Executive Summary

EXECUTIVE SUMMARY

The Executive Summary gives a general synopsis of the Project and the Project assessment work presented in this Application.

1 Overview

Vancouver International Airport (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 aviation fuel refining capacity has declined to the point where international sources now supply the majority of fuel requirements at YVR. In the future, any increase in the demand for aviation fuel at YVR will, of necessity, be supplied from international sources. The existing aviation fuel delivery system is inadequate to meet future fuel requirements at YVR. A significant investment in fuel delivery infrastructure is necessary now to serve the needs of YVR for the future.

Vancouver Airport Fuel Facilities Corporation (VAFFC) proposes a new aviation fuel delivery system (the Project, see **Figure 1**) that will meet the future demand for fuel at YVR and reflect the changes in the supply market logistics. The Project will situate the delivery infrastructure closer to YVR. The components of the Project will include a marine terminal in the South Arm of the Fraser, a fuel receiving and storage facility near the marine terminal and a new delivery pipeline to YVR (**Figure 2**). This new infrastructure will accommodate all fuel delivery requirements for the foreseeable future.

The Project will result in significant economic, social and environmental benefits to the region. 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, Province and country;
- 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; and
- Greatly reduce or eliminate the use of tanker trucks to transport aviation fuel along Highway 99, City and local streets, and reduce vessel transit distance in Canadian

waters, with a corresponding reduction in the related safety and environmental impacts.

Further elaboration follows.

1.1 About Vancouver Airport Fuel Facilities Corporation (VAFFC)

VAFFC is a not-for-profit company owned by a consortium of commercial airlines representing most of the domestic and international carriers that operate at YVR. VAFFC owns and operates fuel storage and distribution facilities at YVR that include fuel storage tanks, an underground pipeline hydrant system and related equipment used to transfer fuel from VAFFC's storage tanks to the airplanes. These facilities are shared among the airlines, allowing them to avoid duplication and minimize costs.

Similar fuel facility corporations operate at all of the major international airports across Canada. VAFFC and its members have significant experience and expertise constructing and operating aviation fuel handling facilities across Canada.

1.2 Existing Fuel Delivery System – The Need for a New Delivery System

Aviation fuel is currently delivered to YVR through a pipeline owned by Trans Mountain (Jet Fuel) Inc. (TMJ) and by tanker trucks from fuel suppliers in the United States (U.S.) (see **Figure 3**). The fuel delivery pipeline system was initially constructed in the late 1960s when four refineries operated in the Burnaby area.

Today, only Chevron Canada Limited's Burnaby refinery remains in operation, and it is the only source of aviation fuel in the Lower Mainland of British Columbia (B.C.). The Chevron Burnaby Refinery delivers its entire fuel inventory to YVR directly through the existing pipeline system. This refinery has reached its maximum aviation fuel production and VAFFC understands that Chevron has no plans to increase production.

The only other source of fuel currently available to YVR is the BP/ARCO Cherry Point Refinery located in Washington State.

The current YVR fuel delivery and supply profile is as follows:

- 80% of the deliveries via the TMJ pipeline, with half being supplied from Chevron's Burnaby Refinery and half being supplied from the Cherry Point Refinery by marine vessel to Westridge Marine Terminal in the Port of Vancouver; and
- 20% of the deliveries via tanker trucks from the Cherry Point refinery.

The existing pipeline system cannot meet fuel demand at YVR during peak demand periods. Since the mid-1990s, the existing pipeline has been supplemented by daily tanker truck deliveries to the point where on average approximately 1,000 round-trips are needed each month to meet demand (i.e., between 25 and 35 deliveries each day). During the Vancouver 2010 Winter Olympics up to 45 deliveries per day were experienced. Recently, tanker truck availability at the Cherry Point Refinery experienced constraints, and deliveries were limited to 25 trucks per day. Without a new fuel delivery system, any incremental growth in fuel demand at YVR will necessitate increased use of tanker trucks from the Cherry Point Refinery. Relying on tanker trucks to supplement the pipeline deliveries is not a viable option over the long-term.

Based on air passenger forecasts by Vancouver Airport Authority, VAFFC expects the limitations of the fuel delivery system to become critical by 2013. Given the long lead time necessary to plan and develop a new fuel delivery system to accommodate the growth in traffic at YVR, VAFFC must prepare now to be ready to meet the imminent need.

1.3 Future Fuel Delivery Planning

VAFFC regularly reviews its future requirements as part of its ongoing system planning for fuel delivery. In 2001, VAFFC began to look at various alternatives for a new fuel delivery system capable of meeting YVR's requirements over the long term. VAFFC evaluated a wide range of potential delivery options including combinations of marine, rail, tanker truck and pipeline infrastructure to bring fuel to YVR.

A common component of the top-ranked options was access to marine transport, recognizing the importance of access to offshore sources of fuel. The Project evolved from this preliminary work.

2 Project Description

The Project consists of three main components (see **Figure 2**), all of which are located in the City of Richmond, Lower Mainland, British Columbia (B.C.):

- Upgrade and operation of an existing marine terminal on the north shore of the South Arm of the Fraser River;
- Development and operation of a new fuel receiving facility on land adjacent to the proposed marine terminal; and
- Development and operation of a new fuel delivery pipeline from the new receiving facility to YVR.

The Project will meet or exceed industry standards in design, construction, and operation. It will improve the efficiency of fuel delivery and, over the long-term, reduce the environmental footprint of activity currently required to maintain fuel delivery to YVR. The Project will be constructed and operated under the following guiding principles:

- Best industry and management practices;
- Latest petroleum handling standards;
- Current building, fire, and safety codes; and
- Applicable federal, provincial and local regulations, and environmental policies and standards.

2.1 Marine Terminal – Upgrade of the Existing Wharf Facility

In 2007, VAFFC acquired a waterfront property on the north shore of the South Arm of the Fraser River in Richmond, approximately 2 kilometres east of Highway 99. This property has an existing wharf facility and a water lot lease. This acquisition followed an extensive survey of potential terminal sites on the South Arm of the Fraser River, conducted in 2006.

The wharf facility is well positioned to serve as a marine terminal for aviation fuel deliveries. The wharf facility was constructed in the late 1990s as a barge operation with a capacity to serve 30,000 deadweight tonne vessels. VAFFC proposes to upgrade the wharf to meet current seismic design criteria, improve structural capacity and accommodate fuel cargo off-loading and transfer facilities for vessels ranging in size from barges up to Panamax-class (see **Figure 4**). The key upgrades will include:

- Structural strengthening of the existing bulkhead wharf;
- Excavation and replacement of fill material in upland areas;
- Construction of new pipe-pile self-supporting breasting dolphins and mooring structures through pile-driving;
- Construction of a self-supporting central cargo off-loading platform to accommodate fuel unloading arms and transfer pipeline;
- Dredging and scour protection works on the riverbed, in deep water at the face and sides of the existing bulkhead perimeter wall;
- Construction of a self-supporting emergency/utility boat launch facility; and

- Construction of ancillary operational equipment, emergency response systems, site security measures, etc.

Once built, the existing aviation fuel shipments that currently off-load at Westridge Marine Terminal east of Second Narrows will be delivered to the VAFFC marine terminal via the Fraser River's deep-sea navigation channel.

The rate of delivery over the foreseeable future is expected to be in the range of 1 to 2 barges per week or several larger tanker vessels per month. The marine terminal will only be in active operation when a vessel is at berth.

2.2 Construction of a New Fuel Receiving Facility

A new fuel receiving facility is proposed on land adjacent to the wharf facility (see **Figure 5**). VAFFC is consulting with Port Metro Vancouver (the Port) to lease an upland portion of Port-owned industrially zoned land to construct and operate the fuel receiving facility. The proposed lease area is located adjacent and northeast of VAFFC's marine terminal property.

The facility will include six above ground steel tanks situated within a secondary containment compound and will have a total storage capacity of approximately 80 million litres (500,000 barrels). The proposed lease area will be able to accommodate a further two tanks if required by the growth in fuel demand at YVR in the future.

Expected construction activities include:

- Site preparation and levelling;
- Earthworks and ground improvements, including:
    - Either preloading (e.g., aboveground placement of sand) or over-excavation (e.g., material removal and replacement) to mitigate settlement of the underlying shallow clayey silts; and
    - Ground densification using vibro-replacement stone columns.
- Installation of secondary containment measures;
- Preparation of infrastructure foundations;
- Storage tank assembly and painting; and
- Construction of ancillary operational equipment, emergency response systems, site security measures, etc.

Once the facility is built, the tanks will be in active operation only when fuel is either being transferred to the facility from a vessel at the marine terminal or when being delivered to YVR.

2.3 Construction of New Fuel Pipelines

(a) Marine Terminal to the Fuel Receiving Facility

A short pipeline (i.e., approximately 0.5 kilometre long) will be constructed to transfer fuel from the marine terminal to the new fuel receiving facility (see **Figure 2**).

The transfer pipeline will be located on land owned by VAFFC or leased by VAFFC from the Port. The exception will be a small crossing under Williams Road.

(b) Fuel Receiving Facility to YVR

An approximate 15-kilometre long pipeline will be constructed to deliver fuel from the new fuel receiving facility to YVR (see **Figure 2**). The pipeline route will follow existing transportation and utility corridors in the City of Richmond.

A preferred route has been identified for the delivery pipeline. Subject to a conditional agreement with Canadian National Railway Company (CNR), VAFFC plans to locate a large section of the pipeline within the CNR railway corridor, between Williams Road and Bridgeport.

The preferred pipeline route goes west from the proposed fuel receiving facility along the Williams Road corridor to reach the CNR railway corridor. It then goes north along the CNR railway corridor for approximately 6 kilometres to reach the Bridgeport Trail.

The route then goes west along a combination of the Bridgeport Trail and City roads to reach the crossing of the Moray Channel (exact location to be determined). City roads are expected to include sections of Van Horne Way, Charles Street, River Road, and No. 3 Road. The route then crosses the Moray Channel to reach Sea Island. On Sea Island, the route goes west along airport service roads to reach the VAFFC fuel facilities at YVR. The route on Sea Island is not expected to change much, if at all, following preliminary consultation with Vancouver Airport Authority.

VAFFC will continue to consult with the City of Richmond and the public on the preferred pipeline route and possible routing alternatives prior to selecting a final corridor for detailed design.

Construction activities are expected to consist of:

- Site preparation;

- Pipe delivery and handling;
- Pipe installation including trenching, lowering in, welding and backfilling; and
- Restoration and pipeline testing.

Where major road and waterway crossings are required (e.g., Highway 99 and the Moray Channel in the Middle Arm of the Fraser River), the pipeline is expected to be installed by directional drilling underground. A geotechnical assessment will be performed during detailed design to confirm locations for directional drilling crossings.

During operations fuel will enter the transfer pipeline when off-loaded from a vessel at the marine terminal. Fuel will enter the delivery pipeline after holding is completed within the tanks at the fuel receiving facility.

3 Expected Capital Cost

The capital cost of the Project is expected to be in the range of $93 to $108 million.

4 Project Schedule

Marine terminal upgrades are expected to take approximately 8 months overall, including 4 months for the in-water works. Construction of the fuel receiving facility is expected to take approximately 18 to 24 months to complete overall, depending on the method used for ground improvements. Pipeline construction is expected to take approximately 12 months to complete overall.

The Project construction phase is expected to begin late 2011 and take up to 24 months to complete. Following system testing and commissioning, Project operations are expected to commence late 2013.

5 Project Benefits

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

(a) Access to more dependable, diverse and competitive offshore fuel supply sources to meet YVR's long-term fuel requirements

The Project will provide airlines with access to a wide range of dependable, diverse and competitive offshore fuel supply sources throughout the world. As long as the fuel source has access to marine water, then it has the potential to ship fuel to YVR via the Project. Access to this global market will greatly improve the economics, reliability and security of fuel supply to YVR.

With the exception of storage expansion at the fuel receiving facility, the Project will accommodate future growth in fuel demand without the need to upgrade or construct additional infrastructure. Given the storage and pipeline capacity of the Project, the fuel supply rate can be increased or decreased by adjusting the marine deliveries. This flexibility will serve YVR's needs over the long-term.

(b) Enhanced global competitiveness of YVR for airlines and travelers which will assist YVR in continuing its important economic contribution to the region, Province and country

YVR is a major economic contributor to B.C., and is Canada's gateway airport to the Asia-Pacific Region. According to the most recent YVR economic impact study (conducted in 2005 and released in 2006), the airport generates $1.7 billion in Gross Domestic Product and $3.4 billion in total economic output each year. The 360 companies and organizations based at YVR support 26,700 direct jobs. Approximately 6,000 airport employees live in the City of Richmond. Every new international long-haul flight generates between $5 and $8 million in wages annually and contributes between $8 and $15 million to the Province's Gross Domestic Product.

The Project will provide the airlines serving YVR with greater access to competitive offshore fuel supply sources, thereby contributing to the airport's continued growth, strengthening its position as a gateway of choice for airlines, and enhancing its position as a powerful economic generator.

(c) Economic contribution during construction and operation

The Project represents a significant investment in important infrastructure in the Province. It is being funded entirely by VAFFC on behalf of the airlines who operate at YVR.

Construction of the Project is expected to result in an estimated 762 person years of direct, indirect and induced employment in B.C. All positions are expected to be filled by members of the existing local labour force. Operation of the Project will create approximately 14 full-time equivalent jobs. Similar to other construction projects, business opportunities exist for local contractors to participate in construction of the Project. While more indirect than the labour force estimates discussed above, the operational business opportunities associated with the Project are expected to be greater in magnitude and duration.

The primary economic development effect of the Project during operations is not limited to direct jobs created. The Project will assist YVR in remaining a competitive, world-

class airport and is expected to indirectly help with the general economic development of Greater Vancouver, the Province and Canada.

As the second busiest airport in Canada and the second largest international passenger gateway on the west coast of North America, YVR is a very important economic driver for Greater Vancouver, the Province and Canada.

The Project and the associated access to safe, reliable and economic aviation fuel will indirectly assist with job creation, provincial, federal and municipal tax revenue and other indirect business opportunities associated with the operation of an efficient international airport.

Increased international ridership, via YVR, benefits Richmond companies in addition to a variety of other industries that rely on access to international travellers, including tourism, real estate, international business and other shipping businesses.

(d) 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

The new fuel delivery infrastructure will be constructed and operated to Best Management Practices (BMPs) for materials, safety and reliability. The use of industry standard materials, design, technology and construction techniques will result in enhanced performance of the system overall. Operations and maintenance will be more efficient because of the design, materials and technology that will be used. In the event of a problem, the pipeline will be easier to locate and access because of the modern mapping techniques and the proposed route alignment.

The combined effect of this modernization will be a more reliable pipeline that is safer and has less environmental risk than the current delivery system. Based on a comparison with the existing system, the existing fuel delivery infrastructure and related activity have an environmental footprint and effects profile that will be displaced by the Project.

(e) Eliminate the need for tanker trucks to transport aviation fuel along Highway 99, City and local streets, and the corresponding emissions and safety concerns

Tanker truck deliveries produce significant greenhouse gas (GHG) and particulate matter emissions compared with bulk transport modes, such as pipelines and marine vessels. Not only will the Project eliminate the need for tanker trucks, it will allow larger, less frequent deliveries of aviation fuel and reduce the length of vessel transit distance in Canadian waters (see below). As reported by FREMP (2006), barging represents

approximately one-tenth of transport costs and one-twentieth the environmental costs compared to an equivalent volume of trucking.

(f) Significantly reduce vessel transit distance in Canadian waters, with a corresponding reduction in GHG and criteria air contaminant emissions

Vessel transit distance will be halved for the shipment of aviation fuel in Canadian waters, which will result in further reduction in GHG and criteria air contaminant (CAC) emissions.

6 Environmental Assessment Review Process

6.1 Provincial

The Project does not exceed any “reviewable project" threshold under the B.C. *Environmental Assessment Act* (the BCEAA or the Act). Nevertheless, by letter to the EAO dated November 28, 2008, VAFFC requested that it be designated a “reviewable project” under the Act. The Project was designated as “reviewable” pursuant to the BCEAA in an order issued by the EAO under section 7(3)(a) of the Act.

The EAO issued a Procedural Order under section 11 of the Act, defining the scope of the Project and the environmental assessment review, and the procedures and methods for conducting the assessment pursuant to the Act. The EAO issued a further order under section 13 of the Act, whereby the scope of the Project and the scope of the environmental assessment were amended.

6.2 Federal

The Project requires a federal environmental assessment review under the *Canadian Environmental Assessment Act* (the CEAA). The federal “trigger” is the requirement for an Approval from Port Metro Vancouver under section 3(1) of the *Canada Port Authority Environmental Assessment Regulations* for VAFFC’s proposed leasing of Port land for the construction and operation of the fuel receiving facility component, and the required expansion in size to the existing Water Lot lease at the marine terminal.

Under the CEAA and the *Canada Port Authority Environmental Assessment Regulations*, the Port is mandated as a Canadian Port Authority to undertake an environmental assessment review of the Project. Since no other federal reviews are “triggered” by the Project, the Port will lead the federal environmental assessment review in accordance with the Port Regulations.

Based on the CEAA criteria, a screening level environmental assessment review is required for the Project. Under the CEAA, this review must be undertaken before other federal approvals may be issued.

The "Canada – B.C. Agreement for Environmental Assessment Cooperation (2004)" provides for a harmonized provincial and federal environmental assessment review of the Project under both the BCEAA and the CEAA, led and coordinated by the EAO.

