Vancouver Airport
Fuel Facilities Corporation

VAFFC

# ENVIRONMENTAL ASSESSMENT CERTIFICATE APPLICATION
# for the Vancouver Airport Fuel Delivery Project

Highway 99 Pipeline Route Assessment Addendum

Prepared for the Vancouver Airport Fuel Facilities Corporation by Hatch Ltd.

03 November 2011

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# Acronyms and Abbreviations

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AIA | Archaeological Impact Assessment |
| ALR | Agriculture Land Reserve |
| B.C. | British Columbia |
| BC CDC | British Columbia Conservation Data Centre |
| BMP | Best Management Practices (see Glossary of Terms in the Application) |
| BOD | Biological Oxygen Demand |
| CACs | Criteria air contaminants (see Glossary of Terms in the Application) |
| CCME | Canadian Council of Ministers of the Environment |
| CDFmm | Coastal Douglas-fir Moist Maritime Subzone |
| CEAA | *Canadian Environmental Assessment Act* |
| cm | centimetre |
| CEA Agency | Canadian Environmental Assessment Agency |
| CEM Plan | Construction Environmental Management Plan |
| CNR | Canadian National Railway Company |
| COD | Chemical Oxygen Demand |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| $CO_2$ | Carbon dioxide |
| $CO_2E$ | Carbon dioxide equivalent (see Glossary of Terms in the Application) |
| CPU | Catch Per Unit Effort |
| CSA | Canadian Standards Association (see Glossary in Terms of the Application) |
| CWD | Coarse Woody Debris |
| CWHxm1 | Coast Western Hemlock Very Eastern Dry Maritime Subzone |
| dB | Decibel |
| dBA | A-weighted decibel (see Glossary of Terms in the Application) |
| DD | Data Deficient |
| DFO | Fisheries and Oceans Canada |

| | |
|---|---|
| E | Endangered |
| EAO | (British Columbia) Environmental Assessment Office |
| ET | Encounter Transect |
| GHG | Greenhouse gas |
| ISO | International Organisation for Standardisation |
| km | kilometre |
| $L_d$ | Daytime (07:00 to 22:00) Equivalent Sound Level |
| $L_{max}$ | Maximum Sound Level |
| $L_n$ | Nighttime (22:00 to 07:00) Equivalent Sound Level |
| LSA | Local Study Area |
| mg | Milligrams |
| MOE | (British Columbia) Ministry of Environment |
| MoT | (British Columbia) Ministry of Transportation and Infrastructure |
| NAR | Not at Risk |
| $NO_x$ | Oxides of nitrogen |
| NTU | Nephelometric Turbidity Unit |
| OCP | Official Community Plan |
| OEM Plan | Operations Environmental Management Plan |
| PM | Particulate Matter (see Glossary of Terms in the Application) |
| RAR | Riparian Area Regulation |
| ROW | Right-of-Way |
| PY(s) | Person Year(s) (of Employment) (see Glossary of Terms in the Application) |
| SAR | Species At Risk |
| SARA | (Federal) *Species-at-Risk Act* |
| SC | Special Concern |
| $SO_2$ | Sulphur dioxide |
| T | Threatened |

| | |
|---|---|
| The Port | Vancouver Fraser Port Authority (doing business as Port Metro Vancouver) |
| The Project | Vancouver Airport Fuel Delivery Project |
| TSS | Total Suspended Solids |
| µg | Micrograms |
| µs | Micro Siemens |
| VAFFC | Vancouver Airport Fuel Facilities Corporation |
| VEC | Valued Ecosystem Component (see Glossary of Terms in the Application) |
| VC | Valued Component (see Glossary of Terms in the Application) |
| VOC | Volatile Organic Compound (see Glossary of Terms in the Application) |
| YVR | Vancouver International Airport |

# Executive Summary

# EXECUTIVE SUMMARY

The Executive Summary gives a general synopsis of the Highway 99 pipeline route option assessment presented in this Addendum. The Addendum follows the framework and content provided in the Vancouver Airport Fuel Delivery Project's (the Project) Environmental Assessment Certificate Application (the Application).

## 1. Introduction and Background

The Application is currently in the Application Review stage of a harmonized provincial / federal environmental assessment review process, led and coordinated by the British Columbia (B.C.) Environmental Assessment Office (EAO). The Application was accepted for review by the EAO on 04 February 2011. It also serves as the Environmental Impact Statement for a federal environmental assessment decision.

On 28 April 2011, the EAO accepted a request made by the Vancouver Airport Fuel Facilities Corporation (VAFFC) to temporarily suspend the Application Review so that a possible alternate route for a section of the fuel delivery pipeline could be evaluated. The route option being investigated by VAFFC is along a portion of the provincial Highway 99 right-of-way (henceforth referred to as "the Highway 99 Pipeline Route Option"), which is under the jurisdiction of the B.C. Ministry of Transportation and Infrastructure (MoT).

The City of Richmond Council suggested that VAFFC explore Highway 99 as an alternative to the No.5 Road and Shell Road corridors. Acknowledging the suggestion of the City of Richmond Council and following preliminary evaluation and consultation with MoT, the Highway 99 Pipeline Route Option is now proposed by VAFFC as the preferred corridor for locating a major section of the delivery pipeline. Preliminary engineering and technical evaluation undertaken to determine route feasibility indicates that construction and operation of the pipeline within the Highway 99 corridor is feasible.

VAFFC continues to hold open the possibility of using the No.5 Road, Shell Road or the Canadian National Railway (CNR) Lulu line corridor options for all or portions of the final alignment. Regardless of the final primary south to north alignment selected, existing City transportation and/or utility corridors will be required for smaller sections of the delivery pipeline.

This Addendum to the Application has been prepared to include the Highway 99 Pipeline Route Option as a possible route for a section of the delivery pipeline within the scope of the environmental assessment, similar to the other route options described in the Application.

Consideration has been given to potential environmental, social and economic, heritage and health effects of Project construction and operations as they relate to the Highway 99 Pipeline Route Option. Consideration has also been given to environmental management planning, accidents or malfunctions and cumulative environmental effects that may be expected in addition to those assessed in the Application.

All other information and assessments presented in the Application remain unaffected by the inclusion of this proposed route option within the scope of the Project's environmental assessment. The Addendum cross-references relevant sections of the Application to supplement the additional information presented herein; otherwise, it follows the same format as the Application. Following the EAO's screening for acceptance of this Addendum, it is expected that the EAO will lift the suspension and the Project's Application Review will recommence at Day 70 of the review stage.

## 2. Project Information

### 2.1 Introduction

VAFFC is seeking approval to construct and operate a new aviation fuel delivery system which is needed to serve the fuel requirements at the Vancouver International Airport (YVR). The Project is located in the City of Richmond, B.C., and consists of the following components:

- Upgrades to an existing marine terminal wharf located on the South Arm of the Fraser River to accommodate a range of aviation fuel cargo vessel types and sizes;
- Construction and operation of facilities at the marine terminal to off-load and transfer fuel from vessels;
- Construction and operation of a new fuel receiving facility located on land near to the marine terminal;
- Construction and operation of a new pipeline to transfer off-loaded fuel from the marine terminal to the new fuel receiving facility; and
- Construction and operation of a new pipeline to deliver fuel from the new fuel receiving facility to VAFFC's fuel facilities at YVR.

This Addendum to the Application assesses an additional fuel delivery pipeline route option, namely the Highway 99 Pipeline Route Option.

## 2.2 Project Overview

### 2.2.1 Fuel Pipelines

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

The preferred route for the delivery pipeline identified in the Application included installing a large section of pipeline within the existing CNR railway corridor, which runs parallel to Shell Road between Williams Road and the Bridgeport Trail. CNR has filed plans to relocate its rail service to the south side of Lulu Island. Since the Application was filed for review, decommissioning of the existing CNR line has been delayed and it will likely not be available for the Project.

The secondary pipeline route presented in the Application follows existing transportation and/or utility corridors in the City of Richmond, including portions of the No.5 Road and Shell Road corridors.

Both the No.5 Road and Shell Road corridors are possible route alternatives to the preferred Highway 99 Pipeline Route Option. VAFFC will continue to consult on all route options before selecting a final alignment for detailed design.

The Highway 99 Pipeline Route Option is within the provincial Highway 99 right-of-way under the jurisdiction of MoT, from where the Williams Road easement intersects Highway 99, north to where the Bridgeport Trail crosses underneath the Oak Street Bridge. The pipeline length within the Highway 99 right-of-way will be approximately 7.7 kilometres. The total pipeline length from the proposed fuel receiving facility location (i.e., on land leased from Port Metro Vancouver) to the existing VAFFC fuel facilities at YVR will be approximately 1.5 kilometres shorter than if either the No.5 Road or Shell Road corridors were used instead of Highway 99.

For the purposes of this Addendum it is assumed that the pipeline could be situated on either the east or west side of the highway right-of-way and could, at intervals, switch from side to side. Further detailed study and consultation with MoT will be required to refine the precise pipeline alignment within the highway right-of-way. In either location the pipeline will be buried.

### 2.2.2 Project Benefits

In addition to the significant economic, social and environmental benefits of the Project to the region as described in the Application, aligning a major section of the delivery pipeline along the Highway 99 corridor will:

- Shorten the total length of pipeline between the fuel receiving facility and YVR, providing the most direct route through Richmond;
- Remove significant lengths of pipeline from road and trail corridors under the jurisdiction of the City of Richmond. Richmond has expressed concerns about the use of its streets;
- Lessen the impact of pipeline construction and operations / maintenance activities to the Richmond community, which will be easier to manage and less disruptive to the public;
- Development and activity on the highway right-of-way will be strictly controlled, so the risk to the pipeline from third-party activity is minimized;
- Once constructed, the pipeline will be buried and will have no impact on the highway;
- Offer a greater separation between the pipeline route and the urban development in Richmond;
- Access to the pipeline for maintenance and repair will be easier because it will be located in the highway right-of-way rather than under a city street;
- Avoid complexities with other underground utilities situated in City roads and right-of-ways. Fewer utility crossings will be involved;
- The highway route will result in the smallest environmental footprint; and
- Richmond has expressed opposition to any aviation fuel pipeline through Richmond, but expressed preference for the Highway 99 route if a pipeline is constructed through Richmond.

## 2.3 Engineering and Design Criteria

Regardless of the route ultimately chosen, the pipeline to YVR will be designed and constructed according to current standards and making use of materials and installation practices that will make it robust enough to protect against the risks associated with the

urban setting of the route options, including seismic and third-party damage risks. It will also be designed with sufficient capacity to accommodate the long-term growth in fuel demand at YVR. A properly designed and protected pipeline can last indefinitely assuming it continues to meet the performance criteria. The Project design life is for a minimum service life of 60 years.

VAFFC will use Best Management Practices (BMPs) and modern design principles in developing detailed designs and operating parameters. The pipeline system will be designed, installed, tested, operated and maintained in compliance with the B.C. *Oil and Gas Activities Act*, current Canadian Standards Association standards and applicable Reference Publications. The design methodology is elaborated in the Application together with a list of BMPs, codes and standards that will be used during detailed engineering. The work will also conform to other relevant acts, regulations, codes and standards, including MoT and Vancouver Airport Authority policies, manuals and procedures.

## 2.4 Capital Costs and Financing

The estimated capital cost of the Project will not change if the Highway 99 Pipeline Route Option is selected as part of the final pipeline alignment (i.e., it is estimated to range from approximately $93 to $108 million). The pipeline component is estimated to have a capital cost of $30 to $45 million, with the higher end of the range reflecting a greater number of horizontal directional drillings underground. The Project will be financed in its entirety by VAFFC. Both the labour force and business opportunities described in the Application remain unaltered if the Highway 99 Pipeline Route Option is selected as part of the final pipeline alignment.

## 2.5 Project Scheduling and Sequencing

The general schedule and sequence for the Project has changed from that described in the Application due to the EAO's suspension of the Application Review at Day 69. Subject to the EAO's acceptance of this Addendum and recommencement of the Application Review by mid-November 2011, completion of the EAO's Final Assessment Report, Consultation Report and Ministerial Referral Package is anticipated in February 2012. A Ministerial decision on whether to grant an Environmental Assessment Certificate for the Project is anticipated sometime in spring 2012.

Subject to the timing of regulatory approvals, Project construction is expected to begin in summer 2012. The Project construction phase is expected to last approximately 18 to 24 months, depending on the method selected for ground improvement at the fuel receiving facility. The pipeline construction phase is expected to last approximately 12

months including approximately 6 months for pipeline construction activities. Following system testing and commissioning, Project operations are expected to commence late 2013 or early 2014.

## 3. Assessment Scope and Methodology

The assessment scope is consistent with the orders issued by the EAO under sections 11 and 13 of the B.C. *Environmental Assessment Act* (BCEAA). The assessment methodology follows the requirements of a harmonized provincial / federal environmental assessment review under the BCEAA and the *Canadian Environmental Assessment Act* (CEAA), and is in accordance with EAO and Canadian Environmental Assessment Agency (CEA Agency) policies and guidelines.

The general approach taken to identify, assess and manage the potential effects of pipeline construction and operations within the Highway 99 corridor, including cumulative impacts (as defined and required by the EAO in their Application Information Requirements Template document) and residual effects, includes:

- Conducting effects assessments for the disciplines under the EAO's five assessment pillars (i.e., environmental, economic, social, heritage and health);
- Identifying measures to eliminate or reduce potential effects to an acceptable level through mitigation, where possible;
- Identifying any adverse residual effects that may remain following implementation of mitigation measures and management strategies, and determining their likely significance; and
- Identifying other known relevant projects and activities (past, present or reasonably foreseeable and sufficiently certain to proceed) that may be reasonably expected to result in a residual environmental, social, economic, health and/or heritage effects of the section of pipeline within the Highway 99 corridor, to cause a cumulative impact.

The methods used to complete each of the effects assessments varied according to discipline. In general, however, the following components are addressed:

- Introduction;
- Methodology;
- Spatial and temporal boundaries;
- Baseline conditions;

- Assessment of potential effects;
- Mitigation measures and management strategies;
- Potential residual effects and analysis of significance;
- Determination of cumulative impacts;
- Summary of key findings; and
- Conclusion.

The approaches taken for the selection of Valued Components (VCs), identification of mitigation measures and management strategies, consideration of significance of residual effects and cumulative impacts, are as described in the Application, where appropriate for the Highway 99 Pipeline Route Option.

The following assessments were undertaken for the Highway 99 Pipeline Route Option, consistent with the Application and provincial and federal requirements:

- Assessment of Environmental Effects;
- Assessment of Social and Economic Effects;
- Assessment of Heritage Effects;
- Assessment of Human Health Effects;
- Accidents or Malfunctions; and
- Cumulative Environmental Effects Assessment.

## 4. Environmental Effects Assessment

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.

### 4.1 Fisheries, Aquatics and Surface Water Quality Assessment

The effects on fisheries, aquatic resources and surface water quality from construction and operations activities of the Highway 99 Pipeline Route Option were identified and assessed. If necessary, mitigation measures are recommended to eliminate or minimize potential effects to an acceptable level. Any remaining residual effects

following implementation of mitigation measures were also identified, their significance was evaluated, and cumulative impacts were identified.

The spatial boundaries for the assessment encompassed drainage ditches and remnant watercourses within the Highway 99 right-of-way between the Bridgeport Trail and the Williams Road easement. The temporal boundary for the assessment was assumed approximately 12 months for the construction phase of the Highway 99 Pipeline Route Option and at least 60 years for pipeline operations.

Existing information was reviewed to identify species occurrence and baseline fisheries, aquatics and surface water quality characteristics in the watercourses within the Highway 99 Pipeline Route Option. Data gaps were addressed through field investigations.

In the absence of mitigation, potential effects from construction activities (e.g., site preparation, pipeline installation, directional drilling) of the Highway 99 Pipeline Route Option could include:

- Loss of habitat in functional riparian areas through which the pipeline is routed because of timber clearing, soil stripping and salvage, and grading for materials and equipment staging during pipeline installation;
- Degradation of surface water quality as a result of erosion and sedimentation from exposed soil and soil piles;
- Degradation of surface water quality as a result of accidental discharge of deleterious materials (e.g., drilling fluids) to surface waters; and
- Temporary interruption or loss of habitat for aquatic species during the installation of water crossings.

Recommended mitigation measures to eliminate or alleviate potential effects from construction activities of the Highway 99 Pipeline Route Option are consistent with those included in the Application. Furthermore, mitigation protocols will be implemented during pipeline construction consistent with BMPs and provincial and federal guidelines, as will be described in the Construction Environmental Management Plan (CEM Plan). The CEM Plan will address issues related to erosion and sediment control, solid and liquid waste management, surface water quality, and fisheries mitigation.

Pipeline construction within riparian setback areas will not occur without prior regulatory approval. Works in and around the drainage ditches along Highway 99 will be conducted within the appropriate fisheries timing window, in isolation of flows, and

following salvage of fish and other aquatic wildlife. If encroachment in riparian areas is unavoidable, riparian effects will be reduced through adherence to BMPs and federal and provincial guidelines. All riparian areas disturbed due to equipment and material staging and pipeline installation will be reclaimed and restored to pre-construction conditions or better.

No potential effects on fisheries, aquatics and surface water quality are expected from regular pipeline operations activities. Thus, no mitigation measures are suggested.

The assessment concludes that adverse residual effects of construction or operations of the Highway 99 Pipeline Route Option on fisheries and aquatics VCs are not expected.

No potential cumulative impacts were identified for the Highway 99 Pipeline Route Option.

### 4.2 Vegetation, Wildlife and Wildlife Habitat Assessment

The effects on vegetation, wildlife and wildlife habitat from construction and operations activities of the Highway 99 Pipeline Route Option were identified and assessed. Mitigation measures are recommended to eliminate or minimize potential effects to an acceptable level. Any remaining residual effects following implementation of mitigation measures were also identified, their significance was evaluated, and cumulative impacts were identified.

For the purpose of this Addendum, the study area encompassed a 50-metre wide linear corridor along Highway 99 from Bridgeport Trail south to Williams Road. The width of the study area was extended to 150 metres where appropriate for the purposes of surveying and assessing potential effects on raptor and heron nests.

The temporal boundary for the assessment was assumed approximately 12 months for the construction phase of the Highway 99 Pipeline Route Option and at least 60 years for pipeline operations.

The assessment is supported by vegetation, wildlife and wildlife habitat baseline information gathered during three field surveys (i.e., encounter transect surveys and habitat assessments) conducted along the Highway 99 Pipeline Route Option in June and July 2011.

In the absence of mitigation, potential effects from construction activities of the Highway 99 Pipeline Route Option could include:

- Alteration of terrestrial habitats adjacent to the pipeline during site preparation and equipment staging from clearing and grubbing of vegetation;

- Disturbance or destruction of plant species and plant communities at risk if present during site preparation and equipment staging;
- Erosion and sediment input into nearby ditches from excavation and soil stockpiling activities during pipeline installation;
- Temporary localized disturbance and dispersion of birds and changes in habitat use patterns by and habitat availability to small mammals, reptiles or amphibians as a result of pipeline construction activities; and
- Disturbance, displacement or mortality of small mammals, reptiles or amphibians, or loss or alteration of their habitat during pipeline installation.

Potential effects from regular operations of the pipeline along Highway 99 are expected to be limited. They may be associated with the periodic removal of trees and large shrubs along the pipeline corridor during right-of-way maintenance required to minimize the risk of compromising the safety and integrity of the buried pipeline.

Recommended mitigation and monitoring measures related to the protection of vegetation and wildlife resources during construction and operations activities along the Highway 99 Pipeline Route Option are consistent with those included in the Application. Site-specific revegetation and habitat enhancement measures will also be identified in the CEM Plan.

No residual effects associated with construction and operations activities along the Highway 99 Pipeline Route Option were identified for aquatic birds, bird species at risk and non-avian species at risk.

Prior to commencement of construction activities within the Highway 99 right-of-way, a rare / at risk plant survey should be undertaken to confirm absence of plant species and plant communities at risk within the pipeline construction and operations footprint. The results of the at risk plant survey will also help determine potential residual effects and their significance from pipeline construction and operations (e.g., vegetation clearing and maintenance, soil disturbance), if at risk vegetation species are present.

No potential cumulative impacts were identified for the Highway 99 Pipeline Route Option.

### 4.3 Local and Regional Air Quality and Climate Assessment

The effects on local and regional air quality and climate from construction and operations activities of the Highway 99 Pipeline Route Option were identified and assessed. Mitigation measures are recommended to eliminate or minimize potential

effects to an acceptable level. Any remaining residual effects following implementation of mitigation measures were also identified, their significance was evaluated, and cumulative impacts were identified.

The Local Study Area (LSA) and Regional Study Area (RSA) used for this assessment are the same as those described in the Application, since these areas also encompass the Highway 99 Pipeline Route Option. Specifically, the LSA was defined as the City of Richmond as it has the greatest potential to be most affected by Project construction. The RSA included the City of Surrey, the Corporation of Delta and the City of Richmond.

The temporal context for this assessment was 18 to 24 months since no change in the Project construction schedule is expected due to the proposed Highway 99 Pipeline Route Option.

Since consideration of the Highway 99 Pipeline Route Option did not change the spatial boundaries of the air quality assessment, no additional baseline studies were required. However, the following assumptions made to assess potential effects on local and regional air quality and climate from pipeline construction activities along Highway 99 are expected to differ slightly:

- Operating hours for pipeline construction equipment;
- Total amount of rock / earth fill to be transported off-site; and
- Total amount of rock / earth fill brought in from off-site.

Potential emissions during pipeline construction along Highway 99 were re-estimated using the revised equipment numbers and activity levels. Results showed a slight increase (less than 1%) in Criteria Air Contaminant (CAC) emissions compared to those previously estimated in the Application. The effect of CAC emissions during construction is expected to be limited to the LSA and therefore the geographic extent is local. Fugitive dust emissions are also expected to slightly increase due to a larger volume of aggregate handled.

Total estimated Greenhouse Gas (GHG) emissions from fossil-fuelled construction vehicles and equipment are expected to increase by less than 0.1% within the RSA. Because GHG emissions have the potential to affect global climate, the geographic extent of potential effects is national / global.

The duration and frequency of construction effects on air quality remain short-term and frequent, respectively, and are still considered reversible after construction is complete.

Since there are other sources of emissions in the LSA and RSA, the ecological context is considered disturbed. Recommended mitigation measures during construction outlined in the Application remain applicable. The potential residual effects on ambient air quality and GHG emissions due to construction of the Project within the Highway 99 Pipeline Route Option remain "not significant".

No change in the assessment of cumulative effects is expected resulting from the consideration of the Highway 99 Pipeline Route Option; cumulative effects remain 'nil' for air quality and climate VCs.

### 4.4 Noise Assessment

The potential noise effects on sensitive receptors from construction and operations activities of the Highway 99 Pipeline Route Option were identified and assessed. Mitigation measures are recommended to eliminate or minimize potential effects to an acceptable level. Any remaining residual effects following implementation of mitigation measures were also identified, their significance was evaluated, and cumulative impacts were identified.

The spatial boundaries of the study area encompass noise sensitive areas that could potentially be affected by pipeline construction along Highway 99, namely one representative section on the west side and one representative section on the east side of the Highway 99 right-of-way. Representative sections are in proximity to the highest density of residential dwellings and thus represent a "worst-case" condition.

The temporal boundary for the assessment was assumed approximately 12 months for the construction phase of the Highway 99 Pipeline Route Option and at least 60 years for pipeline operations.

Noise effects from pipeline construction and installation along Highway 99 were assessed by comparing the predicted noise level from each piece of expected construction equipment to the City of Richmond's noise bylaw limit. Sensitivity adjustments were also applied to "annoying" types of noise.

Noise from pipeline construction activities is not expected to exceed the City of Richmond's noise bylaw limit, provided that the construction work is located at a minimum of 10 metres away from the nearest residential property line. Pipeline construction is expected to progress at an average rate of approximately 300 metres per week. Any noise effect is therefore expected to be short-term lasting for a few days possibly up to two weeks at any particular location.

No adverse potential effects for pipeline operations were identified because the pipeline will be buried underground.

Noise management during construction will be addressed in the CEM Plan and will include a section on noise control requirements, which specifies maximum allowable noise emissions from equipment and machinery, allowable hours of work, communication with the public regarding any construction noise issues that may arise, and procedures for responding to any noise complaints, as described in the Application. No additional mitigation measures are required for the Highway 99 Pipeline Route Option.

Potential residual effects from pipeline construction along Highway 99 are predicted to be 'low' in magnitude in certain locations where residences are in close proximity to Highway 99. Potential residual effects however are considered "reversible" in nature and "local" in geographic extent. The overall significance of the potential residual effects during pipeline construction is deemed to be "Not Significant". No potential residual effects for noise sensitive land uses are anticipated during operations and maintenance activities of the pipeline along Highway 99.

No potential cumulative impacts were identified for the Highway 99 Pipeline Route Option.

### 4.5 Screening Level Contaminated Sites Assessment

The risk of encountering soil or groundwater contamination during construction and operations for the Highway 99 Pipeline Route Option was identified and assessed. Mitigation measures are recommended to eliminate or minimize potential effects to an acceptable level. Any remaining residual effects following implementation of mitigation measures were also identified, their significance was evaluated, and cumulative impacts were identified.

The spatial coverage for this assessment extends two city blocks on either side of the Highway 99 right-of-way, from Williams Road north approximately 7.7 kilometres to the Bridgeport Trail.

The assessment is supported by data gathered after reviewing historical stream maps, City of Richmond business directories, fire insurance maps, aerial photographs, the B.C. Ministry of Environment (MoE) Contaminated Sites Registry, and over 40 environmental site assessment reports for work conducted along the Highway 99 Pipeline Route Option. A site reconnaissance and interviews with MoT staff were also conducted in July 2011 after all historical information had been collected and

summarized. Findings were incorporated into the contaminated sites database developed for the Application.

Each site addressed in the contaminated sites database was assigned a risk ranking of high, moderate or low risk of encountering contamination on, or migrating to, the Highway 99 Pipeline Route Option.

The assessment determined that there is a low to moderate risk of encountering contamination during construction of the Highway 99 Pipeline Route Option. Moderate risk locations are associated with historical streams that may have been filled with contaminated fill and nearby properties that may be sources of contamination. No high risk areas for encountering contamination were identified along the Highway 99 Pipeline Route Option.

The potential for encountering contamination during operations and maintenance along the Highway 99 Pipeline Route Option could occur if pre-existing contamination is not identified during construction. The risk is unlikely that pipeline operations activities will affect baseline conditions in the study area, such that contamination would be encountered during the operations phase.

The recommended mitigation measures described in the Application are the same for the Highway 99 Pipeline Route Option. In summary, if contamination is encountered during construction, appropriate mitigation will be implemented using adaptive management strategies, which will be developed and included in the CEM Plan. In general, any contamination is expected to be managed through a combination of soil excavation and disposal, groundwater treatment, and risk assessment. Remediation will conform to appropriate provincial and/or federal remedial standards / guidelines.

No new potential residual effects were identified for the Highway 99 Pipeline Route Option. There is a low likelihood that the Project would materially increase the migration of existing contamination through the introduction of a new preferred groundwater flow pathway. Finally, the risk of degradation of anti-corrosion coating by contaminants is also considered low.

Due to the purpose and nature of this type of screening-level assessment (i.e., a risk based analysis as opposed to an effects assessment), potential cumulative impacts resulting from potential significant adverse residual effects from the Highway 99 Pipeline Route Option acting in concert with residual effects from other past / present, or future foreseeable projects could not be determined with any confidence, within the scope of the assessment.

## 5. Assessment of 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.

Social and economic effects on the local economy and surrounding communities, businesses, residents, property owners and other stakeholders from construction and operations activities along the Highway 99 Pipeline Route Option were identified and assessed. Mitigation measures are recommended to eliminate or minimize potential effects to an acceptable level. Any remaining residual effects following implementation of mitigation measures were also identified, their significance was evaluated, and cumulative impacts were identified.

The assessment is supported by data on land use designations and municipal zoning in areas adjacent to the Highway 99 Pipeline Route Option gathered after reviewing the City of Richmond's Official Community Plan (OCP) and the City of Richmond's Zoning Bylaw #8500 and site visits. Motor vehicle traffic patterns in the vicinity of Highway 99 were reviewed based on publicly available data.

The spatial boundaries of the study area encompass the Highway 99 right-of-way between Williams Road to Bridgeport Trail and its surrounding residences, farmlands, parks, businesses, and communities. When the Project has broader social and economic implications for Metro Vancouver, a broader RSA is considered.

The temporal boundary for the assessment was assumed approximately 12 months for the construction phase of the Highway 99 Pipeline Route Option and over a design life of at least 60 years of Project operation.

Highway 99 provides an effective barrier for most pipeline construction social effects, so that social effects are likely to be limited to the side of the highway where construction actually occurs. Choosing the Highway 99 Pipeline Route Option is not expected to alter the economic development benefits described in the Application.

Potential social effects during construction activities along Highway 99 may include the following:

- Temporary disruption to businesses due to vehicle and mobility restrictions, restricted access, noise, and effects to landscaping / sidewalks;

- Temporary disruption to private properties due to installation of temporary launching sites to accommodate directional drilling, horizontal auger boring or other forms of trenchless pipeline construction activities;
- Temporary effects on schools, recreation areas and other community features because of disruption to motor vehicle / parking access and pedestrian and non-motorized traffic mobility, noise, dust, and tree and vegetation removal;
- Temporary disruption of motor vehicle traffic on Highway 99, including bus traffic, and temporary changes in traffic patterns away from Highway 99 to Richmond city streets during construction; and
- Temporary loss of access to on-street parking opportunities on Richmond City streets.

Potential effects during operation and maintenance activities along Highway 99 may include the following:

- Possible future Highway 99 right-of-way use conflicts with ongoing upgrades and long-term capacity expansion plans;
- Possible temporary low negative effect to the value of properties adjacent to the proposed pipeline due to changes in public perceptions from time to time. Notwithstanding, the Highway 99 Pipeline Route Option is adjacent to fewer residential properties than the other routing options examined in the Application; and
- Trees removed to create a pipeline corridor within the Highway 99 right-of-way would likely not be replaced, to retain pipeline maintenance access.

Construction-related effects on the neighbourhoods and residents of the City of Richmond that cannot be addressed through careful routing and alignment of the fuel delivery pipeline are expected to be addressed in the CEM Plan. Traffic management will be addressed in a Traffic Management Plan, separate to the CEM Plan. Traffic management will consider motor vehicle, bicycle and pedestrian traffic and include time of day, day of week and seasonal sensitivities, as well as a communication strategy to publicize any likely delays and signage indicating alternate routes if required.

During operations, when periodic maintenance involved with the pipeline occurs, measures to alert the public and accommodate local vehicle, bicycle and pedestrian traffic are recommended to avoid or minimize adverse effects on the surrounding community.

The assessment indicates that the Highway 99 Pipeline Route Option will have no significant adverse residual effects during construction or operations / maintenance provided the recommended mitigation measures are implemented.

During construction, potential residual effects are “Not Significant”, except for the potential effect on motor vehicle traffic and mobility during construction, which is “Potentially Significant”, depending on the final pipeline alignment and/or the selection of construction methods. These effects will be substantially mitigated following implementation of Traffic Management and CEM Plans, which will be developed in communication with MoT and in conformance with MoT standards and guidelines for construction within a highway right-of-way.

During operations / maintenance, the overall Project is expected to have significant positive effects on YVR and economic activity in the region and the province. All other potential residual effects specific to the Highway 99 Pipeline Route Option were rated “Not Significant”.

No potential cumulative impacts were identified for the Highway 99 Pipeline Route Option.

## 6. Assessment of 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.

The effects on archaeological, historical and heritage resources from construction and operations activities along the Highway 99 Pipeline Route Option were identified and assessed. Mitigation measures are recommended to eliminate or minimize potential effects to an acceptable level. Any remaining residual effects following implementation of mitigation measures were also identified, their significance was evaluated, and cumulative impacts were identified.

The assessment is supported by data gathered after reviewing available, appropriate ethnographic and archaeological literature for the Fraser Delta area, unpublished reports on file with the B.C. Archaeology Branch, available databases and maps from the B.C. Archaeology Branch, the Geological Survey of Canada, the B.C. Ministry of Agriculture, the MoE, the B.C. Ministry of Forests and Range (MoFR), and the City of Richmond. The results of the review of historic aerial photographs obtained from the Geographic Information Centre at University of British Columbia prepared for the original application were re-consulted. A field visit to the lands that could potentially be

affected by the Highway 99 Pipeline Route Option was also conducted in June 2011 to visually assess landscape integrity and heritage resource distribution.

The spatial boundaries of the study area encompass a 100-metre buffer on either side of the Highway 99 right-of-way from Williams Road north approximately 7.7 kilometres to the Bridgeport Trail.

