Urban and Rural Areas before starting any project work in and around surface drainage ditches. A Pacific Water Shrew habitat assessment will be conducted to address this condition to determine if any suitable habitat for Pacific Water Shrew exists at the site.

EAC Condition No. 21

EAC Condition No. 21 requires the Holder (i.e., permit Applicant) to complete a bird nest survey before starting project clearing work if clearing work is required during the nesting season. A bird nest survey will be conducted within one week before the start of works to address this condition.

EAC Condition No. 22

EAC Condition No. 22 requires the Holder (i.e., permit Applicant) to complete a raptor nest survey before starting project construction in areas in which suitable habitat for raptors may occur. A raptor nest survey will be conducted within one week before the start of works to address this condition.

EAC Condition No. 23

EAC Condition No. 23 requires the Holder (i.e., permit Applicant) to complete an amphibian breeding survey before the start of project construction in areas where potentially suitable wetlands exist. An amphibian survey will be conducted before the start of works to address this condition.

4.5 Construction Environmental Management Plan (CEMP)

The draft CEMP is provided in Attachment 6.7 for review and comment. A final version of the CEMP will be submitted to VFPA before the start of construction.

The CEMP provides guidance to site contractors in their development of site/activity-specific environmental work plans. Environmental monitoring and reporting will be conducted throughout the works.

The CEMP includes several subcomponent plans, including those summarized below. Further details on the specific requirements of the CEMP are described in the General Conditions of the VFPA EA Decision Statement.

In addition to the general environmental protection and management provisions, the CEMP includes a number of discipline specific subcomponent plans, which will address specific issues and mitigation measures.

The CEMP is a living document and will be regularly reviewed and revised throughout the works, as necessary. The CEMP does not include activities associated with future decommissioning of permanent project infrastructure, because decommissioning, if it ever occurs, would be decades into the future and would occur under a separate environmental management program in consultation with VFPA. In summary:

4.5.1 Accidents or Malfunctions Management Plan

This plan identifies and recommends mitigation measures for potential project malfunctions or accidents that may reasonably occur in connection with the works.

4.5.2 Air Quality and Dust Control Management Plan

This plan identifies and recommends mitigation measures for activities with the potential to impact air quality and/or generate dust. The plan outlines the recommended mitigation measures to control fugitive dust and other airborne emissions associated with vehicle and equipment operation, demolition and/or decommissioning of existing structures, stockpiling of soils, and other site activities.

4.5.3 Archaeological Management Plan

This plan identifies and recommends mitigation measures to address archaeological concerns, including impact assessment and monitoring requirements.

4.5.4 Contaminated Sites Management Plan

This plan identifies and recommends mitigation measures for potential soil contamination issues that may be encountered during the works (e.g., during excavation activities) and/or contamination that may occur as a result of construction activities (e.g., due to equipment fuel spills or leaks).

4.5.5 Noise Management Plan

This plan identifies and recommends mitigation measures for activities with the potential to generate noise emissions.

4.5.6 Spill Prevention and Emergency Response Plan

This plan identifies and recommends mitigation measures for any potential environmental emergencies related to the loss of hydrocarbon-based or other hazardous or deleterious materials that could arise during the works.

4.5.7 Surface Water Quality/Fisheries Protection and Sediment Control Plan

This plan identifies and recommends mitigation measures for activities with the potential to impact water quality and/or fish or fish habitat.

4.5.8 Vegetation and Wildlife Management Plan

This plan identifies and recommends mitigation measures for activities with the potential to impact vegetation and wildlife.

4.5.9 Fuels, Chemicals and Materials Storage and Handling Plan

This plan identifies and recommends mitigation measures for activities with the potential to result in spills or risks to human health and the environment. The Plan describes the typical strategies for managing fuels, chemicals and other materials, and controlling spills or risks to human health and the environment.