7 Information Distribution and Consultation

7.1 Government Consultation Summary

The following government agencies, authorities, departments and organizations are involved in the environmental assessment review of the Project as members of the Technical Working Group:

Agencies/Authorities/Departments/ Organizations	Role
Provincial	
B.C. Environmental Assessment Office	Project Assessment Manager
B.C. Ministry of Environment	Technical Working Group member
B.C. Ministry of Community, Sport and Cultural Development	Technical Working Group member
B.C. Utilities Commission	Technical Working Group member
B.C. Oil and Gas Commission	Technical Working Group member
Local/Regional	
City of Richmond	Technical Working Group member
Corporation of Delta	Technical Working Group member
Metro Vancouver	Technical Working Group member
Federal	
Canadian Environmental Assessment Agency	Federal Agency/Assessment Coordinator
Port Metro Vancouver	Canada Port Authority (the federal lead)
Transport Canada	Expert Federal Authority
Environment Canada	Expert Federal Authority

Agencies/Authorities/Departments/ Organizations	Role
Fisheries and Oceans Canada	Technical Working Group member
Health Canada	Technical Working Group member
Canadian Transportation Agency	Technical Working Group member
Canadian Coast Guard	Technical Working Group member
Indian and Northern Affairs Canada	Technical Working Group member
Vancouver Airport Authority	Technical Working Group member

Provincial and federal milestones during pre-Application included:

- Project Description Report (January 2009). Submitted by VAFFC to the EAO together with a request to opt in to the provincial environmental assessment review process. This document was also submitted to the CEA Agency.
- Section 7(3)(a) order (February 2009). Issued by the EAO designating the Project as "reviewable" under the BCEAA.
- Section 10(1)(c) order (February 2009). Issued by the EAO stating that VAFFC may not proceed with construction of the Project until completion of the environmental assessment review process.
- Environmental Assessment Study Work Plans (July 2009). Submitted by VAFFC to the EAO.
- Technical Working Group (November 2009). VAFFC has met with the Technical Working Group on three occasions:
  - To introduce the Project (December 14, 2009);
  - To provide an update on the Project (April 8, 2010); and
  - To present proposed approaches and methodologies for technical spill modelling and fate and effects assessment (June 7, 2010).
- Section 11 order (November 2009). Issued by the EAO detailing the scope of the Project and the scope of the environmental assessment, and the procedures and methods for conducting the assessment.

- Section 13 order (December 2009). Issued by the EAO whereby the scope of the Project and the scope of the environmental assessment were amended from that described in the section 11 order.

- Federal Environmental Assessment (March 2010). The Project "triggers" a federal environmental assessment review. Approval is required by the Port under section 3(1) of the *Canada Port Authority Environmental Assessment Regulations* and approval may be required by Transport Canada under Section 5(2) of the *Navigable Waters Protection Act*.

- Federal Environmental Assessment (September 2010). Transport Canada approval under Section 5(3) of the *Navigable Waters Protection Act* is required, which does not "trigger" the CEAA.

- Application Information Requirements (October 2010). Approved by the EAO.

Key issues identified by the various government agencies, departments and organizations, and VAFFC's responses to those issues, are summarized below. All comments and responses in their complete and original form can be found online via the EAO's website.

Pre-Application Issues Tracking Summary – Provincial Agencies, Departments and Organizations

Issue Raised By	Key Issue	VAFFC Response
Ministry of Environment (Environmental Management Section, Business & Standards Unit)	Pollution Prevention Measures	This is addressed in **Chapter 9: Environmental Management Program** and **Chapter 17: Spill Prevention, Preparedness and Emergency Response** of the Application.
	Consultation Requirements	This is addressed in **Chapter 3**: **Information Distribution and Consultation** of the Application.
	Spill Response Planning and Management of Hazardous Wastes	This is addressed in **Chapter 9: Environmental Management Program** and **Chapter 17: Spill Prevention, Preparedness and Emergency Response**.
	Air Quality Methodology and Assessment	This is addressed in **Section 5.4: Local and Regional Air Quality and Climate Assessment** of the Application.
Ministry of Environment (Water Stewardship Division)	Changes in and About a Stream and Short Term Use of Water	This is addressed in **Section 2.16: Applicable Permits, Approvals and Authorizations** of the Application.
	Dike Maintenance Approval	The proposed pipeline crossing of the Moray Channel will be achieved by directional drilling underground which will prevent any effects on dikes. Construction works associated with the proposed marine terminal, fuel receiving facility and fuel transfer pipeline are not expected to adversely affect dikes. The safety and integrity of dikes will be maintained in accordance with the requirements of the *Dike Maintenance Act*. The Project is not expected to have any measurable adverse effect on

Issue Raised By	Key Issue	VAFFC Response
		dikes, and is expected to improve the existing structural integrity and access to the section of dike located on the marine terminal property.
Ministry of Environment (Remediation Assurance & Brownfields)	Contaminated Sites and Remediation	This is addressed in **Section 5.6: Screening Level Contaminated Sites Assessment** and **Chapter 9: Environmental Management Program** of the Application.
Ministry of Environment (Environmental Protection Division)	Fisheries, Aquatics and Water Quality Assessment (water quality and flow regime)	This is addressed in **Section 5.2: Fisheries, Aquatics and Surface Water Quality Assessment** and **Chapter 9: Environmental Management Program** of the Application.
	Navigation Feasibility and Risk Assessment	This is addressed in **Chapter 20**: **Navigation Assessment** of the Application.
	Operations Environmental Management Plan	This is addressed in **Chapter 9: Environmental Management Program** of the Application.

Pre-Application Issues Tracking Summary – Regional and Municipal Authorities

Issue Raised By	Key Issue	VAFFC Response
City of Richmond	Municipal Access Agreement	VAFFC will use all reasonable efforts to negotiate a Municipal Access Agreement with the City of Richmond that will define the relevant terms and conditions.
	Pipeline Right-of-Way Compensation	The effect of the pipeline and any appropriate compensation will be addressed in the City of Richmond Municipal Access Agreement.
	Land-Based Spill Modelling	VAFFC will follow all appropriate statutory requirements and standards, including those of the Oil and Gas Commission which is the primary authority for such pipelines and receiving facilities. Any residual issues will be addressed in the City of Richmond Municipal Access Agreement. **Chapter 16: Spill Probability and Risk** of he Application addresses land-based spill risk in accordance with good environmental assessment practice for facilities of this size, type and nature.
	Pipeline Public Consultation	Once the pipeline route has been determined, further consultation directed at potentially affected landowners along the pipeline route will be undertaken in accordance with the requirements of the EAO and the Oil and Gas Commission. Details regarding public consultation activities at all stages of the Project are addressed in **Chapter 3: Information Distribution and Consultation** of the Application.
	Fire Suppression and Fire Fighting Capability	This is addressed in **Chapter 18: Fire Prevention, Preparedness and Emergency Response** of the Application.
	Options Analysis	Alternative means of undertaking the Project, as proposed by VAFFC, is addressed in **Section 2.6: Alternative Means of Undertaking the Project** of the Application. This section is presented in accordance with

Issue Raised By	Key Issue	VAFFC Response
		the requirements of the CEAA. An analysis of alternatives to the Project proposed by VAFFC is not a regulatory requirement and is not within the scope of the environmental assessment review. Nevertheless, **Subsection 2.3.5: Fuel Delivery System Options** of the Application provides a brief discussion of all potential options considered leading up to the Project.
	No Net Loss of City Natural Areas	The proposed pipeline will follow existing transportation and/or utility corridors in the City of Richmond and no net loss of City natural areas is expected. All aspects of the assessment of the Project have been undertaken in accordance with the relevant federal, provincial, regional and local government legislation and policies.
	City Riparian Management Areas	This is addressed in **Section 5.2: Fisheries, Aquatics and Surface Water Quality Assessment** and **Chapter 9: Environmental Management Program** of the Application.
	City Parks, Trails, Environmentally Sensitive Areas	This is addressed in **Chapter 6: Assessment of Social and Economic Effects** and **Chapter 9: Environmental Management Program** of the Application.
	Contaminated Sites	This is addressed in **Section 5.6: Screening Level Contaminated Sites Assessment** and **Chapter 9: Environmental Management Program** of the Application.
	Opportunity to Provide Additional Comments	The EAO will coordinate an opportunity for all members of the Technical Working Group to provide comments on the Application during the Application Review stage.

Pre-Application Issues Tracking Summary – Federal Agencies, Departments and Organizations

Issue Raised By	Key Issue	VAFFC Response
Fisheries and Oceans Canada	Construction Mitigation Measures (fisheries)	This is addressed in each of the effects assessments in **Part B: Assessment of Project Effects, Mitigation, and Significance of Residual Effects**, where appropriate, and in **Chapter 9: Environmental Management Program** of the Application.
Environment Canada	Spill Preparedness, Prevention and Response	This is addressed in **Chapter 17: Spill Prevention, Preparedness and Emergency Response** of the Application.
	Identification of Environmentally Sensitive Areas	This is addressed in each of the effects assessments in **Part B: Assessment of Project Effects, Mitigation, and Significance of Residual Effects**, where appropriate, and in **Chapter 19: Fate and Effects Analysis** of the Application.
	Fate and Effects Analysis of a River Spill	This is addressed in **Chapter 19: Fate and Effects Analysis** of the Application.
	Project Effects	This is addressed in **Chapter 4: Assessment Scope and Methodology**, each of the effects assessments in **Part B: Assessment of Project Effects, Mitigation, and Significance of Residual Effects**, and in **Chapter 19: Fate and Effects Analysis** of the Application. A summary of all identified environmental, economic, social, heritage or health effects associated with the construction and operation of the proposed Project, recommended mitigation measures to avoid or reduce potential adverse effects to an acceptable level, and potential residual effects remaining following implementation of mitigation, and their significance, is provided

Issue Raised By	Key Issue	VAFFC Response
		in **Chapter 23: Summary of Potential Effects, Recommended Mitigation Measures and Potential Residual Effects** of the Application.
	Compensation Measures	Compensation measures are typically associated with significant adverse effects of a project that cannot be avoided or mitigated, and for adverse effects that are not significant but where compensation would be appropriate as determined in consultation with the relevant agencies and/or authorities. Assessment of Project effects, including residual effects and their significance, is provided in each chapter of **Part B: Assessment of Project Effects, Mitigation, and Significance of Residual Effects**, and in **Chapter 19: Fate and Effects Analysis** of the Application. An outline for a conceptual Migratory Bird Habitat Compensation Plan, which would typically be deployed following a large spill in the Fraser River, is included as an appendix to **Chapter 17: Spill Prevention, Preparedness and Emergency Response** of the Application.
	Contaminated Sites / Remediation	This is addressed in **Section 5.6: Screening Level Contaminated Sites Assessment** and **Chapter 9: Environmental Management Program** of the Application.
	Spill Behaviour	This is addressed in **Chapter 19: Fate and Effects Analysis** of the Application.
	Vegetation, Wildlife and Wildlife Habitat Assessment	This is addressed in **Section 5.3: Vegetation, Wildlife and Wildlife Habitat Assessment**, and **Chapter 19: Fate and Effects Analysis** of the Application.

Issue Raised By	Key Issue	VAFFC Response
	Air Quality	This is addressed in **Section 5.4: Local and Regional Air Quality and Climate Assessment** of the Application.
	Fuel Transfer and Delivery Pipelines	A description of construction and operations activities is provided in **Section 2.4: Project Description** of the Application. Effects assessments are provided in each chapter of **Part B: Assessment of Project Effects, Mitigation, and Significance of Residual Effects**. Other relevant assessments include **Chapter 9: Environmental Management Program**, **Chapter 15: Accidents or Malfunctions**, **Chapter 16: Spill Probability and Risk**, **Chapter 17: Spill Prevention, Preparedness and Emergency Response**, and **Chapter 18: Fire Prevention, Preparedness and Emergency Response** of the Application.
	Identification of Valued Ecosystem Components	This is addressed in **Chapter 4: Assessment Scope and Methodology**, in each chapter of **Part B: Assessment of Project Effects, Mitigation, and Significance of Residual Effects**, and in **Chapter 19: Fate and Effects Analysis** of the Application.
	Cumulative Environmental Effects	This is addressed in **Chapter 4: Assessment Scope and Methodology** and in **Chapter 22: Cumulative Environmental Effects Assessment** of the Application.
Vancouver Airport Authority	Fate and Effects Analysis of a River Spill	This is addressed in **Chapter 19: Fate and Effects Analysis** of the Application.

Issue Raised By	Key Issue	VAFFC Response
Environment Canada, Vancouver Fraser Port Authority and Vancouver Airport Authority	Environmental Management Plans	This is addressed in **Chapter 9: Environmental Management Program** of the Application.
Vancouver Fraser Port Authority	Utilities (Drainage)	A description of construction and operations activities, including utilities and drainage, is provided in **Section 2.4.4: Project Component Details** of the Application.
	Fuel Receiving Facility (Storage Tanks Monitoring)	A description of construction and operations activities is provided in **Section 2.4: Project Description** of the Application. See also **Chapter 17: Spill Prevention, Preparedness and Emergency Response** and **Chapter 18: Fire Prevention, Preparedness and Emergency Response** of the Application.
	Facilities and Design Parameters	A description of construction and operations activities is provided in **Section 2.4: Project Description** of the Application.
	Port Facility Security Plan	Port facility security plans are a standard requirement for all terminals and will be developed prior to commencement of operations.
	Existing Pipeline Decommissioning	VAFFC does not own the existing pipeline, and therefore cannot decide on the operation and future of the pipeline. Kinder Morgan does.

Additional Technical Working Group meetings are expected during Application Review, intended to provide input to the Application from the various interests represented on the Technical Working Group.

VAFFC plans to maintain regular telephone and email contact with the EAO, other agencies and stakeholders (including stakeholders who are not already part of the Technical Working Group), as well as conduct an exchange of correspondence, when required. These communications will provide updates on the Project and the environmental assessment review process, answer questions, and arrange meetings.

7.2 Public Consultation Summary

In September and October 2008 VAFFC distributed a Project Backgrounder document to various community and business groups likely to have an interest in the Project. VAFFC held four Public Information Sessions in Richmond in February and March 2009 to introduce the Project concept and receive general feedback from the public. VAFFC has continued to share information and updates about the Project with community, businesses and other stakeholders.

Means of information distribution activities included:

- Information Sessions;
- Media;
- Brochure; and
- Project Website (http://www.vancouverairportfuel.ca).

Key issues identified by the public, and VAFFC's responses to those issues, are summarized below. All comments and responses in their complete and original form can be found online via the EAO's website, www.eao.gov.bc.ca.

Pre-Application Issues Tracking Summary – Public

Key Issue / Subject Area	Number of Comments	VAFFC Response
Natural disasters	26	This is addressed in **Chapter 21: Effects of the Environment on the Project** of the Application, which assesses the potential effects of the environment on the Project, which includes seismic events, flooding, severe weather conditions and other natural disasters. The Project will be designed, constructed and operated in accordance with the applicable regulations, including earthquake resistance criteria.
Human safety and risks	33	Health, safety and risks are addressed in various chapters of the Application including: **Chapter 8: Assessment of Human Health Effects**, **Chapter 15: Accidents or Malfunctions**, **Chapter 16: Spill Probability and Risk**, **Chapter 17: Spill Prevention, Preparedness and Emergency Response**, **Chapter 18: Fire Prevention, Preparedness and Emergency Response**, **Chapter 19: Fate and Effects Analysis**, **Chapter 20: Navigation Assessment**, and **Chapter 21: Effects of the Environment on the Project**.
Environmental risks and effects	37	See previous response. Also, potential environmental, social, economic, heritage and human health effects of the Project are addressed in **Part B: Assessment of Project Effects, Mitigation, and Significance of Residual Effects** of the Application.
Project alternatives	56	Alternative means of undertaking the Project, as proposed by VAFFC, is addressed in **Section 2.6: Alternative Means of Undertaking the Project** of the Application. This section is presented in accordance with the requirements of the CEAA. An analysis of alternatives to the Project proposed by VAFFC is not a regulatory requirement and is not within the scope of the environmental assessment review.

Key Issue / Subject Area	Number of Comments	VAFFC Response
		Nevertheless, **Subsection 2.3.5: Fuel Delivery System Options** of the Application provides a brief discussion of all potential options considered leading up to the Project.
Project rationale	5	This is addressed in **Section 2.3: Project Background and Rationale** of the Application.
Socio-economic / Socio-community concerns	19	This is addressed in **Chapter 6: Assessment of Social and Economic Effects**, and **Chapter 19: Fate and Effects Analysis** of the Application.
Agricultural areas	6	Construction of the Project is not expected to occur in agricultural areas or disturb Agricultural Land Reserve land.

VAFFC will consult with the public during Application Review to include stakeholder meetings and open houses, and any other activities as directed by the EAO. VAFFC will continue to receive comments and respond to enquiries it receives via its website, email and dedicated phone line.

The public review will be implemented in accordance with the regulations established by the EAO. The public review comment period will take place after the Application has been submitted to and accepted by the EAO.

7.3 First Nations Consultation Summary

VAFFC has engaged in consultation with the following twelve First Nations identified by the EAO under section 11 of the BCEAA on November 23 2009:

- Cowichan Tribes
- Halalt First Nation
- Hwlitsum First Nation
- Kwantlen First Nation
- Lake Cowichan First Nation
- Lyackson First Nation
- Musqueam Indian Band
- Penelakut Tribe
- Semiahmoo First Nation
- Stz'uminus First Nation
- Tsawout First Nation
- Tsawwassen First Nation

Each of these First Nations is a member of the Technical Working Group.

During pre-Application the goal was to establish appropriate means by which to consult with each First Nation and identify means to address, avoid or otherwise accommodate any Project-related issues associated with aboriginal and treaty rights (and title), and other interests, raised during these consultations.