The primary potential effect of pipeline construction within the Highway 99 right-of-way on archaeological resources is disturbance due to ground altering and excavation activities. Pipeline construction activities which could disturb archaeological resources include:

- Vegetation clearing (where present);
- Removal of native soils;
- Excavation of pipeline trenches;
- Excavation of entry / exit point for directional drilling; and
- Installation of temporary structures (e.g., roads, drainage).

Potential effects during operations and maintenance activities along the Highway 99 Pipeline Route Option are not expected.

An Archaeological Impact Assessment and a Heritage Resource Overview Assessment will be required before the start of construction activities to address archaeological data gaps and identify and evaluate heritage resource values. Responsive mitigation measures and risk management strategies will be included in the CEM Plan and will be applied during construction and operations activities along the Highway 99 Pipeline Route Option.

A residual effects assessment was not deemed appropriate for as-yet undocumented archaeological sites that may be present along the Highway 99 Pipeline Route Option and that may or may not be discovered during construction. Finally, since no potential effects were identified for historic heritage sites, paleontological fossil occurrence or traditional land use, no residual effects are expected.

No potential cumulative impacts were identified for the Highway 99 Pipeline Route Option.

## 7. Assessment of Human 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.

The effects of construction and operations activities along the Highway 99 Pipeline Route Option on human health were identified and assessed. Mitigation measures are recommended to eliminate or minimize potential effects to an acceptable level. Any remaining residual effects following implementation of mitigation measures were also identified, their significance was evaluated, and cumulative impacts were identified.

The assessment is based on information relevant to human health presented in the local and regional air quality and climate, noise, screening level contaminated sites, and social and economic effects assessments of this Addendum.

The study area covers approximately 7.7 linear kilometres of the Highway 99 right-of-way from the Williams Road easement north to the Bridgeport Trail, and includes a 400-metre 'buffer zone' on either side of the highway right-of-way.

Potential effects during Highway 99 Pipeline Route Option construction may include:

- Exposure to elevated noise levels that may cause annoyance for short durations;
- Exposure to incremental increase of CAC and GHG emissions, which is expected to be temporary and localized and is unlikely to affect the health of local residents;
- Temporary disruption of motor vehicle traffic and change of traffic patterns on Highway 99 and adjacent City streets that will have less effect on pedestrian and bicycle safety when compared to other options presented in the Application;
- Potential remobilization of contaminants into other environmental media during excavation activities that would have neutral effects ; and
- Remediation of contaminated sites that is expected to remove the potential for long-term health effects.

No noise, road traffic safety or contaminated sites related potential effects during Highway 99 Pipeline Route Option operations and maintenance activities are expected. The change in pipeline route is not expected to affect emissions during Project operations; therefore, potential air quality effects are not affected by the Highway 99 Pipeline Route Option operations and maintenance activities.

Recommended mitigation measures to eliminate or alleviate potential effects on human health from the Highway 99 Pipeline Route Option construction and operations are as described in the Local and Regional Air Quality and Climate Assessment, Noise Assessment, Screening Level Contaminated Sites Assessment, and Social and Economic Effects Assessment.

Potential residual human health effects resulting from changes in traffic, noise or air quality are unlikely or will have low severity; therefore deemed “Not Significant”.

No potential cumulative impacts were identified for the Highway 99 Pipeline Route Option.

## 8. Environmental Management Program

An Environmental Management Program will be implemented to minimize the potential for adverse environmental effects during construction and operations / maintenance activities of the Highway 99 Pipeline Route Option. 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 and authorizations, which are issued in relation to the Project. The Environmental Management Program will comprise the CEM Plan, which will be developed prior to commencement of construction consistent with MoT’s Standard Specifications Section 165: Protection of the Environment, and the Operations Environmental Management Plan (OEM Plan), which will be developed prior to commencement of operations. Both Plans will be submitted to the appropriate regulatory agencies and authorities for review and comment before construction and operations commence and will be updated as necessary.

Highway 99 motor vehicle and bus traffic will likely be affected during construction activities for pipeline installation and construction of pipeline highway crossings. Traffic management during construction activities specific to the Highway 99 Pipeline Route Option will be addressed separately in a Traffic Management Plan, which will be a separate component of the CEM Plan. Given the importance of Highway 99 as a provincial transportation corridor, the size of the work zone, work schedule and lane closure requirements during construction activities within the highway right-of-way will likely dictate the structure and content of the Traffic Management Plan, which will be developed in close communication with MoT and in conformance with MoT’s standards and procedures for construction within a highway right-of-way.

VAFFC has being advised that MoT will not grant a registered pipeline right-of-way within Highway 99. Instead, MoT will negotiate an operations agreement with VAFFC.

Also, the MoT Utility Policy Manual (Section 8 Pipelines) prohibits the installation of a high pressure pipeline that runs parallel to the highway centreline. For the pipeline to be installed, it will have to be approved under special MoT permit.

As such, operations and maintenance activities specific to the Highway 99 Pipeline Route Option as well as requirements for a special permit or operating agreement with MoT will be guided by the Pipeline System Operations Manual, which will be used in concert with the OEM Plan. The OEM Plan will also contain environmental protection plans to address foreseeable operations requirements and procedures with associated environmental risks. It will also describe activities required to complete the post-construction / follow-up monitoring and fulfill any agency or authority reporting requirements.

## 9. Accidents or Malfunctions

Accidents or malfunctions were assessed in accordance with the federal requirements under the CEAA. The following potential accidents or malfunctions associated with the Highway 99 Pipeline Route Option were identified for consideration in the assessment:

- Accidental spill of deleterious materials: During construction, possible sources of spills during construction may be failure of equipment and/or operator error during on-site vehicle / equipment refuelling activities, and storage of vehicle / equipment fuel. Compliance with stringent regulations governing the location and implementation of appropriate BMPs will minimize the potential for spills.

  During operations, an accidental upland spill may potentially occur because of a pipeline accident or malfunction. The likelihood of upland spills is considered low because the pipeline system will be designed, installed, tested, operated and maintained in compliance with the B.C. *Oil and Gas Activities Act*, current Canadian Standards Association standards and applicable Reference Publications. Moreover, the entire pipeline system will incorporate measures to prevent, prepare for and respond to a spill, included in the Pipeline System Operations and Maintenance Manual and the OEM Plan.

- Accidental fire: During construction, welding is the only spark-producing activity expected to take place during pipeline installation and may be a source of an accidental fire. Measures to prevent, prepare for and respond to the unlikely event of an accidental fire will be outlined in the Fire Prevention, Preparedness and Emergency Response Plan and the CEM Plan.

  During operations, the risk of fire is minimal because the pipeline is buried which limits the oxygen available to start a fire. Nevertheless, preparedness and

emergency response measures in relation to a fire incident during pipeline operations will be included in the Fire Safety Plan of the OEM Plan.

- Accidental utility disruption: B.C. Hydro high voltage power lines run parallel to the east boundary of the Highway 99 right-of-way. During construction, accidental disruption of power line utilities may occur as a result of the movement of construction equipment. Also, utilities that may be buried underground may be disrupted by excavation, trenching, boring and directional drilling. In the event of utility disruption, emergency response will proceed as described in the CEM Plan.

  During operations, no accidental utility disruptions are expected because the pipeline is buried and stationery.

- Accidental third-party damage: During construction, third-party damage may occur as a result of breach of site security, concurrent or adjacent construction activities, or intentional sabotage. A Construction Site Safety Manual will include measures to secure and monitor the construction site along the highway and reduce the risk of accidental damage caused by unauthorized entry or vandalism.

  During operations, third-party damage to the fuel pipeline during excavations is the only reasonable circumstance of external party interference on the pipeline delivery system. Under the B.C. *Oil and Gas Activities Act*, all activities occurring around the pipeline will be monitored and any ground disturbance within 40 metres of the pipeline will be reported to the pipeline company. To manage and mitigate effects from third-party damage to the proposed fuel delivery pipeline, the Pipeline System Operations and Maintenance Manual will also include a System Integrity Management Program consistent with B.C. Oil and Gas Commission regulations.

- Vehicle accidents: During construction, delivery of materials and machinery required for construction activities of the Highway 99 Pipeline Route Option, as well as equipment staging, will use Highway 99 and adjacent public roadways, resulting in an increase of commercial motor vehicle and truck traffic during construction. To minimize traffic disruption and traffic pattern changes on Highway 99 and adjacent city streets, measures and traffic management strategies will be provided in the Traffic Management Plan and the CEM Plan.

  Periodic pipeline maintenance activities will require construction equipment and personnel to work within the highway right-of-way. This activity may result in a slight highway traffic disruption and may slightly increase the likelihood of vehicle collisions. VAFFC in consultation with MOT, will implement mitigation measures to

minimize traffic disruption and reduce the risk of vehicle accidents during these activities.

The risks of accidents or malfunctions identified above are small and typical for pipelines. The development and implementation of a CEM and OEM Plan will minimize and/or eliminate these risks during construction and operations of the Highway 99 Pipeline Route Option. The Traffic Management Plan will also minimize traffic disruptions and consequently the risk for traffic accidents during pipeline construction and maintenance activities along Highway 99. Lastly, emergency response procedures described in **Chapter 17** and **Chapter 18** of the Application will be implemented to prevent, prepare for and respond to an unlikely event of a pipeline accident or malfunction within the Highway 99 corridor.

## 10. Cumulative Environmental Effects Assessment

An assessment of cumulative environmental effects for the Highway 99 Pipeline Route Option was undertaken in accordance with federal requirements and guidelines. The assessment of potential cumulative impacts to meet provincial requirements is integrated within each of the discipline-specific effects assessments for this Addendum.

The RSA for this assessment is the same as the RSA outlined in the Application. This includes the South Arm of the Fraser River, the Moray Channel, City of Richmond, and the Corporation of Delta. The LSA for this assessment is limited to 100 metres on either side of the Highway 99 and the extent of any potential residual effects.

The temporal scope of this assessment includes construction and operations phases of the pipeline. Project operations are assumed to be for an indefinite life span. Decommissioning and abandonment is not within the scope of the assessment. Decommissioning would be subject to the jurisdiction and approval of the B.C. Oil and Gas Commission.

Past, present and future reasonably foreseeable projects and activities that are sufficiently certain to proceed were considered in the assessment if they were within the RSA and could be reasonably expected to affect environmental, social, economic, health or heritage VCs identified in the Addendum effects assessments. Potential residual effects resulting from the Project's construction and operations phases identified in each of the effects assessments were considered further in the assessment of cumulative effects, except for those potential residual effects deemed to be "Not Significant" or of a positive or beneficial nature.

The following VCs were identified as having potential residual effects of significance:

- Terrestrial vegetation;
- Plant species and plant communities at risk;
- Terrestrial wildlife; and
- Motor vehicle traffic and mobility.

However, the extent of these potential residual effects did not overlap spatially, temporally, or interact with any other past, present and future reasonably foreseeable projects and activities considered in the assessment. For this reason, no cumulative effects are expected for the Highway 99 Pipeline Route Option.

No potential cumulative effects were identified in the effects assessment; therefore, no mitigation is prescribed. Consequently, since no cumulative effects were identified, no significance value can be applied, and no follow-up monitoring is required.

## 11. Summary of Potential Project Effects, Recommended Mitigation Measures and Potential Residual Effects

A summary of potential effects from the Highway 99 Pipeline Route Option, recommended mitigation measures and potential residual effects is provided in **Chapter 11** of the Addendum in accordance with the requirements of the EAO.

## 12. Conclusion

The application for a provincial Environmental Assessment Certificate (the Application) submitted by the Vancouver Airport Fuel Facilities Corporation (VAFFC) for the Vancouver Airport Fuel Delivery Project (the Project), which also serves as the Environmental Impact Statement for a federal environmental assessment decision, was accepted for review by the EAO on 04 February 2011. During the 180-day Application Review stage of a harmonized provincial / federal environmental assessment review process, led and coordinated by the British Columbia (B.C.) Environmental Assessment Office (EAO), VAFFC requested a temporary suspension of the Application Review so that the Highway 99 Pipeline Route Option, a possible alternate route for a section of the fuel delivery pipeline, could be evaluated. The request was accepted by the EAO on 28 April 2011. This Addendum to the Application has been prepared to include the Highway 99 Pipeline Route Option within the scope of the Project's environmental assessment review, similar to the other route options described in the Application.

The Highway 99 Pipeline Route Option is within the Highway 99 right-of-way which is under the jurisdiction of B.C Ministry of Transportation and Infrastructure (MoT). The route commences where the Williams Road easement intersects the highway, north to

where the Bridgeport Trail crosses underneath the Oak Street Bridge. The pipeline length within the Highway 99 right-of-way will be approximately 7.7 kilometres. The total pipeline length from the proposed location for the fuel receiving facility (i.e., on land leased from Port Metro Vancouver) to the existing VAFFC fuel facilities at YVR will be approximately 1.5 kilometres shorter than if either the No.5 Road or Shell Road corridors were used instead of the highway.

Construction and operation activities for the Highway 99 Pipeline Route Option are not expected to differ from those described for the other pipeline route options in the Application. However, all these activities will require a permit or operating agreement with MoT.

This Addendum to the Application has considered potential environmental, social, economic, heritage and health effects of Project construction and operations as they relate to the Highway 99 Pipeline Route Option. Consideration has also been given to environmental management planning, accidents or malfunctions and cumulative environmental effects that may be expected in addition to those assessed in the Application. Based on the discipline-specific assessments conducted in support of this Addendum, and following the application of identified mitigation measures, significant adverse environmental, social, health, heritage or economic residual effects resulting from construction or operations of the Highway 99 Pipeline Route Option are not expected.

Consistent with other pipeline route options, the Highway 99 Pipeline Route Option will be designed, constructed and operated according to the latest regulations, standards, codes, guidelines and best management practices associated with pipelines. VAFFC will work closely with its contractor(s) and operator(s) to verify that the issues identified in **Chapter 11** are understood and that the commitments set out in **Chapter 24** of the Application (which will form the basis for Proponent Commitments if an EAC is issued for the Project) are adhered to during Project construction and operations.

In addition to the economic, social and environmental benefits of the Project to the region as described in the Application (see **Section 2.3.4** of the Application), aligning a major section of the delivery pipeline along the Highway 99 corridor, instead of using the other route options described in the Application, will provide the following benefits:

- Shorten the total length of pipeline between the fuel receiving facility and YVR, providing the most direct route through Richmond;

- Remove significant lengths of pipeline from road and trail corridors under the jurisdiction of the City of Richmond. Richmond has expressed concerns about the use of its streets;
- Lessen the impact of pipeline construction and operations / maintenance activities to the Richmond community, which will be easier to manage and less disruptive to the public;
- Development and activity on the highway right-of-way will be strictly controlled, so the risk to the pipeline from third-party activity is minimized;
- Once constructed, the pipeline will be buried and will have no impact on the highway;
- Offer a greater separation between the pipeline route and the urban development in Richmond;
- Access to the pipeline for maintenance and repair will be easier because it will be located in the highway right-of-way rather than under a city street;
- Avoid complexities with other underground utilities situated in City roads and right-of-ways. Fewer utility crossings will be involved;
- The highway route will result in the smallest environmental footprint; and
- Richmond has expressed opposition to any aviation fuel pipeline through Richmond, but expressed preference for the Highway 99 route if a pipeline is constructed through Richmond.

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 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.

# Chapter 1
## Introduction and Background

# 1 INTRODUCTION AND BACKGROUND

The Application is currently in the Application Review stage of a harmonized provincial / federal environmental assessment review process, led and coordinated by the EAO. The Application was accepted for review by the EAO on 04 February 2011. It also serves as the Environmental Impact Statement for a federal environmental assessment decision.

On 28 April 2011 the EAO accepted a request made by VAFFC to temporarily suspend the Application Review so that a possible alternate route for a section of the fuel delivery pipeline could be evaluated. The alternate route option is along a portion of the Highway 99 right-of-way, which is under the jurisdiction of.

City of Richmond Council suggested that VAFFC explore Highway 99 as an alternative to the No.5 Road and Shell Road corridors. Acknowledging that suggestion, VAFFC consulted with MoT and a preliminary engineering and technical evaluation was undertaken to determine route feasibility. Although technical engineering and environmental challenges exist, and consultation with MoT is ongoing and preliminary studies indicate that construction and operation of the pipeline within the Highway 99 corridor is feasible. Therefore, the Highway 99 Pipeline Route Option is now proposed by VAFFC as the preferred corridor for locating a major section of the delivery pipeline.

VAFFC continues to hold open the possibility of using the No.5 Road, Shell Road or the Canadian National Railway (CNR) Lulu line corridor options for all or portions of the final alignment. Regardless of the final primary south to north alignment selected, existing City transportation and/or utility corridors will be required for smaller sections of the delivery pipeline (i.e., the Williams Road or Francis Road corridors, and City streets located in northwest Lulu Island between the Bridgeport Trail and the Moray Channel crossing).

The activities associated with the construction and operations of the Highway 99 Pipeline Route Option have been assessed in this Addendum. The balance of the activities for the Project will not change if the Highway 99 route is used. So, this Addendum supplements the Application, rather than amending it.

The assessment of the Highway 99 Pipeline Route Option considered potential environmental, social, economic, heritage and health effects of construction and operations activities related to the route. Consideration was also given to relevant environmental management planning, accidents or malfunctions and cumulative environmental effects.

All other information and assessments presented in the Application remain unaffected by the inclusion of this proposed route option within the scope of the Project's environmental assessment. The Addendum cross-references relevant sections of the Application to supplement the additional information presented herein; otherwise it follows the same format as the Application.

Following the EAO's screening for acceptance of this Addendum, it is expected that the Project's Application Review will recommence at Day 70 of the review stage.

# Chapter 2
## Project Information

# 2 PROJECT INFORMATION

## 2.1 Introduction

VAFFC is seeking approval to construct and operate a new aviation fuel delivery system which is needed to serve the fuel requirements at the YVR. The Project is located in the City of Richmond, Lower Mainland, B.C., and consists of the following components:

- Upgrades to an existing marine terminal wharf located on the South Arm of the Fraser River to accommodate a range of aviation fuel cargo vessel types and sizes;
- Construction and operation of facilities at the marine terminal to off-load and transfer fuel from vessels;
- Construction and operation of a new fuel receiving facility located on land near to the marine terminal;
- Construction and operation of a new pipeline to transfer off-loaded fuel from the marine terminal to the new fuel receiving facility; and
- Construction and operation of a new pipeline to deliver fuel from the new fuel receiving facility to VAFFC's fuel facilities at YVR.

This Addendum to the Application relates to an additional fuel delivery pipeline option that is being considered, specifically the Highway 99 Pipeline Route Option.

### 2.1.1 Project Overview

#### *2.1.1.1 Fuel Pipelines*

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

The preferred route for the delivery pipeline identified in the Application included installing a large section of pipeline within the existing CNR railway corridor, which runs parallel to Shell Road between Williams Road and the Bridgeport Trail. CNR has filed plans to relocate its rail service to the south side of Lulu Island. Since the Application was filed for review, decommissioning of the existing CNR line has been delayed and it will likely not be available for the Project.

The secondary pipeline route presented in the Application follows existing transportation and/or utility corridors in the City of Richmond, including portions of the No.5 Road and Shell Road corridors.

Both the No.5 Road and Shell Road corridors are possible route alternatives to the preferred Highway 99 Pipeline Route Option. VAFFC will continue to consult on all route options (see **Figure 2.1.1**) before selecting a final alignment for detailed design.

#### *2.1.1.2 Project Benefits*

In addition to the economic, social and environmental benefits of the Project to the region as described in the Application (see **Section 2.3.4** of the Application), aligning a major section of the delivery pipeline along the Highway 99 corridor, instead of using the other route options described in the Application, will provide the following benefits:

- Shorten the total length of pipeline between the fuel receiving facility and YVR, providing the most direct route through Richmond;
- Remove significant lengths of pipeline from road and trail corridors under the jurisdiction of the City of Richmond. Richmond has expressed concerns about the use of its streets;
- Lessen the impact of pipeline construction and operations / maintenance activities to the Richmond community, which will be easier to manage and less disruptive to the public;
- Development and activity on the highway right-of-way will be strictly controlled, so the risk to the pipeline from third-party activity is minimized;
- Once constructed, the pipeline will be buried and will have no impact on the highway;
- Offer a greater separation between the pipeline route and the urban development in Richmond;
- Access to the pipeline for maintenance and repair will be easier because it will be located in the highway right-of-way rather than under a city street;
- Avoid complexities with other underground utilities situated in City roads and right-of-ways. Fewer utility crossings will be involved;
- The highway route will result in the smallest environmental footprint; and

- Richmond has expressed opposition to any aviation fuel pipeline through Richmond, but expressed preference for the Highway 99 route if a pipeline is constructed through Richmond.

## 2.2 Project Description

### 2.2.1 Design Suitability

The delivery pipeline to YVR will be designed and constructed according to current standards and making use of materials and installation practices that will make it robust enough to protect against the risks associated with the urban setting of the route options, including seismic and third-party damage risks. It will also be designed with sufficient capacity to accommodate the long-term growth in fuel demand at YVR. A properly designed and protected pipeline can last indefinitely assuming it continues to meet the performance criteria. The Project design life is for a minimum service life of 60 years. See **Section 2.4.1** of the Application for further details on Project design suitability.

### 2.2.2 Engineering and Design Criteria

VAFFC will use BMPs and modern design principles in developing detailed designs and operating parameters. The pipeline system will be designed, installed, tested, operated and maintained in compliance with the *Oil and Gas Activities Act*, current Canadian Standards Association (CSA) standards and applicable Reference Publications. The design methodology is elaborated in the Application (see **Chapter 2** of the Application) together with a list of BMPs, codes and standards that will be utilized during detailed engineering and design (see **Appendix 2C** of the Application).

The work will also conform to other relevant acts, regulations, codes and standards, including MoT and Vancouver Airport Authority policies, manuals and procedures. See **Section 2.4.2** of the Application for further details on Project engineering and design criteria.

### 2.2.3 Construction and Operations Plans and Programs

Project construction and operations will be guided by environmental and engineering plans and procedures that meet all relevant regulatory requirements. Construction activities will be guided by the CEM Plan, the Traffic Management Plan and the Construction Site Safety Manual. These plans are outlined in the Application (see **Chapter 9** of the Application).

Traffic management will be addressed separately from the CEM Plan within the Traffic Management Plan, and site-specific health and safety management will be covered in the Construction Site Safety Manual.

If Highway 99 is used for a section of the delivery pipeline, the CEM Plan, Construction Site Safety Manual and Traffic Management Plan will also be developed in accordance with relevant MoT policies, manuals and procedures. See **Section 2.4.3** of the Application for further details on Project construction and operations plans and programs.

## 2.3 Project Component Details – Fuel Pipelines

### 2.3.1 Introduction

Permanent ancillary facilities associated with the delivery pipeline are expected to include the following:

- Two “pig” launching / receiving assemblies;
- Four emergency shutdown valve stations:
  - One station at the fuel receiving facility;
  - One station at the existing VAFFC fuel facilities at YVR; and
  - Two stations at either end of the pipeline crossing under the Moray Channel (i.e., one on Lulu Island and on Sea Island).

See **Section 2.4.4.3** of the Application for further details on permanent ancillary facilities associated with the pipeline system.

### 2.3.2 Reference Footprint – Location and Mapping

The section of the delivery pipeline route under investigation is within the provincial Highway 99 right-of-way (see **Figure 2.3.1**), commencing where the Williams Road easement intersects the highway (Latitude: 54°43.101’ North, Longitude: 49°36.96’ East), north to where the Bridgeport Trail crosses underneath the Oak Street Bridge (Latitude: 54°49.105’ North, Longitude: 49°12.05’ East). Both Williams Road and the Bridgeport Trail (and Bridgeport Road) are assessed in the Application. They are not within the scope of this Addendum.

The pipeline length within the Highway 99 right-of-way will be approximately 7.7 kilometres. The total pipeline length from the proposed location for the fuel receiving facility (i.e., on land leased from Port Metro Vancouver) to the existing VAFFC

fuel facilities at YVR will be approximately 1.5 kilometres shorter than if either the No.5 Road or Shell Road corridors were used instead of the highway.

For the purposes of this Addendum it is assumed that the pipeline could be situated on either the east or west side of the highway right-of-way and could, at intervals, switch from side to side. Further detailed study and consultation with MoT will be required to refine the precise pipeline alignment within the highway right-of-way. In either location the pipeline will be buried.

Source control and end points of the pipeline system, and facilities and design parameters are as described in the Application (see **Section 2.4.4.3**, **Reference Footprint – Location and Mapping**, and **Facilities and Design Parameters** of the Application, respectively).

### 2.3.3 General Arrangement

The general characteristics and Class locations of the Highway 99 Pipeline Route Option are as described in the Application (see **Section 2.4.4.3, General Arrangement** of the Application). The pipeline will be designed to a minimum CSA Class 3 location regardless of location in Richmond to meet design requirements in an urban environment.

### 2.3.4 Construction Phase Activities

#### *2.3.4.1 Site Preparation*

Portions of the Highway 99 right-of-way (i.e., less than 20%) are uncleared. The pipeline alignment will traverse some of these uncleared areas. Where this happens, the entire pipeline workspace will be cleared and grubbed. Merchantable timber will be salvaged and trucked to local sawmills. Non-merchantable timber and stumps will be removed from the work site. All other site preparation activities as well as pipe handling and preparation, lowering-in, pipeline testing and restoration, emergency shutdown valve facilities, and utility and service requirements are as described in the Application (see **Section 2.4.4.3** of the Application).

#### *2.3.4.2 Pipe Installation*

**Trenching**

About 50% of the pipeline route may have limited workspace available for trench spoil stockpiling. For those portions of pipeline construction, all trench spoil will be hauled to a disposal site. This will require additional movement of haulage trucks to dispose of

excavated materials as it is removed from the ground, as well as additional movements of flat-bed trucks to haul and place short lengths of pipe along the work site immediately prior to welding and installation. All other trenching activities are as described in the Application (see **Section 2.4.4.3** of the Application).

**Backfilling**

Where backfill is not stored adjacent to the trench, new backfill that meets MoT and municipal graduation and compaction requirements will be hauled in from local borrow bits and commercial aggregate stockpiles. All other backfilling activities are as described in the Application (see **Section 2.4.4.3** of the Application).

### *2.3.4.3 Pipeline Crossings*

Pipeline crossings of major and minor watercourses, minor roads, railways and utilities are as described in the Application (see **Section 2.4.4.3** of the Application). Construction along Highway 99 will require crossings of the following major roads as encountered moving south to north:

- Highway 99 near the undeveloped Williams Road right-of-way if a pipeline alignment on the west side of Highway 99 is chosen. If an alignment on the east side is selected, a crossing under Highway 99 will not be required at this location;
- Blundell Road;
- Westminster Highway and the associated access ramps;
- No. 5 Road and the associated access ramps;
- Richmond Freeway (Highway 91) and the associated access ramps;
- Shell Road including the Canadian National Railway line;
- Cambie Road;
- Highway 99 access ramps located between Bridgeport Road and Sea Island Way; and
- Bridgeport Road and Sea Island Way.

Following geotechnical assessment, to be undertaken at the detailed design phase, each crossing is expected to be completed in or within approximately 4 weeks by horizontal directional drilling underground. Information on horizontal directional drilling is provided in the Application (see **Section 2.4.4.3** of the Application).

### 2.3.5 Operations Phase Activities

#### *2.3.5.1 Routine Pipeline Maintenance*

The installed pipeline will be subject to periodic maintenance activities that require construction personnel to work within the highway right-of-way. All these activities will occur under a permit or operating agreement with MoT.

The pipeline company also has a duty to protect the integrity of the pipeline by monitoring all activity occurring around the pipeline. Under the B.C. *Oil and Gas Activities Act*, any ground disturbance within 40 metres of the pipeline (i.e., the safety zone) must be reported to the pipeline company before commencing any work. When MoT conducts certain road maintenance activities near the pipeline they must request a pipeline location through B.C. One Call or by directly contacting the pipeline company. All other routine pipeline maintenance activities and utility and service requirements are as described in the Application (see **Section 2.4.4.3** of the Application).

### 2.3.6 Alternative Means of Delivering Fuel from the Fuel Receiving Facility to YVR

As described in the Application (see **Section 2.6.1.5** of the Application), there are no practical alternatives to using a pipeline to regularly deliver aviation fuel to YVR from the proposed fuel receiving facility.

#### *2.3.6.1 Route Evaluation Criteria*

Route evaluation criteria (i.e., regulatory requirements, environmentally sensitive and socially and culturally important areas, infrastructure crossings, set-back distances, primary control points, etc.) are as described in the Application (see **Section 2.6.1.5**, **Route Evaluation Criteria** of the Application). In addition to the secondary control points described, the pipeline route within the Highway 99 right-of-way must consider the risk of future pipeline relocations to accommodate future road expansion and upgrade plans, and the pipeline should avoid areas that are subject to regular highway maintenance activities.

Three primary south-to-north route options have been identified to connect the delivery pipeline with the fuel receiving facility and YVR: the Shell Road corridor, No. 5 Road corridor, and now the Highway 99 corridor (see **Figure 2.1.1**). All routes traverse areas surrounded by similar environmental settings and land use patterns. Although none of the routes would require the pipeline to cross any major watercourses on Lulu Island, each are adjacent to surface water drainage ditches, of which some are classified as having riparian buffer zones. All routes follow existing transportation corridors and

avoid environmentally sensitive areas. Adjacent land use includes Neighbourhood Residential / Community Institutional and Agricultural areas.

#### *2.3.6.2 Shell Road Corridor*

This route option is as described in the Application (see **Section 2.6.1.5**, **Shell Road Corridor** of the Application).

#### *2.3.6.3 No.5 Road Corridor*

This route option is as described in the Application (see **Section 2.6.1.5**, **No.5 Road Corridor** of the Application).

#### *2.3.6.4 Highway 99 Corridor*

This route option goes north along the Highway 99 right-of-way from where the Williams Road easement intersects the highway to where the Bridgeport Trail crosses under the Oak Street Bridge.

#### *2.3.6.5 Possible Routing Alternatives*

Several other possible routing alternatives were identified within the general corridors described above, and are as described in the Application (see **Section 2.6.1.5**, **Possible Routing Alternatives** of the Application). It may be possible to align the pipeline along the Francis Road right-of-way instead of using Williams Road to reach Highway 99 from the fuel receiving facility. A possible alternative to the east-to-west Bridgeport Trail could be along Bridgeport Road. In this case, the alignment would head west along Bridgeport Road from Highway 99 to reach the directional drilling entrance location for the Moray Channel crossing.

#### *2.3.6.6 Preferred Option*

As described in the Application (see **Section 2.6.1.5**, **Preferred Option** of the Application), the Shell Road corridor was originally selected as part of the preferred option for routing the delivery pipeline because the potential existed to locate approximately 6 kilometres of the pipeline along a railway corridor. The preferred corridor option is now west along Williams Road, north along Highway 99 and west along the Bridgeport Trail (see **Figure 2.3.1**). The Francis Road corridor is a distinct possible alternative to Williams Road.

VAFFC will continue to consult with the City of Richmond, Vancouver Airport Authority, MoT, the B.C. Oil and Gas Commission and the public regarding these possible delivery pipeline routing alternatives.

## 2.3.7 Project Setting and Land Use

### *2.3.7.1 General*

The Geological Survey of Canada soil mapping of the Fraser Valley reports Lulu Island as consisting primarily of Ladner series clay, typified by massive grey clay to depths of 1,200 millimetres. The grey clay is underlain by a 1,200 millimetres deep layer of sandy micaceous blue clay. Ladner clays are found below high tide and generally promote the growth of peat bogs.

Secondary soils found within the centre of Lulu Island are peat soils. Peat soils form in areas of poor drainage where swampy conditions prevail. Lulu Island is dyked with a system of open ditch drainages for water level management. The water table is typically considered high.

From the Williams Road easement to the intersection with Alderbridge Way / Highway 91, the land use surrounding the highway is mostly agricultural. The Richmond Nature Reserve is located on both sides of the highway between the Westminster Highway and Highway 91 interchanges. Land use bordering the highway between the Highway 91 interchange and the Bridgeport Trail is predominantly commercial and/or residential.

Based on surrounding land use and urban development, the Highway 99 route option can be broken into four distinct segments (see **Figure 2.3.1**), from south to north, as follows:

- Williams Road easement north to Westminster Highway;
- Westminster Highway north to Highway 91;
- Highway 91 north to Bridgeport Road; and
- Bridgeport Road north to Bridgeport Trail.

### *2.3.7.2 Williams Road north to Westminster Highway*

This section of the route is approximately 3.2 kilometres long. The highway right-of-way is approximately 70 metres wide. B.C. Hydro high voltage power lines run parallel to the east boundary of the highway. The first 400 metres of the highway is adjacent to the Mylora Golf Course on both sides. The balance of this section is adjacent to Agricultural Land Reserve (ALR) lands. Surface drainage ditches run parallel to both sides of the highway.