4.5.10 Waste Management Plan

This plan describes waste generating activities and outlines the methods for waste minimization, recycling, storage and disposal, and the monitoring and reporting requirements. The Plan describes the typical strategies for managing hazardous and non-hazardous wastes. The Plan outlines the procedures and best practices for storage and disposal of wastes generated during construction.

4.5.11 Traffic Management Plan

This plan describes works and activities with the potential to cause traffic disruptions, delays, or adverse impacts to the public and/or wildlife. It outlines the recommended methods for mitigating traffic related concerns, and monitoring and reporting requirements. The Plan describes measures to verify that construction activities will comply with the EAC, regulatory approvals, applicable legislation and applicable industry best management practices and contains a communications strategy to inform stakeholders, including the public and government agencies, about construction progress and identify methods for providing feedback on issues and concerns.

4.5.12 Groundwater Management Plan

This plan identifies and recommends mitigation measures for managing works that involve dewatering such that sediments or other deleterious substances are not released into the aquatic environment.

4.6 Operations Environmental Management Plan (OEMP)

PMV requires draft information in support of the Project Permit review on the operations environmental management plan (OEMP) for aspects of the Project to be located on PMV lands that relate to the development of future plans for managing: accidents or malfunctions, air quality, and noise and nuisance. A full OEMP is not required for the permit review.

References made to “the Project” relate to those Project components that will be located on PMV land only (i.e., the aviation kerosene fuel receiving facility and sections of new transfer and delivery pipelines). This section contains the draft information to meet PMVs Project Permit review requirement as described above. Below is a summary of draft information on the OEMP and the subcomponent accidents or malfunctions, air quality, and noise and nuisance management plans.

The draft information is based on the relevant comprehensive assessments completed during the environmental assessment review process for the components of the Project to be located on PMV land, and the conclusions presented in the Coordinated EAO BCEAA Assessment Report / PMV CEAA Screening Report (14 Dec 2012).

The OEMP for the Project shall be completed and provided to PMV for review and comment before the start of operations. The OEMP shall include several subcomponent plans and/or measures to address foreseeable operations and maintenance activities, requirements and procedures with associated environmental risk. It shall also identify any ongoing monitoring and reporting requirements following completion of construction, and which shall be implemented at the commencement of operations.

Each of the subcomponent plans and/or management strategies shall provide information needed to identify, manage, respond to and mitigate potential adverse environmental effects during the Project operations. Each shall also identify any applicable monitoring parameters and activities, and reporting requirements.

4.6.1 Draft Information on the OEMP

The OEMP shall describe the framework and approach to operations environmental management, monitoring and inspection. It shall describe the key environmental protection measures, practices and/or procedures to be systematically applied during operations to address foreseeable operations and maintenance activities, requirements and procedures with associated environmental risk. The OEMP shall also describe activities involved in completing post-construction/follow-up monitoring.

The objective of the OEMP shall be to minimize the potential for environmental effects and other adverse effects throughout the operational lifespan of the Project facilities to be located on PMV land. The OEMP shall support the achievement of compliance with all applicable legislation, as well as the terms and conditions of all issued permits, approvals or authorizations. The OEMP shall be updated as necessary during operations.

The scope of the OEMP shall not include activities associated with future decommissioning of permanent infrastructure, as decommissioning, if it ever occurs, would be decades into the future and would occur under a separate environmental management plan.

An outline of the OEMP is provided by way of a list of expected environmental management plans which shall be developed once detailed design and construction has been completed, and before the start of operations.

Each of the environmental management plans shall provide information needed to identify, manage, respond to and mitigate potential adverse environmental effects during operations. They shall also identify any applicable monitoring parameters and activities, and reporting requirements. Environmental management plans are expected to be developed to address the following, at minimum, as specified in the PMV Project Permit Application Submission Requirements:

- Accidents or Malfunctions Plan;
- Air Quality Management Plan; and
- Noise and Nuisance Management Plan.

4.6.2 Draft Information on the OEMP Accidents or Malfunctions Plan

The OEMP Accidents or Malfunctions Plan shall identify and recommend mitigation measures and/or strategies to avoid and minimize the risk for potential accidents, malfunctions or unplanned events that could be reasonably foreseen to occur during operations.