VAFFC has focused its efforts on:

- Initiating introductory meetings to introduce the Project concept and the environmental assessment process;
- Developing understandings on the consultation process;
- Agreeing on capacity funding;
- Meetings to explain the Project and to learn about issues and concerns;
- Identifying potential aboriginal and treaty rights (and title) and other interests;

- Holding open houses;
- Facilitating a boat tour of the Fraser River to familiarize First Nations with the Project;
- Conducting an archaeological overview assessment, as part of the assessment of heritage effects and inviting First Nations to participate in the field study;
- Articulating ways in which issues would be addressed and discussing these measures with each First Nation; and
- Preparing a First Nations Consultation Plan.

To assist First Nations with the identification of potential effects of the Project on their interests and take part in the environmental assessment review process, VAFFC offered funding to all twelve First Nations. To date, eleven First Nations have accepted this funding and all First Nations have identified some interests that are matters of concern to them.

VAFFC has listened to and reviewed comments that were identified in consultation meetings, Technical Working Group meetings and in written comments submitted to the EAO on the AIR.

Key issues identified by First Nations, and VAFFC's responses to those issues, are summarized below. All comments and responses in their complete and original form can be found online via the EAO's website.

Pre-Application Issues Tracking Summary – First Nations

Key Issue / Subject Area	VAFFC Response
Capacity funding	VAFFC has offered and provided capacity funding to eleven of the twelve First Nations identified in the section 11 order to ensure their capacity to engage in the environmental assessment review process.
Archaeological interests	All potentially affected First Nation's were contacted regarding participation in field visits and issuance of heritage investigation permits. Field visits required for the completion of the Heritage Assessment were accompanied by members of the First Nation's groups who responded to the invitation to participate in the Assessment. **Chapter 7** identifies and describes mitigation measures and environmental managements strategies to avoid, minimize or mitigate potential adverse effects on archaeological resources during Project construction and operations.
Economic opportunities	VAFFC has explained that the primary economic development effect of the Project's operations is to aid YVR in remaining competitive as a world class airport, and by doing so assist with the general economic competitiveness of Metro Vancouver, B.C., and Canada. However, VAFFC is prepared to discuss Project specific economic development opportunities/challenges with First Nations in the Application Review stage.
The need for environmental contingency plans	Environmental contingency plans will be developed and implemented during Project construction and operations. **Chapter 9** provides an outline of component plans.

Key Issue / Subject Area	VAFFC Response
Protection and enhancement of aboriginal rights	VAFFC acknowledges First Nations concerns regarding potential effects of the Project on aboriginal rights include but are not limited to fishing, hunting and gathering. VAFFC has not identified any residual effects of the Project on aboriginal rights and this is discussed in detail in **Chapter 11**. During the Application Review stage, VAFFC is committed to meeting with First Nations to review the responses provided to concerns regarding effects to aboriginal rights, and to discuss VAFFC's commitments and assurances.
Recognition of aboriginal title	Settlement of the aboriginal title claims involving the Port of Metro Vancouver lands in the vicinity of the Village of *Tl'uqtinus* are beyond the scope of the Project and can only be settled by bilateral discussions and negotiation between the Crown and First Nations

Additional discussions with First Nations are planned during Application Review. Within 30 days following acceptance of the Application for review by the EAO, VAFFC will contact each participating First Nation to schedule a meeting to discuss the Application and agree on communications. VAFFC will undertake the following First Nations consultation activities during Application Review:

- Request to meet with each First Nation to obtain the following:
  - Any additional information regarding specific aboriginal and treaty rights (and title) and other interests which may be adversely affected by the Project;
  - Comments on the Application itself; and
  - Responses to and discussion of proposed measures to avoid, mitigate, or where appropriate, otherwise address or accommodate potentially affected interests.
- Invite First Nations to the Application Review public open houses;
- Record and respond to all issues and concerns raised by First Nations at Technical Working Group meetings, as well as at First Nations meetings held with VAFFC. Issues and responses will be recorded in tracking tables, within the timelines established by EAO;
- Arrange and attend community meetings (if requested by a First Nation) to provide and exchange information with the community on the Application; and
- Report to the EAO in a First Nations Consultation Summary Report. The report will document the results of the First Nations consultation activities, including a record of the concerns raised by First Nations regarding the potential effects on aboriginal and treaty rights (and title) and other interests, and how these concerns will be addressed.

8 Scope of the Project

As described in the orders issued by the EAO under sections 11 and 13 of the BCEAA, the scope of the Project for the purpose of the EAO assessment includes the following on-site and off-site components and activities:

a) Upgrade of an existing marine terminal;

b) Construction and operation of facilities at the marine terminal for off-loading aviation fuel;

c) Construction and operation of an aviation fuel receiving facility;

d) Construction and operation of a pipeline to transfer aviation fuel from the marine terminal to the aviation fuel receiving facility;

e) Construction and operation of a pipeline to deliver aviation fuel from the aviation fuel receiving facility to YVR; and

f) Movement of vessels transporting aviation fuel within the South Arm of the Fraser River to and from the marine terminal, including fuel off-loading and transfer at the marine terminal.

Project operations will be in place for an indefinite life span. Decommissioning or abandonment of permanent infrastructure is not included within the scope of the Project or the scope of the environmental assessment as communicated in the section 11 and 13 orders and in the CEA Agency's "Notice of Commencement of an Environmental Assessment". A separate Decommissioning Plan would be required prior to any future decommissioning of proposed permanent infrastructure to evaluate potential effects at that time.

As confirmed by the CEA Agency and the Port, the federal scope of the Project includes all on-site and off-site components and activities as described above under the provincial scope.

9 Scope of the Environmental Assessment

The provincial scope of the environmental assessment of the Project includes:

- "consideration of potential adverse environmental, economic, social, heritage and health effects, including spill management control and emergency response, and practical means to prevent or reduce to an acceptable level any such potential adverse effects" (section 13 order).

- "consideration of potential adverse effects on First Nations' aboriginal interests and, to the extent appropriate, ways to avoid, mitigate or otherwise accommodate such potential adverse effects; and

- be such that the assessment satisfies all applicable requirements of Chapter 15 of the Tsawwassen Final Agreement" (section 11 order).

First Nations interests and information requirements are addressed in **Part C**.

The following technical discipline-specific assessments comprise **Part B**:

- Assessment of Environmental Effects:

  - Fisheries, Aquatics and Surface Water Quality Assessment;
  - Vegetation, Wildlife and Wildlife Habitat Assessment;
  - Local and Regional Air Quality and Climate Assessment;
  - Noise Assessment; and
  - Screening Level Contaminated Sites Assessment.
- Assessment of Social and Economic Effects:
  - Socio-economic and Socio-community Assessment.
- Assessment of Heritage Effects:
  - Archaeological, Historical and Heritage Resources Assessment.
- Assessment of Human Health Effects.

The Application includes additional assessments to meet the federal scoping requirements under the CEAA. The following assessments comprise **Part D**:

- Accidents or Malfunctions;
- Spill Probability and Risk;
- Spill Prevention, Preparedness and Emergency Response;
- Fire Prevention, Preparedness and Emergency Response;
- Fate and Effects Analysis;
- Navigation Assessment;
- Effects of the Environment on the Project; and
- Cumulative Environmental Effects Assessment.

10 Effects Assessment Methodology and Approach

The general approach taken to identify, assess and manage the potential effects of the Project during construction and operations, including cumulative impacts and residual effects, included:

- Conducting effects assessments for the disciplines under the EAO's five assessment pillars (i.e., environmental, economic, social, heritage and health) to identify potential effects of the Project on Valued Components (VCs);
- Identifying potential effects of the Project to meet the federal assessment requirements;
- Identifying measures to eliminate or reduce potential effects to an acceptable level through mitigation, where possible;
- Developing an outline for an Environmental Management Program, describing the environmental practices and procedures that will be systematically applied during Project construction and operations, to eliminate or minimize environmental effects and other adverse effects throughout the life of the Project;
- Identifying any adverse residual effects that may remain following implementation of mitigation measures and management strategies, and determining their likely significance; and
- Identifying cumulative impacts.

The assessment of potential cumulative impacts is integrated within each of the discipline-specific effects assessments. A separate assessment of cumulative environmental effects is also provided to meet the federal requirements and guidance.

The assessment methodology followed in this Application is consistent with the requirements of a harmonized provincial/federal environmental assessment review under the BCEAA and the CEAA, and in accordance with EAO and CEA Agency policies and guidelines. Methodology was further refined following additional input from the Technical Working Group, the EAO, the CEA Agency, and the public during pre-Application.

The residual effects attributes described below have been generally used for each assessment, using professional judgement and experience. While the definitions applied to these attributes vary, as appropriate for and described in the different effects assessments, general definitions are provided below:

- **Direction:** describes an effect as being neutral, positive or negative, generally with respect to baseline, pre-project conditions;
- **Magnitude:** indicates the intensity or severity of an effect, reflecting the degree of change in a measurement or analysis endpoint;

- **Geographic Extent:** indicates the geographic area over which an effect may occur;
- **Duration:** indicates the length of time that an effect may last;
- **Frequency:** indicates the frequency with which a particular effect may occur;
- **Reversibility:** indicates whether or not the VC is expected to recover from the adverse residual effect;
- **Ecological Context:** provides an indication of the state of the environment where the identified residual effect will occur; and
- **Probability:** indicates the likelihood that a particular residual effect will occur, given the information reviewed during the assessment and professional judgment.

The methodology and rationale for the assessment of potential cumulative impacts under the BCEAA, and the assessment of potential cumulative environmental effects under the CEAA, are consistent with one another, and generally follow the methodology outlined in the "*Cumulative Effects Assessment Practitioners Guide*" (Hegmann *et al.* 1999).

11 Project Effects, Mitigation and Residual Effects

11.1 Environmental Effects

Assessment of environmental effects is the first pillar of assessment required by the EAO, and meets the federal requirements for the assessment of environmental effects and environmental changes.

Fisheries, Aquatics and Surface Water Quality Assessment

The effects of Project construction and operations on fisheries, aquatics and surface water quality were identified and assessed. Mitigation measures are recommended to avoid or reduce effects to an acceptable level.

The assessment focuses on the Lower Fraser River from the trifurcation of the North and South Arms, downriver to Sand Heads. The Moray Channel in the Middle Arm of the Fraser River and surface water drainages on Lulu Island and Sea Island were also key areas of focus.

Existing information was reviewed to identify species occurrence and baseline fisheries, aquatics and surface water quality characteristics in the Project area, including those species considered to be of special management concern. Data gaps were addressed through field investigations. The assessment was prepared by Hatfield Consultants.

VCs identified for this assessment include:

- Provincially red- and blue-listed fish species;
- Fish species identified by the Committee on the Status of Endangered Wildlife in Canada to be endangered, threatened, or of special concern;
- Fish species of special concern according to the federal *Species at Risk Act*;
- Species at risk requiring protection under the provincial Identified Wildlife Management Strategy; and
- Fish species of regional importance.

Potential effects during Project construction include:

- Temporary re-suspension of sediments in the Fraser River during the marine terminal in-water upgrades;
- Percussive underwater noise during pile-driving activities at the marine terminal;
- Alteration of low productivity benthic fish habitat and conversion of some soft-bottomed habitat at the marine terminal to angular boulder habitat;
- Displacement of water column habitat due to the installation of new piles;
- Accidental spills/leaks from barge-based equipment used during the marine terminal upgrades;
- Discharge of sediment-laden waters or materials hazardous/deleterious to fish into the stormwater sewer system or surface drainage ditches during the construction of the fuel receiving facility;
- Loss of habitat in functional riparian areas through which the pipeline is routed or used as staging areas;
- Erosion and sedimentation of exposed soil and soil piles into surface waters; and
- Accidental release of drilling fluids.

Potential effects during Project operations include removal of benthic sediments due to infrequent maintenance dredging between the navigation channel and the marine terminal, if required.

Recommended mitigation measures to eliminate or alleviate potential effects to VCs include:

- Delineate environmentally sensitive “no work” areas to protect riparian areas and surface water quality;
- Manage site drainage throughout construction and operations;
- Develop protocols for proper on-site storage of all hazardous materials and other Best Management Practices;
- Work within the least risk work windows and fisheries timing windows;
- Select pile-diving method(s) that meet technical requirements and, where possible, minimizes sound shock wave generation within the water column;
- Hydrophone monitoring of sound pressure during pile-driving; and
- Dredging in conjunction with the Port’s dredging activities, where practical.

The assessment concludes that following mitigation adverse residual effects of Project construction or operations on fisheries and aquatic VECs are “not significant”. Some localized, temporary effects to VECs may occur during the marine terminal upgrades and during infrequent maintenance dredging at the marine terminal. Any adverse effects on fisheries and water quality are expected to be minor, short-term and reversible, and no permanent loss of environmentally unique, important, or sensitive aquatic habitats is expected. Potential cumulative impacts are assessed as “nil”.

Vegetation, Wildlife and Wildlife Habitat Assessment

The effects of Project construction and operations on vegetation, wildlife and wildlife habitat were identified and assessed. Mitigation measures are recommended to avoid or reduce effects to an acceptable level.

The assessment focuses on upland riparian areas, intertidal marshes, mudflats and seagrass meadows of Lulu Island and Sea Island. Existing information was reviewed and supplemented with a terrestrial field survey to determine baseline conditions of the Project area.

“Vegetation” is defined as plant species and plant communities (i.e., ecosystems), including plant species of conservation concern (i.e., at risk). “Wildlife” is defined as amphibians, reptiles, birds and mammals, including species at risk. “Wildlife habitat” is defined as any ecological area on which a wildlife species depends on to carry out part

or all of its life functions. The assessment was prepared by Robertson Environmental Services Limited.

VCs identified for this assessment include:

- Riverine marshes;
- Terrestrial vegetation;
- Plant species and plant communities at risk;
- Aquatic birds;
- Marine mammals;
- Terrestrial wildlife;
- Bird species at risk;
- Non-avian species at risk;

Potential effects during Project construction include:

- Temporary disturbance of red-coded marsh habitat downstream of the marine terminal due to sedimentation;
- Alteration or destruction of intertidal marsh habitat during the installation of the pipeline at the Moray Channel;
- Alteration of terrestrial habitats adjacent to the pipeline during site preparation;
- Disturbance or destruction of plant species/plant communities at risk during site preparation;
- Temporary localized disturbance or dispersion of birds or marine mammals during pile-driving; and
- Disturbance, displacement or mortality of and small mammals, reptiles or amphibians, or loss or alteration of their habitat during pipeline construction.

Potential effects during Project operations include:

- Periodic disturbance of red-coded marsh habitat downstream of the marine terminal during infrequent maintenance dredging, if required;

- Habitat alteration, loss or destruction during vegetation maintenance along the pipeline right-of-way; and
- Periodic disturbance, displacement or mortality of small mammals, reptiles or amphibians during vegetation maintenance along the pipeline right-of-way.

Recommended mitigation measures to eliminate or alleviate potential effects to VCs include:

- Limit disturbance of construction footprint and avoid sensitive features or areas where possible;
- Conduct nest or wildlife (including species at risk) surveys in advance of construction, where appropriate;
- Prevent discharge of sediment laden water to environmentally sensitive areas;
- Select pile-diving method(s) that meet technical requirements and, where possible, minimizes sound shock wave generation within the water column;
- Place caps over open piles to prevent entry and entrapment of birds;
- Conduct vegetation maintenance during “least risk” windows; and
- Conduct plant (including species at risk) or animal salvage where possible.

The assessment concludes that a potential residual effect of “low significance” was identified for both terrestrial vegetation and terrestrial wildlife. This effect could potentially result from changes to habitat, or possible displacement or mortality of small mammals, reptiles or amphibians during construction and operations of the pipeline.

No residual effects were identified for riverine marshes, bird species at risk and non-avian species at risk. Residual effects were deemed to be “not significant” for aquatic birds and marine mammals in the construction phase, and no residual effects were identified for the operations phase. Potential residual effects of “unknown significance” were identified for plant species and plant communities at risk, pending the outcome of a field survey to determine presence of any species at risk. Potential cumulative impacts are assessed as “nil”.

Local and Regional Air Quality and Climate Assessment

The effects of Project construction and operations on local and regional air quality and climate were identified and assessed. Mitigation measures are recommended to avoid or reduce effects to an acceptable level.

The assessment focuses locally on the City of Richmond, and regionally on the City of Richmond, the Corporation of Delta, and the City of Surrey, to include the extent of any CAC and GHG emissions resulting from Project construction or operations. The assessment also includes the extent of any emissions avoided as a result of Project operations, along with a discussion of other potential reductions not used for calculating the net effects.

Baseline air quality and climate conditions were determined through a review of existing data. Interactions between baseline conditions and Project construction and operations were determined through a comparison of a future with the Project and without the Project. The assessment was prepared by RWDI Inc.

VCs identified for this assessment include:

- Ambient air quality; and
- GHG emissions.

Potential effects during Project construction include:

- Release of CAC and GHG emissions from the operation of vehicles, equipment and tugs;
- Fugitive dust emissions from the handling of rock and soil; and
- Indirect GHG emissions from the production of cement for use in concrete

Potential effects during Project operations include:

- An overall increase in regional sulphur dioxide (SO_2) emissions;
- An overall increase in regional CAC emissions;
- An overall decrease in regional GHG emissions; and
- An overall decrease in regional particulate matter and nitric oxide (NO_x) emissions.

Recommended mitigation measures to eliminate or alleviate potential effects to VCs include:

- Inspection and maintenance of construction vehicles, equipment and tugs;
- Application of water to unpaved roads;
- Implementation of vehicle idling and vessel hotelling restrictions;

- Use of low-sulphur fuel for marine vessels;
- Maintenance of vapour-tight conditions in fuel storage tanks and pipelines;
- Implementation of a leak detection and repair program; and
- Painting tanks a light colour.