#### *2.3.7.3 Westminster Highway north to Highway 91*

This section of the route is approximately 1 kilometre long. The highway right-of-way is very wide to accommodate the Highway 91 / Alderbridge Way interchange and on / off ramps. Richmond Nature Reserve is situated on both the east and west sides of the highway. Surface drainage ditches occur throughout this section, some located around the periphery of the reserve. B.C. Hydro high voltage power lines continue to run parallel to the east boundary of the highway right-of-way.

#### *2.3.7.4 Highway 91 north to Bridgeport Road*

This section of the route is approximately 3 kilometres long. The highway right-of-way varies in width from approximately 60 to 80 metres. Residential neighbourhoods and commercial enterprises are adjacent to the highway right-of-way on both sides. Surface drainage ditches run parallel on both sides. The B.C. Hydro high voltage power lines are no longer running parallel to the east boundary.

#### *2.3.7.5 Bridgeport Road north to Bridgeport Trail*

This section of the route is approximately 0.5 kilometres long. Residential neighbourhoods and commercial enterprises are adjacent to the highway on both sides. The Oak Street Bridge elevates the highway above the ground. The pipeline will remain buried. The highway right-of-way is approximately 35 metres wide.

### 2.3.8 Project Delivery Mechanism

The Project will most likely use a design-bid-build process. However, a design-build method of Project delivery is also possible. See **Section 2.8** of the Application for further details on the Project delivery mechanism.

### 2.3.9 Project Constraints / Challenges – Highway 99

#### *2.3.9.1 Highways in General*

The installation of petroleum transmission pipelines must be designed and installed in a manner that does not impede or disrupt the safe operation of a highway. Along certain classes of highway, a high pressure petroleum line may not be permitted for a longitudinal or parallel installation except under special permit. Pipelines typically have to be installed in areas adjacent to and outside frontage roads. Generally, all utilities can cross all classes of highways perpendicularly.

Where longitudinal pipeline installations have been permitted, the pipeline owner usually must demonstrate that:

- The accommodation does not adversely affect safety and traffic operations;
- Practical alternate locations are not available or cannot be implemented;
- The pipeline can be installed and operated in a manner conducive to pipeline safety and durability;
- The accommodation does not adversely affect the design, construction, operation, maintenance, or stability of the highway;
- No impairment of the economy of maintenance and operations of the highway occurs;
- The pipeline does not interfere with or impair the present use or future expansion of the highway;
- Locating the pipeline outside of the right-of-way would result in the loss of productive agricultural land, or loss of productivity of agricultural land;
- There are significant direct and indirect environmental impacts in alternate locations outside the highway right-of-way;
- Construction, maintenance, operation, and occupancy of a pipeline in the highway right-of-way does not interfere with the free and safe flow of traffic;
- Pipeline occupancy of the right-of-way does not impair the existing highway or its scenic appearance, including removal of buffer trees; and
- Following useful life of the pipeline asset, the abandoned in-place pipeline preserves the safety of the highway and does not interfere with traffic operations.

#### *2.3.9.2 Highway 99 Alignment*

In their discussions with MoT, VAFFC has being advised that MoT will not grant a registered pipeline right-of-way within Highway 99. Instead, MoT will negotiate an operations agreement with VAFFC. At times, a highway authority may purposely take a wider right-of-way width than necessary for the roadway to accommodate future utility installations. This is not the case for Highway 99. The MoT Utility Policy Manual (Section 8 Pipelines) prohibits the installation of a high pressure pipeline that runs parallel to the highway centreline. For the pipeline to be installed, it will have to be approved under special MoT permit. After discussion with MoT, VAFFC understands that MoT will consider the issuance of a special MoT permit in this circumstance if it is

demonstrated that the alternatives are technically more difficult and socially less acceptable.

In terms of workspace, to install a pipeline within the Highway 99 right-of-way is feasible but typical pipeline construction practices will have to be altered. Most likely the length of the pipeline spread will be held to a minimum resulting in reduced amount of equipment and manpower on the work site. This will slow productivity but allow for safer installation of the pipeline. Trench spoil will likely have to be trucked out with new fill imported once the pipeline is lowered into place due to inadequate working space in some areas.

With the exception of plastic test lead posts and plastic markers, all pipeline appurtenances, such as Emergency Shutdown Valve Stations, rectifier boxes and communication facilities, will need to be placed outside of the highway clear zone to ensure road safety. In some instances, this may necessitate placement of these appurtenances outside of the highway right-of-way to eliminate any impact they may otherwise have on highway operations. On Highway 99, the clear zone for the pipeline will generally be 10 metres set-back from all fill sections.

Appropriate measures will be required to control induced currents where pipeline construction and operations / maintenance are to occur in areas adjacent and parallel to high-voltage power lines.

Construction is generally feasible within the Highway 99 right-of-way but two main complications exist that alter a typical Construction Plan for a pipeline installation. The first is controlling access to the linear worksite for construction equipment, manpower and material load-in / load-out, during construction, pipeline maintenance, and for pipe risk reduction activities from third-party interference. The second is traffic management and control to keep workers safe during construction. Both conditions will be managed by the CEM Plan and the Construction Site Safety Manual, as well as the Traffic Management Plan which will be developed in consultation with MoT.

#### *2.3.9.3 Design Limitations*

Locating the pipeline within the highway right-of-way will impose a number of design limitations, restrictions and conditions on the installation. These include:

- Above grade installations such as valve stations or satellite pumps will likely not be permitted on the highway right-of-way;
- Pipeline installation must be designed and located to avoid permanent disturbance to existing highway drainage or drainage facilities;

- Pipeline construction and operation must not alter, impair or make any type of attachment to any existing structures;
- Existing utilities must remain in place in the highway right-of-way;
- VAFFC will require a special permit and an operations agreement with the MoT for construction and operation of the pipeline within the Highway 99 right-of-way;
- Longitudinal installations within the right-of-way must be located as close as practical to the highway property line unless the location is in a future construction area. In the event of conflict with known or future construction, and where no other options exist (i.e., use of ditch slopes), consideration may be given to the use of an existing ditch bottom as a last resort, provided all other safety and environmental provisions are satisfied. The use of an existing ditch bottom would require consultation with MoT to mitigate the potential for permanent drainage impacts, and may also require provincial and/or federal agency review and approvals;
- Installing all sections of pipeline located within the highway right-of-way underground, with a minimum depth of cover to minimize effects from scour or ditch maintenance operations. If a minimum depth of cover cannot be provided or additional mechanical protection is required, concrete slabs or similar materials must be installed over the pipe as protection;
- Pipeline installation may not be permitted within certain scenic and public use areas, where it requires extensive removal of, or damage to, trees visible to the highway user or detract from the appearance of the area, unless there is no feasible and prudent alternative to the use of such lands;
- Emergency shut-off valves must be installed on the pipeline. The shut-off valves must be of automatic design and placed within an effective distance and under effective control of automatic devices;
- Warning signs must be installed; and
- The pipeline must be accompanied by effective locating and marking measures. An identification sign must be installed on each of the marker posts, and must show the name, address, and telephone number of the pipeline utility company.

#### *2.3.9.4 Major Crossings*

All major road, interchange and ditch crossings will likely require trenchless technologies, either by auger bore or horizontal directional drilling underground. As

described in the Application (see **Section 2.9.3.2** of the Application), soils within the area are believed to be conducive to drilling. Significant difficulties are not expected. Geotechnical assessment work will be undertaken during the detailed design phase to determine appropriate locations for drilling entrance and exit points. Any disruptions that may be required to surface drainage ditches are expected to be minor, localized and temporary.

#### *2.3.9.5 Land Use*

Due to highway right-of-way width constraints and possible conflicts with neighbouring infrastructure, in some sections it may be necessary to gain temporarily access to private property during construction. This need will be determined during detailed design if this route option is selected.

### 2.3.10 Project Security

#### *2.3.10.1 Fuel Receiving Facility and Pipelines (Pipeline System)*

As described in the Application (see **Section 2.10.2** of the Application), a security management program will be implemented prior to pipeline system operations. The security management program is expected to include:

- Security policies and procedure manuals;
- Regional security response plans;
- Security vulnerability assessments;
- Threat monitoring and analysis;
- Physical security measures;
- Monitoring, tracking and trending of security incidents; and
- Training and support of operations personnel.

Physical security measures used at above ground pipeline facilities include perimeter fencing, vehicle and traffic barriers, intrusion alarms, surveillance systems and lighting.

The pipeline system will be incorporated into the existing VAFFC security management program and assessment process in place at YVR.

### 2.3.11 Property Requirements

#### *2.3.11.1 Fuel Pipelines*

VAFFC will require a special permit and an operations agreement with the MoT for construction and operation of the pipeline within the Highway 99 right-of-way. As discussed above, depending on detailed design, VAFFC may need to negotiate temporary access to privately owned property during construction.

### 2.3.12 Capital Costs and Financing

The estimated capital cost of the Project will not change if the Highway 99 Pipeline Route Option is selected as part of the final pipeline alignment (i.e., total Project costs are estimated to range from approximately $93 to $108 million). The pipeline component is estimated to have a capital cost of $30 to $45 million, the higher end of the range being for a greater number of horizontal directional drillings underground. The Project will be financed in its entirety by VAFFC. See **Section 2.12** of the Application for further details on the Project's capital costs and financing. Both the labour force and business opportunities described for the Project in **Section 2.13** and **Section 2.14** of the Application remain unaltered if the Highway 99 Pipeline Route Option is selected as part of the final pipeline alignment.

### 2.3.13 General Project Scheduling and Sequencing

The general schedule and sequence for the Project has changed from that described in the Application (see **Section 2.15** of the Application) due to the EAOs suspension of the Application Review at Day 69. Subject to the EAO's acceptance of this Addendum and recommencement of the Application Review by mid-November 2011, completion of the EAO's Final Assessment Report, Consultation Report and Ministerial Referral Package is anticipated in February 2012. A Ministerial decision on whether to grant an Environmental Assessment Certificate for the Project is anticipated sometime in spring 2012.

Subject to the timing for the acquisition of regulatory permits, approvals and authorizations, Project construction is expected to begin in summer 2012. The Project construction phase is expected to last approximately 18 to 24 months, depending on the method selected for ground improvement at the fuel receiving facility. The pipeline construction phase is expected to last approximately 12 months including approximately 6 months for pipeline construction activities. Following system testing and commissioning, commencement of Project operations is anticipated late 2013 or early 2014.

### 2.3.14 Applicable Permits, Approvals and Authorizations

Since the Highway 99 Pipeline Route Option is situated within the highway right-of-way, which is under the jurisdiction MoT, a registered pipeline right-of-way will not be granted. Instead, MoT will negotiate an operations agreement with VAFFC. Other permits, approvals or authorizations VAFFC expects to acquire are as described in the Application (see **Section 2.16** of the Application).

# Chapter 3
## Assessment Scope and Methodology

# 3 ASSESSMENT SCOPE AND METHODOLOGY

The assessment scope of this Addendum is consistent with the orders issued by the EAO under sections 11 and 13 of the BCEAA. The assessment methodology follows the requirements of a harmonized provincial / federal environmental assessment review under the BCEAA and the CEAA, and is in accordance with EAO and CEA Agency policies and guidelines.

The general approach taken to identify, assess and manage the potential effects of pipeline construction and operations within the Highway 99 corridor, including cumulative impacts (as defined and required by the EAO in their AIR Template document (EAO 2010)) and residual effects, includes:

- Conducting effects assessments for the disciplines under the EAO's five assessment pillars (i.e., environmental, economic, social, heritage and health);
- Identifying measures to eliminate or reduce potential effects to an acceptable level through mitigation, where possible;
- Identifying any adverse residual effects that may remain following implementation of mitigation measures and management strategies, and determining their likely significance; and
- Identifying other known relevant projects or activities (past, present or reasonably foreseeable and sufficiently certain to proceed) that may be reasonably expected to result in a residual environmental, social, economic, health and/or heritage effect that overlaps, spatially or temporally, with the predicted adverse residual effects of the section of pipeline within the Highway 99 corridor, to cause a cumulative impact.

Consideration of potential cumulative impacts is integrated within each discipline-specific effects assessment. Separate consideration of cumulative environmental effects is also provided in **Chapter 10** in accordance with the federal requirements and guidance documents.

The methods used to complete each of the effects assessments varied according to discipline. In general, however, the following components are addressed:

- Introduction;
- Methodology;
- Spatial and temporal boundaries;

- Baseline conditions;
- Assessment of potential effects;
- Mitigation measures and management strategies;
- Potential residual effects and analysis of significance;
- Determination of cumulative impacts;
- Summary of key findings; and
- Conclusion.

The approaches taken for the selection of VCs, identification of mitigation measures and management strategies, consideration of significance of residual effects and cumulative impacts, are as described in the Application, where appropriate for the Highway 99 Pipeline Route Option (see **Sections 4.4.1**, **4.4.2**, **4.4.3**, and **4.4.4** of the Application, respectively).

The following assessments were undertaken for the Highway 99 Pipeline Route Option, consistent with the Application and the five assessment pillars required by the EAO, and consistent with federal requirements:

- Assessment of Environmental Effects;
- Assessment of Social and Economic Effects;
- Assessment of Heritage Effects;
- Assessment of Human Health Effects;
- Accidents or Malfunctions; and
- Cumulative Environmental Effects.

Where relevant information is already detailed in the Application, it is summarized in this Addendum and the reader is directed to the relevant Application section for further information. **Chapter 4** of the Application provides further details on the Project assessment scope and methodology.

# Chapter 4
## Environmental Effects Assessment

# Section 4.1
## Fisheries, Aquatics and Surface Water Quality Assessment

# 4 ENVIRONMENTAL EFFECTS ASSESSMENT

## 4.1 Fisheries, Aquatics and Surface Water Quality Assessment

This section assesses the effects on fisheries, aquatic resources and surface water quality during construction and operations of the proposed Highway 99 Pipeline Route Option. This section also recommends mitigation measures to eliminate or minimize potential effects from construction and operations, identifies any remaining residual effects, following implementation of mitigation measures, evaluates their significance, and identifies cumulative impacts.

This assessment was prepared by Hatfield Consultants.

### 4.1.1 Approach and Methodology

This assessment follows the same approach and methodology described in **Section 5.2** of the Application.

For this Addendum, drainage ditches and remnant watercourses along the Highway 99 Pipeline Route between the Bridgeport Trail and the Williams Road easement were assessed. Habitat assessments were conducted on July 19 and 20, 2011 at 10 stations (**Figure 4.1.1**). The Highway 99 Pipeline Route does not parallel or cross any natural watercourses or waterbodies; however, it does parallel drainage ditches for much of its length.

### 4.1.2 Study Area

#### *4.1.2.1 Spatial Boundaries*

The spatial boundaries for the assessment encompass, as described above, drainage ditches and remnant watercourses within the Highway 99 right-of-way between the Bridgeport Trail and the Williams Road easement.

#### *4.1.2.2 Temporal Boundaries*

The temporal boundary for the assessment was assumed approximately 12 months for the construction phase of the Highway 99 Pipeline Route Option and at least 60 years for pipeline operations.

## 4.1.3 Baseline Conditions

### *4.1.3.1 Surface Water Quality*

**Table 4.1.1** summarizes the range of values for conventional surface water quality variables measured along the Highway 99 corridor, including dissolved oxygen, conductivity, pH, and turbidity. The B.C. Ministry of Environment (MoE) and Canadian Council of Ministers of the Environment (CCME) guidelines for the protection of aquatic life in freshwater are also listed in **Table 4.1.1** for each of the variables (Swain 1998; CCME 2010).

**Table 4.1.1 Sampling Site Descriptions and Conventional Surface Water Quality Data Collected to Characterize Ditches within the Highway 99 Pipeline Route, July 2011**

| Station Name and Location | Sample Dates (Source) | Temperature ($^{o}$C) | Dissolved Oxygen (mg/L) | Conductivity (µS/cm) | pH | Turbidity (NTU) [TSS mg/L] |
|---|---|---|---|---|---|---|
| **Site 99-1**- Southbound drainage ditch south of Bridgeport Trail at Gage Road and Beckwith Road | July 19, 2011 (Hatfield Consultants) | 16.2 | < 1 | 585 | 6.85 | 90 |
| **Site 99-2** - Southbound drainage ditch south of No 4 Road off-ramp | July 19, 2011 (Hatfield Consultants) | 15.7 | 0.8 | 504 | 7.05 | 28 |
| **Site 99-3** - Southbound drainage ditch south of Alderbridge Way off-ramp | July 19, 2011 (Hatfield Consultants) | 14.2 | < 1 | 259 | 6.76 | 65 |
| **Site 99-4** - Southbound drainage ditch north of Westminster Highway overpass | July 19, 2011 (Hatfield Consultants) | 20.5 | 1.8 | 411 | 6.80 | 95 |

| Station Name and Location | Sample Dates (Source) | Temperature ($^{o}$C) | Dissolved Oxygen (mg/L) | Conductivity (µS/cm) | pH | Turbidity (NTU) [TSS mg/L] |
|---|---|---|---|---|---|---|
| **Site 99-5** - Southbound drainage ditch south of Blundell Road overpass | July 19, 2011 (Hatfield Consultants) | 18.2 | 2.0 | 390 | 6.80 | 27 |
| **Site 99-6** - Southbound drainage ditch and cross channel north of Williams Road near King Road | July 19, 2011 (Hatfield Consultants) | 19.4 | 1.3 | 427 | 6.74 | 95 |
| **Site 99-7** - Northbound drainage ditch north of Williams Road near King Road | July 20, 2011 (Hatfield Consultants) | 17.4 | 2.5 | 250 | 7.27 | 90 |
| **Site 99-8** - Northbound drainage ditch north of Blundell Road | July 20, 2011 (Hatfield Consultants) | 17.4 | 1.3 | 360 | 6.65 | 80 |
| **Site 99-9** - Northbound drainage ditch north of Westminster Highway | July 20, 2011 (Hatfield Consultants) | 18.8 | 1.0 | 222 | 7.27 | 55 |

| Station Name and Location | Sample Dates (Source) | Temperature ($^{o}$C) | Dissolved Oxygen (mg/L) | Conductivity (µS/cm) | pH | Turbidity (NTU) [TSS mg/L] |
|---|---|---|---|---|---|---|
| **Site 99-10** - Northbound drainage ditch south of Westminster Highway overpass along Vanguard Road | July 20, 2011 (Hatfield Consultants) | 18.5 | < 1 | 329 | 6.83 | 55 |
| CCME Guidelines[1] | (2001 CCME) | - | 5 mg/L | - | 6.5 – 9.0 | - |
| B.C. MoE Guidelines [2] | (Swain 1998) | - | See [3] | - | 6.5 – 8.5 | [See [4] for TSS] |

"-" Indicates variable not measured, or no guideline exists. NTU = Nephelometric Turbidity Units; Conductivity is measured in micro Siemens per centimetre (µS/cm).

[1] Canadian Water Quality Guidelines for the Protection of Aquatic Life. CCME Water Quality Index 1.0 User's Manual (CCME 2001).

[2] Water Quality Assessment and Objectives for the Fraser River from Hope to Sturgeon and Roberts Banks, Summary Report – First Update. (Swain 1998).

[3] May to October: ≥5 mg/L instantaneous; 30-day mean ≥8.0 mg/L or 80% saturation. November to April: ≥ 9 mg/L instantaneous; 30-day mean ≥11.0 mg/L.

[4] ≤10 mg/L increase when the upstream background is less than 100 mg/L; ≤110% of the upstream background when the background is greater than 100 mg/L.

### *4.1.3.2 Fisheries Resources*

A summary of fish species captured in ditches located in the vicinity of the Highway 99 Pipeline Route during the July 2011 sampling program is provided in **Table 4.1.2**. Field sampling locations are shown on **Figure 4.1.1.** Data from fish sampling conducted on July 19 and 20, 2011 have been used to characterize baseline conditions.

**Table 4.1.2 Site Descriptions and Fish Capture Data Collected to Characterize Ditches within the Highway 99 Pipeline Route, July 2011**

| Station Name and Location | Sample Dates (Source) | # of Fish Captured | Species of Fish Captured | Sampling Effort (Minnow Trap hrs) | Catch per Unit Effort (CPU) [fish/hr] |
|---|---|---|---|---|---|
| **Site 99-1** - Southbound drainage ditch south of Bridgeport Trail at Gage Road and Beckwith Road (too shallow for trap) | July 19, 2011 (Hatfield Consultants) | - | - | - | - |
| **Site 99-2** - Southbound drainage ditch south of No 4 Road off-ramp | July 19, 2011 (Hatfield Consultants) | 3 | Three-spine stickleback | 22.3 | 0.13 |
| **Site 99-3** - Southbound drainage ditch south of Alderbridge Way off-ramp | July 19, 2011 (Hatfield Consultants) | 36 | Three-spine stickleback | 22 | 1.64 |
| **Site 99-4** - Southbound drainage ditch north of Westminster Highway overpass | July 19, 2011 (Hatfield Consultants) | 5 | Three-spine stickleback | 21.5 | 0.23 |

| Station Name and Location | Sample Dates (Source) | # of Fish Captured | Species of Fish Captured | Sampling Effort (Minnow Trap hrs) | Catch per Unit Effort (CPU) [fish/hr] |
|---|---|---|---|---|---|
| **Site 99-5** - Southbound drainage ditch south of Blundell Road overpass | July 19, 2011 (Hatfield Consultants) | 30 | Three-spine stickleback | 21 | 1.43 |
| **Site 99-6** - Southbound drainage ditch and cross channel north of Williams Road near King Road | July 19, 2011 (Hatfield Consultants) | 0 | - | 20.7 | 0 |
| **Site 99-7** - Northbound drainage ditch north of Williams Road near King Road | July 20, 2011 (Hatfield Consultants) | 1 | Three-spine stickleback | 2.2 | 0.45 |
| **Site 99-8** - Northbound drainage ditch north of Blundell Road | July 20, 2011 (Hatfield Consultants) | 2 | Three-spine stickleback | 2 | 1.0 |
| **Site 99-9** - Northbound drainage ditch north of Westminster Highway | July 20, 2011 (Hatfield Consultants) | 0 | - | 1.8 | 0 |

| Station Name and Location | Sample Dates (Source) | # of Fish Captured | Species of Fish Captured | Sampling Effort (Minnow Trap hrs) | Catch per Unit Effort (CPU) [fish/hr] |
|---|---|---|---|---|---|
| **Site 99-10** - Northbound drainage ditch south of Westminster Highway overpass along Vanguard Road | July 20, 2011 (Hatfield Consultants) | 2 | Three-spine stickleback | 1.3 | 1.54 |

## Biophysical Characteristics and Aquatic Resources

The drainage ditches and associated riparian areas in the vicinity of the Highway 99 Pipeline Route Option are all located within a provincial right-of-way under the jurisdiction of B.C. Ministry of Transportation and Infrastructure (MoT). The riparian setback requirements for these drainage ditches may vary according to the guidelines set out by different levels of government. For the purpose of this assessment, and following consultation with Fisheries and Oceans Canada (DFO) (Naito 2011, pers. comm.), the potential effects of sections of the delivery pipeline located on land under provincial jurisdiction have been evaluated in accordance with the provincial Riparian Areas Regulation (RAR) governed under Section 12 of the provincial *Fish Protection Act*. The RAR requires a top-of-bank offset of two times the channel width (a minimum of 5 meters to a maximum of 10 metres) for drainage ditches (B.C. Ministry of Environment 2006a, Naito 2011). Depending on the final pipeline route selected, and as Project design progresses, further consultation will be conducted with DFO and MoE to obtain more detailed site-specific riparian setback requirements for the development of the Surface Water Quality / Fisheries Protection and Sediment Control Plan. This Plan will be a subcomponent of the CEM Plan, which will be developed following Project Certification and prior to commencement of construction.

Site 99-1: Highway 99 (below ramp) at intersection of Gage Road and Beckwith Road (**Photo 4.1-1** to **Photo 4.1-4**, **Appendix 4.1A**)

The drainage ditch along Beckwith Road passes under Highway 99. At the time of the site visit, the width of the channel ranged from 2 to 3 metres, while the wetted width was on average 1 metre. Water in the ditch was approximately 0.1 metres deep and exhibited little, if any, flow. The ditch banks were well-vegetated throughout; vegetation included invasive species, such as morning glory (*Convolvulus arvensis*) and Himalayan blackberry (*Rubus armeniacus*), as well as various species of grass. Instream cover was dense, consisting primarily of emergent grasses. There were significant amounts of garbage and foreign debris in the ditch. Iron staining and algae were also evident, indicating a likelihood of high chemical oxygen demand (COD) and biological oxygen demand (BOD).

Substrate consisted exclusively of fines and organic material. Overhead cover was variable, consisting primarily of Himalayan blackberry, ranging from 2 to 4 metres in height. Land use in this area was primarily industrial. Dissolved oxygen levels were too low to measure using a titration method. Shallow water depth did not permit the deployment of minnow traps.

Site 99-2: Southbound Highway 99 at large culvert near off-ramp to No 4 Road (**Photo 4.1-5** and **Photo 4.1-6**, **Appendix 4.1A**)

This drainage ditch flows under Highway 99 through a 4-metre diameter arch culvert.

At the time of the site visit, the channel and wetted widths were approximately 6 and 4 metres, respectively, with the vegetated riparian area extending approximately 3 to 4 metres on both sides. Water in the channel was approximately 0.3 metres deep; the ditch banks were relatively steep. Riparian vegetation consisted of evergreen blackberry (*Rubus villosus*), Himalayan blackberry, and common grasses.

There was little instream cover in this drainage ditch. The substrate consisted predominantly of organic material and cobble. Sections of the channel appeared to be concrete-lined. Flow was estimated at 0.1 to 0.2 metres/second. Iron staining and algae was also evident, indicating a likelihood of high COD and BOD. Three three-spine sticklebacks (*Gasterosteus aculeatus*) were caught at this site during the fish sampling program.

Site 99-3: Southbound Highway 99 immediately north of the on-ramp (Exit 37) to Alderbridge Way (**Photo 4.1-7** to **Photo 4.1-10**, **Appendix 4.1A**)

This drainage ditch flows parallel to Highway 99, to the west side of the southbound lane.

At the time of the site visit, the channel and wetted widths were approximately 1.5 and 1.2 metres, respectively. The riparian area extended approximately 3 to 4 metres on both sides. Water in the channel was approximately 0.3 meters deep and exhibited little, if any, flow. Ditch banks were steep and well-vegetated with grasses and shrubs. Riparian vegetation consisted of evergreen blackberry, Himalayan blackberry, and sedges and common grasses.

Dense emergent grass provided instream cover in this drainage ditch. The substrate consisted predominantly of organic material and fines. Duckweed was also recorded in the wetted area of the channel. Iron staining and algae were evident, indicating a likelihood of high COD and BOD. Thirty-six three-spine sticklebacks were caught at this site during the sampling program. Large tadpoles were also caught during the overnight minnow trap soak.

Site 99-4: Southbound Highway 99 immediately north of Westminster Highway overpass (**Photo 4.1-11** and **Photo 4.1-12**, **Appendix 4.1A**)

This drainage ditch flows parallel to Highway 99, along the west side of the southbound lane. The road surface is within 5 metres of the ditch. The ditch connects southward with a small pool immediately north of Westminster Highway and then flows into a concrete culvert at the south end of the pool.

At the time of the site visit, the channel and the wetted widths were approximately 7 and 5 metres, respectively. The pool and the culverted ditch section were approximately 4.5 and 2.5 metres wide, respectively. Water in the pool was approximately 0.7 metres deep, exhibited high turbidity but little, if any, flow. Ditch banks within 2 metres of the channel were moderately steep and well-vegetated with grasses. Riparian vegetation consisted of sedges and common grasses; however, the riparian cover of the east bank was limited due to the proximity to the highway.

Moderate emergent grass and floating vegetation (duckweed) provided instream cover in the pool. The substrate consisted of organic material and fines. Iron staining and algae were also evident, indicating a likelihood of high COD and BOD. Five three-spine sticklebacks were captured at this site during the sampling program.

Site 99-5: Southbound Highway 99 immediately south of Blundell Road overpass (**Photo 4.1-13** to **Photo 4.1-15**, **Appendix 4.1A**)

This drainage ditch flows parallel to the southbound lane on the west side of Highway 99. The paved surface of the highway is within 5 metres of the drainage ditch. A second ditch flows to the west, through a concrete culvert along a short access road to the B.C. Muslim Association Funeral Office.

At the time of the site visit, the channel and the wetted widths were approximately 6 and 4 metres, respectively. The width of the ditch varied from approximately 4 to 2 metres. Water level was approximately 0.35 metres, and exhibited relatively high turbidity and little, if any, flow. Ditch banks within 2 metres of the channel were moderately steep and well-vegetated with grasses. Riparian vegetation consisted of sedges and common grasses; however, riparian cover on both banks was limited due to the proximity to the highway and urban development.

Moderate emergent grass and large areas with floating vegetation (duckweed) provided instream cover in the ditch. The substrate consisted of organic material and fines. Iron staining and algae were also evident, indicating a likelihood of high COD and BOD.

Thirty three-spine sticklebacks and a large tadpole were captured at this site during the sampling program.

Site 99-6: Southbound Highway 99 north of Williams Road (**Photo 4.1-16** to **Photo 4.1-20**, **Appendix 4.1A**)

This drainage ditch flows parallel to the southbound lane on the west side of Highway 99. The paved surface of the highway is within 5 metres of the drainage ditch. A second network of drainage ditches flows to the west (perpendicular to Highway 99) through a well defined irrigation channel lined with large poplars.

At the time of the site visit, the channel and wetted widths were approximately 6 and 4.5 metres, respectively. Water in the ditch was approximately 0.45 metres deep, and exhibited relatively high turbidity and little, if any, flow. Ditch banks within 2 metres of the channel were moderately steep and well-vegetated with grasses and shrubs. Riparian vegetation on the left bank of the drainage ditch consisted of sedges and common grasses but riparian cover was limited due to the proximity to the highway. The right bank of the drainage ditch, as well as the banks of the westerly tributary were lined with large poplar trees and deciduous shrubs, providing over-story canopy cover.

There was very little emergent or floating vegetation (duckweed) in the channel. The substrate consisted exclusively of fines with a deep organic layer. Although the channel appeared to provide high rearing potential for fish, none were captured during the sampling program.

Site 99-7: Northbound Highway 99 north of Williams Road (**Photo 4.1-21** to **Photo 4.1-24**, **Appendix 4.1A**)

This drainage ditch flows parallel to the northbound (eastern) lane of Highway 99. The paved surface of the highway is located within 5 metres of the drainage ditch.

At the time of the site visit, the channel and wetted widths were approximately 4.5 and 4 metres, respectively. Water in the ditch was approximately 0.25 metres deep, exhibited relatively high turbidity, and little, if any, flow. The banks of the drainage ditch were moderately steep and well-vegetated with grasses and shrubs. Riparian vegetation consisted of shrubs, Himalayan blackberry and common grasses. The riparian cover on the west bank of the ditch was limited due to the proximity to Highway 99.

Moderate emergent, submergent, and floating vegetation (duckweed) provided instream cover in this drainage ditch. The channel substrate consisted of fines and an established organic layer. Iron staining and algae were evident, indicating a likelihood

of high COD and BOD. One three-spine stickleback was captured at this site during the sampling program.

Site 99-8: Northbound Highway 99 north of Blundell Road (**Photo 4.1-25** to **Photo 4.1-28**, **Appendix 4.1A**)

This drainage ditch flows parallel to the northbound (eastern) lane of Highway 99. The paved surface of the highway is within 5 metres of the drainage ditch.

At the time of the site visit, the channel and wetted widths were approximately 4.5 and 3.5 metres, respectively. Water in the ditch was approximately 0.30 metres deep, and exhibited relatively high levels of turbidity, and little, if any, flow. The banks of the drainage ditch were moderately steep and well-vegetated with grasses and shrubs. Riparian vegetation consisted of shrubs, Himalayan blackberry and common grasses. Riparian cover on the west bank was limited due to the proximity to Highway 99.

Moderate emergent and submergent vegetation and extensive floating vegetation (duckweed) provided instream cover in this drainage ditch. The channel substrate consisted of fines and an established organic layer. Iron staining and algae were also evident, indicating a likelihood of high COD and BOD. Two three-spine sticklebacks and four large tadpoles were captured at this site during the sampling program.

Site 99-9: Northbound Highway 99 north of Westminster Highway (**Photo 4.1-29** to **Photo 4.1-32**, **Appendix 4.1A**)

This drainage ditch flows parallel to the northbound (eastern) lane of Highway 99. The paved surface of the highway is within 5 meters of the drainage ditch.