The OEMP Accidents or Malfunctions Plan shall cover events that may result in adverse environmental effects during operations.

It shall provide procedures for responding to situations that pose an imminent or potential threat to environmental resources or human health. Measures to control health and safety risks to workers and the general public shall be outlined, including signage and security. Emergency response procedures in the event of a health and safety-related incident shall also be described and/or cross-referenced to other relevant plans.

A summary of the specific nature of issues related to accidents or malfunctions and how they shall be mitigated during operations is provided in Table 1.

Table 1 Issues and Mitigation Related to Accidents or Malfunctions during Operations

Issues	Mitigation
Accidental spill of deleterious material	Implementation of: ▪ System Integrity Management Program ▪ Spill Prevention, Preparedness and Emergency Response Plan; ▪ Solid, Liquid and Hazardous Wastes Management Plan; ▪ Training; ▪ Measures to prevent further movement of spilled material into the environment, such as blocking drains and roadside ditches; ▪ Measures to prevent the consumption of any produce which had or was suspected to have come into direct contact with spilled material; and ▪ Testing of any potentially contaminated surface or groundwater and soil sediments if required.
Accidental Fire	▪ Separation of the fuel transfer pumps from the storage tank areas; ▪ Implementation of the Fire Safety Plan; ▪ Implementation of the requirements of the National and BC Fire Codes and Building Codes; ▪ Appropriate fire prevention, fire protection and fire-fighting equipment shall be put in place; and ▪ Installation of hazard monitoring, detection and alarm

	facilities.
Vessel and Vehicle Accidents	▪ Pumps and other process equipment will be protected by concrete filled bollards or other barriers designed to stop or deflect vehicles; and ▪ All fuel handling facilities will be situated within secondary containment areas.
Accidental Third-Party Damage	▪ Implementation of the System Integrity Management Program to prevent third party damage to the fuel system; ▪ Participation in BC One Call; ▪ Public education; ▪ Site supervision and surveillance; ▪ Periodic pipeline patrols; and ▪ Signage.

4.6.3 Draft Information on the OEMP Air Quality Management Plan

The OEMP Air Quality Management Plan shall identify and recommend mitigation measures and/or strategies to manage ongoing facility emissions during operations. Emissions of volatile organic compounds (VOCs) were the primary cause of potential concern for the fuel receiving facility during the environmental assessment review as associated with the movement of fuel levels within the tanks and the energy adsorption characteristics of the tanks based on the external paint colour to be used. Both of these issues were satisfactorily addressed through engineering design commitments during the environmental assessment review (e.g., the tanks will be equipped with a pressure vacuum venting system and will be painted light in colour).

The movement of fuel in the tanks will only occur when product is received and delivered as determined by the frequency of vessel visits to the marine terminal and fuel demand at the airport, respectively (i.e., the fuel receiving facility will not be receiving or delivering fuel 24/7 and fuel levels in the tanks will remain stationary for sustained periods during operations). As concluded in the EAC Application (refer to Section 5.4 of the Application), any increases in VOC emissions are considered to be not significant.

The OEMP Air Quality Management Plan shall include measures and/or cross-references to other relevant plans and shall include incident and response procedures, and monitoring and reporting requirements (including responsibilities).

A summary of the specific nature of issues related to air quality management and how they shall be mitigated during operations is provided in Table 2.