There will be a small increase in local emissions of air pollutants (less than 1%) and regional emissions of GHG (less than 0.1%) due to Project construction. These emissions are expected to occur during the daytime and will stop after the construction period. The magnitude of Project construction effects for all pollutants is rated as low. The effects of Project construction emissions are reversible after construction is complete. Due to the low magnitude and short-term reversible nature of these increases, they are considered to be “not significant”.

Thousands of tanker trucks will be removed from local highways and roads every year. A single barge shipment will replace approximately 460 trucks and a tanker shipment will replace approximately 1,400 trucks. This will result in a reduction in the exposure to diesel exhaust for the people who drive on or live near these roads. GHG emissions will also decrease as a result of the Project. In comparison to the existing delivery system, the Project has the potential to result in a decrease in GHG emissions of approximately 70%.

There could be a small incremental increase in evaporated volatile organic compound (VOC) emissions from the fuel receiving facility in the local and regional context. These emissions will be less than existing emissions resulting from the movement of aviation fuel through the existing delivery system. However, emissions from the existing infrastructure are not included in calculating the net effects. If floating pan roofs are not included in the tank design, the incremental effect of VOC emissions on local and regional air quality will be minor.

The sulphur content of marine fuel is higher than the sulphur content of the diesel used in trucks and therefore emissions of SO_2 are expected to increase a small amount. Ambient concentrations of SO_2 and VOCs resulting from these emissions are expected to be at least ten times less than ambient air quality objectives. Therefore these increases are considered to be “not significant”.

The magnitude of Project operations effects for all pollutants is rated low. As such, the probability of an adverse residual effect is also considered low and potential residual effects were deemed to be “not significant”. Potential cumulative impacts were assessed as “nil”.

Noise Assessment

Noise effects during Project construction and operations were identified and assessed. Mitigation measures are recommended to avoid or reduce effects to an acceptable level.

The assessment determined baseline ambient noise levels in the Project vicinity and compared those to expected Project construction and operations activities.

For Project construction, two metrics were applied since there are currently no published criteria appropriate for construction noise assessment. The first one is a comparison between the predicted noise level from each piece of construction equipment and the City of Richmond's noise bylaw limit. The second one is a comparison between the predicted Daytime Equivalent Sound Level resulting from all of the construction equipment and the measured baseline noise conditions.

For Project operations, the predicted Daytime Equivalent Sound Level and Night-time Equivalent Sound Levels from the noise sources were compared to the measured existing sound levels at the nearby residences to assess the significance of any effects. Since engine exhaust noise from shipboard generators is predominantly low frequency, the predicted C-weighted noise levels were also compared to the measured baseline C-weighted noise levels at the receiver locations. The assessment was prepared by BKL Consultants.

The VC identified for this assessment is sound quality.

Potential effects during Project construction include:

- Noise from construction equipment and machinery.

Potential effects during Project operations include:

- Noise from shipboard generators on vessels berthed at the marine terminal; and
- Noise from transfer pumps at the fuel receiving facility and the marine terminal.

Recommended mitigation measures to eliminate or alleviate potential effects to VCs include:

- Notify potentially affected residents/communities in advance of construction pile-driving;
- Select pile-diving method(s) that meet technical requirements and, where possible, minimizes sound shock wave generation;

- Coordinate and schedule construction activities to minimize noise;
- Restrict construction activities to normal weekday daytime hours, where possible;
- Apply any noise shielding to stationary equipment to reduce noise or construct temporary noise barriers around sensitive areas;
- Turn off idling equipment when not in use;
- Supply all equipment with appropriate covers, hoods, shields, etc., and operate in place and latched shut;
- Carry out regular maintenance on all equipment;
- Monitor construction noise, to ensure municipal by-law limits are being adhered to; and
- Limit the sound level and encourage use of the quietest shipboard generators during operations.

The noise effects of Project construction are predicted to be low, except for pile-driving which is predicted to have a high noise effect. Pile-driving will have a noticeable effect on sound quality and was deemed to be a “significant” residual effect. However, it will be short-term and infrequent in nature and will cease once construction is complete.

For Project operations, low to moderate noise effects could occasionally occur at neighbouring residences due to low frequency noise from shipboard generators operating at night (assuming night-time operations were to occur). Noise during Project operations will not exceed the City of Richmond’s noise by-law. Residual effects to sound quality during operations were deemed to be “not significant”. Potential cumulative impacts were assessed as “negligible”.

Screening Level Contaminated Sites Assessment

The risk of encountering soil or groundwater contamination during Project construction and operations was identified and assessed. Mitigation measures are recommended to avoid or reduce risk to an acceptable level.

The assessment focuses on identifying known contaminated sites which may interact with the Project’s construction or operations to pose a risk or cause an effect. Sites on Lulu Island and Sea Island were considered if they were within the two city blocks of the direct footprint of the Project. A risk ranking was assigned to known contaminated sites to determine risk levels.

The most likely effect when installing the fuel delivery pipeline is the identification of previously unknowncontaminated sites, which is beneficial. It is possible that the anti-corrosion coating on the fuel delivery pipeline degrades in the event that it is placed in a location that is highly contaminated. The risk of installing the proposed pipeline in a highly contaminated area or one that becomes contaminated sufficient to cause damage to the pipeline is low, given that none of the known contaminated sites are especially large or likely to be problematic.

If excavations for the proposed pipeline extend below the water table, preferred groundwater flow pathways may be created over time. However, given the large number of other similar pathways, and the low gradients in the area, the pipeline's placement is unlikely to materially affect contaminant migration.

The pipeline routing alignment will consider location of known high risk areas of contamination and take measures to avoid these locations where possible. Any discovery of previously unidentified contamination will be subsequently remediated, inducing a beneficial residual effect. Any encountered contamination will be managed and addressed following an adaptive management strategy.

In general, there is low to moderate risk of encountering pre-existing contamination during Project construction. Moderate risk locations are primarily associated with historical and current rail lines and streams. Two site specific locations of high risk of encountering contaminants at or near the surface were also been identified. While it is likely that some contamination will need to be managed, none of the identified sites are especially large or likely to be problematic. They are best managed by an adaptive management process that responds to the Project specifications. Any identified potential residual effects relating to soil and groundwater contamination from Project construction or operations were deemed to be "not significant".

11.2 Social and Economic Effects

Assessments of social and economic effects are the second and third pillars of assessment required by the EAO, and meet the federal requirements for the assessment of environmental effects and environmental changes.

Socio-Economic and Socio-Community Assessment

Social and economic effects of Project construction and operations were identified and assessed. Mitigation measures are recommended to avoid or reduce effects to an acceptable level.

The assessment focuses on the City of Richmond, the Corporation of Delta and the South Arm of the Fraser River, but also considers Greater Vancouver, B.C. and Canada where broader social and economic effects are expected.

Existing information was reviewed to determine the social and economic baseline conditions. Additional issues relevant to the assessment were included as identified by stakeholders during consultations. The assessment highlights indicators (VCs) which may be affected by the Project. The assessment was prepared by Pierce Lefebvre Consulting.

VCs identified for this assessment include:

- Economic development;
- Land use;
- Property acquisitions and property value;
- Motor vehicle traffic and mobility;
- On-street parking;
- Bicycle/pedestrian traffic and mobility;
- Schools/recreation access and other community features;
- Street/trail trees;
- Marine traffic;
- Aesthetic values/visuals;
- Railway right-of-way; and
- Utilities.

Potential effects during Project construction include:

- Disruptions to motor vehicle, bicycle and pedestrian mobility, particularly along the pipeline corridor;
- Temporary disruptions to on-street parking during pipeline construction;
- An estimated 320 person years of direct construction employment or approximately 160 person years per year for approximately 2 years;

- An additional 330 person years of indirect employment during construction from supplying goods and services to the Project and another 112 person years of induced employment from purchases of goods and services by direct and indirect employees; and
- Gross Domestic Product increase of approximately $52.8 million including direct, indirect and induced benefits.

Potential effects during Project operations include:

- An estimated 14 full-time equivalent jobs;
- Significant reduction or elimination of tanker trucks which will reduce motor vehicle traffic volumes and congestion, increase traffic safety and reduce road maintenance costs;
- Improvements to bicycle and pedestrian mobility through the continuation of Richmond's river dyke access trail, and public access to that trail; and
- Assist YVR in remaining competitive as a world class airport, and by doing so enhance the general economic competitiveness of Richmond, Greater Vancouver, B.C. and Canada.

The assessment identified several adverse residual effects to VCs, but none were deemed to be "significant". On the other hand, residual effects on economic development were deemed "significant" and of positive nature because of the expected increase in the competitiveness of YVR.

The final routing of the fuel delivery pipeline will determine the significance of construction activities on motor vehicle traffic and mobility and bicycle/pedestrian traffic and mobility. Potential "significant" residual effects for bicycle/pedestrian traffic and mobility could occur during construction due to a change in bicycle and pedestrian access to trails and roads. These changes will likely involve detours with additional street crossings for bicycle and pedestrian traffic, but will ultimately depend on the final pipeline routing. Trails that could be affected include the Shell Road Trail and Bridgeport Trail. Should the pipeline be constructed where the existing CNR railway corridor is located, disruption to bicycle/pedestrian traffic and mobility may be significantly reduced. Potential cumulative impacts were identified for bicycle/pedestrian traffic and mobility and were assessed as being "negligible".

11.3 Heritage Effects

Assessment of heritage effects is the fourth pillar of assessment required by the EAO, and meets the federal requirements for the assessment of environmental effects and environmental changes.

Archaeological, Historical and Heritage Resources Assessment

The effects of Project construction and operations on archaeological, historical and heritage resources were identified and assessed. Mitigation measures are recommended to avoid or reduce effects to an acceptable level.

The assessment focused on identifying archaeological, historical and heritage resources on Lulu Island and Sea Island through a review of pre-existing documentation. A rating system to determine the resource potential of sites potentially affected by the Project was applied to known sites. Site visits were undertaken, but no subsurface investigations were conducted, as they will be undertaken with a Heritage Inspection Permit during construction. The assessment was prepared by the Archaeology and Cultural Heritage group at AMEC Earth and Environmental (formerly Arcas Consulting Archaeologists Ltd.).

VCs identified for this assessment include:

- Paleontological resources;
- Historic or heritage sites;
- Traditional land use; and
- Archaeological sites.

Potential effects during Project construction include:

- Activities which could disturb archaeological resources such as:
  - vegetation clearing (where present);
  - ground levelling;
  - removal of native soils;
  - placement of piles and ground densification;
  - excavation of pipeline trenches;
  - excavation of entry/exit points for directional drilling; and

- installation of temporary structures (roads, drainage, footings).

Potential effects during Project operations are not expected.

Although several traditional place names are recorded on Lulu Island and Sea Island, only the South Arm seasonal village of *Tl'uqtinus* is associated with lands near the Project footprint. Nearly all of the Project facilities will be built within existing transportation or utility rights-of-way or in landscapes that have been profoundly altered by modern settlement and land use. Therefore, the Project is not expected to have any net adverse effect on contemporary, traditional use of these lands by the First Nations' communities with asserted interests in the Lulu Island – Sea Island locality.

As a result of this assessment, two known archaeological sites with "Moderate" or "High" potential of occurring in vicinity to the proposed fuel receiving facility location and the proposed Moray Channel pipeline crossing (DgRs-17 and DhRs-26, respectively) were identified.

A heritage resource impact assessment at the fuel receiving facility and the Moray Channel directional drilling exit point (or areas within the Project footprint rated as having "High" or "Moderate" archaeological resource potential) is recommended. The heritage resources impact assessment will be most effective if conducted during Project construction. Results of this study will enable the development of appropriate mitigation measures and heritage management strategies that will be applied during Project construction and operations.

Residual effects associated with the two identified archaeological sites are deemed to be "not significant" and no cumulative impacts are expected to occur.

11.4 Health Effects

Assessment of health effects is the fifth pillar of assessment required by the EAO, and meets the federal requirements for the assessment of environmental effects and environmental changes.

Human Health Effects Assessment

The effects of Project construction and operations on human health were identified and assessed. Mitigation measures are recommended to avoid or reduce effects to an acceptable level.

The assessment focuses on groups of individuals that may incur human health effects from air quality, noise, contaminated sites, or social/economic effects of the Project.

Groups of people that were considered in the assessment include local residents in close proximity to the Project, and the general public of Greater Vancouver.

The assessment is primarily based on information relevant to human health presented in the air quality, noise, contaminated sites, and socio-economic and socio-community effects assessments. Each of these presents a detailed assessment of potential effects of the Project from a biophysical or social/economic perspective.

The assessment provides a general description of the potential agents of exposure, including noise, air quality, road traffic, recreation and contaminated sites. Human health conditions are discussed in the context of potential exposures to agents that have the potential to affect human health (i.e., VCs) either negatively or positively. The relationship each exposure agent or VC has to the Project is also described. The assessment was prepared by AMEC Earth and Environmental.

VCs identified for this assessment include:

- Human health effects from noise;
- Human health effects from air quality;
- Human health effects from road traffic;
- Human health effects from the extension of a public access trail; and
- Human health effects from contaminated sites.

Potential effects during Project construction include:

- Noise during pile-driving activities at the marine terminal and fuel receiving facility;
- Air quality during construction activities;
- Increased traffic during construction activities;
- Traffic disruption; and
- Remediation of contaminated sites.

Potential effects during Project operations include:

- Low noise effects from vessels hotelling at the marine terminal;
- Marginal net increases for SO_2 and VOCs;
- Reduced CAC emissions for particulate matter (PM_{10}, $PM_{2.5}$) and NO_x; and

- Indirect positive effects due to extension of the public access trail near the marine terminal.

Recommended mitigation measures to eliminate or alleviate potential effects to VCs are as presented above for the Local and Regional Air Quality and Climate Assessment, Noise Assessment, Screening Level Contaminated Sites Assessment, and Socio-Economic and Socio-Community Assessment, where relevant to potential human health effects.

Potential residual human health effects resulting from changes in traffic, noise or air quality are unlikely or will have low severity, and were therefore deemed "not significant".

12 Environmental Management Program

An Environmental Management Program will be implemented to minimize the potential for adverse environmental effects throughout construction and the lifespan of the Project. The Environmental Management Program will support VAFFC's commitments and the achievement of compliance with all applicable legislation, as well as the terms and conditions of all permits, approvals or authorizations which are issued in relation to the Project. The structure of the Environmental Management Program is divided into two sections. A Construction Environmental Management Plan (CEM Plan) will be developed prior to commencement of construction and an Operations Environmental Management Plan (OEM Plan) will be developed prior to commencement of operations.

Both Plans will be submitted to the appropriate regulatory agencies and authorities for review and comment prior to the commencement of construction and operations, and updated as necessary.

An outline of key environmental protection measures, practices and/or procedures that will be systematically applied during Project construction and operations is provided.

12.1 Project Construction

Environmental protection will be the primary focus of the CEM Plan. Topics where management plans will be developed and that are expected to be covered include:

- Accidents or Malfunctions Management Plan;
- Air Quality and Dust Control Management Plan;
- Archaeological Management Plan;

- Contaminated Sites Management Plan;
- Directional Drilling Planning and Execution Plan;
- Environmental Education and Awareness Plan;
- Environmental Monitoring Plan;
- Surface Water Quality / Fisheries Protection and Sediment Control Plan;
- Fuels, Chemicals and Materials Storage and Handling Plan;
- Noise Management Plan;
- Spill Prevention and Emergency Response Plan;
- Vegetation and Wildlife Management Plan; and
- Waste Management Plan.

Traffic management will be addressed separately in a Traffic Management Plan. Health and safety will also be managed separately in the Construction Site Safety Manual.

A qualified Environmental Monitor will be retained by the Contractor to provide on-site monitoring services during all construction activities identified as having the potential for adverse environmental effects.

VAFFC will retain an Environmental Manager and/or environmental staff to oversee the work and carry out periodic Quality Assurance/Quality Control audits of construction activities and procedures to verify that the Project is managed to the satisfaction of VAFFC and the regulatory agencies, as set out in all applicable environmental regulations and permit conditions, Proponent's commitments, and all requirements outlined in the CEM Plan.

The Contractor will keep a Construction Environmental Inspection Field Log for the Project summarizing activities and actions taken to minimize effects and that documents the effectiveness of mitigation measures. The log will provide a comprehensive account of environmental issues and observations, a description of actions required and taken, a list of parties consulted, and an indication of how specific issues were resolved.

12.2 Project Operations

The OEM Plan will contain environmental protection plans and/or management strategies to address the following:

- Greenhouse Gas Voluntary Reporting Program;
- Accidents or Malfunctions Plan;
- Communications Plan;
- Solid, Liquid and Hazardous Wastes Plan; and
- Spill Prevention, Preparedness and Emergency Response Plan.

The OEM Plan will also contain Post-Construction Compliance Monitoring, which will describe any monitoring and reporting activities identified during the assessment process.

The Spill Prevention, Preparedness and Emergency Response Plan will meet all Transport Canada requirements for spill response and all B.C. Oil and Gas Commission requirements for emergency response. This plan is expected to be developed in close co-operation will all relevant stakeholders including, Transport Canada, the Port, the City of Richmond, Richmond Fire-Response and designated spill response organizations, including Western Canada Marine Response Corporation. In addition, fire safety will be addressed to meet all requirements of the National Fire Code for buildings and open areas handling flammable and combustible liquids.

13 First Nations Information Requirements

First Nations people used the South Arm of the Fraser River and the adjacent foreshore prior to contact with Europeans. During this time, First Nations engaged in resource-use activities integral to Coast Salish culture, and common to all twelve First Nations with whom VAFFC has been consulting.

Pre-Application consultation ascertained that First Nations harvested marine resources, including the five species of salmon, eulachon, sturgeon, crabs, cockles, horse clams, sea lions, hair seal and porpoise, within the mouth and estuary of the Lower Fraser River and that some of them travelled as far up the river as the Franklin Rock above Yale.