At the time of the visit, the channel and wetted widths were approximately 5.5 and 5 metres, respectively. Water in the ditch was approximately 0.15 metres deep, and exhibited relatively high turbidity, and little, if any, flow. The banks of the drainage ditch exhibited moderate to shallow slopes and were well-vegetated with grasses. Riparian vegetation consisted primarily of common grasses. The riparian cover of the west bank was limited due to the proximity to Highway 99. The ditch appeared to have been recently contoured and grass seeded.

Emergent and submergent vegetation provided limited instream cover in the channel. The substrate consisted of fines and an established organic layer. Iron staining and algae were also evident, indicating a likelihood of high COD and BOD. No fish were captured at this site during the sampling program.

Site 99-10: Northbound Highway 99 parallel to Vanguard Road (**Photo 4.1-33** and **Photo 4.1-34**, **Appendix 4.1A**)

This drainage ditch flows parallel to the northbound (eastern) lane of Highway 99. The paved surface of the highway is 5 metres away from the drainage ditch.

Open ditches along Vanguard Road are also present in this section of Highway 99. Site 99-10 lies at the foot of the steep eastern bank of the raised Highway 99 road surface.

At the time of the site visit, the width of the channel ranged from 2.5 to 3 metres. Water in the ditch was approximately 0.1 metres deep and exhibited little, if any, flow. The west bank was steeply-sloped, while the east bank slope was more gradual. The entire wetted perimeter was well-vegetated with invasive species such as morning glory and Himalayan blackberry, as well as various grasses. There was dense instream cover consisting primarily of emergent cattails (*Typha* spp.). The riparian cover on the east bank was limited due to the proximity to Vanguard Road. There were significant amounts of garbage and debris in the ditch. Iron staining and algae were also evident, indicating a likelihood of high COD and BOD. The substrate consisted of fines and organic material. Overhead cover was variable, consisting primarily of grasses, cattails, and Himalayan blackberry on the west bank with some low grasses on the east bank. Two three-spine sticklebacks were captured at this site during the sampling program.

## Surface Water Quality

Surface water quality measurements were taken from the east and west drainage ditches along Highway 99. In general, measurements indicated that surface water quality conditions did not meet minimum criteria for salmonid habitat (B.C. Ministry of Environment 2009); this was consistent with findings from the water samples collected in the drainage ditches near / along Highway 99 in November 2009 for the Application (see Section 5.2). Results for the July 2011 sampling event were as follows:

- Temperature ranged from 14.2°C to 20.5°C, with 100% of temperature measurements being near or outside the range required for salmonids to maintain normal life history functions (Meehan and Bjornn 1991);
- Dissolved oxygen ranged from <1 to 2.5 milligrams per litre, with 100% of dissolved oxygen measurements being below the minimum required concentration required for salmonids to maintain normal life history functions (B.C. Ministry of Environment, Lands and Parks 1997); and

- pH ranged from 6.65 to 7.27, with no pH measurements being outside the pH range required for salmonids to maintain normal life history functions (Swain 1998).

Compared to the summer water quality, winter water quality in the Highway 99 drainage ditches (as far as temperature and dissolved oxygen level are concerned) can be considered more improved; however, based on testing results of water samples collected in the drainage ditches near / along Hwy 99 on November 30, 2009 for the EAC Application, only approximately half of the temperature and pH results and none of the dissolved oxygen results meet requirements for salmonid rearing.

**Fisheries Resources**

Fish inventories undertaken in support of this Addendum resulted in the capture of a total of 79 three-spine sticklebacks with 70% of the minnow traps recording at least one fish. Three-spine sticklebacks were caught in the drainage ditches along both the northbound and southbound lanes of Highway 99. No other fish species were captured.

### 4.1.4 Potential Effects, Recommended Mitigation Measures and Potential Residual Effects

#### *4.1.4.1 Project Construction*

**Description of Potential Effects**

Any effects due to the construction of the fuel delivery pipeline along Highway 99 will be localized and of limited duration (i.e., over the period in which construction begins until successful restoration and reclamation has occurred).

In advance of construction along Highway 99, riparian areas may require timber clearing, soil stripping and salvage, and grading for materials and equipment staging during pipeline installation, resulting in temporary loss of riparian habitat. Loss of habitat could occur in functional riparian areas. The drainage ditches located along the Highway 99 Pipeline Route offer, at best, marginal habitat for salmonids (see **Section 4.1.3**). Generally, conditions in these drainage ditches are only considered suitable for small-bodied fish species (e.g., three-spine stickleback) that can survive in a wide range (typically harsh) of environmental conditions.

Dry-ditch trenching will isolate the work area from water flow either through the installation of dams upstream and downstream of the trench alignment, or by redirecting water around the area using pumps or a flume pipe. Following backfilling, all work areas will receive a final grading to restore pre-construction contours and natural

drainage patterns. The areas will then be restored, in accordance with the CEM Plan, which will be developed prior to the commencement of construction (outline provided in **Chapter 9** of the Application).

In the absence of mitigation, potential effects during site preparation, pipeline construction, and site reclamation could include: erosion and sedimentation from exposed soil and soil piles resulting in the degradation of surface water quality, accidental discharge of deleterious materials to surface waters, and temporary interruption or loss of habitat for aquatic species during the installation of water crossings. Directional drilling has the potential to result in the accidental release of drilling fluids either at the construction site during drilling activities, or during disposal of excavated material. Permanent loss of riparian habitat may occur if portions of the final pipeline alignment are situated within buffer zones that are contributing functional aquatic habitat. However, the typically degraded state of riparian areas located adjacent to the drainage ditches along the Highway 99 Pipeline Route are likely to be improved during post-construction reclamation and restoration, relative to existing conditions.

## Mitigation Measures and Best Management Practices

Mitigation measures and best management practices are outlined in **Section 5.2.4.4** of the Application. During pipeline construction, mitigation protocols will be implemented that are consistent with BMPs and provincial and federal guidelines, as will be described in the CEM Plan (see **Chapter 9** of the Application). The CEM Plan will address issues related to erosion and sediment control, solid and liquid waste management, surface water quality, and fisheries mitigation.

Pipeline construction within riparian setback areas will not occur without prior regulatory approval. Works in and around the drainage ditches along Highway 99 will be conducted within the appropriate fisheries timing window, in isolation of flows, and following salvage of fish and other aquatic wildlife. If encroachment in riparian areas is unavoidable, riparian effects will be reduced through adherence to BMPs and federal and provincial guidelines (e.g., Fisheries and Oceans Canada and B.C. Ministry of Environment, Lands and Parks 1992; B.C. Ministry of Water Land and Air Protection 2004; B.C. Ministry of Environment 2006b). All riparian areas disturbed due to equipment and material staging and pipeline installation will be reclaimed and restored to pre-construction conditions or better.

**Potential Residual Effects**

Although temporary loss or alteration of riparian or aquatic habitat is expected, no species was identified within any of the five fisheries Valued Ecosystem Components (VECs; provincially Red- and Blue-listed Fish Species; Fish Species Identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) to be Endangered, Threatened, or of Special Concern; Fish Species of Special Concern Under the *Species at Risk Act* (SARA) Schedule 1; Species at Risk Requiring Protection Under the Provincial Identified Wildlife Management Strategy; and Fish Species of Regional Importance) for the Highway 99 routing alignment. In field surveys, only stickleback was confirmed as present. Surface Water Quality measurements at sampling locations indicated that surface water quality conditions did not meet minimum criteria for salmonid habitat. Since no effects were identified for VECs or surface water quality, no residual effects are anticipated.

#### *4.1.4.2 Project Operations*

No potential effects on fisheries, aquatics and water quality are expected from regular pipeline operations activities. As such, no mitigation measures are suggested for operations. No adverse residual effects are anticipated.

### 4.1.5 Significance of Residual Effects

For the purpose of this assessment, 'significant' residual effects have been defined as those that are expected to result in a permanent change to a VEC. Permanent changes have been identified where there may be a measurable change in aquatic habitat for identified VECs or surface water quality. Additionally, any physiological changes to biological VECs that result from temporarily diminished quality of aquatic habitat or surface waters would also be deemed significant residual effects. This approach is consistent with that taken for the assessment presented in **Section 5.2** of the Application.

#### *4.1.5.1 Project Construction*

Any loss of riparian or aquatic habitat during pipeline construction will be localized and temporary. Restoration and reclamation of riparian areas disturbed during construction will be conducted in accordance with Fisheries and Oceans Canada operational guidelines (Fisheries and Oceans Canada 2011) and modified as necessary to address site-specific local conditions.

No permanent loss of instream habitat will result from pipeline construction because:

- the pipeline will not be located in the instream portion of any surface water drainage ditches; and
- staging areas for pipeline construction will not be located in the instream portion of any watercourse.

No residual effects are expected from construction of the Highway 99 Pipeline Route Option.

#### *4.1.5.2 Project Operations*

Pipeline design features will ensure that the fuel delivery pipeline is safeguarded and potential residual effects during operations are prevented. As such, no potential residual effects during pipeline operations have been identified.

### 4.1.6 Potential Cumulative Impacts

The identification of cumulative impacts is dependent on there being a significant adverse residual effect resulting from Project construction or operations. Since no potential residual effects were identified in the assessment, no cumulative impacts were identified for fisheries and aquatics VECs for the Highway 99 Pipeline Route Option.

### 4.1.7 Conclusion

This assessment concludes that following mitigation no adverse residual effects of Project construction or operations on fisheries and aquatic resources VECs are expected. Potential cumulative impacts are assessed as “nil”.

### 4.1.8 References

B.C. Ministry of Environment. 2006. Riparian Area Regulation, Schedule 1: Riparian Area Regulation Assessment Methods. [Online] Available at: http://www.env.gov.bc.ca/habitat/fish_protection_act/riparian/documents/assessment_methods.pdf (Accessed on September 29, 2011).

B.C. Ministry of Environment. 2006b. Develop With Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia. [Online] Available at: http://www.env.gov.bc.ca/wld/documents/bmp/devwithcare2006/develop_with_care_intro.html (Accessed on October 15, 2009).

B.C. Ministry of Environment, Lands and Parks. 1997. Ambient Water Quality Criteria for Dissolved Oxygen. Water Management Branch, Victoria, British Columbia.

[Online] Available at: http://www.env.gov.bc.ca/wat/wq/BCguidelines/do/do_over.html

B.C. Ministry of Water, Land and Air Protection. 2004. Standards and Best Practices for Instream Works. Ecosystem Standards and Planning, Biodiversity Branch. WLAP BMP Series. [Online] Available at: http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf (Accessed on October 15, 2009).

Canadian Council of Ministers of the Environment (CCME). 2010. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Ammonia. Update to Canadian Water Quality Guidelines for the Protection of Aquatic Life. Summary Table. Updated December 2007. *In:* Canadian Council of Ministers of the Environment. 2010. Canadian Water Quality Guidelines. Winnipeg, Manitoba.

City of Richmond. 2009. Riparian Areas Regulation (RAR). Policies and Initiatives. [Online] Available at: http://www.richmond.ca/services/Sustainable/environment/policies/rar.htm

Fisheries and Oceans Canada. 2011. Operational Statements for British Columbia and Yukon. [Online] Available at: http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/index-eng.htm#Operational_Statements_for_British_Columbia_and_Yukon (Accessed on October 13, 2011).

Fisheries and Oceans Canada and B.C. Ministry of Environment, Lands and Parks. 1992. Land Development Guidelines for the Protection of Aquatic Habitat. Prepared by B. Chilibeck, Department of Fisheries and Oceans and G. Chislett and G. Norris, B.C. Ministry of Environment, Lands and Parks. [Online] Available at: http://www.dfo-mpo.gc.ca/Library/165353.pdf (Accessed on October 15, 2009).

Meehan, W.R. and T.C. Bjornn. 1991. Salmonid distributions and life histories: influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication no. 19:47-82.

Naito, B. 2011. Senior Habitat Biologist – Fisheries and Oceans Canada. Telephone conversation with Dan Moats of Hatfield Consultants Partnership with regard to riparian setbacks on August 4 and September 29, 2011.

Swain, L.G. 1998. Water quality assessment and objectives, for the Fraser River from Hope to Sturgeon and Roberts Banks. Summary Report – First Update. B.C.

Ministry of Environment, Lands and Parks. [Online] Available at: http://www.env.gov.bc.ca/wat/wq/objectives/hopebank/lowerfraser.html

# Section 4.2
## Vegetation, Wildlife and Wildlife Habitat Assessment

# 4.2 Vegetation, Wildlife and Wildlife Habitat Assessment

## 4.2.1 Approach and Methodology

This assessment follows the same approach and methodology described in **Section 5.3.2** of the Application. Potential effects to vegetation, wildlife, and wildlife habitat associated with construction and operation of the Highway 99 Pipeline Route Option are assessed. Mitigation measures to avoid or minimize adverse effects are described, and the significance of any potential residual effects is evaluated. The assessment is supported by data gathered during fieldwork in June and July 2011.

This assessment was prepared by Robertson Environmental Services Ltd.

### *4.2.1.1 Methodology Framework*

**Species at Risk / Rare Species**

Species at risk and rare species that may potentially occur were identified and are listed in **Table 4.2A-1** (**Appendix 4.2A**). Rare and/or listed species are discussed in detail in **Section 5.3.3** of the Application.

**Field Surveys**

A total of three field surveys were conducted for terrestrial wildlife and vegetation along the Highway 99 Pipeline Route Option on June 26, July 1, and July 2, 2011.

**Figure 4.2.1** shows the survey locations of encounter transects. Detailed survey methods are described in **Section 5.3.3.5** of the Application.

**Encounter Transect Surveys**

Sixteen encounter transect surveys were completed along the Highway 99 Pipeline Route Option (**Figure 4.2.1**). Five transects were completed on June 26, eight on July 1, and three on July 2, 2011, thoroughly covering all representative habitats. Surveys were conducted directly from the shoulder of Highway 99. Due to seasonal sampling constraints (e.g., summer), site access logistics, site safety (i.e., highway environment), and timing of year (i.e., visibility restrictions during leaf-out conditions), there were limitations to the information collected. Site-specific attributes documented included; all wildlife observed, raptor nests visible from Highway 99, apparent use of trees by raptors indicating potential breeding territory (e.g., whitewash, pellets, feathers, etc.), indicators

of wildlife activity (e.g., foraging, shed hair, tracks, recently excavated cavities, etc.) and wildlife movement corridors.

**Habitat Assessment Surveys**

For each of the sixteen encounter transects conducted, a habitat assessment was simultaneously completed. Habitat assessment methodology is described in **Section 5.3.3.5** of the Application.

**Valued Ecosystem Components**

VECs were identified based on an evaluation of vegetation and wildlife resources following the characterization of baseline conditions, the results of supplementary field investigations, and the professional judgment of the study team. VECs for this assessment are described in **Section 4.2.4.**

**Determination of Significance of Potential Residual Effects**

The methodology for determining the significance of potential residual effects is described in **Section 5.3.2.5** of the Application.

### 4.2.2 Study Area

#### *4.2.2.1 Spatial Boundaries*

For the purpose of this Addendum, the study area (**Figure 4.2.1**) encompassed a 50-metre wide linear corridor along Highway 99 from Bridgeport Trail south to Williams Road. The width of the study area was extended to 150 metres where possible for the purposes of surveying and assessing potential effects on raptor and heron nests.

#### *4.2.2.2 Temporal Boundaries*

The temporal boundary for the assessment was assumed approximately 12 months for the construction phase of the Highway 99 Pipeline Route Option and at least 60 years for pipeline operations.

## 4.2.3 Baseline Conditions

### *4.2.3.1 Terrestrial Vegetation*

**Ecosystem Overview**

The Highway 99 Pipeline Route Option lies predominantly within the CDFmm (Moist Maritime Coastal Douglas-fir) biogeoclimatic subzone, which is characterized by long growing seasons, warm, dry summers and mild winters. A small area (≤5%) between Cambie Road and the Bridgeport Trail characterized by commercial and industrial landscapes, lies within the CWHxm1 (Very Dry Maritime Coastal Western Hemlock) subzone.

The Highway 99 Pipeline Route Option is within a four-to-six lane highway right-of-way and traverses through highly modified urban, commercial and industrial areas to the north, and agricultural lands to the south. The Richmond Nature Park to the east and west of Highway 99 buffers the urban / commercial / industrial areas from the agricultural areas. The park consists of over 200 acres of raised peat bog habitat (City of Richmond 2011).

**Table 4.2.1** provides results from the Supplemental Summary Habitat Assessment Forms. **Figure 4.2.1** shows locations of the habitat assessment areas surveyed. A description of the habitat assessment sampling stations is found in **Table 4.2A-2** (**Appendix 4.2A**). Habitat types and vegetation communities along Highway 99 are characterized in more detail below.

**Table 4.2.1 Habitats (Structural Stage, Percentage of Crown Closure and Coarse Woody Debris) and Dominant Vegetation at Habitat Assessment Stations along the Highway 99 Pipeline Route Option**

| Description | Station 1 | | | |
|---|---|---|---|---|
| | ET-5 | ET-6 | ET-11 | ET-16 |
| Habitat | | | | |
| Structural Stage | 3B | 4 | 3B | 3B |
| Crown Closure (%) | 5 | 10 | 5 | 5 |
| CWD 2 (%) | 1 | 2 | 1 | 1 |
| Dominant Vegetation | | | | |
| Tree Species | % | % | % | % |
| *Alnus rubra* | - | 5 | - | 1 |

| Description | Station 1 | | | |
|---|---|---|---|---|
| | ET-5 | ET-6 | ET-11 | ET-16 |
| *Betula x pipera* | 92 | 30 | 30 | 60 |
| *Pinus contorta* | - | 10 | - | - |
| *Populus balsmifera* | 4 | 10 | 5 | - |
| *Pseudotsuga menziesii* | - | 10 | - | - |
| *Thuja plicata* | - | 10 | - | - |
| Shrub Species | % | % | % | % |
| *Epilobium angustifolium* | 2 | - | - | 1 |
| *Gaultheria shallon* | 80 | - | - | 6 |
| *Pteridium aquilinum* | 8 | 1 | - | 1 |
| *Rosa nutkana* | - | - | 1 | - |
| *Rubus laciniatus* | 8 | 1 | 3 | 3 |
| *Rubus spectabilis* | 1 | 1 | - | - |
| *Sambucus racemosa* | - | 12 | 5 | - |
| *Sorbus sitchensis* | 2 | 10 | - | 1 |
| *Spiraea douglasii* | 1 | 1 | 5 | 6 |
| *Tsuga heterophylla* | 2 | 10 | - | 8 |
| *Vaccinium* sp. | - | - | - | 1 |

The locations of habitat assessment stations are provided in **Table 4.2A-2** (**Appendix 4.2A**).
ET = Encounter Transect
CWD = Coarse Woody Debris
Urban (Residential / Agricultural / Industrial) Landscape

## Agricultural Lands

A contiguous tract of agricultural lands lies between Westminster Highway and Williams Road, along both east and west sides of the southern portion of the Highway 99 Pipeline Route Option. ALR lands are bordered by a variety of cultivated fields (including vegetable crops, blueberries and pasture), fallow fields, small lots and the Mylora Golf Course. Highway edges in this area are covered in reed canary grass (*Phalaris arundinacea*) and other mixed grasses (10+ species), fireweed (*Epilobium angustifolium*), horsetail (*Equisetum* sp.), vetch (*Astragalus* sp.), purple-leaved willow herb (*Epilobium ciliatum*), foxglove (*Digitalis purpurea*), curled dock (*Rumex crispus*), and other roadside weeds (**Photo 4.2-1**, **Appendix 4.2B**; **ET-4**). The agricultural fields are often lined with scattered hedgerows of birch (*Betula* sp.), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), red alder (*Alnus rubra*), ornamental cedar,

mountain ash (*Sorbus* sp.), Himalayan (*Rubus armeniacus*) and evergreen blackberries (*Rubus laciniatus)*, and/or hardhack (*Spiraea douglasii* ssp. *douglasii*).

Between Westminster Highway and Blundell Road, remnant bog forest habitat (structural stage 3B – tall shrub) is evident on both sides of Highway 99 in varying widths ranging from 15 to 225 metres and abuts adjacent agricultural lands. The dominant tree species is birch, which is complimented by other less dominant species of trees including western hemlock (*Tsuga heterophylla*), cherry (*Prunus* sp.), red alder, and black cottonwood. The understory comprises hardhack, salal (*Gaultheria shallon*), mountain ash, red elderberry (*Sambucus racemosa)*, bracken fern (*Pteridium aquilinum)*, Himalayan and evergreen blackberries, as well as over ten species of grasses and other roadside forbs. ET-5 is representative of this type of habitat (**Table 4.2.1**; **Photo 4.2-2**, **Appendix 4.2B**).

**Residential / Industrial Areas**

Along the west side of Highway 99 where it crosses Shell Road north to the Bridgeport Trail, a hedgerow of trees and shrubs comprising laurel, Himalayan blackberry, cherry, alder, ash and ornamental trees creates a buffer between a residential / commercial / industrial area and Highway 99 (**Photo 4.2-3**, **Appendix 4.2B**; **ET-9**). A strip of mixed grasses line the highway. A ditch parallels Highway 99 between No. 4 and Shell Roads. No ditch exists between No. 4 Road and Bridgeport Road.

The east side of Highway 99 from Bridgeport Road to the Highway 99 / 91 interchange either lacks a vegetation buffer or supports a thin fringe of grasses and forbs. The area was not sampled because it lacked any noteworthy habitat attributes.

**Aquatic Habitat**

Aquatic habitats in the study area are limited to the surface water drainage ditches bordering Highway 99. Vegetation along the ditches includes grasses, fireweed, blackberry, hardhack, and red elderberry. A perimeter ditch on both east and west sides of Highway 99 extends from Westminster Highway south to the Williams Road easement and beyond (**Photo 4.2-4**, **Appendix 4.2B**; **ET-16**). These ditches support duckweed (*Lemna* sp.), sedges (*Carex* sp.) and rushes (*Juncus / Luzula* sp.). Cattails (*Typha* sp.) and bullrushes are limited to the east drainage channel south of Westminster Highway.

## Woodland Habitat

A high water table and acidic soils in bog areas limit tree growth on Lulu Island, with only two species adapted to these conditions: birch (primarily European birch (*Betula pendula*) and hybrids with paper birch (*Betula papyrifera*) and shore pine (*Pinus contorta* var. *contorta*). The only areas where woodland habitat (< 1 ha) occurs along the Highway 99 Pipeline Route Option lie between the Highway 99 / 91 interchange and Westminster Highway (Richmond Nature Park), and the remnant bog forest along the west side of Highway 99 south of Shell Road.

The Richmond Nature Park is situated between Highway 91 / Alderbridge Way and Westminster Highway: the public park on the west side of Highway 99 and the study centre on the east side. A structural stage 4 birch-dominated forest with 10% crown closure exists along ET-6 (**Photo 4.2-5**, **Appendix 4.2B**; **Table 4.2.1**).

A small isolated woodland (approximately 1.2 hectares) exists south of Shell Road north of the Highway 99 / 91 interchange on the west side of Highway 99 (**Photo 4.2-6**, **Appendix 4.2B**; **ET-11**). This remnant bog forest patch comprises hybrid birch and black cottonwood as the treed layer, a shrub layer of Himalayan blackberry, red elderberry, hardhack, evergreen blackberry and mountain ash, and is lined by reed canary grass and other grasses and forbs. A perimeter ditch system carries southwards to the Highway 99 / 91 interchange.

## Rare Plants

Rare plants that may potentially occur in the study area are documented in **Table 4.2A-1** (**Appendix 4.2A**). Species in this table that were previously described in the Application (and whose status remained unchanged since Application submission) are discussed in **Section 5.3.4.3** of the Application.

Nine new species were identified as rare and have the potential to occur in the study area: Cyperus (*Cyperus retrorsus*), Poverty Oatgrass (*Danthonia spicata)*, Milk Spurge (*Euphorbia supins),* Large Canadian St. John's Wort (*Hypericum majus*), Purple-leaved Willowherb (*Epilobium ciliatum* ssp. *watsonii),* Yellowseed False Pimpernel (*Lindernia dubia* var. *dubia*); Howell's Montia (*Montia howellii*), Pink Watergreen (*Pyrola asarifolia* var. *purpurea*), and Northern Water-meal (*Wolffia borealis)* (B.C. Conservation Data Centre 2011). Of these nine species, Yellowseed False Pimpernel and Northern Water-meal are provincially Red-listed. The Purple-leaved Willowherb has been delisted from Blue to Yellow since the submission of the Application for review, but is still considered a rare species.

No systematic rare plant surveys were conducted during the June / July 2011 field surveys. These surveys are recommended prior to the onset of any construction-related activities, which is consistent with the approach described in the Application.

#### *4.2.3.2 Terrestrial Wildlife*

**Birds**

Thirty-nine species of birds comprising 611 individuals were detected during the breeding bird surveys conducted in June / July, 2011(**Table 4.2A-3**, **Appendix 4.2A**). The most abundant species were Northwestern Crow (*Corvus caurinus*), Black-capped Chickadee (*Poecile atricapillus*), Cedar Waxwing (*Bombycilla cedrorum*), Song Sparrow (*Melospiza melodia*), and American Goldfinch (*Carduelis tristis*). The most frequently detected species were the Northwestern Crow, American Robin, Cedar Waxwing, Song Sparrow and American Goldfinch. Conversely, species with the lowest number of individuals were Double-crested Cormorant (*Phalacrocorax auritus*), Northern Harrier (*Circus cyaneus*), Pacific Slope Flycatcher (*Empidonax difficilis*), Red-eyed Vireo (*Vireo olivaceus*), Brown Creeper (*Certhia americana*), White-crowned Sparrow (*Zonotrichia leucophrys*), Lazuli Bunting (*Passerina amoena*), and Purple Finch (*Carpodacus purpureus*).

The majority of birds detected are assumed to be breeders or dispersing individuals due to the timing of the surveys (i.e., during the breeding bird window). **Table 4.2A-3** (**Appendix 4.2A**) provides a complete list of species and number of individuals detected per encounter transect.

Double-crested Cormorant (provincially Blue-listed), Caspian Tern (*Hydroprogne caspia*; provincially Blue-listed species), and Black Swift (*Cypseloides niger*), were noted as “flyovers” and were not considered part of the regular avifauna; suitable habitat for these species does not exist within the study area. Other species detected that would not likely breed in the study area and are likely migrants and/or passing through between roosting and foraging areas included the Glaucous-winged Gull (*Larus glaucescens*), Red-eyed Vireo, and Lazuli Bunting.

All other species detected in the June / July 2011 field surveys are expected to breed in the vicinity of the study area. Barn Swallow (provincially Blue-listed) is the only species at risk expected to breed adjacent to the study area in barns, sheds and other structures.

Species expected to occur in the study area and not detected during the June / July 2011 field surveys include Cooper's Hawk (*Accipter cooperii*), Northern Flicker (*Colaptes auratus*), Hammond's Flycatcher (*Empidonax hammondii)*, Red-breasted Nuthatch (*Sitta canadensis),* Red-winged Blackbird (*Agelaius phoeniceus*), and Brewer's Blackbird (*Euphagus cyanocephalus*).

**Passerines (Breeding Songbirds)**

The songbird species most frequently detected during the June / July 2011 field surveys are listed in **Table 4.2.2**. It should be noted that the number of birds detected is not necessarily a measure of relative abundance as many birds are easier to detect than others due to their behaviour.

**Table 4.2.2 Most Frequently Detected Songbird Species and Total Number of Individuals Recorded during Encounter Transect Surveys – June 26, July 1 and 2, 2011**

| Songbird Species Detected | Total No. Detected |
|---|---|
| Northwestern Crow | 88 |
| Black-capped Chickadee | 71 |
| Cedar Waxwing | 70 |
| Song Sparrow | 53 |
| American Goldfinch | 48 |
| American Robin | 44 |
| European Starling | 28 |
| Barn Swallow | 18 |
| Common Yellowthroat | 18 |
| Spotted Towhee | 14 |
| House Finch | 14 |
| Brown-headed Cowbird | 8 |

**Passerines (Non-breeding Songbirds)**

Due to seasonal sampling limitations, surveys targeting spring and fall migration as well as over-wintering birds were not conducted. Spring and fall migration would bring an influx of diverse songbird species passing through the study area as they continue in transit. Overwintering songbird species expected to occur in the study area, including many of the passerines detected during the June / July 2011 breeding bird surveys are listed in **Table 4.2.3**.

**Table 4.2.3 Overwintering Songbird Species Expected to Occur in the Richmond Study Area**

| Common Name | Latin Name |
|---|---|
| Northern Shrike | *Lanius excubitor* |
| Steller's Jay | *Cyanocitta stelleri* |
| Northwestern Crow | *Corvus caurinus* |
| Black-capped Chickadee | *Poecile atricapillus* |
| Bushtit | *Psaltriparus minimus* |
| Red-breasted Nuthatch | *Sitta canadensis* |
| Brown Creeper | *Certhia americana* |
| Bewick's Wren | *Thryomanes bewickii* |
| Pacific Wren | *Troglodytes pacificus* |
| Golden-crowned Kinglet | *Regulus satrapa* |
| Ruby-crowned Kinglet | *Regulus calendula* |
| American Robin | *Turdus migratorius* |
| Varied Thrush | *Ixoreus naevius* |
| European Starling | *Sturnus vulgaris* |
| Cedar Waxwing | *Bombycilla cedrorum* |
| American Pipit | *Anthus rubescens* |

| Common Name | Latin Name |
|---|---|
| Spotted Towhee | *Pipilo maculatus* |
| Savannah Sparrow | *Passerculus sandwichensis* |
| Fox Sparrow | *Passerella iliaca* |
| Song Sparrow | *Melospiza melodia* |
| Lincoln's Sparrow | *Melospiza lincolnii* |
| White-crowned Sparrow | *Zonotrichia leucophrys* |
| Golden-crowned Sparrow | *Zonotrichia atricapilla* |
| Dark-eyed Junco | *Junco hyemalis* |
| Red-winged Blackbird | *Agelaius phoeniceus* |
| Western Meadowlark | *Sturnella neglecta* |
| Brown-headed Cowbird | *Molothrus ater* |
| Purple Finch | *Carpodacus purpureus* |
| House Finch | *Carpodacus mexicanus* |
| American Goldfinch | *Carduelis tristis* |
| House Sparrow | *Passer domesticus* |

(Source: M. Toochin, Unpublished Field Notes)

**Raptors**

Raptor species that may potentially utilize the study area for breeding include; Bald Eagle (*Haliaeetus leucocephalus)*, Cooper's Hawk, Red-tailed Hawk (*Buteo jamaicensis*), Barn Owl (*Tyto alba*), Great-horned Owl (*Bubo virginianus*), Barred Owl (*Strix varia*), and Long-eared Owl (*Asio otus*).

Surveys targeting diurnal and nocturnal raptor nests were not conducted because optimal timing passed by the time the June / July 2011 surveys had commenced.

A Red-tailed Hawk nest was coincidentally detected on July 2, 2011 approximately 12 metres from the ground on top of a birch snag along the west side of Highway 99, approximately 250 metres south of the Westminster Highway overpass (**Photo 4.2-7**, **Appendix 4.2B**). The status of this nest was not confirmed, and given the time of year

observed, young may have already fledged from the nest. However, based on its physical appearance (e.g., nest structure appeared to be well maintained) at this time of year, and the presence, frequency of occurrences and proximity of adult Red-tailed Hawks to the nest site (July 2, 2011), the nest was likely active this year. One adult Red-tailed Hawk was observed on June 26, 2011 within 1.5 kilometres of the nest, and was also observed twice on July 2, 2011 within 2.5 kilometres of the nest flying over the study area and also perched on a tree within 100 metres of the nest site. A pair of adult Red-tailed Hawks was observed within 50 metres of the nest on July 2, 2011.

Other raptor species (e.g., Bald Eagle, Cooper's Hawk) may also use trees along the vegetated strip of Highway 99 for breeding, provided adequate security is available (i.e., nest is concealed enough from predators and people). Supplementary bird nest surveys are recommended before the onset of any construction-related activities along the Highway 99 Pipeline Route Option.

The proximity of forest habitat to adjacent agricultural fields may also provide suitable breeding and foraging habitat for Great Horned Owls. The Barn Owl (SARA-1- and provincially Blue-listed) could potentially breed in barns and sheds adjacent to the study area and would likely use agricultural fields for foraging. Barred and Long-eared Owls, the Sharp-shinned Hawk (*Accipter striatus)* and Merlin (*Falco columbarius*) have also been known to overwinter in the study area (M. Toochin, pers. comm.). Northern Saw-whet Owl (*Aegolius acadicus)* would likely use the forested area for roosting and agricultural fields / forest / edge habitat for feeding.