Table 2 Issues and Mitigation Related to Air Quality Management during Operations

Issues	Mitigation
Emissions of Criteria Air Contaminants (CACs) and Greenhouse Gases (GHGs)	▪ Inspections of equipment (including exhaust systems) shall be conducted; ▪ All diesel and gasoline-powered vehicles and equipment shall be maintained to manufacturers' guidelines to maximize efficiency. A preventative maintenance program shall be implemented for all diesel and gasoline-powered equipment (e.g., 500 hours or sooner if required by manufacturer); ▪ All equipment shall be fit with standard emission control devices in compliance with federal, provincial, regional district, and municipal regulations and standards; ▪ Equipment shall only be used for its intended purpose and within rated load capacities; ▪ Vehicle and equipment idling time shall be restricted and minimized during operations in accordance with regional bylaws. Employees shall be required to turn off vehicles or heavy equipment when not in use. Idle reduction initiatives will be communicated and encouraged during site orientations and health and safety, and progress meetings; and ▪ Procedures for documenting and responding to any air quality or odor related complaints shall be implemented.
Fugitive VOC emissions	▪ Incorporation of a fixed roof design on fuel tanks with either a pressure/vacuum venting system or free-venting system with floating pans; ▪ Implementation of bottom loading into fuel receiving tanks; ▪ Maintenance of vapour-tight conditions in fuel receiving tanks and pipelines; ▪ Implementation of a leak detection and repair program;

	and ▪ Painting of the fuel receiving tanks a lighter colour (i.e. white) resulting in less heating and therefore fewer fugitive emissions.

4.6.4 Draft Information on the OEMP Noise and Nuisance Management Plan

The OEMP Noise and Nuisance Management Plan shall identify and recommend mitigation measures and/or strategies to manage ongoing facility noise during operations. As identified and assessed during the environmental assessment review, the primary noise source during operations will be the transfer pumps at the fuel receiving facility. However, no significant noise effects are expected from the operation of the transfer pumps. As concluded in the EAC Application (refer to Section 5.5 of the Application), any perceptible noise from operations is considered to be not significant.

A summary of the specific nature of issues related to noise and nuisance management and how they shall be mitigated during operations is provided in Table 3.

Table 3 Issues and Mitigation Related to Noise and Nuisance Management during Operations

Issues	Mitigation
Noise from transfer pumps, machinery and equipment at the fuel receiving facility	▪ Noise emissions shall be managed to comply with the City of Richmond Noise Regulation Bylaw No. 8856 (unless otherwise permitted through exemption) and the WorkSafe BC Occupational Health and Safety Regulations (BC Reg. 296/97); ▪ Noisy stationary equipment (e.g., compressors, pumps, etc.) shall be located and/or oriented so as to take advantage of any inherent noise shielding available from the natural terrain, or other large objects (e.g., equipment, buildings, etc.) and to reduce noise emissions from the site; ▪ In areas where personnel may be exposed to noise levels of 85 dBA or greater, hearing protection (e.g., ear plugs, ear muffs) shall be required and shall be readily available on-site; ▪ Preservation of existing external hedgerows and site topography and proposed landscaping shall provide acoustic as well as visual screening; ▪ Equipment shall be kept in good working order and

	properly muffled, if applicable; ▪ All gas or diesel-powered equipment shall be fitted with intake (if appropriate) and exhaust silencers (i.e., mufflers) that meet or exceed manufacturers' recommendations for optimal attenuation; ▪ Vehicle and equipment idling time shall be restricted and minimized during construction in accordance with municipal bylaws; ▪ High noise machinery (such as pumps, generators, etc.) may be retro-fitted with damping materials or contained within enclosures and/ or noise barriers. To be effective, such barriers shall be made wider and higher than the noise source, where possible; ▪ Regular maintenance on all equipment shall be carried out, including lubrication and replacement of worn parts, especially exhaust systems ▪ Procedures shall be put in place for receiving and responding to noise complaints. Records of any complaints shall be kept for a minimum of six months.

4.7 Hazard and Risk Mitigation and Emergency Response

As part of the Environmental Assessment Certificate process a detailed Fire Prevention, Preparedness & Emergency Response overview was prepared, and is located in Chapter 18 of the EAC Application and included here as Attachment 6.6. This document provides a comprehensive background of fire risk and the regulatory regime related to the various project elements. Refer to specific section on the Fuel Receiving Facility (18.6.3).