Terrestrial resources utilized by First Nations were identified to include culturally important plants used for multiple domestic purposes. Deer, black bear and waterfowl were also identified to have been hunted with bow and arrow, spears or nets. Major structures comprising high poles and very large open mesh nets were constructed near sloughs and waterways for catching large numbers of waterfowl.

The marine terminal property and proposed location for the fuel receiving facility are on lands that have been significantly altered by industrial or other anthropogenic development in the last century. There is no remaining possibility for gathering plants

and herbs for food and medicinal purposes on these lands. There has been First Nations access to resources on the lands proposed for the Project for several generations. The environmental conditions conducive to vegetation importance to First Nations may exist on agricultural plots outside the footprint of the marine terminal property and proposed fuel receiving facility location.

In light of the available information and the conditions of the landscape that have prevailed for at least four generations, effects of the marine terminal property and adjacent fuel receiving facility site on aboriginal rights are considered by VAFFC to be negligible.

VAFFC recognizes the importance of the fisheries and other marine resources in the river to the First Nations groups who continue to use the river for harvesting these resources. VAFFC has assessed the risks to these resources in detail since the potential effects on the marine environment is a major focus of the Project review. VAFFC has also identified measures to mitigate the risks to acceptable levels. The results of this assessment are presented in detail in the Application.

VAFFC believes that the Project design and mitigation measures will reduce the residual risk to First Nations interests to an acceptable level. However, as noted above, judgment of potential effects on aboriginal rights will need to be reconciled between the First Nations and the Crown.

During Application Review, VAFFC is committed to meeting with First Nations to review the responses provided to concerns regarding effects on aboriginal rights, and to discuss VAFFC's commitments.

The rights of aboriginal title that have been cited by some First Nations during pre-Application consultation are:

- Aboriginal title to the village site of *Tl'uqtinus*;
- Loss of undeveloped Crown land from a treaty settlement; and
- Compromise of that aboriginal title on account of questions about the legality of the transfer of federal Crown lands to Port Metro Vancouver.

The matter of aboriginal title will rest on whether one or some of the First Nations that assert it on the lands where the Project is proposed can show exclusive use and occupation prior to the assertion of British sovereignty in 1846. VAFFC is not in a position to assess whether the asserted seasonal occupation of *Tl'uqtinus* by several First Nations would ground a title claim. A century or more has passed since the area

was actively used. This Application reports the findings of two apparently contradictory studies on the precise location of the village.

The issue of potential aboriginal title asserted by some First Nations and any economic accommodation that may arise, can only be settled by bilateral discussions and negotiation between the Crown and First Nations. It is beyond the reasonable scope of VAFFC's delegated responsibility to settle this issue with First Nations during the environmental assessment review process of the Project.

VAFFC foresees discussion between the Crown and Port Metro Vancouver and First Nations on this question. As a private company, VAFFC has no jurisdiction or authority to respond to this issue.

The "Tsawwassen Nation Final Agreement" outlined four treaty rights applicable to the Project, including the right to harvest fish, the right to harvest wildlife, the specific right to hunt migratory birds and the right to harvest and gather plants.

The concern that increased marine traffic may threaten the Tsawwassen First Nation's treaty rights in the area is acknowledged, as are the specific concerns regarding depleted fisheries values and increased risks to the Fraser River South Arm fishery. VAFFC, however, has concluded that these concerns will be addressed and prove negligible in light of the small volume of increased traffic and adoption of all safety measures. VAFFC also concludes that hunting rights will not be threatened by the Project and that the Project will not reduce populations of migratory birds. During Application Review, VAFFC is committed to meeting with the Tsawwassen First Nation to review and discuss the issues and responses provided above.

VAFFC has respectfully considered and responded to all comments made by the Tsawwassen First Nation and has concluded that the risks of the Project on these four treaty rights are the same as those articulated for aboriginal rights discussed above.

VAFFC is also aware of the Douglas Treaty Rights of the Tsawout First Nation. VAFFC's studies conclude that the treaty rights of the Tsawout First Nation will not be infringed. During Application Review, VAFFC is committed to meeting with the Tsawout First Nation to review and discuss the issues and responses provided above.

First Nations have raised other interests that are not directly related to traditional uses, including: possible effects of dredging, noise, fuel spills and cumulative effects; as well as questions about process, permitting, social costs and benefits, and employment opportunities. As directed by the EAO, VAFFC has addressed these interests separately in the Application.

VAFFC believes that the mitigation measures proposed will resolve any residual effects to an acceptable level.

14 Federal Information Requirements

14.1 Accidents or Malfunctions

Accidents and malfunctions were assessed in accordance with the federal requirements under the CEAA. Through discussions with Project engineers and regulators, the following potential accidents or malfunctions were identified for consideration in the assessment:

- Accidental spill of deleterious materials;
- Accidental fire;
- Vessel and vehicle accidents;
- Accidental third-party damage; and
- Accidental utility disruption.

Accidental Spill of Deleterious Materials

During construction, there is minimal likelihood that equipment failure or operator error during on-site fuel storage, refuelling activities, and other activities associated with over-water and upland works may initiate an accidental spill of deleterious material. Of these, an accidental spill during equipment refuelling is most likely to occur. Any construction-related spill would be expected to be a localized, one-time event of relatively small quantities of fuel. As a result, significant effects on biophysical resources and heritage or First Nations resources are not expected. Due to the magnitude of a spill, direct or indirect human health effects as a result of a spill are considered highly unlikely. Comprehensive plans for the management and mitigation of spills during construction will be included in the CEM Plan, which will provide prescriptive measures for fuel storage, equipment refuelling and protocols to follow during over-water and upland construction works (see **Chapter 9**).

During Project operations, an accidental upland spill of deleterious material could potentially occur from fuel pipelines, from the fuel receiving facility and/or during cargo transfer operations at the marine terminal. Over-water spills could also potentially occur during the process of fuel off-loading from a vessel berthed at the marine terminal or from a vessel during its transit in the river, or during fuel bunkering at the marine terminal. The probability and risk associated with potential spills of aviation fuel, during

the operation of all Project components, is addressed in **Chapter 16**. The probability of an in-water spill related to fuel bunkering activities is low, due to the low numbers of vessels expected to frequent the marine terminal (i.e., 3 to 5 vessels per month) and the provision of this service by an experienced operator. Bunkering transportation and refuelling activities are routinely undertaken in the Fraser River. Depending on the location of a spill (in-water or upland), there may be direct or indirect human health, biophysical or socio-economic effects. The System Integrity Management Program and the Spill prevention, Preparedness and Emergency Response Plan will serve as cornerstone documents to prevent, prepare for and respond to an accidental spill (see **Chapter 17** for further details).

Accidental Fire

As a result of the characteristics of the surrounding environment and minimal use of fire- or spark- producing equipment during construction, there is a possible but extremely low likelihood of initiating localized construction-related fires. In the unlikely event of an accidental fire, there is the potential for minimal, temporary adverse effects on public and worker safety, infrastructure and ecological health. Response measures required in the event of an emergency, such as fire, will be included in the Spill Prevention and Emergency Response Plan included in the CEM Plan. This will include pre-emergency planning, emergency organization and responsibilities in addition to emergency and evacuation protocols.

During operations, aviation fuel, which has the potential to act as a combustible fuel source if improperly handled, will be stored, transported and transferred. Without a source of ignition, fuel storage tanks are not at risk of fire and have minimal likelihood of initiating a fire. The marine terminal has an extremely unlikely risk of fire as a result of mechanical malfunction or human error during fuel unloading activities. Due to the buried nature of the pipelines and lack of oxygen available within the pipelines, the possibility of fire being initiated along their length is also minimal. The urban and industrial setting of the Project area limits the potential effect on biophysical and heritage or archaeological resources. An accidental fire, however, may affect nearby infrastructure and public and worker safety, which may be associated with economic costs. Prevention, preparedness and emergency response measures in relation to a fire incident during Project operations are described in **Chapter 18**.

Vessel and Vehicle Accidents

The introduction of new traffic patterns during construction may slightly increase the likelihood of vehicle accidents. However, traffic alteration is expected to be similar in scope and scale to most infrastructure engineering projects and poses little risk with adequate mitigation put in place during construction. Potential effects associated with

vessel and vehicle accidents include injury, mortality, property damage, and construction delays which may be associated with economic costs. A Traffic Management Plan will be prepared prior to construction that will describe the procedures and practices to be followed to minimize construction-related interference with the flow of public traffic and avoid safety-related effects associated with the movement of construction equipment and vehicles.

During operations, the Project's marginal contribution to increased marine vessel traffic volumes and the low percentage of historic vessel accidents indicate that the likelihood of a vessel accident as a result of the Project is extremely low. In addition, the likelihood of a vehicle accident associated with Project operations is also considered extremely low. Depending on the scale and location, a vessel accident may affect vessel integrity and stationary objects, and have related safety, financial and environmental effects/costs. An accidental vehicle accident may induce an accidental spill by compromising the integrity of piping and process equipment. Management and mitigation measures to be implemented during Project operations to reduce the risks associated with a potential vessel accident are presented in **Chapter 20**. Mitigation measures will adhere to *Canada Shipping Act*, the *Canada Marine Act*, the *Harbour Commissions Act*, the *Navigable Waters Protection Act*, the *Pilotage Act* and the *Transportation of Dangerous Goods Act*. To protect the fuel receiving facility from accidental vehicle impacts, pumps and other process equipment are protected by concrete filled bollards or other barriers designed to stop or deflect vehicles. Also, all fuel handling facilities will be situated within secondary containment areas.

Accidental Third-Party Damage

During the construction phase of the Project, risk of third-party damage can occur as a result of breach of site security, concurrent or adjacent construction activities, or intentional sabotage. The likelihood of third-party damage occurring during construction is low provided the appropriate communications and security measures are in place. Generally, third-party damage to construction sites may be potentially harmful to the persons involved in terms of personal safety and may result in damage to property and financial loss, but usually poses little risk to environmental resources. Third-party damage will be mitigated through use of the Construction Site Safety Manual.

Plausible third-party interference with Project operations is expected to be limited to third-party damage to the proposed fuel delivery pipeline as a result of digging, boring and drilling activities, especially in or around statutory right-of-way crossings. **Chapter 16** indicates that for the pipeline under consideration, approximately 50% of pipeline failure is expected to be caused by external interference of third-parties. However, the overall likelihood of pipeline failure is expected to be very low. Third-party

damage to fuel pipelines as a result of human error during digging, boring and drilling activities could have potential financial, health/safety and environmental effects, dependent on the size and location. The Project Operations and Maintenance Manual will include a System Integrity Management Program to prevent third-party damage to the proposed fuel system including the marine terminal, fuel receiving facility and fuel pipelines, consistent with B.C. Oil and Gas Commission regulations. The pipeline location will be registered as part of the "B.C. One Call" Program such that it is identified to others who may be working in the vicinity of the pipeline once it is in the ground.

Accidental Utility Disruption

During construction, the possibility of utility disruption can occur during excavations associated with the construction of the delivery pipeline. Due to the standard nature of the construction technique employed and with use of the appropriate mitigation measures, accidental utility disruption is considered unlikely. Depending on the utility affected, disruption of utility lines could result in an accidental spill of water, sewage or petroleum hydrocarbon products, which may have associated biophysical and socio-economic effects. The Project will employ standard construction protocols and will be part of the "B.C. One Call" Program to mitigate any potential for utility disruptions. Additional measures required for emergency response will be set out in the CEM Plan.

14.2 Spill Probability and Risk

Vessel Movements in the River and Marine Terminal Operations

A review of historical accidental cargo release statistics relating to the movement of liquid petroleum hydrocarbons in local and international waters was undertaken. Based on this review and the expected throughput of fuel shipments for the Project, an estimate for spill probability was determined.

Because worldwide statistics are used in the analysis, the assumption is that tanker safety and navigational risks associated with the Project vessels are similar to those in the rest of the world. This is a conservative assumption. The approach is adopted directly from a method developed by the U.S. Minerals Management Service for analyzing large, crude oil tanker spills. Since 1983 the Minerals Management Service has analyzed worldwide tanker spills of crude oil in depth to determine the best risk exposure to use in normalizing spill data.

After analyzing spill frequencies in terms of voyage length, vessel size, product volumes transported, spill location, etc., it was concluded that a simple exposure of product volumes transported (e.g., billions of barrels) is as good as any in predicting risk. Spill frequencies are best expressed in terms of a risk exposure factor, such as billions of

barrels of crude oil transported. The most recent detailed report from the Minerals Management Service on the subject is provided by Anderson and LaBelle (2000). Because the Minerals Management Service spill statistics have been extensively peer-reviewed and are updated regularly, they are used as the primary source for this analysis of potential larger operational-related spills.

Spill statistics from 2001 to 2008 were also consulted from Fisheries and Oceans Canada, Canadian Coast. From this overall record, statistics were extracted for all spills related to fuel-barge traffic for the sub-region "South Coast and Interior and Vancouver".

Frequencies derived from worldwide and Canadian statistics were used to predict the probability of spills for the Project. The predicted spill rates are based on the appropriate historical spill frequency per size category, and multiplying with the estimated annual throughput of the Project.

The results of the conservative probabilistic analysis are as follows:

- Spills less than 50 barrels have a 1 in 6 year chance of occurring;
- Spills in the 50 to 999 barrel category have a 1 in 32 year chance of occurring;
- Spills greater than 1,000 barrels and less than 10,000 barrels have a 1 in 134 year chance of occurring; and
- Spills larger than 10,000 barrels are highly unlikely events (i.e., a 1 in 500 year chance of occurring), and become increasingly unlikely as the size range increases.

The conservative nature of this analysis based on the use of worldwide statistics is supported by the following factors:

- The recent spill statistics produced by the International Tanker Owners Pollution Federation and the Mineral Management Service database indicate that spill rates have continued to decline and are significantly lower in recent years;
- Actual spill data for barges in the Fraser River indicates no significant spills from marine vessels over the past 7.5 years of record, indicating no unusual conditions in this area in terms of operating practices or navigational hazards for these barges;
- Navigation of large deep-sea vessels in the Fraser River is a routine activity that has taken place for decades with an extremely low rate of incidents; and
- The Fraser River Pilots are very familiar with the nature of the river and do not think that tankers of the size proposed for the Project will pose any particular difficulty.

Pipeline System

The objective of this assessment is to undertake an analysis of spill probability and risk associated with proposed fuel receiving facility and pipeline (pipeline system) operations, and to identify and assess spill risk in accordance with good environmental assessment practices for facilities of this size, type and location.

The approach taken is a combined quantitative/qualitative approach and evaluation for both components of the pipeline system. Quantitative evaluation is an approach that is widely used in the petroleum industry, and conforms with the B.C. Oil and Gas Commission's "Assessment Protocols for the Evaluation of Integrity Management Programs for Pipeline Systems" and the Canadian Standards Association (CSA) (CSA Z662-07 Standard).

Both approaches follow a common framework, which includes the following steps:

- System description;
- Hazard identification;
- Mitigation measures/risk control measures;
- Incident failure probability;
- Consequence analysis; and
- Risk evaluation.

A review of relevant historical data, information, and previous similar risk assessments was undertaken to identify potential hazards, determine potential consequences of a fuel spill or leak, identify mitigation measures and/or risk control measures, and to determine the probability of such an event.

The primary spill risk factors associated with the design, construction and operation of the pipeline system are as follows:

- External and internal corrosion;
- Manufacturing, design or construction defects;
- Equipment failure or malfunction;
- Third-party damage or interference;
- Operator error;

- Accidental impact; and
- Power outages.

The principal way to reduce pipeline system spill risk to an acceptable level is by using proactive measures during construction and operations to reduce the probability of an event occurring. The following measures will be implemented:

- Design and engineering of the pipeline system will be of the highest quality using BMPs and protocols;
- Operations, maintenance and other key stakeholder expertise will be engaged early on in the design process;
- A thorough analysis of the operating areas (primarily the fuel receiving facility and marine terminal) will be conducted to optimize equipment spacing and access routes for fire and emergency spill response;
- Management will be engaged and take an active role in day to day activities; and
- Both the construction and operations workforce will be well trained.

The severity of a spill can be mitigated by well organized, rapid response reactive measures. Thus, overall relative risk can be reduced by ensuring that:

- Spill response plans are current and widely circulated to emergency response organizations including Richmond Fire Rescue, Western Canada Marine Response Corporation and other first responders;
- A clear chain of command is instituted during emergency response activities;
- Emergency response exercises are carried out frequently and, where possible, with the participation of joint responders;
- Spill response equipment, including fire suppression systems, and personnel protective equipment are routinely inspected and maintained; and
- Phone and pager lists are maintained and kept current.

In addition to meeting code regulations and BMPs, appropriate preventative maintenance programs and practices will be employed for tanks, process piping and equipment systems, and proposed pipeline, such as:

- Cleaning/testing programs;

- Compliance inspections;
- Integrity inspections;
- Corrosion control systems;
- Flow monitoring/inventory reconciliation systems;
- Smart “pigging” capability;
- Cathodic protection systems; and
- Pipeline leak detection systems.

These systems can provide early warning signs of potential deficiencies, for remedial action, before the onset of hazardous events. Shutdown and isolation devices will be provided to reduce the risk of a spill event or leak persisting in duration to become a much larger catastrophic event.

The pipeline system will be designed, operated and maintained to:

- Implement risk control measures to maintain acceptable risk levels;
- Minimize and control hazards to integrity; and
- Eliminate pipeline hazards that may lead to undesirable consequences.