**Aquatic Birds**

The only waterfowl species observed during the June / July 2011 breeding bird surveys was the Mallard (*Anas platyrhynchos)*. This species was detected at 5 of 16 transects; typically 1 to3 individual adults were observed utilizing the ditches along Highway 99 or heard flying over on one occasion. A female Mallard with 6 ducklings was observed in the riparian pond habitat east of Highway 99 between Westminster Highway and Alderbridge Way.

Other overwintering waterfowl expected to utilize the ditches, ponds, and agricultural fields along Highway 99 are Canada Geese (*Branta canadensis)*, American Widgeon (*Anas americana)*, Northern Pintail (*Anas acuta)* and Green-winged Teal (*Anas crecca*). Hooded Merganser (*Lophodytes cucullatus*) may also utilize these ditches for feeding in the winter.

## Non-avian Wildlife

A list of non-avian wildlife detected during the June / July 2011 field surveys is provided in **Table 4.2.4**. A complete list of non-avian wildlife expected to occur in the study area is provided in **Section 5.3.4.3** and **Appendix 5.3D** of the Application.

**Table 4.2.4 Non-avian Wildlife Recorded during Encounter Transect Surveys in June / July 2011**

| Common Name | Latin Name | Encounter Transect | Detection Type | Date |
|---|---|---|---|---|
| Green Frog | *Lithobates clamitans* | ET-11 | Call | July 1, 2011 |
| | | ET-12 | Call | July 2, 2011 |
| | | ET-15 | Call, Visual | July 2, 2011 |
| | | ET-16 | Call, Visual | July 2, 2011 |
| Coyote | *Canis latrans* | ET-2 | Visual | June 26, 2011 |

No significant wildlife features were noted along Highway 99. The riparian area along the east side of Highway 99 between Alderbridge Way and Westminster Highway, the ditch networks along Highway 99 and the bog forest of the Richmond Nature Park and remaining remnant strips along Highway 99 would provide some habitat values for species (e.g., mice, voles, squirrels) listed in **Appendix 5.3D** of the Application.

## Amphibians and Reptiles

A total of seven Green Frogs (*Lithobates clamitans*) were observed and/or heard calling from the drainage ditches along Highway 99 during four encounter transect surveys on July 1 and 2, 2011 (see **Table 4.2.4**). Systematic surveys specifically targeting amphibians and reptiles were not conducted. Additional information on amphibians and reptiles is available in **Section 5.3.3** of the Application.

## Insects

**Appendix 5.3D** of the Application lists potential insect species that may occur in the vicinity of the pipeline routes assessed in the Application and Addendum. **Table 4.2.5** below lists species that may occur in addition to those listed in the Application that were not previously documented due to new information obtained since the submission of the Application (Hatch 2010).

**Table 4.2.5 List of Insect Species that Occur in Richmond, B.C. (in addition to Those Listed in Appendix 5.3D of the Application)**

| Common Name | Latin Name |
|---|---|
| **Dragonflies and Damselflies** | |
| Pacific Forktail | *Ischnura cervula* |
| Swift Forktail | *Ischnura erratica* |
| Spotted Spreadwing | *Lestes congener* |
| California Darner | *Rhionaeschna californica* |
| Blue-eyed Darner | *Rhionaeschna multicolor* |
| Paddle-tailed Darner | *Aeshna palmata* |
| Cardinal Meadowhawk | *Sympetrum illotum* |
| **Butterflies** | |
| Arctic Skipper | *Carterocephalus palaemon* |
| Anise Swallowtail | *Papilio zelicaon* |
| Margined White | *Pieris marginalis* |
| Western-tailed Blue | *Everes amyntula* |
| Purplish Copper | *Lycaena helloides* |
| Milbert's Tortoiseshell | *Aglais milberti* |
| Mourning Cloak | *Nymphalis antiopa* |
| California Tortoiseshell | *Nymphalis californica* |
| Red Admiral | *Vanessa atalanta* |
| Painted Lady | *Vanessa cardui* |
| West Coast Lady | *Vanessa annabella* |

(Source: Klinkenberg 2011a,b; Davis and Klinkenberg 2008)

The Western Pine Elfin *sheltonensis* ssp. (*Callophrys eryphon sheltonensis*), a provincially Blue-listed butterfly species, was recorded from the Richmond Nature Park in 2002 and 2003 (Davis and Klinkenberg 2008) and could potentially occur along Highway 99.

**Mammals**

Mammal species that could occur along Highway 99 are described in **Section 5.3.4.3** of the Application. During encounter transect surveys in June / July 2011, five young Coyote (*Canis latrans*) pups were observed dispersed throughout a bare field. The pups were then observed heading towards a potential den location mid-way along the northern edge of the field paralleling Kingsbridge Drive to the west.

**Species at Risk**

Species at Risk are described in **Section 5.3.4.3** of the Application.

### 4.2.4 Valued Ecosystem Components

#### *4.2.4.1 Identification of VECs*

Consistent with the approach described in the Application for identifying VECs, the six VECs selected for the Highway 99 Pipeline Route Option include:

- Terrestrial vegetation;
- Plant species at risk;
- Aquatic birds;
- Terrestrial wildlife;
- Bird species at risk; and
- Non-bird species at risk.

#### *4.2.4.2 Provincially red and blue-listed wildlife, plant species, and plant communities*

Ten plant and twenty-three wildlife species included in this assessment are provincially blue-listed; four plant and ten wildlife species are red-listed (see **Table 4.2A-1**, **Appendix 4.2A**). A complete list of wildlife and plant species at risk that potentially occur along Highway 99 is provided in **Table 4.2A-1** (**Appendix 4.2A**).

Provincially listed species are included in the selected VECs (**Table 4.2.6**). The VECs were inclusive categories, thus many species are included in more than one category.

**Table 4.2.6 Provincially Blue- and Red-listed Wildlife and Vegetation Species, Species Groups and Communities Included within Valued Ecosystem Components**

| Valued Ecosystem Components | Species / Species Groups / Communities | |
|---|---|---|
| | **Blue-Listed** | **Red-Listed** |
| Terrestrial Vegetation | Vancouver Island Beggarticks, Three-flowered Waterwort, Small Spike-rush, Nuttall's Waterweed, Pointed Rush, Flowering Quillwort, False Pimpernel, Ussurian Water-milfoil, Yellow Marsh Marigold | Green-fruited Sedge, Yellowseed False Pimpernel, Streambank Lupine, Northern Watermeal |
| Plant Species and Plant Communities at Risk | Henderson's Checkermallow, plus all blue listed species under Terrestrial Vegetation | Green-fruited Sedge, Yellowseed False Pimpernel, Streambank Lupine, Northern Watermeal |
| Aquatic Birds | Great Blue Heron *fannini* ssp., American Bittern, Green Heron, Caspian Tern | Black-crowned Night-Heron |
| Terrestrial Wildlife | Western Toad, Northern Red-legged Frog, Great Blue Heron *fannini* ssp., Short –eared Owl, Olive-sided Flycatcher, Sooty Grouse, Barn Swallow, Western Screech Owl *kennicotti* ssp., Band-tailed Pigeon, Purple Martin, Barn Owl | Western Painted Turtle (Pacific Coast Population), Northern Goshawk *laingi* ssp., Peregrine Falcon *anatum* ssp., Snowshoe Hare *washingtonii* ssp., Long-tailed Weasel *altfrontalis* ssp., Southern Red-backed Vole *occidentalis* ssp., Keen's Myotis Pacific Water Shrew, Olympic Shrew |
| Bird Species at Risk | Great Blue Heron *fannini* ssp., Short-eared Owl, American Bittern, Green Heron, Olive-sided Flycatcher, Sooty Grouse, Barn Swallow, Caspian Tern, Western Screech-owl *kennicottii* ssp., | Northern Goshawk *laingi* ssp., Peregrine Falcon *anatum* ssp., Black-crowned Night-Heron |

| Valued Ecosystem Components | Species / Species Groups / Communities | |
|---|---|---|
| | **Blue-Listed** | **Red-Listed** |
| | Band-tailed Pigeon, Purple Martin, Barn Owl | |
| Non-Bird Species at Risk | Western Toad, Northern Red-legged Frog, Townsend's Big-eared Bat, Trowbridge's Shrew, Beaverpond Baskettail, Blue Dasher, Autumn Meadowhawk, Western Pine Elfin *sheltonensis* ssp., Monarch, Silver-spotted Skipper, Dun Skipper | Western Painted Turtle (Pacific Coast Population), Snowshoe Hare *washingtonii* ssp., Long-tailed Weasel *altfrontalis* ssp., Southern Red-backed Vole *occidentalis* ssp., Keen's Myotis, Pacific Water Shrew, Olympic Shrew, Zerene Fritillary *bremnerii* ssp. |

#### *4.2.4.3 Wildlife and plant communities identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Endangered, Threatened, or of Special Concern*

Seventeen plant and wildlife species designated "at risk" by COSEWIC (i.e., three as "Endangered", five as "Threatened", and nine as "Special Concern"; **Table 4.2A**, **Appendix 4.2A**) with the potential to occur along Highway 99 are included below within appropriate VECs (**Table 4.2.7**).

**Table 4.2.7 Species Listed by COSEWIC as Endangered, Threatened, and Of Special Concern and Included as Valued Ecosystem Components in the Addendum**

| Valued Ecosystem Components | COSEWIC Listed Species | | |
|---|---|---|---|
| | **Endangered** | **Threatened** | **Special Concern** |
| Terrestrial Vegetation | Streambank Lupine | - | Vancouver Island Beggarticks |
| Plant Species at Risk | Streambank Lupine | - | Vancouver Island Beggarticks |
| Aquatic Birds | - | - | Great Blue Heron *fannini* ssp. |

| Valued Ecosystem Components | COSEWIC Listed Species | | |
|---|---|---|---|
| | Endangered | Threatened | Special Concern |
| Terrestrial Wildlife | Western Painted Turtle (Pacific Coast Population), Pacific Water Shrew | Northern Goshawk *laingi* ssp., Olive-sided Flycatcher, Barn Swallow, Barn Owl, Dun Skipper | Western Toad, Northern Red-legged Frog, Great Blue Heron *fannini* ssp., Short-eared Owl, Peregrine Falcon *anatum* ssp., Western Screech-Owl *kennicottii* ssp., Band-tailed Pigeon, Monarch |
| Bird Species at Risk | - | Northern Goshawk *laingi* ssp., Olive-sided Flycatcher, Barn Swallow, Barn Owl | Great Blue Heron *fannini* ssp., Short-eared Owl, Peregrine Falcon *anatum* ssp., Western Screech-Owl *kennicottii* ssp., Band-tailed Pigeon, Monarch |
| Non-Bird Species at Risk | Western Painted Turtle (Pacific Coast Population), Pacific Water Shrew | Dun Skipper | Western Toad, Northern Red-legged Frog, Monarch |

#### *4.2.4.4 Wildlife and plant species listed in Schedules 1, 2, and 3 of the SARA, and areas identified as Critical Habitat under SARA or in any posted draft Recovery Strategy*

Fifteen plant and wildlife species considered in this assessment are included on the SARA Schedule 1 list, and two on the SARA Schedule 3 list (see **Table 4.2A-1**, **Appendix 4.2A**). Those designated in the two categories are listed below within appropriate VECs (**Table 4.2.8**).

**Table 4.2.8 Species at Risk Listed under the *Species at Risk Act* Schedules 1 and 3 that are Included as Valued Ecosystem Components in the Addendum**

| Valued Ecosystem Components | *Species at Risk Act* Schedules | |
|---|---|---|
| | 1 | 3 |
| Terrestrial Vegetation | Vancouver Island Beggarticks, Streambank Lupine | - |
| Plant Species at Risk | Vancouver Island Beggarticks, Streambank Lupine | - |
| Aquatic Birds | Great Blue Heron *fannini* ssp. | - |
| Terrestrial Wildlife | Western Toad, Northern Red-legged Frog, Western Painted Turtle (Pacific Coast Population), Northern Goshawk *laingi* ssp., Great Blue Heron *fannini* ssp., Olive-sided Flycatcher, Peregrine Falcon *anatum* ssp., Western Screech-Owl *kennicottii* ssp., Band-tailed Pigeon, Barn Owl, Pacific Water Shrew, Monarch, Dun Skipper | Short-eared Owl, Keen's Myotis |
| Bird Species at Risk | Northern Goshawk *laingi* ssp., Great Blue Heron *fannini* ssp., Olive-sided Flycatcher, Peregrine Falcon *anatum* ssp., Western Screech-Owl *kennicottii* ssp., Band-tailed Pigeon, Barn Owl | Short-eared Owl |
| Non-Bird Species at Risk | Western Toad, Northern Red-legged Frog, Western Painted Turtle (Pacific Coast Population), Pacific Water Shrew, Monarch, Dun Skipper | Keen's Myotis |

Note: no Schedule 2 species were encountered in this study

#### *4.2.4.5 Species at risk and Regionally Important Wildlife that are subject to special management under the provincial Identified Wildlife Management Strategy*

Of the plant and wildlife species covered in this assessment, six have been listed under the provincial Identified Wildlife Management Strategy (see **Table 4.2A-1**, **Appendix 4.2A**). These are listed below within appropriate VECs (**Table 4.2.9**).

**Table 4.2.9 Species at Risk and Regionally Important Wildlife in the Study Area subject to Special Management under the Provincial Identified Wildlife Management Strategy Included in the Addendum**

| Valued Ecosystem Components | Identified Wildlife Species |
|---|---|
| Terrestrial Vegetation | - |
| Plant Species at Risk | - |
| Aquatic Birds | Great Blue Heron *fannini* ssp. |
| Terrestrial Wildlife | Northern Red-legged Frog, Northern Goshawk *laingi* ssp., Great Blue Heron *fannini* ssp., Short-eared Owl, Keen's Myotis, Pacific Water Shrew |
| Bird Species at Risk | Northern Goshawk *laingi* ssp., Great Blue Heron *fannini* ssp., Short-eared Owl |
| Non-Bird Species at Risk | Northern Red-legged Frog, Keen's Myotis, Pacific Water Shrew |

#### *4.2.4.6 Wildlife species of regional importance (i.e., prioritized by government agencies, First Nations or public concern)*

Under the provincial Identified Wildlife Management Strategy (B.C. Ministry of Environment 2011), a list of species important to the Lower Mainland region is currently being developed. Although this list is not formally available, provincial and federal regulators place strong emphasis on the protective provisions of the federal *Migratory Birds Convention Act* and the provincial *Wildlife Act*, particularly as they apply to breeding birds (next sub-section). In particular, provisions of these statutes have been used to protect nests of Bald Eagle, Osprey, other raptors using conspicuous platform nests, and smaller birds particularly songbirds.

#### *4.2.4.7 Large congregations of wintering, staging, or summering migratory or resident birds, including waterfowl, shorebirds, raptors, wading birds and land birds*

Within the study area the major regularly occurring concentration of birds is during spring and fall migration when waterfowl and other aquatic birds may be distributed in the agricultural areas. These are included in the aquatic birds VEC.

#### *4.2.4.8 Breeding Birds*

Surveys conducted along the Highway 99 Pipeline Route Option in June / July 2011 identified woodland and field species, most of which would be expected to breed in the study area. One Red-tailed Hawk nest on top of a birch snag was confirmed on the west side of Highway 99 (see **Figure 4.2.1**). Breeding birds are considered within the appropriate VECs.

#### *4.2.4.9 Designated protected areas (i.e., Ramsar sites, Western Hemisphere Shorebird Reserve Network, Important Bird Areas, National Wildlife Areas, Migratory Bird Sanctuaries, Provincial Ecological Reserves)*

Protected areas within the Project vicinity are identified in **Section 5.3.3.2** of the Application. There are no provincially-protected areas along Highway 99. Richmond Nature Park is the only municipal park that abuts both east and west sides of Highway 99. Protected areas have not been considered VECs, but the habitats they comprise and the species they support compose the six VECs selected in the Addendum.

#### *4.2.4.10 Upland Habitats*

Upland habitats are discussed in **Section 5.3.3.3** of the Application. In this Addendum, upland habitats are covered under the Terrestrial Vegetation VEC. The approximate length of terrestrial habitats along the Highway 99 Pipeline Route Option is shown in **Table 4.2.10**.

**Table 4.2.10 Approximate Length of Terrestrial Habitats along the Highway 99 Pipeline Route Option**

| Terrestrial Habitat Type | Total Distance (km) |
|---|---|
| Agricultural Land | 3.3 |
| Richmond Nature Park | 1.1 |
| Urban / Industrial / Commercial Land | 2.7 |
| **TOTAL** | **7.1** |

## 4.2.5 Potential Effects and Recommended Mitigation Measures

### *4.2.5.1 Potential Effects*

**Project Construction**

Vegetation

Construction activities along Highway 99, such as equipment staging and pipeline installation, may require clearing and grubbing of some vegetation. However, due to the proximity to the existing road right-of-way, vegetation along Highway 99 is considered typical of highly modified, disturbed landscapes. In addition, no rare and/or at risk terrestrial plant species and/or communities were identified during the review of background information and the June / July 2011 surveys. The potential effects associated with clearing and grubbing activities along the Highway 99 Pipeline Route Option are expected to be limited.

Pipeline installation will require excavation and stockpiling of soils resulting in the potential for erosion and sediment input into nearby ditches in the absence of mitigation. Erosion degrades the soil, reducing its productivity for revegetation, while sedimentation can choke out the vegetation lining the ditches. Disturbed soils are more susceptible to colonization by invasive species and wind erosion of soil stockpiles can spread the seeds of invasive plants.

Wildlife and Wildlife Habitat

Short-term loss of wildlife habitat may occur due to clearing and grubbing, as well as excavation, during construction activities along the Highway 99 Pipeline Route Option. Also, adjacent areas may be indirectly affected due to changes in wildlife use patterns in proximity to disturbance. Wildlife mortality may also occur during soil excavation for pipeline installation. In the absence of mitigation, stockpiling of the soil could result in sedimentation of nearby ditches resulting in the suffocation of or habitat alteration for amphibians and aquatic insects.

Vegetation clearing during the bird breeding season could result in high levels of mortality if nests were destroyed or adult birds abandoned the nests as a result of disturbance.

In the absence of mitigation, stripping and soil excavation during clearing and grubbing may result in the mortality of small mammals that inhabit woody debris, litter and soil.

Changes in habitat availability, may affect wildlife species with limited home ranges or territories, or dens and other site-specific habitat requirements located within or in close proximity to the Highway 99 Pipeline Route Option. Small species with limited mobility and small home ranges or territories (e.g., shrews, voles, frogs, aquatic insects) may be affected to a greater degree than highly mobile species with large home ranges or territories (e.g., raptors, waterfowl, ducks, raccoons).

During construction, sensory disturbance to wildlife may occur in the immediate vicinity of the Highway 99 Pipeline Route Option, due to elevated noise (e.g., during equipment operation or directional drilling), olfactory stimuli (e.g., due to odours associated with hydrocarbons and humans), and visual stimuli (e.g., due to presence of construction personnel, equipment and equipment movements). The effects of sensory disturbances are considered reversible once the disturbance ceases or the individual leaves the disturbance zone and normal activity patterns resume. Some wildlife species may become acclimated to certain re-occurring sensory disturbances, particularly those associated with construction activities, or regular vehicle movements.

Collisions with vehicles could result in the injury or mortality of wildlife, including small mammals, amphibians and some bird species (e.g., Barn Owls). Since the Highway 99 Pipeline Route Option follows existing roads and corridors, the incremental effect associated with vehicle movements is expected to be negligible.

VEC – Terrestrial Vegetation

Construction will involve both temporary and permanent alteration of terrestrial habitats within the Highway 99 right-of-way. Due to the need to ensure the safety and integrity of the pipeline through its operations phase, trees and large shrubs will not be permitted to re-establish in some areas, potentially resulting in a long-term change to terrestrial habitat characteristics. This effect on terrestrial habitats may be of particular importance within riparian areas of drainage ditches along Highway 99 and adjacent to the Richmond Nature Park.

VEC – Plant Species at Risk

The potential effects from construction activities along the Highway 99 Pipeline Route Option on rare and at risk plants are: alteration or loss of habitat due to clearing and grubbing; and/or temporary soil stockpiling. A total of fourteen plant species at risk and nine additional rare plants were identified as potentially occurring along the Highway 99 Pipeline Route Option (**Table 4.2A-1**, **Appendix 4.2A**). Since more than ample area is available for staging of directional drilling along significant portions of the Highway 99

right-of-way, it would be relatively easy to avoid any such vegetation through flagging after a rare plant survey prior to construction.

VEC – Aquatic Birds

Elevated noise levels during directional drilling and trenching along the Highway 99 right-of-way may cause temporary local sensory disturbance to aquatic and other birds. However, given the existing high levels of noise from aircraft and vehicle traffic, the effect associated with noise from construction activities along Highway 99 is expected to be negligible.

VEC – Terrestrial Wildlife

Other than birds, few wildlife or signs of wildlife were recorded along the Highway 99 Pipeline Route Option. The only amphibian species recorded from the drainage ditches along Highway 99 is non-native to B.C. Species most likely to be affected by construction activities include breeding birds, aquatic insects, amphibians, reptiles and small mammals through habitat loss, alteration and direct mortality. Field edges, where small mammals occur, are within or adjacent to the Highway 99 Pipeline Route Option. In the absence of mitigation, temporary habitat loss, alteration and/or direct mortality to small mammals may occur during construction activities.

Most of the songbird species detected during the 2011 field surveys occurred in birch forest and hedgerow habitat in which nests would be expected. Habitat alteration, including the permanent removal of trees or shrubs, may result in some loss of bird nesting habitat. However, revegetation of disturbed areas will likely restore nesting habitat potentially occurring along Highway 99. Direct mortality to birds due construction along Highway 99 is not anticipated because terrestrial birds are more mobile and will disperse.

VEC – Bird Species at Risk

Fifteen bird species at risk have been assessed as potentially occurring along the Highway 99 Pipeline Route Option (**Table 4.2A-1**, **Appendix 4.2A**). Only three, Double-crested Cormorant, Caspian Tern and Barn Swallow, were confirmed during the June / July 2011 field surveys. The first and second species were flyovers, not atypical of species observed infrequently but having limited association with the habitats along Highway 99. Potential effects on these species as a result of pipeline construction are unlikely because of lack of suitable habitat along Highway 99. Barn Owl and Barn Swallow are the only regularly observed species at risk that occur in fields adjacent to the Highway 99; both nest in barns and outbuildings, and forage over agricultural land.

Construction of the Highway 99 Pipeline Route Option will be confined within the highway right-of-way and therefore it is unlikely to have an effect on these species.

VEC – Non-Avian Species at Risk

Nineteen non-bird species at risk were assessed as potentially occurring along the Highway 99 Pipeline Route Option (**Table 4.2A-1**, **Appendix 4.2A**). However, no non-avian species at risk were recorded along Highway 99 during the June / July 2011 field surveys. In areas in which suitable habitat for wildlife species at risk may occur, appropriate mitigation measures will be implemented during construction, thus potential effects on non-avian species at risk are considered unlikely.

**Project Operations**

Effects from regular operations of the pipeline along Highway 99 are expected to be limited. Potential effects may be associated with the periodic removal of trees and large shrubs along the pipeline corridor during right-of-way maintenance to minimize the risk of compromising the safety and integrity of the buried pipeline.

### *4.2.5.2 Recommended Mitigation Measures*

**Design Mitigation**

During detailed design of the pipeline route, it is expected that opportunities will arise to address site-specific issues through minor, localized modifications to structure locations and the pipeline alignment, further reducing the likelihood of adverse effects. For example, riparian areas of drainage ditches along Highway 99 will be delineated and protected during pipeline construction, in accordance with provincial and federal requirements.

**Construction Mitigation**

**Section 5.3.4.1** and **Chapter 9** of the Application, and **Chapter 8** of this Addendum, specifically address mitigation and monitoring measures related to the protection of vegetation and wildlife resources during construction along the Highway 99 Pipeline Route Option. Site-specific revegetation and habitat enhancement measures will also be identified in the CEM Plan.

**Operations Mitigation**

**Section 5.3.4.2** and **Chapter 9** of the Application, and **Chapter 8** of this Addendum, specifically address mitigation and monitoring measures related to the protection of vegetation and wildlife resources during pipeline operation along the Highway 99.

### 4.2.6 Potential Residual Effects and their Significance

VECs which had no associated residual effects or residual effects that were deemed to be "not significant" for construction and operations included: aquatic birds, bird species at risk and non-avian species at risk. The only identified VECs which had associated potential residual effects included: terrestrial vegetation, plant species at risk, and terrestrial wildlife.

With the exception of potential mortality of terrestrial wildlife during the pipeline construction, all incidences of "low" or "unknown" significance during construction were due to potential habitat alteration, loss or destruction for the construction of the pipeline, and were in relation to terrestrial vegetation, terrestrial wildlife and plant species at risk. The initial clearing of the pipeline right-of-way during construction could destroy habitat and lead to mortality of terrestrial wildlife, particularly non-avian species. No species at risk are believed to be vulnerable to these specific effects.

Although details have yet to be confirmed it is likely that vegetation would be periodically cut back along the right-of-way and adjacent to facilities to maintain visibility of the right-of-way, facilitate access during inspection patrols and maintenance, and eliminate nuisance trees. Potential residual effects from vegetation maintenance along the pipeline corridor may result in potential alteration, loss or destruction of terrestrial wildlife habitat. However, the significance of the potential residual effects is assessed as "negligible to low".

The "negligible to low" significance rating was determined as the clearing will prevent the re-establishment of the tall shrub and tree layer. The residual effect on plant species at risk was deemed to be of "unknown" significance. This is owing to uncertainties about the exact pipeline route and the absence of systematic information on potential plant species at risk. Once the pipeline route is confirmed, research on plant species at risk based on existing sources is recommended. Appropriate rare plant surveys should also be conducted as warranted.

The significance of potential residual effects occurring as a result of construction or operations is evaluated in **Table 4.2.11** and **Table 4.2.12**.

**Table 4.2.11 Residual Effects Matrix for Vegetation, Wildlife and Wildlife Habitat VECs associated with Construction activities of the Highway 99 Pipeline Route Option.**

| Valued Component | Potential Residual Effect | Significance Criteria | | | | | | | | Overall Significance Rating |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Magnitude | Geographic Extent | Direction | Duration | Frequency | Reversibility | Ecological Context | Probability | |
| Terrestrial Vegetation | Depending on the extent to which vegetation can be restored following pipeline construction, habitat alteration, loss or destruction may occur | Low | Sub-regional | Negative | Short-term | Once | Irreversible | Disturbed | High | Low Significance |
| Plant Species and Plant Communities at Risk | Residual effects are considered unlikely in the presence of mitigation measures. Any potential residual effect (in the form of habitat alteration, loss or destruction) is pending the outcome of a field survey for rare or at risk plant species | Low | Sub-regional | Negative | Short-term | Once | Irreversible | Disturbed | Uncertain | Unknown Significance |
| Terrestrial Wildlife | Any wildlife displaced from adjacent areas during construction will likely return when equipment operation and associated elevated noise levels cease (i.e., sensory disturbance) | Low | Sub-regional | Negative | Short-term | Once | Reversible | Disturbed | High | Not Significant |
| | Some wildlife mortality is expected for amphibians, reptiles, and small mammals, depending on the final routing alignment and method of pipeline installation (e.g., directional drilling vs. trenching) | Low | Sub-regional | Negative | Short-term | Once | Irreversible | Disturbed | High | Low Significance |
| Aquatic Birds | Quality habitat for aquatic birds in the vicinity of Highway 99 is limited (e.g., ditches and agricultural areas). Any birds that are dispersed from this area due to elevated noise levels during construction will likely return when noise disturbance ceases | Low | Local | Negative | Short-term | Once | Reversible | Disturbed | High | Not Significant |
| Bird Species at Risk | No expected residual effects | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Non-avian Species at Risk | No expected residual effects | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

**Table 4.2.12 Residual Effects Matrix for Vegetation, Wildlife and Wildlife Habitat VECs associated with Operations of the Highway 99 Pipeline Route Option.**

| Valued Component | Potential Residual Effect | Significance Criteria | | | | | | | | Overall Significance Rating |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Magnitude | Geographic Extent | Direction | Duration | Frequency | Reversibility | Ecological Context | Probability | |
| Terrestrial Vegetation | Potential habitat alteration, loss or destruction during vegetation maintenance | Low | Sub-regional | Negative | Long-term | Sporadic and Intermittent | Irreversible | Disturbed | High | Negligible to Low Significance |
| Plant Species and Plant Communities at Risk | Potential habitat alteration, loss or destruction during vegetation maintenance | Low | Sub-regional | Negative | Long-term | Sporadic and Intermittent | Irreversible | Disturbed | Uncertain | Unknown Significance |
| Aquatic Birds | No expected residual effects | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Terrestrial Wildlife | Potential wildlife habitat alteration, loss or destruction during vegetation maintenance | Low | Sub-regional | Negative | Long-term | Sporadic and Intermittent | Irreversible | Disturbed | High | Negligible to Low Significance |
| | Temporary or permanent displacement or accidental mortality of amphibians, reptiles and small mammals during periodic vegetation maintenance | Low | Sub-regional | Negative | Long-term | Sporadic and Intermittent | Irreversible | Disturbed | High | Not Significant |
| Bird Species at Risk | No expected residual effects | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Non-Avian Species at Risk | No expected residual effects | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

### 4.2.7 Potential Cumulative Impacts

The identification of cumulative impacts is dependent on there being significant adverse residual effects resulting from Project construction or operations. Potential residual effects were identified for three of the VECs identified in this assessment; terrestrial vegetation, plant species and plant communities at risk, and terrestrial wildlife. Although the 'low' or 'unknown' significance rating could potentially act cumulatively with other residual effects from other projects with spatial or temporal overlap in effect type, no projects were identified to meet these criteria. For this reason, no cumulative impacts were identified for this assessment.

### 4.2.8 Conclusion

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 bird species at risk and non-avian species at risk. Residual effects were deemed to be "not significant" for aquatic birds 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 at risk, pending the outcome of a field survey to determine presence of any species at risk.

### 4.2.9 References

B.C. Conservation Data Centre. 2011. B.C. Species and Ecosystem Explorer. Province of B.C. [Online] Available at http://a100.gov.bc.ca/pub/eswp/ (Accessed August 16, 2011).

B.C. Ministry of Environment. 2011. *Forests and Range Practices Act* – Category of Species – Regionally Important Wildlife. Province of B.C. [Online]. Available at http://www.env.gov.bc.ca/wld/frpa/species.html (Accessed August 20, 2011).

City of Richmond. 2011. Richmond Nature Park – About the Nature Park. [Online] Available at: http://www.richmond.ca/parksrec/ptc/naturepark/about.htm (Accessed August 15, 2011).

Davis, N. and R. Klinkenberg (editors). 2008. A Biophysical Inventory and Evaluation of the Lulu Island Bog, Richmond, B.C. Richmond Nature Park Society, Richmond, B.C.

Klinkenberg, B. 2011a. Biodiversity of Richmond, B.C: Department of Geography, University of British Columbia. [Online] Available at http://www.geog.ubc.ca/richmond/city/ (Accessed August 17, 2011).

Klinkenberg, R. 2011b. Biodiversity of Richmond, B.C. – Butterflies. Department of Geography, University of British Columbia. [Online] Available at http://www.geog.ubc.ca/richmond/city/richmondbutterflies.html (Accessed August 17, 2011).

Toochin, M. 2011. Personal communications. Richmond resident and independent local naturalist. Conversation with Susanne Sloboda of Robertson Environmental Services Ltd. during project field work (June 25, 26; July 1, 2).

# Section 4.3
## Local and Regional Air Quality and Climate Assessment

# 4.3 Local and Regional Air Quality and Climate Assessment

## 4.3.1 Approach and Methodology

The pipeline along the proposed Highway 99 route will be located underground, except for some aboveground pump stations. Since this underground setting is consistent with the routes described in the Application, the change in pipeline route is not expected to affect emissions during Project operations. Therefore, only construction emissions were addressed in this assessment.

The overall approach and methodology used to assess air quality effects from construction of the Highway 99 Pipeline Route Option were the same as described in **Section 5.4.2** of the Application. Potential Project construction emissions were re-estimated using revised equipment numbers and activity levels for the pipeline construction. Construction emissions were then assessed using the residual effects assessment criteria ratings provided in **Table 5.4.3** of the Application. The emission estimation methodology is described in **Section 5.4.4.1** of the Application.

This assessment was prepared by RWDI Air Inc.

## 4.3.2 Spatial and Temporal Boundaries

### *4.3.2.1 Spatial Boundaries*

The LSA and RSA used for this assessment are the same as those described in **Section 5.4.2.2** of the Application, since these areas also encompass the Highway 99 pipeline route. Specifically, the LSA was defined as the City of Richmond as it has the greatest potential to be affected by Project construction. The RSA included the City of Surrey, the Corporation of Delta and the City of Richmond.