A fire risk and hazard analysis been completed and reviewed with Richmond Fire Rescue to get early direction for the design basis. The document, titled Risk and Hazard Analysis Design Brief for Fuel Receiving Facility, is as Attachment 6.9.

Fire flow modelling has demonstrated that available municipal water supply and pressure is adequate for fire fighting purposes and will meet design fire requirements.

The following fire protection systems are described in this section and are reflected in the drawings and risk/hazard analysis.

a. Fire Water Design

b. Fire Foam System

c. Equipment

d. Command/Control Systems and Locations.

Fire Water Design includes a dedicated looped hydrant main surrounding the facility and strategic hydrants located near other key components of the facility. The system will be fitted with high capacity electric fire pumps which can operate from the emergency backup generator in the event of power failure. These pumps will be capable of running both the in-tank foam suppression system and several foam/water monitors for dyke/process area fires and for tank cooling. The system will be connected to the Marine Terminal foam/water monitors via a dedicated water main which will cross Williams Road.

The in-tank fire foam suppression system will be equipped with on-site foam and pumping system to respond within minutes of a detected fire inside a tank. The foam system will meet the provisions of NFPA 11 for tanks of this size and product. The system will be partially automated, requiring input from the operator for tank selection.

Specific water monitors around the facility will also be fitted with foam suppression capability depending on the nature of the incident. At least one of these monitors will be tower mounted with remote directional control to cover a range of possible incidents. In addition, trailer-mounted foam-dispensing equipment will supplement the fixed systems for use by authorized personnel and the response organization (Richmond Fire).

Richmond Fire Rescue has been consulted at an early stage of preliminary design and provided some feedback on site access, location of equipment, and water system connections. The site will be provided with two main entrances plus an auxiliary entrance with a crash gate for emergency fire access. The entrances and fire equipment locations will allow for response in varying environmental conditions (ie wind, smoke). Their feedback has been incorporated into relevant features and descriptions in the drawings and risk/hazard analysis.

4.8 Stormwater Pollution Prevention

Stormwater pollution prevention measures during construction works are included in Attachment 6.7: CEMP Appendix A10).

Infrastructure required for managing stormwater on and around the project site during operations, including mechanisms for containing and preventing the release of deleterious materials (e.g., oil/water separators), are shown on Drawing CU-101 (for operations).

The project infrastructure will be designed, constructed and operated in compliance with the law which requires that deleterious materials must not be released to the surrounding aquatic environment.

4.9 Energy Efficiency Study

BATNEEC (Best Available Technology Not Entailing Excessive Cost) energy efficient equipment will be implemented.

The fuel new fuel facility will be designed and constructed using energy efficient materials and products. This shall include the use of LED, Variable Frequency Drives and Soft Starters, and energy efficient buildings/structures.

Lighting

Area lighting within the facility will use LED fixtures which provide two levels of intensity; 1) a security level of lighting and 2) a working level of lighting allowing for a higher light level for employees to perform duties in the area. The light intensity will be motion sensing with a timer feature to ensure the lights are only on the brighter intensity as needed.

Fuel Transfer Pump Motors

The largest energy load at the fuel facility will be the operating fuel transfer pumps. There will be two primary size transfer pumps. This will include two 75 hp pumps which will be used to transfer fuel within the facility from tank to tank and through filtration. The fuel transfer from the Fuel Receiving Facility to YVR International Airport will use three 500 hp pumps at peak flow rates. The motors for these pumps will be specified as high efficiency motors. The starters for the motors will be either a variable frequency drive (VFD) units or soft starters to reduce the in rush of current during the starting operations. The use of VFDs is being investigated as an alternative to the soft starters. The prime benefit is the pump speed may be reduced when the fuel transfer flow rates are reduced thereby using less energy. This allows the fuel transfer pumps to generate only the pressure required to transfer the fuel from one facility to the other rather than generating the pressure required at the worst case conditions such as the highest flow rate desired and transferring into a nearly full tank at YVR. Further cost benefit analysis will be completed to determine the true benefit of VFDs over soft starters.