14.3 Spill Prevention, Preparedness and Emergency Response

VAFFC will implement measures to prevent, prepare for, and respond to an accidental aviation fuel release during Project operations. A comprehensive Spill Prevention, Preparedness and Emergency Response Plan will be developed before the commencement of Project operations, in consultation with the appropriate agencies. The plan will be consistent with B.C. Oil and Gas Commission’s permitting requirements and CSA Z662-07. To maximize effectiveness, a single coordinated emergency spill response program covering all aspects of the marine terminal, fuel receiving facility and pipelines will be developed.

Spill risk management measures will conform to the Spill Reporting Regulation, the Contaminated Sites Regulation and the Hazardous Waste Regulation under the B.C. *Environmental Management Act*, Emergency Response Plan Requirements under the B.C. Oil and Gas Commission, and the *Canada Shipping Act* (2001).

The Project will enhance current spill response capability in the Fraser River. Western Canada Marine Response Corporation has been consulted in this regard and during the development of this chapter, and has provided comments.

Vessel Movements in the River

Fuel cargo spills from vessels transiting the Fraser River could be caused by vessel collision with other vessels, groundings, and collision with man-made structures (e.g., docks). Although the river geomorphology is characterized by sedimentary deposits, groundings on rip-rap areas are possible and are therefore included in the assessment.

Navigation on the Fraser River falls within the jurisdiction of the Port. Terminals in the Fraser River currently handle a wide variety of vessels and cargoes, from barges, to bulk freight carriers, to Panamax-class car carriers and container ships. Spills originating from vessels are the responsibility of the vessel owner. All vessels calling on the marine terminal will be required, under the *Canada Shipping Act*, to have a formal arrangement in place with Western Canada Marine Response Corporation, who is responsible for coordinating and undertaking emergency spill response. Additional compensation may be provided through Canada's Ship-Source Oil Pollution Fund and the International Oil Pollution Compensation Fund/Civil Liability Convention.

VAFFC will require that vessels calling on the marine terminal meet all national and international requirements for the movement of aviation fuel cargo (i.e., registration, insurance, and the use of pilots, tugs, etc.). In addition, VAFFC will require that all vessels be double-hulled to further minimize the risk of spills.

Marine Terminal Operations

Improved technology and operating procedures have greatly reduced the frequency and volume of spills from terminal facilities in the past 10 years. The marine terminal will be upgraded to create a new berthing face for aviation fuel off-loading, accessible to barges, handysize tankers and partly-laden Panamax-class tankers. The marine terminal will be designed, constructed and operated to BMPs, and will be covered under the Project's overall Spill Prevention, Preparedness and Emergency Response Plan and Marine Terminal Operations and Maintenance Manual.

Spills at the marine terminal could be caused by equipment malfunction or human error. These could only occur during fuel off-loading procedures. The marine terminal will employ a number of prevention measures related to fuel off-loading procedures, including monitoring of cargo transfer operations, adherence to a fuel cargo transfer operations plan, use of hydraulic cargo unloading arms, containment areas surrounding all process equipment, etc. Monitoring of operations will occur manually and through

automatic fuel delivery system-wide mechanisms such as a Supervisory Control Data Acquisition System, Programmable Logic Control System, and Leak Detection System.

Fuel Receiving Facility Operations

The main source of spill risk at the fuel receiving facility is from a fuel leak or rupture of the fuel storage tanks, pipelines or process equipment. The maximum loss of product from an entire tank could conceivably be in the range of 10 to 12 million litres. The tanks will be situated above and within a secondary containment area, which will be surrounded by a raised perimeter retention berm. The secondary containment area will be designed to hold at least the capacity of one tank plus 10% of the aggregate volume of all remaining tanks (i.e., approximately 20 million litres). The containment capacity is designed to minimize or eliminate the risk of any fuel product escaping beyond the containment zone. The containment area membrane material is tested to resist penetration and covered with fire resistant media, to eliminate the possibility of a membrane failure during a fire.

There are also secondary, much smaller, sources of risk, such as miscellaneous system spills from small quantities of solvents, cleaning supplies, vehicles, waste oil tank, etc. These sources of risk would be common to any industrial plant site. A third source of risk (and much smaller), could be from the fire-fighting foam/water/dry chemical liquid and fuel mixtures, left over after extinguishing a fire.

Based on the above features, any reasonably foreseeable product lost due to leaks, spills, or even catastrophic loss of a tank will be entirely contained within the secondary containment area.

The process piping systems will be operated under pressure and will have manual and automated controls to shutdown all process transfer pumps and valves, in the event of a leak or spill. The tank inventory control system will monitor all activities during flow, no flow, and partial flow conditions. The system will be capable of shutdown within seconds of detecting conditions outside of normal operating parameters.

Piping system ruptures on the supply side of the tanks could only be created under system pressure during transfer from the marine terminal. In the event of an accidental spill, all spilled product would drain to the oil/water separator system. Spilled product contained within process equipment pads would either be cleaned up using an independent means (i.e., vacuum truck) or the spill would be released through a manually operated valve to the oil/water separator system.

The oil/water separator system is a holding facility that will be designed to handle all drainage from the fuel receiving facility, including the tank sumps, process equipment

pads, and site drains. The separator system is designed to hold, separate and monitor any petroleum hydrocarbon product from stormwater, before the water is discharged to the offsite storm water drainage system. These systems are typically installed with a lift station or oil/stop valve so product does not move beyond the separator to the storm drainage system.

The oil/water separator system will be designed to hold up to approximately 75,000 litres, and will be located upstream of the automatic oil/water stop valve and downstream of the manual shut-off valves. With the operator present during all fuel transfer activities, coupled with emergency shut-down systems, a spill large enough to overwhelm the oil/water separator system and enter the storm drainage system is extremely unlikely. Any spills from the process lines will be contained on site.

Operations staff at the fuel receiving facility will be responsible for carrying out all spill response activities in accordance with an approved Spill Prevention, Preparedness and Emergency Response Plan, and reporting to VAFFC, its representatives and authorities having jurisdiction.

Fuel Pipeline Operations

Spills and leaks on the pipelines could range from small corrosion pits to major pipeline rupture due to third-party damage or a natural disaster.

The pipelines will use BMPs for testing and monitoring during shutdown and process modes of operation, and will be complete with corrosion protection, leak detection, and “pigging” devices to minimize or eliminate the potential for fuel leaks.

The maximum fuel leakage rate for the pipeline, estimated during preliminary design based on maximum flow rates, is expected to be equal to approximately 12,500 litres per minute. This could only flow for a brief period of time, due to the detection of flow discrepancies, which can activate automatic system shutdown in seconds. Equipment will use modern flow measurement leak detection technology.

The detection limit of measurement equipment during no-flow conditions will be considerably lower due to the capability to isolate the pipeline. Systems currently in use on airport fuel pipeline systems are capable of detecting leak rates of 0.0004% of the volume being tested. With the pipeline designed with several segments and isolation valves, a similar pressure testing methodology on this pipeline system will yield extremely accurate results. No-flow conditions on the pipeline will occur regularly as the pipeline will only operate during transfer of fuel (a few days a month).

Operations staff will be responsible for carrying out all spill response activities in accordance with an approved Spill Prevention, Preparedness and Emergency

Response Plan and reporting to VAFFC, its representatives and authorities having jurisdiction.

14.4 Fire Prevention, Preparedness and Emergency Response

Methods were identified to prevent an accidental fire, identify the systems in place to suppress a fire, and outline the fire safety plan that will be deployed in a fire emergency within the Fraser River, at the marine terminal, fuel receiving facility and along the fuel pipelines.

Specific fire suppression solutions will be in compliance with regulatory requirements and consistent with systems typically used for fire prevention and preparedness at bulk liquid petroleum hydrocarbon handling marine terminals, fuel facilities and pipelines, and on marine vessels. Regulatory requirements for aviation fuel, classified as a Class II combustible liquid, have been identified to guide the fire preparedness measures recommended, including spill control, ventilation, leak detection and emergency response. A Fire Safety Plan will be completed prior to, and implemented upon commencement of Project operations, following consultation with the relevant agencies, authorities and organizations.

Vessel Movements in the River

A major fire onboard a vessel could impair and adversely affect operations. As a result, a number of national and international guidelines have been developed to guide fire prevention and preparedness. These guidelines incorporate a variety of design considerations, including the separation of fuel cargo from engine areas and other sources of ignition to prevent onboard fires/explosions. As a result, the probability of a fire occurring during vessel movements in the Fraser River is extremely low.

To further prevent the possibility of on-board fire, the safety of vessels to deliver Class II aviation fuel to the proposed marine terminal will be assessed by VAFFC during the standard vessel vetting process. In addition, at minimum, a fire safety plan and on-board fire-fighting equipment that meet the requirements of ISGOTT, will be utilized. As a result of ongoing enforcement and inspections by the Canadian Coast Guard, all vessels are expected to have sufficient fire response capability to meet fire protection requirements.

Marine Terminal Operations

At the marine terminal, a major fire could interrupt and adversely affect operations. Fires at the marine terminal would only be possible while a vessel is at berth and the fuel cargo off-loading process is underway. As a result, fuel off-loading areas or transfer

points such as hose connections, valves or pump manifolds, are areas of most concern during cargo off-loading. An accidental fire is considered extremely unlikely but could potentially occur as a result of mechanical malfunction or human error.

The marine terminal will be operated according to standard, detailed operational procedures designed to reduce risk of an accidental spill that are described in the Marine Terminal Operations and Maintenance Manual. In addition, the following preparedness measures will be employed in accordance to ISGOTT and National Fire Protection Association 30 and 11: fire safety plan, fire-fighting equipment and detection and alarm facilities. The existing fire response capability at the marine terminal is minimal at present. However, the fire preparedness measures recommended are expected to meet all requirements once implemented.

Fuel Receiving Facility Operations

Fuel within the storage tanks located at the fuel receiving facility could act as a potentially flammable and pressurized fuel source. Without a source of ignition, however, these storage tanks are not at risk of fire or explosion. The design of the fuel receiving facility will separate the fuel transfer pumps from the storage tank areas. This will further minimize the potential for an accident or malfunction to create an external heat source capable of causing a fire. As a result, the likelihood of fire at the proposed fuel receiving facility is considered to be minimal.

The fuel receiving facility will be designed to incorporate a number of prevention measures including: spacing and clearances of above-ground storage tanks, normal and emergency venting, openings, secondary containment of aboveground storage tanks and design of piping and transfer systems. The following preparedness measures are also expected to be implemented in accordance to requirements of the National Fire Protection Association: fire safety plan, fire-fighting equipment, appropriate water supply and a hazard monitoring system. Implementation of these measures is expected to meet all requirements for fire prevention, preparedness and emergency response at the fuel receiving facility.

Pipeline Operations

The pipelines connecting the marine terminal, fuel receiving facility and storage facility at YVR will be buried and therefore lack oxygen necessary to support combustion of fuel underground. Fuel that escapes the pipeline and reaches the ground surface is at risk of ignition. As a result, the risk of fire is almost exclusively associated with a fuel spill or leak. The provision of preventative measures and BMPs will minimize the potential risk of fire.

A number of fire prevention measures will be incorporated into the design of the fuel pipeline, including: material selection, corrosion protection and leak prevention, third-party damage prevention programs, join welding, location and arrangement, provision for expansion and contraction, appropriate valves and transfer methods and operating requirements. In addition, a fire safety plan and fire response equipment will be employed as fire preparedness measures. Fire response equipment for the pipeline will be available at the proposed fuel receiving facility and at the fuel storage facility at YVR. Fire protection systems and response measures at the fuel receiving facility will provide coverage for the transfer and delivery pipeline systems.

14.5 Fate and Effects Analysis

The potential environmental fate and effects of aviation fuel are described for a potential worst-case accidental spill into the Fraser River during fuel cargo off-loading and transfer operations at the marine terminal or during vessel transit within the river. The assessment explores the potential biophysical consequences of a spill, as well as socio-economic, heritage and human health considerations that may be associated with spill effects. The area of focus is primarily the South Arm of the Fraser River. This is because areas and resources outside of the river environment are already exposed to the risks associated with the shipment of liquid petroleum hydrocarbons, including aviation fuel, regardless of the Project. Nevertheless, areas outside of the river where fuel could potentially reach are included.

Fate and effects are assessed for a worst-case spill scenario. A worst-case event assumes that the entire content of a single cargo compartment on the largest design vessel capable of servicing the Project is lost into the river and no active mitigation measures are applied to reduce the amount of fuel spilled or undertaken for spill containment and clean-up. These assumptions are considered to be very conservative.

To assess the fate of spilled fuel and the potential spatial extent and effects of a worst-case spill, spill simulation modelling was undertaken to reflect a range of environmental conditions (e.g., river flow, tide, wind, air temperature), at specific times during the year 2002, when the Fraser River had a relatively large freshet. Stochastic modelling was also undertaken to delineate the broader study area that could potentially be reached by a worst-case spill and the associated probability of these areas being reached. Detailed spill simulations identified four areas of concern (i.e., the South Arm and Delta Front (including Sturgeon and Roberts Banks) of the Fraser River, Ladner Slough, and the Strait of Georgia) with environmentally sensitive habitat and resources that may potentially be at risk in the event of a spill.

Fate of Spilled Fuel

The spill simulations tracked the fuel for a period of 120 hours following release. This time is sufficient for all fuel to be removed from the water surface through evaporation, dispersion, photo-oxidation, and shore retention. Spill modelling suggested that during a worst-case spill, aviation fuel could contact shorelines mainly in the South Arm of the Fraser River and Ladner Slough, with diminishing contact and effects downriver towards the Delta Front and the Strait of Georgia. Some upriver movement of the spill was also predicted when the flood tide had a large range and the river was not in freshet. General movement in the Strait of Georgia was west- and northward. Potential effects were of higher magnitude in areas closer to the spill source.

A worst-case spill within the Fraser River would likely result in one or more fuel stranding events on the shoreline of the South Arm. A spill could potentially reach Ladner Slough and the Delta Front within one and seven hours after the spill event, respectively. About half of the spilled fuel would evaporate within the first 24 hours. As such, significantly weathered aviation fuel would reach and disperse into the Strait of Georgia, approximately one day after a spill event. More than 95% of the fuel would evaporate further and/or disperse within 48 hours after the spill. Man-made shorelines (i.e., rip-rap: impermeable substrate) would retain minimal amounts of fuel and persistence would be short (a few days). Retention would be minimal to moderate on beaches (i.e., permeable substrate) and fuel would persist from days to a few weeks. Retention would be highest on marshes (i.e., organic shoreline with oleophilic substrates) where fuel could persist from weeks to a few months.

Biophysical effects

Marshes and other aquatic plant communities are distributed along the shorelines of the South Arm and Ladner Slough. Their sensitivity to stranded aviation fuel and high fuel retention rates deemed potential spill effects significant. A worst-case spill could result in direct mortality and damage of the marshes as well as invertebrate communities immediately following a spill, because the slick would be confined and less weathered. However, effects would be temporary and reversible. In contrast, effects of a worst-case river spill on vegetation (i.e., salt marsh, eelgrass, biofilms and marine algae) and invertebrates of the Delta Front and the Strait of Georgia were assessed as not significant.

Effects of a worst-case spill on fish (particularly juveniles) were assessed as significant for the estuarine and Ladner Slough areas, because of their close proximity to potential spill locations and high concentrations of less-weathered fuel that could be found on the surface and within the water column. Also, the shallow and slow moving waters of these areas are frequented by juvenile fish that are more sensitive to spill effects than adults.

In contrast, effects of a worst-case spill on adult fish were assessed as not significant for all four areas of concern, due to lower sensitivity of adult fish to spills and greater capability to avoid them.

Effects of a worst-case spill on mammals (riverine and marine) were mostly assessed as not significant, mainly because mammals have the ability to detect spills and tend to avoid affected areas. Contact of individual mammals with a slick could accidentally occur. However potential spill effects at the individual level may not necessarily be detrimental and affect the state of the population as a whole. Spill effects for the Southern Resident Killer whales were assessed as significant, because of their small population and current state of duress (due to prey depletion and pollution). Lastly, spill effects on geese, swans, wading birds, shorebirds, diving and dabbling ducks (but not on raptors, gulls and terns) were assessed as significant for Ladner Slough and the Delta Front areas of concern. Aviation fuel may affect aquatic birds indirectly by reducing reproductive potential and causing displacement.

Socioeconomic and Other Considerations

Within the Fraser River area of concern, commercial and industrial day-to-day operations, as well as recreational activities could potentially be affected by an accidental worst-case fuel spill. In particular, if a spill was to occur, the Fraser River and Strait of Georgia commercial, recreational and First Nations fisheries may be disrupted, especially due to precautionary fishery closures. Also recreational uses of the river waterfront as well as marine transportation in the river, other port and industrial operations, marinas and houseboat communities could also be affected. In all cases, effects were assessed as short-term and generally reversible.

Archaeological sites were identified within the intertidal zone of areas that could potentially be affected by a worst-case spill. Magnitude of effects would depend on proximity to spill source and time between the spill event and fuel stranding. A spill could adversely affect organic remains (e.g., wooden fish weir stakes, shell midden deposits) and radiocarbon dating material. However, spill effects were assessed as being of low significance on intertidal lithics, petroglyphs (rock carvings) and petroforms (canoe skids, fish traps). Also, spill clean-up activities could result in some landscape alterations and potentially compromise the integrity of archaeological sites; however such effects could easily be mitigated.

Potential implications of a worst-case spill to human health are also discussed. Pathways of human exposure to spilled fuel may include: fire and explosion of spilled fuel; ingestion of food contaminated with fuel; aspiration of liquid drops into the lungs; inhalation of fuel vapors in the atmosphere; and direct contact of spilled fuel with the skin and/or eyes. In general, potential health effects could range from negligible to

severe. In the absence of mitigation, the extent of such consequences would depend on the level of contamination, amount of contaminated food consumed and concentration of evaporated fuel in the atmosphere, proximity to and length of exposure time, and an individual's sensitivity and state of health.