### *4.3.2.2 Temporal Boundaries*

The temporal context for this assessment was limited to 18 to 24 months, since no change in the Project construction schedule is expected due to the proposed Highway 99 Pipeline Route Option.

### 4.3.3 Baseline Conditions

In **Section 5.4.3** of the Application, baseline conditions were assessed for the entire LSA and RSA. Since the location of the Highway 99 Pipeline Route Option did not change the spatial boundaries of the air quality assessment, no additional baseline studies were required.

### 4.3.4 Potential Effects and Recommended Mitigation Measures

For the purposes of this Addendum, local and regional air quality and climate were re-assessed for the Project overall assuming the Highway 99 Pipeline Route Option. Consideration of pipeline construction along Highway 99 would result in a few changes to the assumptions described in the Application for the other possible routing options. These changes include:

- Operating hours for pipeline construction equipment (**Table 4.3.1**);
- The total amount of rock / earth fill to be transported offsite (**Table 4.3.2**); and
- The total amount of rock / earth fill brought in from offsite (**Table 4.3.2**).

**Table 4.3.1 Estimated Typical Construction Equipment and Activity Levels for Pipeline Construction Assuming Highway 99 Pipeline Route Option**

| Equipment Type | Size | Fuel | Number of Units | Total Hours per Unit |
|---|---|---|---|---|
| Bore / Drill Rigs | L | Diesel | 2 | 360 |
| Concrete / Industrial Saws | M | Diesel | 2 | 120 |
| Cranes | M | Diesel | 4 | 384 |
| Excavators | M | Diesel | 2 | 700 |
| Generator | M | Diesel | 2 | 640 |
| Paver | M | Diesel | 1 | 160 |

| Equipment Type | Size | Fuel | Number of Units | Total Hours per Unit |
|---|---|---|---|---|
| Paving Equipment | M | Diesel | 1 | 160 |
| Plate Compactor | M | Diesel | 2 | 450 |
| Roller | M | Diesel | 1 | 300 |
| Rubber Tire Loader | M | Diesel | 1 | 256 |
| Signal Board / Lighting Plant | M | Diesel | 2 | 460 |
| Skid Steer Loader | S | Diesel | 1 | 864 |
| Tractors / Loaders / Backhoes | M | Diesel | 2 | 384 |

**Table 4.3.2 Estimated Total Volume of Aggregate Handled for Pipeline Construction Assuming Highway 99 Pipeline Route Option**

| Parameter | Value | Unit |
|---|---|---|
| Total amount of rock / earth fill to be transported offsite | 45,000 | $m^3$ |
| Total amount of rock / earth fill to be brought in from offsite | 45,000 | $m^3$ |

Revised CAC emissions estimated for the purposes of this assessment are summarized in **Table 4.3.3**. CAC emissions (see **Table 4.3.3**) from fossil-fuelled equipment are expected to increase compared to those previously estimated for and included in the Application (see **Table 5.4.11** in the Application). This is likely attributed to an increase in the number of hours some fossil-fuelled equipment will be required to operate during Project construction (see **Table 4.3.1**). Fugitive dust emissions are also expected to increase due to an increase in the volume of aggregate handled (i.e., 90,000 $m^3$ of aggregate compared to 80,000 $m^3$ estimated for the other routing options described in the Application). Emissions from vehicles, tugs and barges and tank painting will not change based on the Highway 99 routing alignment.

The percent change in total annual LSA emissions for Project construction with the Highway 99 Pipeline Route Option increased by 0.01% and 0.02% for $PM_{2.5}$ and $NO_x$,

respectively. This is likely attributed to an increase in the operating hours of some fossil-fuelled equipment (see **Table 4.3.1**). The percent change in the total annual LSA $PM_{10}$, $SO_2$ and VOC[1] emissions for Project construction with the Highway 99 Pipeline Route Option is essentially the same as presented in the Application (see **Table 5.4.11** in the Application).

**Table 4.3.3 Total CAC Emission Estimates from Project Construction Assuming Highway 99 Pipeline Route Option**

| Emission Source | Emissions (kg) | | | | |
|---|---|---|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ | $NO_x$ | $SO_2$ | VOC |
| Fossil-Fuelled Equipment | 1,637 | 1,588 | 29,450 | 26 | 1,872 |
| Vehicle Traffic | 16 | 11 | 526 | 2 | 250 |
| Tug and Barge | 6 | 5 | 212 | 6 | 14 |
| Fugitive Dust | 5 | 0.7 | - | - | - |
| Tank Painting | - | - | - | - | 10,100 |
| Total Construction Emissions | 1,663 | 1,605 | 30,188 | 34 | 12,236 |
| % Change in Total Annual LSA Emissions | 0.20 | 0.31 | 0.58 | 0.02 | 0.20 |

Total estimated direct and indirect GHG emissions (i.e., $CO_2E$) due to Project construction, including the Highway 99 Pipeline Route Option, are summarized in **Table** 4.3.4 and expected to increase by approximately 0.05% in the RSA. When compared to those estimated in **Table 5.4.12** of the Application, total annual RSA $CO_2E$ emissions from fossil-fuelled construction equipment increased by 63 tonnes, which represents a 1.4% increase.

[1] Note that the percent increase in total annual LSA emissions of VOCs is incorrectly reported as 0.28% in **Table 5.4.11** of the Application. The correct value is 0.20%. This correction does not change the conclusions of the assessment in the Application.

**Table 4.3.4 Total GHG Emission Estimates from Project Construction Assuming Highway 99 Pipeline Route Option**

| Emission Source | $CO_2E$ Emissions (tonnes) |
|---|---|
| Fossil-Fuelled Equipment | 3,429 |
| Vehicle Traffic | 174 |
| Tug and Barge | 18 |
| Production of Cement | 1,034 |
| Total Construction Emissions | 4,655 |
| % Change in Total Annual RSA Emissions | 0.05 |

Recommended mitigation measures during construction outlined in **Section 5.4.4.1** of the Application remain applicable. No additional mitigation measures are recommended for the Highway 99 Pipeline Route Option.

### 4.3.5 Potential Residual Effects and Their Significance

Ratings of residual effects for the Project with the Highway 99 Pipeline Route Option remain the same as those summarized in **Table 5.4.23** of the Application for the other route options. Specifically, overall emissions are expected to increase and therefore the direction is negative. Total CAC emissions estimated for Project construction represent less than 1% increase in the LSA for all contaminants, and GHG emissions are expected to increase by less than 0.1% in the RSA. Therefore, the magnitude of potential CAC and GHG emissions remains low. The effect of CAC emissions during construction is expected to be limited to the LSA and therefore the geographic extent is local. On the other hand, GHG emissions have the potential to affect global climate, hence the geographic extent is national / global. The duration and frequency of construction effects on air quality remain short-term and frequent, respectively, and are still considered reversible after construction is complete. Since there are other sources of emissions in the LSA and RSA, the ecological context is considered disturbed.

As a result, the potential residual effects on ambient air quality and GHG emissions due to construction of the Project assuming the Highway 99 Pipeline Route Option remain “not significant”.

### 4.3.6 Potential Cumulative Impacts

No change is expected in the potential cumulative impact assessment of 'Ambient Air Quality' and 'GHG emissions' resulting from the consideration of the Highway 99 Pipeline Route Option. Both were assessed as 'nil' for Project construction and operations, as stated in **Section 5.4.6** in the Application.

### 4.3.7 Conclusion

Consideration of pipeline installation along Highway 99 is likely to affect Project emissions during construction slightly. A small increase in emissions of CACs and GHGs was estimated compared to other route alternatives. However, this increase was not sufficient to change the rating of Project residual effects or the assessment of potential cumulative impacts to 'Ambient Air Quality' and 'GHG emissions'. Effects of construction of the Project with the Highway 99 Pipeline Route Option were assessed to be "not significant".

As the Highway 99 Pipeline Route Option is not expected to affect Project operations, conclusions stated in the **Section 5.4.7** of the Application regarding Project operations remain the same.

# Section 4.4
## Noise Assessment

# 4.4 Noise Assessment

## 4.4.1 Approach and Methodology

A three-dimensional acoustic model was developed using the software Cadna / A (Version 3.7) to assess the potential noise effects of pipeline construction and operations on sensitive receptors for the proposed Highway 99 Pipeline Route Option. Noise levels were predicted using this model according to the International Organization for Standardization (ISO) 9613-2:1996 standard (ISO 1996).

This assessment was prepared by BKL Consultants.

### *4.4.1.1 Methodology Framework*

The methodology framework consisted of the following steps:

1. Determining appropriate noise criteria;
2. Predicting noise levels from pipeline construction;
3. Identifying potential effects associated with construction noise levels based on model results;
4. Recommending mitigation measures that may be used to avoid or minimise adverse effects; and
5. Identifying potential residual effects and evaluating their significance.

### *4.4.1.2 Noise Criteria*

The assessment uses the same noise criteria as in **Section 5.5.3.1** of the Application. The City of Richmond's Public Health Protection Bylaw (Bylaw #6989) was used as criteria for this assessment, as Metro Vancouver, Port Metro Vancouver and Vancouver Airport Authority have no noise bylaws or regulations for construction noise. The City of Richmond's Public Health Protection Bylaw imposes both time constraints and a maximum noise level on construction activities, but also permits application for exemption from these requirements. The relevant sections of the bylaw are included in the **Appendix 5.5B** of the Application. Noise effects from pipeline construction and installation have been assessed by comparing the predicted noise level from each piece of expected construction equipment to the City of Richmond's noise bylaw limit. Sensitivity adjustments described by ISO 1996-1:2003 (ISO 2003) were applied to "annoying" types of noise.

Pipeline construction is expected to progress at an average rate of approximately 300 metres per week. Any noise effect is therefore expected to last for a few days possibly up to two weeks at any particular location. Considering the short construction duration associated with each section of pipeline, the operating noise level from construction equipment provides a good indication of the likelihood of community annoyance.

#### *4.4.1.3 Noise Predictions*

Noise effects have the potential to develop from construction and installation of sections of pipeline in proximity to residential housing. This assessment uses the same noise prediction methodology as described in **Section 5.5.2.3** of the Application.

#### *4.4.1.4 Determination of Significance of Potential Residual Effects*

The attributes used to assess the significance of potential residual effects are the same as described in **Section 5.5.2.5** of the Application, except for Magnitude which only uses $L_{max}$ rather than both $L_{max}$ and $L_d$ / $L_n$. This is because $L_d$ / $L_n$ was used to assess the significance of potential effects from construction of the marine terminal and the fuel receiving facility as described in the Application.

### 4.4.2 Study Area

#### *4.4.2.1 Spatial Boundaries*

The spatial boundaries of the Study Area encompass noise sensitive areas that could potentially be affected by pipeline construction along Highway 99. The pipeline could be located on either side of the highway right-of-way, so the Study Area includes one representative section on the west side and one representative section on the east side of the right-of-way. Construction activities and noise levels are expected to be similar along the entire pipeline alignment.

Representative sections are in proximity to the highest density of residential dwellings and thus represent a “worst-case” condition. Noise levels at residences further away from the pipeline route will be lower.

The representative section on the west side of the Highway 99 right-of-way includes the first two rows of houses between Cambie Road and Odlin Road; and the representative section on the east side of the Highway 99 right-of-way includes the first two rows of houses between Montego Street and Alderbridge Way (see **Figure 4.4.1**). The first two rows of houses in both residential sections are located at least 25 metres away from Highway 99.

#### *4.4.2.2 Temporal Boundaries*

The temporal boundary for the assessment was assumed approximately 12 months for the construction phase of the Highway 99 Pipeline Route Option and at least 60 years for pipeline operations.

### 4.4.3 Baseline Conditions

As described in **Section 4.4.1.2**, noise effects from pipeline construction and installation have been assessed by comparing the predicted noise level from each piece of expected construction equipment to the City of Richmond's noise bylaw limit for construction noise (see **Appendix 5.5B** in the Application), since effects are expected to last for a very short duration (i.e., a few days possibly up to two weeks) at any particular location. Therefore, baseline measurements were not required along the pipeline route in the Study Area.

### 4.4.4 Potential Effects and Recommended Mitigation Measures

This section describes the potential noise receptors and the duration of the predicted noise, and the significance of the potential effects. Further analysis of the potential effects of noise on the community including interference with essential activities including speech and sleep and generation of annoyance / negative reactions from community members is included in **Chapter 8** of the Application.

#### *4.4.4.1 Predicted Noise Levels*

Pipeline construction and installation will produce noise, with limited practical means of noise control. However, during construction the Contractor(s) will be required to meet the noise requirements of the City of Richmond.

Modelled construction equipment is summarised in **Table 4.4A-1** (see **Appendix 4.4A**), including A-weighted (dBA) sound power levels and expected numbers of hours of operation per day. Noise predictions did not assume the use of any special noise mitigation measures such as noise barriers, only that the generated equipment noise would be typical.

Sensitivity adjustments have been applied to vehicle backup alarms as recommended by ISO 1996-1:2003 standard (ISO 2003). A 5 decibel (dB) penalty has been applied to backup alarm noise. The sound power levels listed in **Table 4.4A-1** (**Appendix 4.4A**) include these sensitivity adjustments.

Construction noise is expected to be highly variable due to the variety of construction equipment and proximity to receivers. To be conservative, the highest noise levels from each piece of construction equipment were predicted at each of the two rows of houses in the Study Area (i.e., between Cambie Road and Odlin Road, and between Montego Street and Alderbridge Way). **Table 4.4.1** below lists the highest predicted noise levels, assuming a minimum distance of 10 metres between each piece of construction equipment and the nearest residential property line, because the final alignment of the fuel delivery pipeline is currently unconfirmed.

**Table 4.4.1 Pipeline Construction – Highest Predicted Levels at the Two Rows of Houses (Assuming a 10 metre Minimum Distance to the Nearest Property Line)**

| Typical Equipment / Machinery | On the West Side of the Highway 99 Right-of-Way (dBA) | | On the East Side of the Highway 99 Right-of-Way (dBA) | |
|---|---|---|---|---|
| | 1st row | 2nd row | 1st row | 2nd row |
| Concrete / industrial saw | 75 | 67 | 73 | 61 |
| Crane | 70 | 61 | 68 | 55 |
| Excavator | 70 | 62 | 68 | 56 |
| Generator | 56 | 48 | 54 | 42 |
| Paver | 68 | 60 | 66 | 54 |
| Paving equipment | 68 | 60 | 66 | 54 |
| Plate compactor | 69 | 61 | 67 | 55 |
| Roller | 66 | 59 | 64 | 53 |
| Rubber tire loader | 71 | 64 | 69 | 58 |
| Signal boards / lighting plant | 56 | 48 | 54 | 42 |
| Skid steer loader | 71 | 64 | 69 | 58 |

| Typical Equipment / Machinery | On the West Side of the Highway 99 Right-of-Way (dBA) | | On the East Side of the Highway 99 Right-of-Way (dBA) | |
|---|---|---|---|---|
| | 1st row | 2nd row | 1st row | 2nd row |
| Tractor / loader / backhoe | 71 | 64 | 69 | 58 |
| Backup alarm | 75 | 68 | 73 | 62 |

Noise levels will be higher if construction equipment is positioned less than 10 metres away from the nearest property line and lower if positioned further than 10 metres away from nearest property line. The change in noise level with distance to the construction equipment roughly follows the inverse square law (i.e., a reduction of 6 dB per doubling of distance).

#### *4.4.4.2 Potential Effects*

Noise from pipeline construction activities is not expected to exceed the City of Richmond's noise bylaw limit of 80 dBA, provided that the construction work is located at a minimum of 10 metres away from the nearest residential property line. Considering that pipeline construction is only expected to last for a day or two at each section (i.e., 100 to 200 metres per section), any "annoyance" caused by pipeline construction noise will be very short-term.

No adverse potential effects for pipeline operations were identified in this assessment, because there are no significant noise sources during pipeline operations; the pipeline will be buried underground.

#### *4.4.4.3 Recommended Mitigation Measures*

As described in the Application (**Section 5.5.4**), noise management during construction will be addressed in the CEM Plan and will include a section on noise control requirements, which specifies maximum allowable noise emissions from equipment and machinery, allowable hours of work, communication with the public regarding any construction noise issues that may arise, and procedures for responding to any noise complaints. The main intent of the noise control specification is to ensure that Contractor(s) do not utilize any excessively noisy equipment (i.e., equipment that is significantly noisier than the typical equipment assumed in the noise prediction calculations). As described in **Section 4.4.4.1**, construction noise is expected to be

highly variable due to the variety of construction equipment and proximity to receivers. Any construction noise issues that may arise from what was not expected in the preliminary Project design stage, such as the potential use of additional equipment and less than 10 metres from the equipment to receivers, will be addressed by implementing BMPs and standard recognized mitigation measures (i.e., the use of temporary noise barriers) to meet City of Richmond's noise bylaw requirements.

The Contractor(s) should consider appropriate selection, operation and maintenance of the equipment or process and specific BMPs relating to the fuel delivery pipeline, as described in **Section 5.5.4** of the Application. No additional mitigation measures are required for the Highway 99 Pipeline Route Option.

### 4.4.5 Potential Residual Effects and their Significance

Potential residual effects following implementation of recommended mitigation measures were assessed using the criteria described in **Section 5.5.2.5** of the Application and are summarized below in **Table 4.4.2**.

Although the probability of residual effects during pipeline construction and installation is expected to be 'high' in specific locations, due to close proximity to nearby residences, potential residual effects are predicted to be 'low' in magnitude. The nature of any potential residual effect is also 'reversible' and 'local' in geographic extent. The overall significance of the potential residual effects during pipeline construction and installation is deemed to be "Not Significant".

No residual effects are anticipated during the Operations phase of the Project for noise sensitive land uses, as no potential effects were identified.

### 4.4.6 Potential Cumulative Impacts

The identification of cumulative impacts is dependent on their being significant adverse residual effects resulting from Project construction or operations. Since no potential residual effects were identified in the assessment, no cumulative impacts were identified for 'noise sensitive land uses' for the Highway 99 pipeline routing option.

### 4.4.7 Conclusion

No significant residual effects were identified for pipeline construction or operations for the Highway 99 Route Option.

**Table 4.4.2 Effects Assessment Matrix for Noise during Construction and Operations of the Pipeline along Highway 99**

| Project Component | Positive or Negative Effect | Mitigation[1] | Evaluation Criteria for Assessing Residual Environmental Effects | | | | | | Overall Significance |
|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Duration / Frequency | Reversibility | Ecological Context | Probability | |
| **Construction Phase** | | | | | | | | | |
| Fuel Pipelines | Negative | 1, 2, 3 | Low | Local | Short-term, Once only | Reversible | Disturbed | High | Not Significant |
| **Operations Phase** | | | | | | | | | |
| Fuel Pipelines | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | No anticipated residual effect |

[1]Mitigation:
1. Implement BMPs.
2. Manage interactions between employees/contractors and local communities.
3. Minimize duration of construction.

### 4.4.8 References

ISO. 1996. Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation. Reference No. ISO 9613-2:1996(E). Geneva, International Organisation for Standardisation.

ISO. 2003. Acoustics - Description, Measurement and Assessment of Environmental Noise - Part 1: Basic Quantities and Assessment Procedures. Reference No. ISO 1996-1:2003(E). Geneva, International Organisation for Standardisation.

# Section 4.5
## Screening Level Contaminated Sites Assessment

# 4.5 Screening Level Contaminated Sites Assessment

## 4.5.1 Approach and Methodology

This section assesses the risk of encountering soil or groundwater contamination along the Highway 99 Pipeline Route Option using the same approach and methodology as described in **Section 5.6.2** of the Application. The data collected for review is summarized in the following sections, tables, and appendices. The updated database incorporates all of the assessment results.

This assessment was prepared by Pottinger Gaherty Environmental Consultants Ltd.

### *4.5.1.1 Review of Reports*

The findings from over 40 environmental site assessment reports (Pottinger Gaherty Environmental Consultants Ltd. 1994–2009), for work conducted within the Study Area (see **Section 4.5.2**) have been incorporated into the database. No additional reports were identified as the study areas of the reports reviewed previously overlapped the Highway 99 Pipeline Route Option.

### *4.5.1.2 Waterways Assessment*

Historical stream maps (Fisheries and Oceans Canada 2011) reviewed for the Highway 99 Pipeline Route Option are provided in **Figures 4.5A-1** to **4.5A-3** (**Appendix 4.5A)**.

### *4.5.1.3 Review of City Business Directories*

City of Richmond business directories were obtained from the Vancouver Public Library and Pottinger Gaherty project files. They were reviewed at five-year intervals from the most recent to the earliest available directory. Directory listings for each street were reviewed in detail and sites that had the potential for contamination were entered into the database (**Table 4.5B-1**, **Appendix 4.5B**).

### *4.5.1.4 Review of Fire Insurance Maps*

No new fire insurance maps were reviewed for the Highway 99 Pipeline Route Option, as all available fire insurance maps were reviewed for the Application.

### *4.5.1.5 Review of Aerial Photographs*

Approximately 100 aerial photographs, dated from 1938 to 2009, were reviewed. These are summarized in **Table 4.5C-1** (**Appendix 4.5C**).

#### *4.5.1.6 Ministry of Environment Contaminated Sites Registry Search*

The B.C. Ministry of Environment (2009) Contaminated Sites Registry search findings compiled for the Application were reviewed again for the Highway 99 Pipeline Route Option, which falls entirely within the original Site Registry search area. Two new sites were identified within the Highway 99 corridor (see **Table 4.5C-2** in **Appendix 4.5C**), which were also added to the database (**Table 4.5B-1**, **Appendix 4.5B**).

#### *4.5.1.7 Highway 99 Corridor Inspection*

A site reconnaissance was conducted on July 5, 2011 after all historical information had been collected and summarized.

#### *4.5.1.8 Interviews*

Interviews were conducted with Roanna Cruz, Senior District Development Technician with the MoT. Ms. Cruz contacted the environmental departments of the regional MoT office as well as the head office in Victoria and concluded that there were no environmental files related to contaminated sites along the Highway 99 corridor (Cruz 2011, pers. comm.).

#### *4.5.1.9 Risk Ranking Methodology*

The risk ranking methodology is described in **Section 5.6.2.3** of the Application. In summary, each site addressed in the database has been assigned a risk ranking of 1, 2 or 3 corresponding to high, moderate or low risk of encountering contamination on, or migrating to, the Highway 99 Pipeline Route Option. Risk rankings along the Highway 99 route option are shown schematically on **Figures 4.5.2** through **4.5.4**, and are defined as:

- High (1) - known release of contaminants onsite or a long history of occupation by industrial or specific commercial uses.
- Moderate (2) - short history of occupation by industrial or specific commercial uses.
- Low (3) - history of residential use or short occupation by industrial or specific commercial uses that typically have minimal risk of causing significant contamination.

### 4.5.2 Study Area

The Study Area for this assessment covers the direct footprint of, and extends two city blocks equivalence either side of, the Highway 99 right-of-way, from Williams Road north approximately 7.7 kilometres to the Bridgeport Trail (**Figure 4.5.1**).

### 4.5.3 Baseline Conditions

Physical factors including land use, topography, geology and depth to groundwater were assessed in the Application through site inspections and historical research, which also encompasses the Highway 99 Pipeline Route Option. Baseline conditions along the Highway 99 route option remain consistent with those described in **Section 5.6.3** of the Application.

### 4.5.4 Potential Risks and Recommended Mitigation Measures

The risk rankings assigned to each site along Highway 99 serve as the risk potential for encountering contamination during construction. There is a low to moderate risk of encountering contamination during construction. Moderate risk locations are associated with historical streams that may have been filled with contaminated fill (five locations; see **Figures 4.5.2**, **4.5.3** and **4.5.4**), and nearby properties that may be sources of contamination (three locations; see **Figures 4.5.2** and **4.5.3** and **Section 5.6.5** of the Application). No high risk areas for encountering contamination were identified along the Highway 99 Pipeline Route Option.

One of the two new listings identified in the MoE Contaminated Sites Registry was associated with a school; the second one corresponded to a property that was already included in the risk ranking database previously compiled for the Application. Both properties were ranked as low risk.

The potential for encountering contamination during Project operations could occur if pre-existing contamination is not identified during construction. There is an unlikely risk that Project operations will affect baseline conditions in the Study Area, such that contamination would be encountered during the operations phase.

The recommended mitigation measures described in the Application (see **Section 5.6.4.3** of the Application) are the same for the Highway 99 Pipeline Route Option. In summary, if contamination is encountered during construction, appropriate

mitigation will be implemented using adaptive management strategies[2]. Management for contaminated sites will be developed and included in the CEM Plan prior to the commencement of construction for areas where encountering contamination is likely (i.e., medium to high risk). In general, any contamination is expected to be managed through a combination of excavation and disposal (i.e., for soils), treatment (i.e., for groundwater), and risk assessment (i.e., in the event contamination will be left in place). If water is generated during construction, dewatering may require discharge to a sanitary sewer (permit required) or holding tank. A mobile water treatment facility may also be an option. Remediation to applicable guidelines should take into account both current and future land use and ownership to establish appropriate provincial and/or federal remedial standards and guidelines.

### 4.5.5 Potential Residual Effects and their Significance

No new potential residual effects were identified for the Highway 99 Pipeline Route Option. In the absence of any newly identified high risk areas, potential residual effects and their significance are the same as described in the Application (see **Section 5.6.5** of the Application). As presented in the Application (see **Section 5.6.5** of the Application), a beneficial effect would result from remediation of any previously unidentified contamination encountered during Project construction. There is a low likelihood that the Project would materially increase the migration of existing contamination through the introduction of a new preferred groundwater flow pathway. Finally, the risk of degradation of anti-corrosion coating by contaminants is also considered low.

### 4.5.6 Potential Cumulative Impacts

As stated in the Application (see **Section 5.6.6** of the Application), due to the purpose and nature of this type of screening-level assessment (i.e., a risk based analysis as opposed to an effects assessment), potential cumulative impacts resulting from significant adverse residual effects from the Project acting in concert with residual effects from other projects could not be determined with any confidence, within the scope of the assessment.

[2] With respect to Screening Level Contaminated Sites Assessment, "Adaptive Management Strategy" is an approach to contamination on a site-specific basis that considers the nature and location of contamination and risk to the contractors, pipeline and operators to establish appropriate remediation approaches. Remediation approaches may include excavation and disposal, treatment, and risk assessment.

### 4.5.7 Conclusion

There is a low to moderate risk of encountering pre-existing contamination during Project construction. Moderate risk locations are associated with historical streams that may have been filled with contaminated fill and nearby properties that may be sources of contamination. No high risk areas were identified along the Highway 99 Pipeline Route Option. Any contamination encountered during construction along the route option is unlikely to be problematic and is best managed by an adaptive management process that responds to the Project specifications.

### 4.5.8 References

B.C. Ministry of Environment. 2009. Contaminated Sites Registry Search. [Online] Available at: https://www.bconline.gov.bc.ca (Accessed May 1, 2009).

Cruz, R. 2011. Senior District Development Technician, B.C. Ministry of Transportation and Infrastructure. Personal phone conversations in July 2011.

Fisheries and Oceans Canada. 2011. Wild, Threatened, Endangered and Lost Streams of the Lower Fraser Valley. [Online] Available at: http://www-heb.pac.dfo-mpo.gc.ca/maps/loststrm/loststreams_e.htm (Accessed on June 20, 2011).

Geological Survey of Canada. 1976. Surficial Geology Vancouver Map 1486A.

# Chapter 5
## Assessment of Social and Economic Effects

# 5 ASSESSMENT OF SOCIAL AND ECONOMIC EFFECTS

## 5.1 Approach and Methodology

This assessment follows the same approach and methodology defined in **Section 6.2** of the Application, and is similarly presented as a combined socio-community and socio-economic assessment.

As in **Chapter 6** of the Application, which includes assessment for other pipeline routing alternatives, this section assesses how construction and operations of the Highway 99 Pipeline Route Option may affect the local economy and surrounding communities, businesses, residents, property owners and other stakeholders.

Land use designations and municipal zoning in areas adjacent to the Highway 99 Pipeline Route Option were identified based on a review of the City of Richmond's OCP and the City of Richmond Zoning Bylaw #8500. Information regarding land use, including the relative location of the pipeline facilities to designated parks, trails and recreational areas, as well as schools, hospitals and other institutions, was identified based on publicly available information and site visits. Motor vehicle traffic patterns in the vicinity of Highway 99 were reviewed based on publicly available data.

This assessment was prepared by Pierce Lefebvre Consulting.

## 5.2 Study Area

### 5.2.1 Spatial Boundaries

Potential effects were identified and evaluated with respect to a LSA encompassing the Highway 99 right-of-way between Williams Road to Bridgeport Trail and its surrounding residences, farmlands, parks, businesses, and communities. When the Project has broader social and economic implications for metro Vancouver, as described in **Section 6.2.2.1** of the Application, a broader RSA is considered.

### 5.2.2 Temporal Boundaries

The temporal boundary for the assessment was assumed approximately 12 months for the construction phase of the Highway 99 Pipeline Route Option and over a design life of at least 60 years of Project operation.

## 5.3 Baseline Conditions

**Chapter 6** of the Application describes the general social and economic context of the Project within the City of Richmond. It also describes the social and economic setting of

the Corporation of Delta; YVR operations, of which the Project will be a significant component; key community features in close proximity to Project components; and shipping, fishing and shoreline activities on the lower Fraser River. Note that **Part C** of the Application identifies potential specific effects of the Project on individual First Nations values including effects on food fisheries, gathering and traditional use of plants and wildlife, or other effects specific to First Nations, and provides an assessment of how they can be avoided or mitigated. Consideration and mitigation of potential effects on First Nations values from Project construction are not expected to differ if the Highway 99 Pipeline Route Option is selected.

This section reviews the baseline social and economic conditions that are specific to the Highway 99 Pipeline Route Option.

### 5.3.1 Population, Communities and Community Features

The Highway 99 Pipeline Route Option is located entirely within the City of Richmond. Community features that are described in **Section 6.3** of the Application that are particularly relevant to the Highway 99 Pipeline Route Option include:

- **Richmond Nature Park**: offers a network of walking trails and nature areas as well as an interpretive centre and a playground located at the corner of Westminster Highway and No. 5 Road. Richmond Nature Park reports 95,000 annual visits including estimates for casual and program attendees (Bauder, pers. comm. 2009). No. 5 Road, Highway 99 and interchanges between Highway 91 and Highway 99 cross through the middle of Richmond Nature Park, with the Highway 99 right-of-way extending well beyond the current Highway 99 travel surface.

- **Mylora Golf Courses**: **'**Mylora on Five' is an 18-hole executive golf course located between No. 5 Road and Highway 99 north of the Williams Road right-of-way. 'Mylora on Sidaway' is an 18-hole executive course located between Sidaway Road and Highway 99 also north of Williams Road (Mylora Golf Courses 2010).

Other community gathering places adjacent to the Highway 99 Pipeline Route Option include:

- **B.C. Muslim Association Facilities**: fronting Blundell Road and extending to the south on the west side of Highway 99, this property includes a large mosque, a funeral services building, a primary (K-7) school, other school related buildings, and playing fields / sports courts near Highway 99;

- **Sportstown**: soccer / tennis / tavern complex located near the intersection of Highway 91 and Highway 99; and

- **Hotels / Light Industrial and Retail Businesses**: are located between Highway 91 and Bridgeport Road along Highway 99.

### 5.3.2 Land Use Regime and Existing Land Use

**Chapter 6** of the Application describes the land use regime of the pipeline routing options reviewed as part of the Application. This Addendum provides new information for pipeline route segments that are unique to the Highway 99 Pipeline Route Option.

The land use regime and existing land use from Williams Road to Westminster Highway is described as follows:

- The pipeline route runs along Highway 99, adjacent to the Mylora Golf Courses (i.e., Mylora on Five and Mylora on Sidaway), and some large properties zoned for a combination of Assembly (ASY) and Agriculture (AG1) uses, or exclusively for Agriculture (AG1) with buildings and the occasional farm house generally fronting No. 5 Road, Sidaway Road or Blundell Road. These property parcels generally have no buildings located near the Highway 99 frontage. One farm house fronting Blundell Road is located close to the Highway 99 right-of-way eastern boundary, but approximately 65 metres from the current Highway 99 travel surface.

- Existing developments and buildings near the Highway 99 right-of-way include: the Mylora golf courses with no related buildings near Highway 99 frontage; the B.C. Muslim Association facilities fronting Blundell Road and extending back along the west side of Highway 99, which include a large mosque, school related buildings and playing fields / sports courts near Highway 99; and a Go-Kart track operation accessible from Sidaway Road but without any buildings or improvements near Highway 99.

The land use regime and existing land use from Westminster Highway to Bridgeport Trail is described as follows:

- The pipeline route continues along Highway 99 between the west and east portions of the Richmond Nature Park with no park buildings near Highway 99, through several undeveloped areas that accommodate highway interchange ramps and overpasses located in a wide Highway 99 right-of-way, and past a mix of industrial / commercial / retail developments and residential areas adjacent to Highway 99.

- Existing developments near Highway 99 include 62 homes (27 single family homes, 1 duplex and 33 townhomes) that are adjacent to Highway 99 or to city streets immediately parallel to Highway 99. Existing developments also include many industrial / commercial / retail buildings, including a cluster of industrial / retail

buildings on the southwest side of Highway 99 with a single vehicle access point (Vanguard Road) from the northeast side of elevated Highway 99. Other industrial / commercial / retail buildings include the Sportstown soccer / tennis / tavern complex, some light industrial and automotive retail developments, a self-storage operation, a large car dealership, Holiday Inn Hotel, Costco and Pacific Grove shopping plaza.

**Appendix 5A** provides a detailed description of land use for the Highway 99 Pipeline Route Option, as well as the City of Richmond zoning bylaw designations and the Richmond OCP land use designations.

## 5.4 Potential Effects and Recommended Mitigation Measures

### 5.4.1 Project Construction

#### *5.4.1.1 Potential Effects*

Detailed construction plans have not yet been developed but the magnitude of the construction effects will depend partly on the time required to complete the Highway 99 pipeline construction and the exact location of the alignment. Pipeline construction for the Highway 99 Pipeline Route Option is expected to take approximately 6 months to complete, which is well within the 18 to 24 months construction schedule indicated in **Chapter 2** of the Application. Where relevant and applicable, other elements of the construction schedule and constraints are reviewed in this section as part of the effects assessment on individual socio-economic and socio-community values / indicators.

This assessment identifies the potential socio-economic and socio-community effects of pipeline construction within the Highway 99 right-of-way. The highway itself provides an effective barrier for most pipeline construction effects, so that effects are likely to be limited to the side of the highway where construction actually occurs.

**Economic Development**

**Chapter 6** of the Application provides estimates of person years of employment, gross domestic product and tax impacts that may result from Project-related capital spending. Choosing the Highway 99 Pipeline Route Option is not expected to alter the economic development benefits described in the Application.

**Land Use Regime and Existing Land Use**

**Table 5.4.1** summarizes the approximate number of residential properties near the Highway 99 Pipeline Route Option, data which are comparable to the information provided in **Table 6.4.2** of the Application.

**Table 5.4.1 Approximate Number of Residences in Proximity to the Highway 99 Pipeline Route Option**

| Pipeline Route Option | Approximate Number of Nearby Residences (Includes Some Townhomes and Duplexes) | | |
|---|---|---|---|
| | West of Alignment | East of Alignment | Total |
| Highway 99 | 43 | 19 | 62 |

Note: The total number of residences along the entire pipeline route, including those segments common to all routing options (Bridgeport Trail and Williams Road or Francis Road) would be 74 if Williams Road is used from the fuel receiving facility to Highway 99, or 66 if Francis Road is used from the fuel receiving facility to Highway 99. This compares to the range of 199 to 287 residences for other pipeline route options reviewed in **Chapter 6** of the Application.

As shown in **Table 5.4.1**, some 62 residences (with significant setbacks in some cases) are adjacent to the Highway 99 pipeline route alignment; 43 residences are adjacent to the west side of the Highway 99 right-of-way, and 19 residences are adjacent to the east side. If the Highway 99 were selected as the final pipeline route, the number of residences that would be located near the pipeline corridor would decrease by over 60% when compared to the other pipeline route options reviewed in **Chapter 6** of the Application.

**Section 5.2.2** and **Appendix 5A** of this Addendum describe the land use regime, and existing land use context along the Highway 99 Pipeline Route Option, as well as provide an inventory of the types of businesses that are adjacent to the Highway 99 Pipeline Route Option. These businesses do not have direct access from Highway 99, and they generally have more than one point of vehicle access to their sites. The exception is an industrial / retail area near Shell Road on the west side of Highway 99 that has a single access road (Vanguard Road) that crosses under Highway 99.

Effects to businesses along the pipeline route due to construction may include vehicle and mobility restrictions, restricted access, noise, effects to landscaping / sidewalks, depending on the final alignment selected.

**Property Acquisitions and Property Value**

Pipeline construction for the Highway 99 Pipeline Route Option is not expected to require acquisition of private properties for long-term use. However, directional drilling, horizontal auger boring or other forms of trenchless pipeline construction will likely be required in several locations, which may require installation of temporary launching sites on private properties to accommodate this type of construction. There are

approximately 10 cross streets, access ramps or egress ramps at grade on each side of Highway 99 that may require trenchless pipeline construction techniques.

Property values reflect long-term utility expectations which are not likely to be affected by short-term construction activities. Short-term liquidity of property can be affected by construction activities in circumstances of forced sale. Construction activity is not expected to last sufficiently long to materially affect property values.

## Motor Vehicle Traffic and Mobility

As noted in **Chapter 2** of the Application, pipeline construction is expected to be similar to routine utility construction projects, with each 100 metres of pipeline construction typically requiring approximately one day. In areas where trenchless construction techniques are required pipeline construction is expected to proceed more slowly.

The Highway 99 Pipeline Route Option will likely have negative effects on motor vehicle traffic during construction as a result of:

- Potential disruptions to Highway 99 traffic including bus traffic;
- Potential temporary changes in traffic patterns away from Highway 99 to Richmond city streets during construction; and
- The potential disruption to city streets such as Vanguard Road, Patterson Road and St. Edwards Drive depending on the final choice of alignment.

## Potential Disruptions to Highway 99 Motor Vehicle Traffic

Northbound and southbound total traffic counts for the portion of Highway 99 that crosses Lulu Island in Richmond range between 60,000 and 80,000 vehicles per day (MoT 2011). Given the importance of Highway 99 as a transportation corridor, any major disruption to Highway 99 traffic would be significant.

There are several access and egress ramps that link Highway 99 with major arteries in Richmond including Steveston Highway (south of Williams Road), Westminster Highway, Highway 91, Shell Road, and Bridgeport Road / Sea Island and No. 4 Road. Traffic counts for three of the ramps are routinely monitored, and for those three ramps, average annual week day traffic averages between 6,000 and 12,500 vehicles per day (MoT 2011).

Passenger bus routes operate on Highway 99, and any delay in motor vehicle traffic would also likely delay bus traffic. Highway 99 generally has 3 lanes of traffic each way including one HOV / bus lane.

Traffic counts are typically lower on weekend days than on weekdays, and are lowest at night, offering opportunities to schedule construction to avoid the busiest periods. For example, using the permanent traffic count located south of Westminster Highway on Highway 99, in 2009, the average weekday traffic count for the year was 60,780 vehicles, or 26% higher than the average weekend day traffic count of 48,376 vehicles (MoT 2011). Within each working day, traffic is typically higher between 6 am and 6 pm with high variability in direction volumes during the morning and afternoon rush periods (MoT 2011).

The Highway 99 right-of-way is relatively narrow between the Williams Road easement and Blundell Road and construction may necessitate use of the Highway 99 shoulder which could result in temporary alterations to the operation of one of the existing Highway 99 HOV / bus lanes. Traffic congestion in the corridor tends to be related primarily to the George Massey Tunnel and Oak Street Bridge river crossings, so reduced capacity between the Williams Road easement and Blundell Road may not have a large impact on total trip time for most vehicles. Nevertheless, altering the operation of a Highway 99 HOV / bus lane during construction could have a significant short-term adverse effect on some motor vehicle traffic.

**Potential Disruptions to City Streets in Proximity to Highway 99**

Construction of the pipeline could temporarily affect motor vehicle traffic on city streets that are close to Highway 99, for example, No. 5 Road, Sidaway Road, No. 6 Road, Vanguard Road, St. Edwards Drive and/or Patterson Road. Construction could also temporarily affect the cluster of industrial / retail businesses located on the southwest side of Highway 99 which are accessible only from Vanguard Road under Highway 99 near Shell Road.

**Potential Effects of Highway 99 Expansion / Upgrade Plans**

Known expansion / upgrade plans for Highway 99 may include an interchange at Blundell Road, replacement and/or expansion of the Oak Street Bridge, and replacement and/or expansion of the George Massey Tunnel and the Steveston Highway interchange.

Selecting a final alignment for the pipeline within the Highway 99 right-of-way will require consideration of those plans to minimize future right-of-way use conflicts.

**On-Street Parking**

Richmond city streets that offer street-side parking opportunities and that may be disrupted depending on the choice of alignment options include: Vanguard Road both

on the east and west side of Highway 99, St. Edwards Drive, and/or Patterson Road. Socio-economic / socio-community effects of possible temporary loss of access to on-street parking opportunities in those areas are expected to be low.

**Bicycle and Pedestrian Traffic and Mobility**

Neither bicycles nor pedestrians are permitted on Highway 99 from 1st Avenue in Surrey to the south approach of the Oak Street Bridge, including the highway portion that crosses Lulu Island. Bicycles and pedestrians may use the sidewalk along the Oak Street Bridge.

Bicycle traffic and pedestrian crossing under Highway 99 near Shell Road, and bicycle and pedestrian traffic going onto the Highway 99 Oak Street Bridge sidewalk from the Patterson Road bicycle path may need to be accommodated if existing bicycle and pedestrian access is disrupted.

**Schools, Recreation Areas and Other Community Features**

The main effects of pipeline construction on schools, recreation areas and other community features are expected to be temporary and relate to motor vehicle access, pedestrian and non-motorized traffic mobility, noise, dust, parking access including on-street parking, and tree and vegetation removal.

On the west side of Highway 99 between the Williams Road easement and Blundell Road, the B.C. Muslim Association facilities fronting Blundell Road and extending back along Highway 99 (including a large mosque, school related and other buildings and playing fields / sports courts) may be temporarily affected during pipeline construction. A small neighbourhood green space, Kilby Park that is adjacent to Highway 99 near Kilby Drive north of Cambie Road may also be temporarily affected.

Other community features that are adjacent to Highway 99 and that may be temporarily affected during pipeline construction include the Mylora Golf Courses and the Richmond Nature Park.

**Chapter 6** of the Application describes potential pipeline construction effects on Bridgeport Trail. If Highway 99 is selected, a much shorter portion of Bridgeport Trail would be affected, compared to the other pipeline route options.

**Street and Trail Trees**

**Section 5.3** of the Application and **Section 4.3** of this Addendum assess the potential effects on vegetation and wildlife. No attempt has been made in this assessment to

evaluate the value or significance of individual trees or groupings of trees with respect to species, age, health, or heritage value. The following paragraphs review potential pipeline construction effects on aesthetics of trees along the Highway 99 corridor in Richmond.

Existing trees along the Highway 99 Pipeline Route Option may be affected during construction, depending on the final pipeline alignment, construction methodology and footprint, and on how access to the Highway 99 right-of-way is gained. Trees that may be affected during construction, depending on the final pipeline alignment, include:

- Trees lining Highway 99 along the two Mylora Golf Courses; these are at least partly on the Highway 99 right-of-way;
- Undeveloped treed areas on both sides of Highway 99 between Blundell Road and Westminster Highway;
- Trees near the Richmond Nature Park; the Highway 99 right-of-way between the west and east portions of the Richmond Nature Park is very wide. However, a pipeline alignment near the northeast corner of the Highway 99 right-of-way boundary could potentially result in significant tree removal;
- Trees lining residential areas located north of Highway 91 on the east side of the Highway 99 right-of-way;
- Trees lining residential areas located between Shell Road and Cambie Road on the west side of Highway 99; and
- Trees lining the residential areas located north of Cambie Road on the west side of Highway 99.

From a socio-economic / socio-community perspective, trees that are removed for construction of the pipeline could likely be replaced in most cases if desired, but it may take some time for the new trees to provide the same screening and aesthetic value that currently exists.

**Air Quality, Noise and Health**

Separate assessments have been undertaken for potential air quality, noise and human health effects (see **Sections 4.3**, **4.4** and **Chapter 7**).

## Aesthetic Values / Visuals

As noted in **Chapter 6** of the Application, construction of the pipeline will require that construction machinery be brought in to build the system; as a result there will likely be some minor visual effects during construction for short periods of time in specific locations. In particular, directional drilling is likely to require on-site heavy construction equipment and there may be temporary and minor visual effects for residences along the pipeline routing, depending on directional drilling entry and exit points.

The Highway 99 Pipeline Route Option anticipates requiring more trenchless pipeline construction than the other routing options. As well, construction equipment required to build the pipeline will be visible from Highway 99 and surrounding properties. The Highway 99 corridor is lined primarily by agricultural lands and industrial / commercial uses, with very few residences directly adjacent. Visual effects associated with the construction equipment are therefore expected to be low.

Staging sites for trenchless pipeline construction will not be identified until the final alignment for the pipeline route option is defined. If the pipeline route is on the east side of Highway 99, areas where possible drilling sites may result in visual impacts to local residents include a possible site north of Blundell Road on the east side of Highway 99; and a possible site north of Bridgeport Road just east of Highway 99. If the pipeline route is on the west side of Highway 99, there could be visual impacts associated with a possible drilling site near the B.C. Muslim Association property south of Blundell Road, and possible drilling sites near residential properties south of Westminster Highway, and between Shell Road and Bridgeport Road.

## Railway Right-of-Way

The Highway 99 Pipeline Route Option will traverse under the current CNR rail right-of-way parallel to the Shell Road corridor north of Highway 91 at the Shell Road / Highway 99 overpass. Whether or not the Highway 99 Pipeline Route Option is aligned on the northeast or southwest side of Highway 99, the pipeline will be required to cross Vanguard Street, the railway tracks, potentially the Shell Road bike path and Shell Road itself.

As with other pipeline routing options, trenchless pipeline construction will likely be used for crossings under active railway tracks. As noted in **Chapter 6** of the Application, these crossings are expected to take approximately 1 week each to complete (Lavers, 2009, pers. comm.), but given the complexity of the crossing at Shell Road, more time may be required.

Crossing the CNR rail right-of-way at the Shell Road / Highway 99 overpass is unlikely to have any effect on existing railway traffic. There are long-term plans to decommission the CNR railway along Shell Road, and existing railway traffic is currently very limited.

**Utilities**

A high capacity power line parallels Highway 99 on the east side from the Williams Road easement north to Shell Road. A 10-metre separation is expected to be required between the high voltage power line and the pipeline.

As with all routing options presented in the Application, the Highway 99 Pipeline Route Option will cross the existing aviation fuel delivery pipeline operated by Kinder Morgan. Trenchless pipeline construction is likely to be required for this crossing.

More information on utility crossings / conflicts is expected to become available as the specific alignment along the Highway 99 corridor is defined. Some of the utility crossings that will need to be considered when preparing the final pipeline route alignment include:

- Gas line and fibre optic cable north of the Williams Road easement along the east shoulder of Highway 99;
- Water lines and gas lines along Blundell Road and Westminster Highway;
- Gas lines and other utilities under St. Edwards Drive on the east side of Highway 99; and
- Various utilities including water and gas lines beneath Vanguard Road and Shell Road.

Effects from utility crossings / conflicts are expected to be minor.

#### *5.4.1.2 Recommended Mitigation Measures*

Construction-related effects on the neighbourhoods and residents of Richmond that cannot be addressed through careful routing and alignment of the fuel delivery pipeline are expected to be addressed in the CEM Plan (see **Chapter 9** of the Application).

**Land Use Regime and Existing Land Use Context**

Pipeline construction plans will need to take into account existing land uses including businesses that operate adjacent to the Highway 99 corridor. There may be seasonal

sensitivities for certain types of businesses / community features that could be considered during construction planning.

**Motor Vehicle Traffic and Mobility**

As noted in the Application, traffic management will be addressed in a Traffic Management Plan (see **Chapter 9** of the Application), separate to the CEM Plan. Traffic management will consider motor vehicle, bicycle and pedestrian traffic and include time of day, day of week and seasonal sensitivities, as well as a communication strategy to publicize any likely delays and signage indicating alternate routes if required.

Measures that will be implemented to mitigate effects on motor vehicle traffic and mobility from pipeline construction are described in **Section 6.4.1.2** of the Application. Should any disruption to Highway 99 traffic flow be required, the following additional mitigation measures are recommended:

- Construction should be scheduled in consideration of the busiest traffic periods as will be described in the Traffic Management Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum), which will be developed in consultation with MoT;
- Trenchless pipeline construction should be used where beneficial and feasible and the use of Highway 99 shoulders or travel lanes for construction staging should be minimized; and
- Consideration should be given to using Francis Road to connect to Highway 99. If the Francis Road option is used from the fuel receiving facility to Highway 99, the length of pipeline construction in the most constricted portion of the Highway 99 right-of-way will be reduced approximately by half, relative to the Williams Road option.

Special considerations for effects on motor vehicle traffic and mobility on other city streets in proximity to Highway 99 as a result of pipeline construction along Highway 99 may also include construction across Vanguard Road. This should be undertaken in such a way that traffic flows to the cluster of industrial / retail businesses near Shell Road on the west side of Highway 99 are not significantly disrupted.

**Effects on On-Street Parking**

To minimize indirect effects of construction on street parking, parking for construction workers is recommended not to occur in areas where curbside parking is in high demand.

**Bicycle and Pedestrian Traffic**

Very limited to no impacts on bicycle and pedestrian traffic are expected. Provision for bicycle access across Highway 99 near Shell Road, and across Highway 99 to the Oak Street Bridge sidewalk may be required if existing routes are disrupted.

**Schools / Recreation Access and Other Community Features**

Major community features that may need to be considered in the CEM Plan include the B.C. Muslim Association facilities if the final alignment uses the west side of Highway 99, the Richmond Nature Park and the Mylora Golf Courses. Mitigation would include selection of the pipeline alignment to minimize effects on these features, or the use of trenchless construction methods.

**Street and Trail Trees**

As indicated in **Chapter 6** of the Application, environmental protection for street and trail trees will be incorporated in the CEM Plan using environmental BMPs to minimize effects to surrounding vegetation and tree stands of public value. This protection is expected to include methods to protect trees of high historical value, and a narrowed construction footprint, as appropriate, to minimize effects on greenbelt areas. At the completion of construction, greenbelts will be reseeded in the disturbed areas and visual screens of trees may be planted in selected locations.

**Utility Crossings and/or Conflicts**

A communication strategy will be incorporated into the CEM Plan to give advance notice of utility works and any disruptions in services that may result.

#### *5.4.1.3 Summary of Construction Effects and Mitigation*

Construction of the Project is expected to result in economic benefits arising from capital spending. The choice of pipeline route option, whether along Highway 99, Number 5 Road and/or the Shell Road corridor, will not alter those economic benefits.

The potential adverse socio-economic and socio-community effects from construction will be temporary and in general, are expected to be primarily associated with the adverse effects on Highway 99 motor vehicle traffic flows. Bus and motor vehicle traffic flows on Highway 99 may be particularly affected between the Williams Road easement and Blundell Road where either the east or west shoulder of Highway 99 and one of the HOV / bus lanes may be disrupted for pipeline construction. Using the right-of-way along Francis Road rather than along Williams Road to reach Highway 99 would reduce

by half the length of pipeline to be constructed in this narrow part of the Highway 99 right-of-way south of Blundell Road.

The Highway 99 Pipeline Route Option could have an adverse effect on street / trail trees including trees on either side of Highway 99 north of the Williams Road easement; trees lining several clusters of residential areas between Highway 91 and Bridgeport Trail; and trees located on the highway right-of-way near the Richmond Nature Park. Environmental protection for street and trail trees will be incorporated into the CEM Plan (see **Chapter 6** of the Application).

### 5.4.2 Project Operations / Maintenance

#### *5.4.2.1 Potential Effects*

This section reviews the potential effects from on-going operations of the fuel delivery pipeline for the Highway 99 Pipeline Route Option. Potential effects as a result of an accident or malfunction are assessed in **Chapter 9** of this Addendum.

**Economic Development**

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. The choice of pipeline routing option will have no impact on the economic development benefits that are expected as a result of the Project.

During operations, the Project will generate approximately 14 full-time equivalent jobs and this will not be affected by the choice of pipeline routing option.

**Land Use Regime and Existing Land Use**

**Section 5.2.2** reviews the land use regime, existing land use and properties nearby the Highway 99 Pipeline Route Option. Regardless of the pipeline routing option, once in operation, the existence of an underground aviation fuel pipeline will not affect future uses of the privately or publicly owned properties that are adjacent to the pipeline (construction of structures would not be permitted directly above the pipeline right-of-way). As noted in **Chapter 6** of the Application, there is no land use restriction associated with proximity to an aviation fuel pipeline. Also, the existence of an underground aviation fuel pipeline would not prevent other utilities from using that same corridor, although it would require that any new utility be installed with some minimum separation from the fuel delivery pipeline.

Highway 99 is a major regional and provincial transportation route with ongoing upgrades and long-term capacity expansion plans. Known expansion / upgrade plans for Highway 99 may include an interchange at Blundell Road, replacement and/or expansion of the Oak Street Bridge, and replacement and/or expansion of the George Massey Tunnel and the Steveston Highway interchange. Selecting a final alignment for the pipeline within the Highway 99 right-of-way will require consideration of those plans to minimize possible future right-of-way use conflicts.

**Property Value**

As described in **Chapter 6** of the Application, throughout this assessment, the term 'property value' refers to market value, which is driven by the 'highest and best use' of a property. This may be different than the use and enjoyment value of a property to its owner. For example, an individual may derive less 'enjoyment' value from his/her property as a result of the proposed pipeline, but the market may not place a value on his/her uneasiness from residing in a property that is now adjacent to the pipeline corridor. One of the main potential concerns of residents in the City of Richmond could be whether the existence of an aviation fuel pipeline will affect property values.

Also explained in **Chapter 6** of the Application, there is little evidence that the existence of an aviation fuel pipeline would affect property values negatively. It is possible that some short-term negative effects on property values along the pipeline corridor could develop under certain circumstances during operations. For example, this could occur if there was a significant pipeline accident or malfunction that had substantial negative effects on a property or neighbourhood, even if that accident involved a natural gas or oil pipeline that bears little resemblance to the operations and risks associated with an aviation fuel pipeline. In the medium- to long-term (beyond 3 years of any such effects arising), it is expected that those effects would dissipate.

The Highway 99 Pipeline Route Option would reduce by over 60% the number of residences near the delivery pipeline corridor relative to the other routing options examined. As indicated in **Section 5.3.1**, between 66 and 74 residences (with significant setbacks in some cases) have the potential to be adjacent to the overall Highway 99 Pipeline Route Option (including segments common to other options). These include 43 residences that are near the west side of the Highway 99 right-of-way, and 19 residences that are near the east side of the Highway 99 right-of-way. In contrast, the number of residences adjacent to the other pipeline route options reviewed in **Chapter 6** of the Application was greater and ranged from 199 to 287.

**Motor Vehicle Traffic, Mobility and On-Street Parking**

Once the Project is in operation, it will eliminate the need for the significant number of tanker trucks that currently carry aviation fuel to YVR on a daily basis.

Once the Project is in operation, pipeline maintenance requirements should have little effect on motor vehicle traffic or on-street parking along the pipeline corridor.

**Bicycle and Pedestrian Traffic**

Once the pipeline is in operation, there are not expected to be any negative effects on pedestrian or bicycle traffic, as the pipeline corridor is expected to be returned to pre-construction conditions or better.

Long-term maintenance of the pipeline may require periodic access by localized excavation. It would be expected that any maintenance would be carried out in much the same way as the pipeline construction activities.

**Schools, Recreation Areas and Community Features**

The on-going operations / maintenance activities of the delivery pipeline are not expected to have any effects on schools, recreation areas and community features.

**Street and Trail Trees**

The on-going operations / maintenance of the delivery pipeline is not expected to have any effects on street or trail trees with the possible exception of the Highway 99 right-of-way portion that is adjacent to the Richmond Nature Park. Trees removed to create a pipeline corridor in this area would likely not be replaced, to retain pipeline maintenance access.

**Air Quality, Noise and Health**

Separate assessments have been undertaken for potential air quality, noise and human health effects (see **Sections 4.3**, **4.4** and **Chapter 7** of this Addendum).

**Aesthetic Values / Visuals**

The pipeline will be located underground (with the exception of valve stations) and as a result there should be no visual effects once in operation.

**Railways**

No effect on railway corridors is expected during operations.

**Utilities**

Once pipeline construction is completed, the crossings of utilities, natural gas pipelines, and the existing fuel delivery pipeline should not conflict with the operations of those utilities.

#### *5.4.2.2 Recommended Mitigation Measures*

**Motor Vehicle, Bicycle and Pedestrian Traffic**

During operations, when periodic maintenance involved with the pipeline occurs, measures to alert the public and accommodate local vehicle, bicycle and pedestrian traffic are recommended to avoid or minimize adverse effects on the surrounding community.

#### *5.4.2.3 Summary of Operations Effects and Mitigation*

The major long-term benefit of the Project is to assist YVR in remaining competitive as a world class airport, and by doing so enhance the general economic competitiveness of Richmond, Metro Vancouver, B.C. and Canada. The fuel delivery system is an integral part of YVR operations, and the YVR Master Plan recognizes the need for a new airport fuel delivery system.

The choice of pipeline routing option will have no effect on the benefits associated with the fuel delivery system to Metro Vancouver in terms of the elimination of truck traffic carrying aviation fuel and to YVR.

Activities along the pipeline corridor related to operations will be rare and short in duration. When periodic maintenance occurs along the pipeline right-of-way, measures to alert the public and accommodate local vehicle, bicycle and pedestrian traffic are recommended.

Some minor adverse socio-economic / socio-community effects from on-going operations may result from short-term effects on property value during periods of general public concern over pipeline safety, but to the extent that this may occur, the choice of the Highway 99 Pipeline Route Option may help minimize impacts on neighbourhoods and residential areas.

## 5.5 Potential Residual Effects and Their Significance

This assessment indicates that the Highway 99 Pipeline Route Option will have no significant adverse residual effects during construction or operations / maintenance provided the recommended mitigation measures are implemented.

During construction, all potential residual effects are rated “negative moderate” or better (Not Significant) except for the potential effect on motor vehicle traffic and mobility during construction which is rated as ”negative moderate / high” (potentially Significant), depending on the final pipeline alignment and/or the selection of construction methods. The potential effect on motor vehicle traffic relates primarily to Highway 99 between the Williams Road easement and Blundell Road. Those effects may be substantially mitigated once traffic management and construction management plans are developed.

During operations / maintenance, the project is expected to have significant positive effects on YVR and economic activity in the region and the province. All other potential residual effects were rated “Not Significant”.

Potential residual effects from the Highway 99 Pipeline Route Option construction and operations / maintenance are summarized in **Table 5.5.1** and **Table 5.5.2**. A legend for these summary tables is shown in **Table 6.2.1** of the Application**.**

**Table 5.5.1 Socio-Economic and Socio-Community Residual Effects from Construction**

| Valued Component | Potential Residual Effect from Highway 99 Pipeline Route Option | Specific Activities/Primary Concerns | Significance Criteria | | | | | | | | Overall Significance Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Direction | Duration | Frequency | Reversibility | Ecological Context | Probability | |
| Economic Development | Project effects on jobs, Gross Domestic Product and economic activity | Section 5.4.1 | Low | Region | Positive | Short-term | Ongoing | Irreversible | N/A | High | Not Significant (positive) |
| Land Use | No residual effects are expected | Section 5.4.1 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Property Acquisitions and Property Value | May affect liquidity during construction period; some short-term use of private property may be required | Section 5.4.1 | Low | Local | Negative | Short-term | Ongoing | Reversible | N/A | Low | Not significant (adverse) |
| Motor Vehicle Traffic and Mobility | Changes in motor vehicle traffic flows and access – significance depends on specific alignment, construction methods and feasibility of mitigation measures | Section 5.4.1 | Moderate / High | Region | Negative | Short-term | Ongoing | Reversible | N/A | High | Potentially Significant (adverse) |
| On-street Parking | Changes to roadside parking availability | Section 5.4.1 | Low | Local | Negative | Short-term | Ongoing | Reversible | N/A | High | Not significant (adverse) |
| Bicycle / Pedestrian Traffic and Mobility | Changes to bicycle and pedestrian access | Section 5.4.1 | Low | Local | Negative | Short-term | Ongoing | Reversible | N/A | High | Not significant (adverse) |
| Schools / Recreation Access and Other Community Features | Changes to access and enjoyment: effects depend on final alignment within Highway 99 right-of-way; west side alignment may impact B.C. Muslim Association facilities | Section 5.4.1 | Low / None | Local | Negative | Short-term | Ongoing | Reversible | N/A | High | Not significant (adverse) |
| Street / Trail Trees | Changes to street or trail trees: effects depend on final alignment within Highway 99 right-of-way; potential effects near Richmond Nature Park, trees lining Mylora golf courses | Section 5.4.1 | Low / Moderate | Local | Negative | Short-term | Once | Reversible | N/A | High | Not significant (adverse) |
| Aesthetic Values / Visuals | Visuals associated with trenchless pipeline construction and other construction equipment | Section 5.4.1 | Low | Local | Negative | Short-term | Ongoing | Reversible | N/A | High | Not significant (adverse) |
| Railway Rights-of-Way | Railway right-of-way and crossing of tracks near Shell Road and the Moray Channel | Section 5.4.1 | Low | Local | Negative | Short-term | Ongoing | Irreversible | N/A | High | Not significant (adverse) |
| Utilities | Pipeline corridor utility crossings and/or utility displacement | Section 5.4.1 | Low | Local | Negative | Long-term | Ongoing | Irreversible | N/A | High | Not significant (adverse) |

**Table 5.5.2 Socio-Economic and Socio-Community Residual Effects from Operations/Maintenance**

| Valued Component | Potential Residual Effect from Highway 99 Pipeline Route Option | Specific Activities/Primary Concerns | Significance Criteria | | | | | | | | Overall Significance Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Direction | Duration | Frequency | Reversibility | Ecological Context (Ability to Recover) | Probability | |
| Economic Development | Positive effects on jobs, Gross Domestic Product and economic activity, mainly from effects on YVR; same for all pipeline routing options | Section 5.4.2 | Moderate | Region | Positive | Long-term | Ongoing | Irreversible | N/A | High | Significant (positive) |
| Land Use | No anticipated residual effects | Section 5.4.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Property Acquisitions and Property Value | Possible temporary low negative effect to property value adjacent to the proposed pipeline due to changes in public perceptions from time to time; Highway 99 Pipeline Route Option is adjacent to fewer residential properties than other options | Section 5.4.2 | Low | Local | Negative | Short-term | Infrequent | Reversible | N/A | Uncertain | Not Significant (adverse) |
| Motor Vehicle Traffic and Mobility | Changes in truck traffic volumes on city streets and highways; same for all pipeline routing options | Section 5.4.2 | Low | Local | Positive | Long-term | Ongoing | Reversible | N/A | High | Not Significant (positive) |
| On-street Parking | No anticipated residual effect | Section 5.4.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Bicycle / Pedestrian Traffic and Mobility | Changes to bicycle and pedestrian access from need to access pipeline for maintenance; Highway 99 does not allow bicycles / pedestrians except near Oak Street Bridge | Section 5.4.2 | Low | Local | Negative | Long-term | Infrequent | Reversible | N/A | Low | Not Significant (adverse) |
| Schools / Recreation Access and Other Community Features | No anticipated residual effects | Section 5.4.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Street / Trail Trees | Possible permanent tree removal near Richmond Nature Park depending on final route alignment within Highway 99 right-of-way | Section 5.4.2 | Low / Moderate | Local | Negative | Long-Term | Ongoing | Reversible | N/A | Uncertain | Not Significant (adverse) |
| Aesthetic Values / Visuals | No anticipated residual effects | Section 5.4.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Railway Rights-of-Way | No anticipated residual effects | Section 5.4.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Utilities | No anticipated residual effects | Section 5.4.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

## 5.6 Potential Cumulative Impacts

One potentially significant adverse residual effect was identified for the construction phase of the Highway 99 Pipeline Route Option. Motor vehicle traffic and mobility may be affected in a potentially significant way, depending on the final alignment, the construction methods, and the feasibility of mitigation measures. Although this potentially significant residual effect was identified, no other projects were found to have a spatial or temporal overlap in effect type, so no cumulative impacts were identified for this assessment.

## 5.7 Conclusion

All potential residual effects are assessed as not significant, except for the potential effects on motor vehicle traffic and mobility primarily to Highway 99 between Williams Road easement and Blundell Road, which may be substantially mitigated with the traffic management and construction management plans to be developed. No significant adverse residual effects during operations / maintenance have been identified. The Project is expected to have significant positive effects on YVR and economic activity in the region and the province. Potential cumulative impacts are assessed as "nil".

## 5.8 References

Bauder, K. 2009. Richmond Nature Park. Personal Communication. E-mail to Pierce Lefebvre Consulting. November 7, 2009.