Mitigation

It is important to emphasize that, during a fate and effects analysis of a worst-case spill, mitigating steps to reduce the amount of spilled fuel and/or contain and clean up the spill were conservatively ignored. However, measures will be in place to minimize the risk of a spill and, in the unlikely event of a spill, address the potential biophysical, socio-economic, heritage or human health effects. A comprehensive Spill Prevention, Preparedness and Emergency Response Plan will be in place to serve as a cornerstone document to prevent, prepare for and respond to an accidental spill. Following mitigation, the risks associated with a worst-case spill event in the Fraser River are deemed to be minimal. In the event of such a spill, effects would generally be expected to be short-term and reversible, although some direct mortality could occur.

Conventional spill response and clean-up measures will be used in the event of small operational spills at the marine terminal, including those that enter the marine environment. Automatic control and containment measures will prevent most fuel spills from migrating down the Fraser River. In the extremely unlikely event of a large operational spill or a worst-case spill during vessel transit in the Fraser River, internal and external response measures would be activated to maximize response capabilities. The rigorous modelling undertaken by VAFFC has contributed to the development of response strategies that will form part of the comprehensive Spill Prevention, Preparedness and Emergency Response Plan. The plan will be the guide to timely response, maximum product recovery, deflection of product from sensitive areas, and minimizing effects and promoting recovery of environmental resources. The characteristics of aviation fuel allow for a balanced approach to spill response. Product that cannot be contained and recovered will be directed towards open water where dispersion and evaporation will quickly remove the majority of fuel from the marine environment. The conservative approach of the analysis gives VAFFC confidence that these response measures are the extreme case, and the risk of such an event extremely low.

14.6 Navigation Assessment

An assessment was undertaken for the feasibility and associated risks of navigating the proposed range vessels through the South Arm of the Fraser River between Sand Heads at the river mouth and the marine terminal, and all areas of the river required for

vessel manoeuvres, including turnaround. Many of the elements consistent with Transport Canada's TERMPOL ("Technical Review Process of Marine Terminal Systems and Transshipment Sites") Review requirements are addressed.

Each year approximately 600 to 700 ocean-going vessels, including automobile carriers and container ships, transit the South Arm of Fraser River. From a navigation feasibility point of view, it is the largest, least manoeuvrable vessels which govern the viability of the Project. This assessment is, therefore, based on a partly-laden Panamax-class vessel with a maximum draft of 11.5 metres. The assessment was conducted in two phases: a preliminary desktop assessment and a fast-time vessel manoeuvring simulation study.

The preliminary desktop assessment synthesized available data, such as Canadian and international navigation channel design requirements, and consulted local vessel masters, pilots and the Port to establish the limiting factors and constraints on navigation operations. The navigation of a partly-laden Panamax-class vessel from Sand Heads to the marine terminal appears feasible based on the following criteria:

- Channel Depth and Transit Window:

  Partly-laden Panamax-class vessels must navigate the channel using tidal assistance because there is insufficient depth to transit the channel at low tide. Channel depths are routinely resurveyed after every freshet season to determine if maintenance dredging is required. Based on Port operating standards at the existing channel design grades, there is at least one 2-hour tidal window for a Panamax-class vessel with a draft of 11.5 metres to transit the channel on any given day of the year. Actual vessel arrival times will be coordinated in advance with the Port and the Fraser River Pilots.

- Channel Width:

  The present inner channel width of 130 metres is adequate for straight-line, one-way transit of Panamax-class vessels. With the move to a single channel of at least 200 metres width, single lane traffic for Panamax-class vessels is well within international guidelines. Two-way passing would be limited to wider and naturally deeper reaches of the river at the discretion of the Fraser River Pilots.

- Bend Radius:

  All bends exceed minimum radius requirements recommended by international standards. No additional widening of the river is required.

- Turning Basin:

  There is an existing suitable turning area a short distance upstream of the marine terminal. Furthermore, the Fraser River Pilots indicate that there is sufficient width in the natural channel immediately adjacent to the marine terminal for turning the vessel prior to or after berthing.

Following the preliminary desktop assessment, a fast-time vessel manoeuvring simulation study was conducted. This study utilized the SHIPMA software developed by MARIN (Maritime Research Institute of Netherlands), which uses a mathematical description of the hydrodynamics of a given vessel to simulate manoeuvring in approach channels and harbours. The hydrodynamic description of a vessel includes response to current forces, turning radius, maximum engine speeds and rudder angles. The simulations were conservatively performed for a loaded Panamax-class vessel transiting from the river mouth to the marine terminal, and for a ballasted vessel departing the berth, completing the turning manoeuvre and transiting downstream to the river mouth.

The results of the manoeuvring simulation study indicate that a loaded Panamax-class vessel can complete the desired manoeuvres in any of the expected river conditions. The most challenging river conditions, based on the simulations performed, is the combination of the high river discharge on a large falling tide and a northwest wind. As a whole, the manoeuvres were well controlled and completed successfully with a significant amount of reserve of the three major control mechanisms: engine power, rudder and tug power.

Navigation Risk

The navigation risk within the South Arm of the Fraser River was inferred from reviewing the historical rates of reportable incidents/accidents as recorded by the Pacific Pilotage Authority for piloted vessels, and by Transport Canada for overall vessels. Records indicate that the occurrence of a navigation accident or incident on the Fraser River is a rare event. The average yearly incident rate for piloted vessels in the Fraser River is approximately 0.12% which is equal to twelve incidents for every 10,000 transits. It is important to note that a “reportable incident” defined by Pacific Pilotage Authority could be as small as a scratch on the plating or a cracked wooded pile. There were three accidents and incidents recorded by Transport Canada in the South Arm of the Fraser River which involved cargo vessel transits between Sand Heads and New Westminster between 1991 and 2008. None of these resulted in significant damage to the vessels, and no cargo damage or fuel loss occurred.

The number of vessels calling on the marine terminal over the foreseeable future is expected to be approximately 1 to 2 barges every two weeks and 1 larger tanker every month (i.e., 3 to 5 vessels per month, which equates to approximately 36 to 60 vessels per year in total. This represents an approximate 5% increase in traffic volumes when considering only vessels piloted by the Fraser River Pilots (i.e., excluding barges, fishing vessels, pleasure craft and other non-commercial vessels). If barge transits (and other vessel traffic) are considered, the projected increase in river traffic volumes as a result of the Project would be significantly less. The proposed vessel traffic is not expected to have any adverse effects on the existing marine traffic on the Fraser River.

A dynamic mooring analysis was undertaken to assess the potential effects of the imposed forces on vessels that will be moored at the marine terminal from passing vessels. If unaccounted for in the design of mooring configurations at terminal berths, these forces can be sufficiently large to potentially break mooring lines or produce large vessel motions during cargo transfer operations. The design moored vessel for the marine terminal is a typical Panamax-class vessel, and the design passing vessel is Panamax-class containership.

This assessment was assisted by using the following tools:

- DELPASS model developed by Pinkster Marine Hydrodynamics for computing passing vessel loads; and
- TERMSIM II software developed by MARIN to examine the effects of the passing vessel forces on moored vessel.

To maintain a secure mooring, it is recommended that Panamax-class vessels calling at the marine terminal have a minimum of 14 mooring lines on winch drums and that mooring lines have a minimum breaking load of about 80 tonnes. These requirements will be communicated to vessel masters and pilots in advance (e.g., published as part of the marine terminal and/or Port operating rules). Critical to the safe operation of these berths is the maintenance of pretension on all mooring lines.

The results of the simulation suggest that vessels passing on the north edge of the navigation channel, closest to the marine terminal, will need to limit passing speed to 4.6 metres per second (9 knots) or less. However, if the passing containership remains on or on the south side of the navigation channel centerline, then it may pass at speeds of up to 6.1 metres per second (12 knots). It is recommended that passing vessels be limited to the central part of the navigation channel (i.e., the former “Inner Channel”).

Due to the small footprint of the new in-water pipe-piles relative to the wide river channel section at the marine terminal, and the close proximity of these pile structures

to the existing berthing face, no significant effects to the river hydraulics and channel geomorphology are expected as a result of the addition of new pipe-piles.

During construction of the marine terminal upgrades, increased vessel traffic as a result of barging construction materials to the existing wharf facility will be minimal, if at all required. Other in-water construction activities and equipment will be performed from upland areas of the property or form a spud-anchored barge. Barges will be either moored to the existing wharf facility or anchored immediately adjacent. Barges used during construction should not generally impede the river's navigational channel safety setback zone. As such construction activities are expected to have little or no effect on deep-sea navigation.

Considering the small and temporary nature of the construction footprint and short duration of the works, the width of Gravesend Reach and set-back distance to the navigation channel, the potential interference of in-water construction works on recreational and commercial fishing activities, and other small boat traffic, is expected to be insignificant, localized and short-term, if at all. Proposed mitigation measures for the construction phase include:

- The establishment of an emergency telephone number for the marine community to contact during construction; and
- Issuance of public notices through the weekly Notice to Mariners published by Transport Canada.

Overall, with the proposed mitigation measures in place, it is expected that the Project will have negligible interference on river navigation during the construction phase.

Following installation of the proposed pile-supported berthing structures, the entire physical footprint of the upgraded marine terminal will not impede the navigation channel safety set-back zone. Potential interference from the upgraded marine terminal structure itself on vessels within the navigation channel is not expected.

Moored vessels, however, will encroach somewhat into the safety set-back zone. The amount of encroachment will range from approximately 5 to 20 metres depending on the specific type and size of vessel at berth and the final design of the marine terminal. This encroachment has been reviewed by the Port, Transport Canada, the Fraser River Pilots and the Pacific Pilotage Authority (meeting on February 4, 2010) and is not considered to be significant. No mitigation measures have been identified by the above mentioned agencies (meeting on February 4, 2010). Nevertheless, an Approval from Transport Canada is required under section 5(3) of the *Navigable Waters Protection Act*.

Overall, it is expected that the Project will have no interference on river navigation during operations.

14.7 Effects of the Environment on the Project

An assessment of the effects of the environment on the Project is required under the CEAA. This includes an assessment of the environmental conditions that have the potential to adversely affect the Project, including extreme weather events, flooding, seismic activity and climate change.

Extreme Weather and Weather-Related Events

Although extreme weather events, including extreme temperatures, heavy precipitation, wind speeds and storm events have occurred in the past within the Project area, construction and operational effects are expected to be minimal. Extreme temperatures are not expected to affect the functioning of equipment during construction of the Project. Construction delays and potential increases in sediment run-off may occur as a result of heavy precipitation in the form of rain or snow, wind speeds or storm events. Appropriate site planning and design will be undertaken in addition to the implementation of measures detailed in the CEM Plan.

During operations, all Project components will be designed according to the ambient and climatic conditions of the National Building Code of Canada, as they apply to Richmond. Off-loading operations may be minimally affected by accumulated snowfall and ice. However, removal of snow and ice from the unloading arms is expected to eliminate effects during off-loading operations. Vessel transits in the river are not expected to be affected by extreme weather events during operations as vessel transits will only occur during safe weather conditions, as determined by the Fraser River Pilots. Should an unexpected and extreme storm/wind event occur when a vessel is berthed at the marine terminal, fuel off-loading and transfer operations would cease.

Flooding

The Project is located within the Lower Fraser Valley floodplain. Risk of flooding is a consideration, specifically the potential for a breach of the Richmond South dike during a winter storm surge event or the potential for flash floods as a result of heavy rainfall. During construction, flooding could potentially disrupt above and below ground activities and create greater opportunities for surface water contamination. Flooding in excavated areas could increase the possibility of sediment influx into surface drainage systems or watercourses. During construction, the Ministry of Environment River Forecast Centre and the Environment Canada Weather Warnings will be monitored. Details of specific flood planning, preparedness and emergency response measures will be included in the

CEM Plan, consistent with the "Flood Planning and Response Guide for British Columbia", the Emergency Program Management Regulation and the *Dike Maintenance Act* (Ministry of Environment 1999).

During operations, a flood event could potentially affect the functioning of the marine terminal and halt cargo off-loading. Structural damage to Project infrastructure is not expected to occur as all permanent components, including the pipeline crossing of the Moray Channel, will be designed to withstand, at minimum a 1-in-200 year flood event. The marine terminal will be designed to withstand all physical river loads, including current velocity and direction (i.e., based on a range of outflow conditions, such as during the freshet season, and the range of tidal conditions) and waves. The drainage systems will generally be designed to accommodate the rainfall flow generated from a 1-in-10 year rainstorm. Measures to ensure that the pipeline has negative buoyancy will be used along any sections that may be subject to buoyant forces such as watercourse crossings and areas with a high water table or surficial water. In addition, the pipeline will be designed to shut in and contain all product should any terminal facility become compromised during a flood or seismic event.

Wildfire

Due to the urban and industrial setting of the Project and the high percentage of impermeable surface areas present, the potential of naturally induced fire during construction or operations is low to nil. Both the marine terminal and the proposed location for the fuel receiving facility are situated within a heavy industrial zoned land that is highly anthropogenically altered.

Seismic Activity

Generally, Greater Vancouver is located within an area of high potential for ground movement associated with earthquakes. There is a 30% chance of experiencing significant earthquake-related damage once every 50 years (Natural Resources Canada 2010b). Specifically, the City of Richmond is located in one of the higher seismicity areas in Canada with a classified seismic intensity of 0.5 g (Institute for Research in Construction 2005). In addition, the City of Richmond is known to be underlain by loose soils and water-saturated sediments that have a relatively high potential for liquefaction under seismic loading (City of Richmond 2010c). The main seismic-related hazard to the Project is the potentially high ground deformation and strength loss within the subsurface soils induced by a strong earthquake shaking.

Due to the relatively short construction period (i.e., in the order of a few months to a year or two) for each of the components, in comparison with the return periods of the design earthquakes (i.e., 500 years to 2,500 years depending on the design

requirements of the individual component), the risk of a strong (i.e., design level) earthquake occurring during the construction period is considered to be very low. Ground failure during construction poses potential safety threats to the on-site workers and the public that are present in the immediate vicinity of the Project at the time of the construction. Geotechnical investigation will be completed to develop a sufficient level of understanding on the specific site conditions, and all temporary structures to be used for construction of the marine terminal, fuel receiving facility, and pipelines will be designed and constructed in accordance with the pertinent regulations and codes, including the WorkSafeBC requirements.

If fuel off-loading is taking place during a seismic event, the fuel unloading connection arm may be ruptured and fuel could be released into the Fraser River. A severe earthquake may result in a rupture of the pipeline that connects the marine terminal to the fuel receiving facility. Considering the expected infrequent docking of vessels and the relatively short period of the fuel off-loading process, and with the return period of the design earthquake, the possibility of a damaging earthquake occurring during fuel off-loading is considered to be extremely low. These hazards could have potential effects on public safety, the environment, and the operation of YVR.

The automated electronic/mechanical devices will also be installed within the new fuel receiving facility and the fuel pipeline system. The mechanized sensors and pressure indicators within the pipelines and the various control valves are expected to cease the fuel transmission immediately after detection of a potential damage or loss in the pipeline's integrity. Geotechnical work tasks, including site specific subsoil and ground water investigations, seismic modelling for liquefaction analysis, ground settlement evaluation, and analyses on temporary and permanent ground movements including lateral spreading, will be completed to develop appropriate, earthquake-resistant engineering solutions that will suit the specific needs of the key Project components. The marine terminal will be designed to withstand a seismic event with an equivalent return period of 475 years, which corresponds to a 10% probability of exceedance in 50 years. The fuel receiving facility and pipeline river crossing will be designed to withstand a seismic event with an equivalent return period of 2,475 years, which corresponds to a 2% probability of exceedance in 50 years. The sections of the pipeline away from the river crossing will be designed to maintain structural and pressure integrity under the seismic loading of, at minimum, a 1-in-475 year earthquake.

Climate Change

Climate change is also expected to have physical effects, such as increasing frequency and severity of extreme weather (i.e., heat waves, drought, and high-intensity rainfall), changes in river flow, increased flood risk, increased wildfire risk, shrinking glaciers and

snowpacks at most locations, rising sea level, and alteration of ocean temperature, salinity, and density. Climate change may increase the severity and probability of extreme weather and weather-related events, especially those related to temperature and precipitation. The affects of climate change may also contribute to an increase in the number of extreme high water events and a rise in sea level. As a result, the potential effects associated with climate change during construction and operations will be magnified effects associated with extreme weather-related events and flood risk.

14.8 Cumulative Impacts/Environmental Effects

An analysis of cumulative environmental effects was undertaken in accordance with BC EAO and CEA Agency guidelines. Cumulative environmental effects consider both direct environmental effects and indirect social and economic effects caused by an activity (in this case Project-related activities) in association with other, past, present and future human activities.

Potential residual effects identified in the environmental effects assessments were considered in conjunction with past, present and future foreseeable projects and activities, that may reasonably be expected to result in an environmental, social, economic, health or heritage effect(s) to VCs identified for the Project. VCs that were previously identified in the effects assessments were evaluated for relevance to the assessment of cumulative effects based on their having a significant adverse potential effect.

The Regional Study Area (RSA) comprised the City of Richmond, Corporation of Delta, South Arm of the Fraser River and the Moray Channel. Other projects within the RSA were considered and evaluated for temporal overlap with the construction and operations phases of the Project. A Local Study Area (LSA) was also determined by the extent of any adverse residual effects identified in the effects assessments. Projects identified within the RSA were considered further in the assessment if their adverse effects or adverse potential effects overlapped spatially and temporally with the LSA.

Five VCs were identified for the assessment of cumulative impacts/environmental effects:

- Sound quality;
- Terrestrial vegetation;
- Plant species and plant communities at risk;
- Terrestrial wildlife; and

- Bicycle/pedestrian traffic and mobility.

Four projects were found to have overlap with the LSA:

- Fraser Wharves Ltd. vehicle storage facility expansion project;
- An application to conduct works to upgrade the No.4 Road pump station;
- Works associated with the Port Metro Vancouver Richmond office seismic upgrade; and
- Ewen branch rail line extension project.

In summary, only sound quality and bicycle/pedestrian traffic and mobility were found to have potential cumulative effects associated with them; in both cases these were assessed as “negligible”. Cumulative effects to sound quality could occur through concurrent pile-driving activities with the Fraser Wharves Ltd. Project. This potential cumulative effect is entirely dependant on the timing of any pile-driving activities and the implementation of recommended mitigation measures. Cumulative effects to bicycle/pedestrian traffic and mobility may occur in conjunction with the upgrade to the No.4 Road pump station, which is located near Bridgeport Trail. However, this project is set for completion in June 2011, and there are several alternate bike routes in the vicinity. As well, mitigation measures including the traffic management strategies (detailed in the CEM Plan) are expected to resolve any potential cumulative effects.

15 Conclusions

15.1 Summary of All Potential Effects, Recommended Mitigation Measures and Potential Residual Effects

This is provided in **Chapter 23** in accordance with the requirements of the EAO.

15.2 Summary of Proponent Commitments

This is provided in **Chapter 24** in accordance with the requirements of the EAO.

15.3 Conclusion

The Project is subject to a harmonized provincial/federal environmental assessment review under the BCEAA and the CEAA. VAFFC requires an Environmental Assessment Certificate before it can proceed with Project construction and operation. VAFFC also requires a decision from Port Metro Vancouver (a Canadian Port Authority and the federal responsible authority for the Project) pursuant to the CEAA that allows

the Port to exercise any power or perform any duty or function with respect to the Project.

VAFFC must also apply for and receive other municipal, provincial and federal permits, licences, approvals and/or authorizations, as applicable, before work can commence on the Project.

This Application has been prepared in accordance with the requirements set out in orders issued by the EAO under sections 10 and 11 of the BCEAA, and with the approved Application Information Requirements, developed with input from the CEA Agency and the Port, other members of the Technical Working Group, First Nations, and the public. The objective of the harmonized provincial/federal environmental assessment review processes is to promote sustainable development while minimizing adverse effects to the environment and economic, social, heritage and health values.

The Project consists of three main components, all of which are located in the City of Richmond, Lower Mainland, B.C.:

- Upgrade and operation of an existing marine terminal on the north shore of the South Arm of the Fraser River;
- Development and operation of a new fuel receiving facility on land adjacent to the proposed marine terminal; and
- Development and operation of a new fuel delivery pipeline from the new receiving facility to YVR.

Fuel cargo will be off-loaded from vessels berthed at the marine terminal and transferred by pipeline about 0.5 kilometres to the new fuel receiving facility. The fuel receiving facility will be built on an industrial zoned property, owned by Port Metro Vancouver, located in close proximity to VAFFC's marine terminal property. Fuel stored at this receiving facility will be delivered to VAFFC's airport facilities on Sea Island via an approximately 15 kilometre long pipeline.

Once the Project is in operation, the existing aviation fuel shipments that currently off-load at Westridge Marine Terminal east of Second Narrows will be delivered to the VAFFC marine terminal via the Fraser River's deep-sea navigation channel. Fuel shipments to the marine terminal are expected to involve a range of vessel types and sizes, from barges up to Panamax-class tankers. The rate of delivery over the foreseeable future is expected to be in the range of 1 to 2 barges per week and 1larger tanker vessel per month. The marine terminal will only be in active operation when a vessel is at berth.

Based on the discipline-specific assessments conducted in support of this Application, VAFFC has identified minimal adverse environmental, social, health, heritage or economic residual effects resulting from Project construction or operations. The risks associated with accidental spills of aviation fuel, either in the Fraser River from vessels in transit or during cargo off-loading and transfer at the marine terminal, or from the pipeline system, can be reduced to an acceptable level through Project planning and design, inspection and maintenance programs, and implementation of spill prevention protocols during operations.

To achieve this outcome, VAFFC will work closely with its Contractor(s) and Operator(s) to verify that the issues identified in **Chapter 23** are understood and that the commitments set out in **Chapter 24** are adhered to during Project construction and operations.

All elements of the Project will be designed, constructed and operated according to the latest regulations, standards, codes, guidelines and BMPs associated with marine terminals, fuel handling facilities, and pipelines. Recognizing the environmental sensitivity of the Fraser River estuary and the potential consequences of an accidental spill, VAFFC will design, construct and operate the Project in a manner that minimizes this risk.

The Project has significant economic, social and environmental benefits including:

- Access to 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 to the local and provincial economy during construction and operation;
- Elimination of the need for tanker trucks to transport aviation fuel along Highway 99 and local streets, and the corresponding emissions and safety concerns;
- Significant reduction in vessel transit distance in Canadian waters, and the corresponding GHG and CAC emissions;
- Reduced reliance on the existing pipeline system infrastructure over the short-term, followed by expected decommissioning of the existing pipeline system;
- Transition to a single fuel delivery system that will:

- modernize the fuel receiving, storage and delivery infrastructure to YVR; and
- enhance the performance of fuel delivery in all respects, including: operational, maintenance, reliability, safety and environmental.

Key outcomes of the federal and provincial harmonized environmental assessment review process include the promotion of sustainable development and the identification and mitigation, to the extent possible, of the Project's potential adverse environmental, social, health, heritage and economic effects.

The numerous benefits of the Project, together with the predicted minimal adverse residual effects, the demonstrated ability to manage the risks of spill-related incidents, and the reduced environmental footprint compared to the existing fuel delivery infrastructure, will significantly improve the environmental sustainability of fuel delivery to YVR now and well into the future.

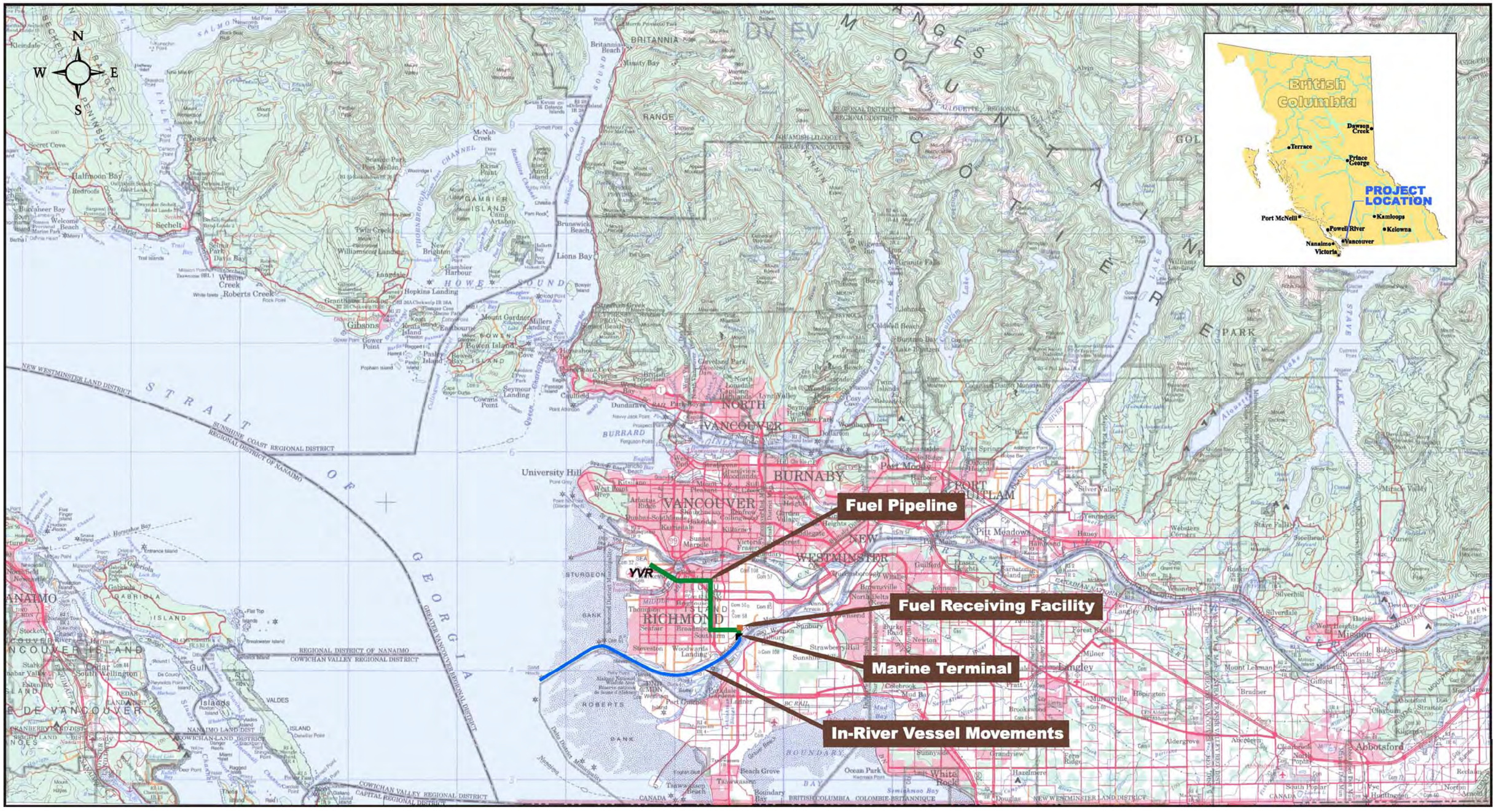

Figure 1
Project Location Overview – Regional Context
Vancouver Airport Fuel Delivery Project
Environmental Assessment Certificate Application

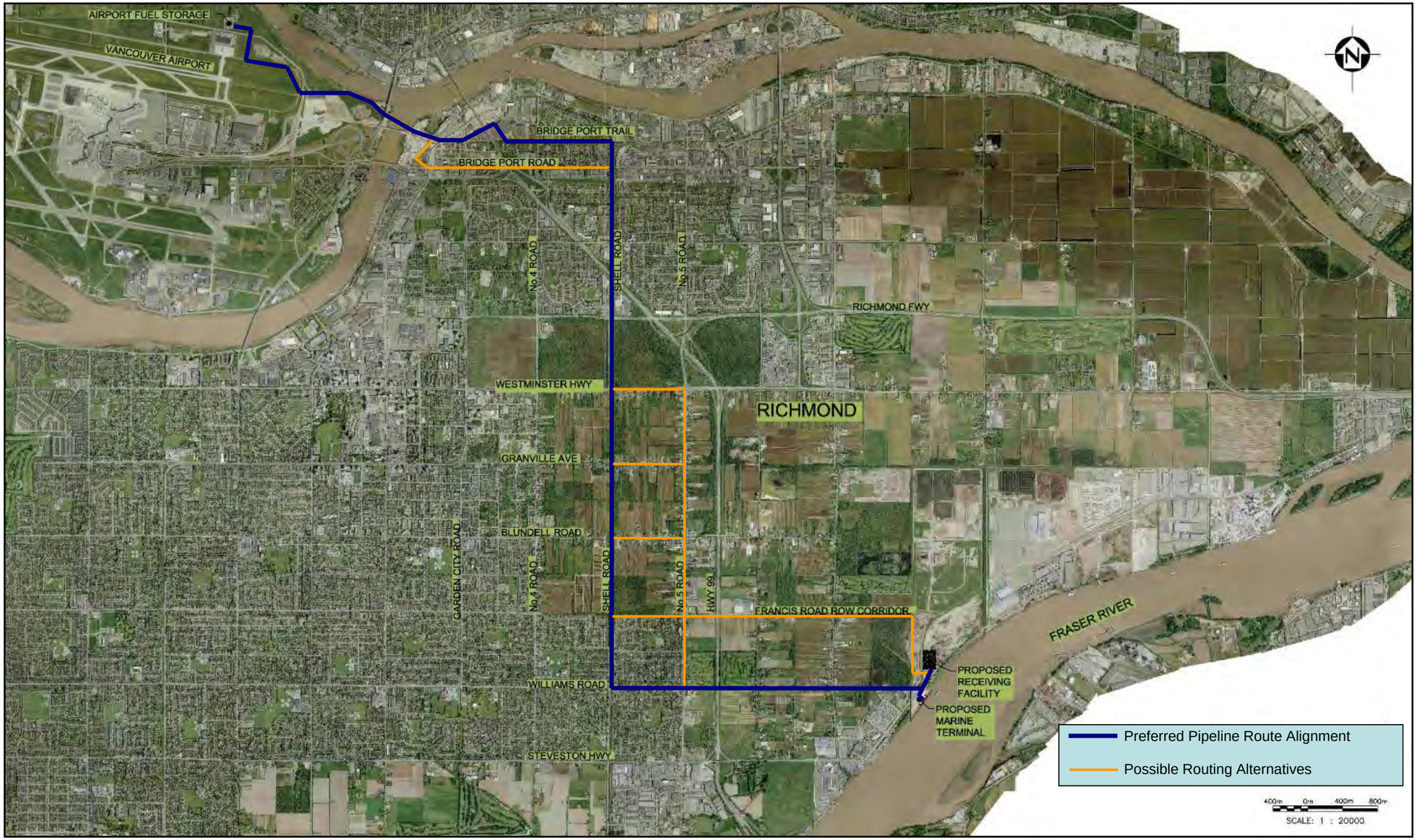

Figure 2
Project Components – Local Context
Vancouver Airport Fuel Delivery Project
Environmental Assessment Certificate Application

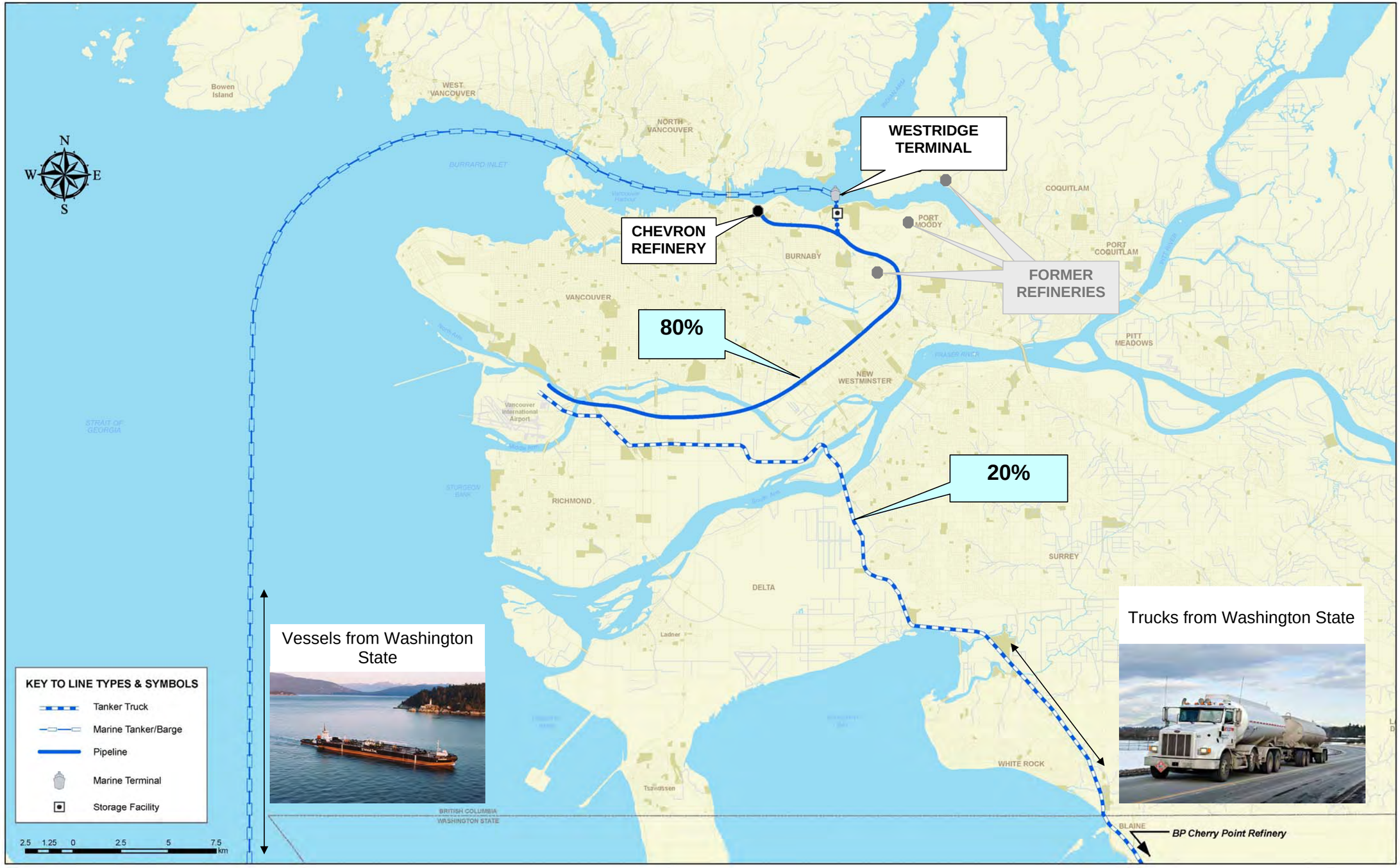

Figure 3
Existing Fuel Delivery System to YVR
Vancouver Airport Fuel Delivery Project
Environmental Assessment Certificate Application

Figure 4
Conceptual Rendering of the Marine Terminal Upgrade
Vancouver Airport Fuel Delivery Project
Environmental Assessment Certificate Application

Figure 5
Conceptual Rendering of the Proposed Fuel Receiving Facility
Vancouver Airport Fuel Delivery Project
Environmental Assessment Certificate Application