Lavers, J. 2009. Chinook Engineering Ltd. Personal Communication. Telephone conversation with Sylvie Lefebvre and Claude Pierce of Pierce Lefebvre Consulting. December 4, 2009.

MoT. 2011. Traffic Data Program for 2009 and 2010. B.C. Ministry of Transportation and Infrastructure. [Online] Available online at: http://www.th.gov.bc.ca/trafficdata/tradas/tradas.asp?loc=P-16-3B (Accessed on June 22, 2011).

Mylora Golf Courses. 2010. Our Courses. [Online] Available at: http://www.mylora.ca/index_files/ourCourses.htm (Accessed on April 8, 2010).

City of Richmond. 2011. Zoning Bylaw 8500. [Online] Available online at: http://www.richmond.ca/__shared/assets/AmendmentList850024569.pdf (Accessed on August 12, 2011).

# Chapter 6
## Assessment of Heritage Effects

# 6 ASSESSMENT OF HERITAGE EFFECTS

## 6.1 Approach and Methodology

The approach and methodology for the assessment of heritage effects for the Highway 99 Pipeline Route Option are as described in **Section 7.2** of the Application. This included a review of available, appropriate ethnographic and archaeological literature for the Fraser Delta area and unpublished reports on file with the provincial Archaeology Branch in Victoria. Information of archaeological site distribution was obtained from the Remote Access to Archaeological Data application. Biophysical information was obtained from maps prepared by the Geological Survey of Canada (surficial geology), B.C. Ministry of Agriculture and Lands (soils), MoE (historic vegetation patterns), the MoFR (biogeoclimatic zones), and the City of Richmond (historic slough distribution). The results of the review of historic aerial photographs obtained from the Geographic Information Centre at University of British Columbia prepared for the original application were re-consulted.

This assessment was prepared by AMEC Environment and Infrastructure (formerly Arcas Consulting Archaeologists Ltd.).

### 6.1.1 Field Reconnaissance

A field visit to the lands that could potentially be affected by the Highway 99 Pipeline Route Option was conducted to visually assess landscape integrity and heritage resource distribution. The inspection was carried out on June 27, 2011.

Field reconnaissance methodology is described in **Section 7.2.3.3** of the Application.

The focus of the field reconnaissance was a visual inspection of the Highway 99 Pipeline Route Option to assess its archaeological resource potential. Both sides of Highway 99 were inspected. Landscape features (both natural and cultural) observed during the review of aerial photographs were identified in the field, and their relative integrity and potential influence on archaeological site distribution was evaluated. Where present, subsurface soil exposures visible in drainage ditches along Highway 99 were also examined.

## 6.2 Study Area

The Highway 99 Pipeline Route Option is located within the RSA as described in **Section 7.2.2** of the Application. For the purposes of this assessment, the LSA is defined as the Highway 99 corridor from Williams Road north approximately 7.7

kilometres to the Bridgeport Trail, and includes a 100-metre buffer on either side of the highway right-of-way (**Figure 6.2.1**).

## 6.3 Baseline Conditions

Information on biophysical characteristics affecting archaeological potential, including landscape and terrain, geology and soils, hydrology, modern and historic vegetation patterns, paleontological setting, cultural setting, archaeological resource potential, and VCs for the RSA are described in **Section 7.3** of the Application and summarized below.

### 6.3.1 Landscape and Terrain

The Highway 99 Pipeline Route Option is situated within the interior portion of Lulu Island, the largest of the Fraser Delta islands at the mouth of the Fraser River. Most of the land is at an elevation within 1.5 metres above mean sea level.

### 6.3.2 Geology and Soils

The western half of Lulu Island, and the location of the LSA, was formed by progradation of the Fraser Delta from 5,000 BP until present (Clague et al. 1983, Ryder 1996, Williams and Roberts 1989) with no bedrock formations present anywhere on Lulu Island (Johnston 1923). The sediments of Lulu Island are principally comprised of Holocene-aged Fraser River sediments (i.e., silty to silty-clay loam overbank deposits overlying deltaic sediments) or lowland peat deposits on top of overbank sediments (Armstrong and Hicock 1979).

### 6.3.3 Hydrology

Of particular importance to the archaeology potential of the Highway 99 Pipeline Route Option is the presence of historic slough complexes. As Ham (1987) has stressed, delta sloughs once provided internal communication routes and access to resources that were restricted to wetland and/or riparian environmental settings, and were also critical fish-rearing habitat. These historic sloughs are mostly gone today, having been diverted into roadside drainage ditches and/or filled-in. The City of Richmond has prepared a map showing the distribution of these sloughs (**Figure 6.2.1**). A branch of Phoenix Slough is shown to be located at the southern end of the LSA. Highway 99 crosses Cambie Road, Elliot and Scratchley Sloughs in the north part of the LSA.

### 6.3.4 Modern and Historic Vegetation Patterns

North et al. (1979) produced a map of historic vegetation patterns of the Fraser Lowland, based upon the observations of 19th century land-surveyors. Comparison of

that map to the route of Highway 99 indicates that the southern portion of the LSA formerly consisted of prairie grass with shrubs, with a cranberry marsh north to the Richmond Nature Park. The northern portions of the LSA consisted of prairie to mixed shrubland on the North Arm of the Fraser River.

### 6.3.5 Paleontological Setting

An assessment of paleontological resources within the Highway 99 Pipeline Route Option was conducted to determine paleontological potential, identify any reported resources and evaluate the potential for encountering paleontological resources during Project construction. A complete description is available in **Section 7.3.2** of the Application.

### 6.3.6 Archaeological Setting

A full description of the archaeological setting for the Highway 99 Pipeline Route Option is available in **Section 7.3.3** of the Application. The types of archaeological resources that can be expected include: artefact scatters, wetsites, and fish weirs in the sloughs. Explanation of the various types of archaeological resources is provided in **Section 7.3.3.1** of the Application.

Archaeologists have divided the last 9,000 years of human occupation in the RSA into archaeological time periods. From oldest to youngest they are: Old Cordilleran (9,000-4,500 BP), St. Mungo (4,500-3,300 BP), Locarno Beach (3,300-2,300 BP), Marpole (2,400-1,000 BP) and Stselax or Developed Coast Salish (1,000-200 BP). Summary information on the various phases is presented in **Table 7.3.1** of the Application with supplementary information on archaeological research for the RSA provided in **Section 7.3.3.3** of the Application. Thirty prehistoric sites have been identified in the RSA, with 44 sites consisting of historic remains and/or structures and five sites with a mix of prehistoric and historic cultural remains. Refer to **Table 7B-1** in **Appendix 7B** of the Application for more details.

### 6.3.7 Ethnographic Setting

Lands upon which the Highway 99 Pipeline Route Option is situated were traditionally occupied and/or used seasonally by the ancestors of several Coast Salish communities, including the Hwiltsum, Katzie, Kwantlen, Musqueam, Semiahmoo, Tsawout, Tsawwasen, Snuneynuxw, Chemainus, Halalt, Lake Cowichan, Cowichan Tribes, Lyackson and Penelakut First Nations.

The Katzie, Kwantlen, Musqueam and Tsawassen First Nations are Mainland Halkomelem language speakers. The Chemainus, Halat, Lake Cowichan, Lyackson,

Penelakut, Cowichan Tribes and Snuneymuxw First Nations are Island Halkomelem language speakers. The Semiahmoo Nation speak the North Straits language. The Mainland Halkomelem, Island Halkomelem, and Northern Straits languages are part of the Central Coast Salish group. Some Mainland Halkomelem-speaking groups in this area are represented by the Stó:lō Research and Resource Management Centre on cultural heritage issues. A summary of traditional Coast Salish society is provided in **Section 7.3.4** of the Application**,** with a list of Traditional place names known for the RSA provided in **Table 7.3.2** and their locations shown on **Figure 7.3.1** of the Application. Traditional place names in proximity to the Highway 99 Pipeline Route Option LSA are shown on **Figure 6.2.1**.

### 6.3.8 Historical Setting

A summary of the historical setting for the RSA is provided in **Section 7.3.5** of the Application. The section of Highway 99 through Lulu Island was constructed from the 1950s to early 1960s. The current Highway 99 freeway across Lulu Island opened in 1962, though the George Massey Tunnel has been open to traffic since April 1958. Prior to construction of the highway, lands upon which the highway is situated were covered by shrub forest or cranberry bog or a mix of both. Later, the lands served as peat farms or for agriculture, and after construction of the highway saw the growth of industrial / commercial activities and residential developments bordering the highway.

### 6.3.9 Archaeological Resource Potential

#### *6.3.9.1 Historic Aerial Photography Interpretation and Additional Historic Imagery*

The results of the interpretation of historic aerial photographs and additional archival imagery for the RSA is provided in **Section 7.3.6.1** and **Section 7.3.6.2** of the Application (see also **Table 7C-1** in **Appendix 7C** of the Application). Historic aerial photographs from 1955 to 1962 were not available, and therefore no imagery of the Highway 99 Pipeline Route Option while the highway was under construction was viewed. However, the 1954 and 1963 aerial photographs did allow for interpretation of alterations to the landscape resulting from highway construction (see **Table 7C-1** in **Appendix 7C** of the Application).

#### *6.3.9.2 Field Reconnaissance Results*

Photos from the field reconnaissance are presented in **Appendix 6A**. **Photos 6A-1, 6A-2, 6A-3,** and **6A-4** show the Highway 99 corridor from the Blundell Road overpass.

No undocumented archaeological remains were observed along either side of Highway 99.

#### *6.3.9.3 Evaluation of Landscape Attributes*

The landscape attributes selected for this assessment are as described in the Application (see **Section 7.3.6.4** of the Application). Based upon the outcome of the background research and the field reconnaissance, the relative utility of each attribute is assessed as follows:

- **Historic vegetation patterns**: The vegetation patterns observed by 19th century land-surveyors on Lulu Island (North et al. 1979) were significantly different from those present today. For land that could be occupied by the pipeline within the Highway 99 Pipeline Route Option, landscape modifications have removed most if not all of the original vegetation. Evidence for wetland complexes (i.e., sphagnum bog, cranberry marsh) and the Labrador Tea-Pine association associated with the Central Lulu Island Bog (see **Section 7.3.1.4** of the Application for explanation of the various vegetation associations historically present in the RSA) were observed in cutbank profiles of drainage ditches along Highway 99. Remnants of the historic Central Lulu Island Bog are present today within the confines of the Richmond Nature Park, on both sides of Highway 99 between Westminster Highway and Highway 91. Based on the distribution of documented prehistoric sites, this variable was moderately useful for assessing archaeological resource potential within the Highway 99 Pipeline Route Option.

- **Proximity to documented cultural heritage resources**: Only one documented prehistoric site (DhRs-80; see **Figure 6.2.1**) appears to be situated within 400 metres of the Highway 99 Pipeline Route Option. No historic sites are recorded in the LSA. For these reasons, the proximity of documented cultural heritage resources was not particularly useful for understanding heritage resource potential within the Highway 99 corridor.

- **Traditional place names (cultural geography)**: No traditional place names are associated with any part of the Highway 99 Pipeline Route Option. Given that ethnohistoric land use patterns emphasize the importance of traditional resources that are most abundant in inland habitats (e.g., cranberries) this variable is considered to be moderately important for assessing heritage resource potential within the Highway 99 corridor.

- **Proximity to aquatic features**: Highway 99 crosses several former distributary sloughs along its route through inland settings on Lulu Island. No evidence of the

former sloughs was observed during the field reconnaissance. However, old sloughs were located where Highway 99:

- Crosses and/or parallels an old slough channel at its intersection with Williams Road
- Crosses three old slough channels between the Highway 91 and Bridgeport Trail

Given that the sloughs have been identified as being critical access routes across Lulu Island (Ham 1987, 1996b), and that documented archaeological sites in this locality are clearly configured to past or present slough channels (e.g., DgRs-27, DgRs-28), the presence of aquatic features (old slough channels) are considered to be a critical variable for assessing cultural heritage resource potential within the Highway 99 Pipeline Route Option.

- **Soil texture and drainage quality**: Available soil mapping is only available south of Westminster Highway. Soils are characterized as being poorly to very poorly drained due to a high groundwater table (Luttmerding 1980). Given that documented archaeological sites are present in demonstrably poor drainage locations on Lulu Island, this variable is not critical for assessing cultural heritage resource potential.

- **Current understanding of traditional resource use and settlement**: Ham (1996b) emphasizes a traditional pattern of seasonal dispersal of family-based resource-harvesting groups to Lulu Island from permanent winter villages or house-sites. Ham (1987) notes that although some fish species spawned in the slough channels, plant resources were the primary attraction of interior locations on the delta islands. Traditional land use patterns in the interior of Lulu Island would have principally resulted in the formation of archaeological sites comprised of localized artefact scatters associated with transitory resource-harvesting sites. As a result, this variable is important for understanding the distribution of archaeological resource potential within the Highway 99 Pipeline Route Option.

- **Environmental settings of documented heritage sites**: No prehistoric archaeological sites are recorded in the LSA (i.e., within 100 metres of the Highway 99 right-of-way). However, over 30 recorded prehistoric sites have been identified within the RSA and 38 historic urban or rural structures are also recorded (see **Figure 7.3.1** of the Application). The diversity of environmental settings for both prehistoric and historic sites are important variables for assessing archaeological and historic resource potential.

- **Landscape integrity as a reflection of modern land use practices**: Landscape integrity is considered to be the most critical variable for assessing cultural heritage resource potential. The construction of Highway 99 has degraded the integrity of all lands within its right-of-way. Based upon observations made by numerous archaeological authorities (e.g., Kidd 1968, Yip and Gose 1979, Ham 1987, 1996a, Arcas Consulting Archeologists 1997, 2002, Alexander 2003), and the distribution of documented archaeological and historic sites on Lulu Island, the prospects for finding archaeological sites within the Highway 99 Pipeline Route Option, that could be disturbed during construction, are predicted to be minimal.

### 6.3.10 Valued Components

VCs for this assessment include four resource types: paleontological sites, archaeological sites, traditional places and traditional land use, and historic and heritage sites. Full definitions are available in **Section 7.3.7** of the Application.

## 6.4 Potential Effects and Recommended Mitigation Measures

As the Highway 99 Pipeline Route Option is within the existing highway corridor, the potential for encountering undocumented archaeological and historic resources is low. The presence of recorded archaeological sites in Lulu Island settings like the Highway 99 corridor signify that Aboriginal people did make use of environments like those traversed by the Highway 99 Route Option.

### 6.4.1 Potential Effects on Heritage Resources

The types and frequencies of heritage resources that may be encountered during construction of the Highway 99 Pipeline Route Option are described below and summarized in **Table 6.4.1**.

#### *6.4.1.1 Paleontological Resources*

There are no bedrock outcrops on Lulu Island in which fossils could occur, and as geoscientists have determined that the western portion of Lulu Island did not form until around 5,000 years ago, there is no possibility of finding Quaternary-aged fossil organisms in unconsolidated Fraser River sediments. Additional information can be found in **Section 6.3.5** and in **Section 7.3.1.2** of the Application. There is no potential for paleontological resources to be encountered during Highway 99 Pipeline Route Option construction or operations.

#### *6.4.1.2 Archaeological Resources*

Archaeological sites can be categorized into two types:

- Scatters of stone artefacts, sometimes accompanied by fire-altered rocks; and
- Wetsites, including the remnants of fish weir features.

#### *6.4.1.3 Historical Heritage Resources*

None of the documented historic sites in the Richmond Heritage Inventory (see **Section 7.4.1.3** of the Application) are within the Highway 99 Pipeline Route Option, and no historic heritage resources were observed during the field reconnaissance. Therefore, historic heritage resources will not be affected by the Highway 99 Pipeline Route Option.

**Table 6.4.1 Predicted Heritage Site Types Within the Highway 99 Pipeline Route Option**

| Likely Encounter Location | Type | Examples | Environmental Setting | Potential |
|---|---|---|---|---|
| Southern end of Option, at Williams Road – tributary of Phoenix Slough crossing | Artefact scatter | DgRs-28; DhRs-80, DhRt-89 | Beside slough channels | Moderate |
| Between Alderbridge Way and Cambie Road – Cambie Road Slough | | | Potentially all environment types in Highway 99 Pipeline Route Option | Moderate |
| Between Cambie Road and Bridgeport Trail – Elliot and Scratchley Sloughs | | | | |
| All slough crossings | Wetsite | DgRs-15; DgRs-17; DhRt-23 | Old slough channels; bogs | Moderate |
| Lands within Central Lulu Island Bog | | | | Moderate |

### 6.4.2 Assessment of Potential Effects

The Highway 99 Pipeline Route Option has limited potential for archaeological and other heritage sites due to its highly disturbed nature (low landscape integrity) resulting from construction and on-going maintenance of the highway. Only prehistoric archaeological sites could possibly be affected by the Highway 99 Pipeline Route Option, with the following locations (summarized in **Table 6.4.2**) having the highest sensitivity:

**Highway 99 Pipeline Route Option – Southern End:** The southern end of the corridor at its intersection with the Williams Road easement crosses a tributary channel of the historic Phoenix Slough. Small artefact scatters have been discovered in association with slough channels elsewhere on Lulu Island, and Ham (1987) has emphasized the traditional importance of sloughs to Aboriginal communities. Given the developed condition of Highway 99, such archaeological sites would tend to have low "archaeological visibility" in this corridor, and would only have the potential to be encountered in excavations that extended into native soils.

- **Highway 99 Pipeline Route Option – Westminster Highway to Alderbridge Way:** This section of the highway corridor crosses the buried channels of the Cambie Road Slough. One archaeological site (DhRs-80) has been found in a comparable setting north of the Highway 99 corridor near Cambie Road. As above, sites associated with old slough channels would only have the potential to be encountered during excavations that extended into native soils.

- **Highway 99 Pipeline Route Option – Alderbridge Way to Bridgeport Trail**: This section of the highway corridor crosses buried channels of the Elliot and Scratchley slough complexes. As noted above, small archaeological sites have been found in comparable settings in association with old slough channels. Such sites, as described above, would only have the potential to be encountered during excavations that extended into native soils, even though sites may not be deeply buried within them.

**Table 6.4.2 Potential Effects of Pipeline Construction within Highway 99 in Locations where Archaeological Resources could be Encountered**

| Site | Location | Construction Effects | Residual Effects Potential |
|---|---|---|---|
| Unknown | Pipeline – south end of Highway 99 at Williams Road; tributary of Phoenix Slough | Possible Conflict | Unknown |
| Unknown | Pipeline - between Westminster Highway and Alderbridge Way – Cambie Road Slough | Possible Conflict | Unknown |
| Unknown | Pipeline - between Alderbridge Way and Bridgeport Trail – Elliot and Scratchley Sloughs | Possible Conflict | Unknown |

#### *6.4.2.1 Potential Effects from Project Construction*

The primary potential effect of pipeline construction within the Highway 99 right-of-way on archaeological resources is destructive disturbance due to ground altering and excavation activities. Pipeline construction activities which could disturb archaeological resources include:

- Vegetation clearing (where present);
- Removal of native soils;
- Excavation of pipeline trenches;
- Excavation of entry / exit points for directional drilling; and
- Installation of temporary structures (roads, drainage).

#### *6.4.2.2 Archaeological, Historical and Heritage Data Gaps*

An Archaeological Impact Assessment (AIA) will be required in accordance with regulatory compliance under the B.C. *Heritage Conservation Act*, to address archaeological data gaps, and provide site-specific recommendations for protecting and/or mitigating effects on archaeological resources. Specific recommendations with regard to the completion of the AIA are listed below:

- An AIA should be conducted in areas where ground disturbing activities will take place within the Highway 99 Pipeline Route Option in locations rated as having "Moderate" archaeological resource potential (i.e., crossings of old slough channels). The AIA must be conducted in accordance with the conditions of a Section 14 (Heritage Inspection) Permit issued by the B.C. Ministry of Forests, Lands and Natural Resource Operations (Archaeology Branch) pursuant to the B.C. *Heritage Conservation Act*.

- Construction excavations in areas rated as having "Moderate" archaeological potential and that extend into native soils beneath Highway 99 should be monitored by qualified archaeologists.

No further studies are required to assess potential Project effects on paleontological resources and historical or non-archaeological heritage resources, or within lands rates as having "Low" potential for encountering archaeological resources.

### 6.4.3 Mitigation Measures and Management Strategies

As noted in **Section 7.4.4** of the Application archaeological, historical and heritage resources are non-renewable, meaning that adverse effects to these resources are irreversible. For this reason, and in nearly all situations, the preferred management recommendation is avoidance of archaeological, historical and heritage sites through Project design / redesign measures (e.g., pipeline routing realignments). In circumstances where such a measure is not practical (e.g., redesign options limited by existing infrastructure or environmental constraints), mitigation, as described in **Section 7.4.4** of the application, is a normal requirement for a project's approval.

As a basic principle of cultural heritage resource management, "mitigation" refers to measures that can be implemented to reduce the deleterious effects of Project construction and operations / maintenance on archaeological, historical and heritage resource values (Archaeology Branch 1998: Section 3.6.1). In most cases, mitigative studies like systematic data recovery (i.e., scientific excavations) will be necessary prior to any land-altering construction activities that could adversely affect the integrity of such resources.

The heritage resource overview assessment (presented here) is an appropriate preliminary stage for identifying and evaluating heritage resource potential within lands that will be occupied by Project facilities or disturbed during construction. **Section 7.4.2.2** of the application describes the recommended AIA as a typical next step following a heritage resource overview assessment. Mitigation measures recommended through completion of these two studies shall be included in the CEM Plan (**Chapter 9** of the application).

The AIA for the Highway 99 Option would be most effective if conducted during Project construction, due to factors that will significantly constrain a more customary pre-construction assessment of these lands, such as:

- Presence of deep deposits of imported fill overlying possible archaeological remains;
- Native soils associated with historic slough channels that are deeply buried beneath the modern land surface; and
- Locations where deep testing will be required may be beneath existing urban / suburban thoroughfares.

Should heritage resources be identified during the AIA, the 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. Information on the legislative requirements are specified in the CEM Plan (**Chapter 9** of the Application).

## 6.5 Potential Residual Effects and Their Significance

A residual effects assessment was not deemed appropriate for as-yet undocumented archaeological sites that may be present along the Highway 99 Pipeline Route Option and that may or may not be discovered during construction. Finally, since no potential effects were identified for historic heritage sites, paleontological fossil occurrence or traditional land use, no residual effects are expected.

## 6.6 Potential Cumulative Impacts

This assessment identified no potential residual effects for paleontological, historic, or traditional use sites, since there was no potential for these to occur within the Highway 99 Pipeline Route Option. As yet undocumented archaeological sites may be discovered during construction, but the assessment of residual effects of such sites is not appropriate for this assessment. The identification of cumulative impacts is dependent on their being significant adverse residual effect resulting from Project

construction or operations. Since no residual effects were identified for the assessment, no cumulative impacts were identified for the assessment.

## 6.7 Conclusion

There is no potential for paleontological, historic, or traditional use sites to occur within the Highway 99 Pipeline Route Option.

There is the possibility of encountering as-yet undocumented sites that may occur along the Highway 99 Pipeline Route Option, but assessment of residual effects to such sites is not appropriate for this stage of the assessment (see **Table 6.4.1**). Project construction, including vegetation clearing, removal of native soils, excavation of pipeline trenches, and excavation of entry / exit points for directional drilling, has the potential to encounter archaeological resources in some areas.

An AIA is recommended during construction for areas rated as having "Moderate" archaeological resource potential, if Highway 99 is selected for a section of the delivery pipeline. In addition, any construction excavations in locations rated as having "Moderate" archaeological potential (i.e., crossings of old slough channels) that extend into the native soils underneath Highway 99 should be monitored by qualified archaeologists.

All work will follow an Archaeological Management Plan as a component of the CEM Plan (**Chapter 9** of the Application), to be developed following Project certification and prior to commencement of construction. Prior to the initiation of any investigative field work a Section 14 (Heritage Investigation Permit) issued pursuant to the B.C. *Heritage Conservation Act* must be obtained.

## 6.8 References

Alexander, D.A. 2003. Archaeological Overview Assessment of Geotechnical Investigations for the Richmond and Airport Segment of the Richmond / Airport / Vancouver Rapid Transit Project. Prepared for EBA Engineering Consultants Ltd., Vancouver, B.C.

Arcas Consulting Archaeologists. 1997. B.C. Packers Steveston Property: Archaeological Overview Assessment. Consultants' report on file, Archaeology Branch, B.C. Ministry of Tourism, Culture and the Arts, Victoria, B.C.

Arcas Consulting Archeologists. 2002. Imperial Landing Development, Steveston - Archaeological Impact Assessment. Consultants' report on file, Archaeology Branch, B.C. Ministry of Tourism, Culture and the Arts, Victoria, B.C.

Armstrong, J. and S. Hicock. 1976. Surficial Geology, Vancouver, British Columbia (Map). Geological Survey of Canada, Map 1486A. Ottawa, ON.

Clague, J.J., J.L. Luternauer and R.J. Hebda. 1983. Sedimentary environments and postglacial history of the Fraser Delta and lower Fraser Valley, British Columbia. Canadian Journal of Earth Sciences 20:1314-1326.

Ham, L.C. 1987. An Archaeological Heritage Resource Overview of Richmond, B.C. Consultant's report on file, Archaeology Branch, B.C. Ministry of Tourism, Culture and the Arts, Victoria, B.C.

Ham, L.C. 1996a. Archaeological Impact Assessment, Eburne, DhRs-026 [Permit # 1996-156]. Consultant's report on file, Archaeology Branch, Ministry of Tourism, Culture and the Arts, Victoria, B.C.

Ham, L.C. 1996b. Musqueam Settlement Pattern Models (map). Prepared for the Musqueam Indian Band, Vancouver, B.C.

Johnston, W.A. 1923. Geology of the Fraser River Delta Map-area. Geological Survey of Canada, Memoir 135. Ottawa, ON.

Kidd, R.S. 1968. Archaeological Survey in the Lower Fraser River Valley, British Columbia, 1963. National Museum of Canada, Bulletin 224, Contributions to Anthropology VI, Archaeology, pp. 208-247. Ottawa, ON.

Luttmerding, H.A. 1980. Soils of the Langley-Vancouver Map Area. British Columbia Ministry of Environment, Resources Analysis Branch, Bulletin 18. Victoria, B.C.

North, M.E.A., M.W. Dunn and J.M. Teversham. 1979. Vegetation of the Southwestern Fraser Lowland, 1858-1880 (map). Lands Directorate, University of British Columbia, Vancouver, B.C.

Ryder, J. 1996. Geoarchaeological investigations. In Archaeological Investigations at the Beach Grove Site (DgRs 1), Tsawwassen, B.C., prepared by Arcas Consulting Archeologists Ltd. Consultants' report on file, Archaeology Branch, B.C. Ministry of Tourism, Culture and the Arts, Victoria, B.C.

Williams, H.F.L. and M.C. Roberts. 1989. Holocene sea-level change and delta growth: Fraser River delta, British Columbia. Canadian Journal of Earth Sciences 26:1657-1666.

Yip, S.K., and P. Gose. 1979. The Evaluation of Archaeological Resources of the Greater Vancouver Regional District (Fraser Valley Planning Study): Proposals

for Management, Part II. Report on file, Archaeology Branch, Ministry of Tourism, Culture and the Arts, Victoria, B.C.

# Chapter 7
## Assessment of Human Health Effects

# 7 ASSESSMENT OF HUMAN HEALTH EFFECTS

The Highway 99 Pipeline Route Option is expected to present lower levels of health concern for potentially affected populations, compared with the other routing alternatives assessed in **Chapter 8** of the Application. Only those environmental and social factors that are expected to change as a result of using Highway 99 as the routing alignment are addressed in this assessment.

## 7.1 Approach and Methodology

The overall approach and methodology used to assess potential human health effects associated with construction and operation of the Highway 99 Pipeline Route Option was the same as described in **Section 8.2** of the Application and in **Supplement 2**: Memorandum on Human Health Effects to "The Agency and First Nations Issues Tracking Table". Potential effects were evaluated based on the outcome of the following discipline studies presented in this Addendum:

- **Section 4.3**: Local and Regional Air Quality and Climate Assessment
- **Section 4.4**: Noise Assessment
- **Section 4.5**: Screening Level Contaminated Sites Assessment
- **Chapter 5**: Assessment of Social and Economic Effects

Residual human health effects were assessed using the criteria ratings provided in **Table 8.2.1** of the Application.

This assessment was prepared by AMEC Environment and Infrastructure.

## 7.2 Study Area

The study area covers approximately 7.7 linear kilometres of the Highway 99 right-of-way from the Williams Road easement north to the Bridgeport Trail, and includes a 400-metre 'buffer zone' on either side of the highway right-of-way (**Figure 7.2.1**).

## 7.3 Baseline Conditions

Baseline conditions are consistent with those described in **Section 8.3** of the Application, with the exception of noise generated by vehicles using Highway 99. No other updates to the baseline conditions are required.

## 7.4 Potential Effects and Recommended Mitigation Measures

### 7.4.1 Noise Effects during Construction

Noise begins to annoy people in residences significantly when the sound level outside their home is around 55 dBA (Health Canada 2005).

Construction noise is expected to be variable due to the variety of construction equipment and proximity to receivers. Assuming a 10-metre minimum distance to the nearest property line, the highest predicted noise levels for local residents in close proximity to the construction activity is between 56dBA and 75dBA (see **Section 4.4**). Exposures to noise levels greater than 55dBA are expected to occur for short durations (i.e., 1-2 days) at any one residence and these residents may be "highly annoyed" during this time. There is no quantitative information available on how many people may be exposed to noise levels greater than 55dBA. Based on noise modelling criteria and results, a buffer zone of 800 metres (i.e., 400 metres either side of Highway 99) has been selected to encompass potentially affected residents. The locations of schools, pre-schools, day cares, places of worship and senior homes in the study area are shown in **Figure 4.4.1**.

### 7.4.2 Noise Effects during Operations

As described in **Section 4.4.4.2**, there are no expected noise effects during pipeline operations.

### 7.4.3 Air Quality Effects during Construction

As described in **Section 4.3.4**, compared to previously evaluated Project construction emissions, emissions of CACs from fossil-fuelled equipment and fuguive dust from the additional volume of aggregate handled are expected to slightly increase for construction activities associated with the Highway 99 Pipeline Route Option. The potential for exposure will increase incrementally for any person exposed and adverse health effects are expected to be temporary and localized. The Project involves standard construction activities and will use accepted mitigation measures.

### 7.4.4 Air Quality Effects during Operations

As described in **Section 4.3**, the change in pipeline route is not expected to affect emissions during Project operations.

### 7.4.5 Road Traffic Effects during Construction

Road traffic effects during construction are expected to be primarily associated with disruptions to the Highway 99 motor vehicle traffic flows, which may also cause traffic pattern changes on parallel city streets (see **Section 5.3.1.1**.) including, but not limited to, No. 5 Road, Sidaway Road or No. 6 Road. Pedestrians and bicycles are not permitted on Highway 99; therefore, pedestrian and bicycle safety is expected to be less affected by this option.

A Traffic Management Plan (see **Section 5.3.1.2**) will be developed to minimize the adverse effects on road traffic.

### 7.4.6 Road Traffic Effects during Operations

As described in **Section 5.3.2.1**, the Highway 99 Pipeline Route Option is not expected to affect road traffic during Project operations. No road safety effects are expected.

### 7.4.7 Contaminated Sites Effects during Construction

Two “low” risk and 8 “moderate” risk locations for contaminated sites have been identified for the Highway 99 Pipeline Route Option (see **Section 4.5.4**). Construction activities at contaminated sites present the opportunity for the contamination to be remediated; however, excavation also may cause remobilization of contaminants into other environmental media. The likelihood of remobilization is low (see **Section 4.5.4**). Long-term effects are estimated to be neutral to positive No “high” risk locations have been identified.

### 7.4.8 Contaminated Sites Effects during Operations

There is an unlikely risk that Project operations will affect baseline conditions in the Study Area, such that contamination would be encountered during the operations phase. There is no potential exposure pathway.

## 7.5 Potential Residual Effects and Their Significance

Compared to previously evaluated exposures in the context of Project residual effects, the potential for change in exposures is small to negligible. Residual effects ratings are unaffected. No significant residual effects are expected.

## 7.6 Potential Cumulative Impacts

The identification of cumulative impacts is dependent on the presence of significant adverse residual effects resulting from Project construction or operations. Since no significant potential residual effects were identified for the Highway 99 Pipeline Route

Option, there was no potential for spatial or temporal overlap in effect type of residual effects from other projects. As such, no cumulative impacts were identified for this assessment.

## 7.7 Conclusion

No significant residual effects on human health are expected during, or as a result of, construction or operation of the Highway 99 Pipeline Route Option.

# Chapter 8
## Environmental Management Program

# 8 ENVIRONMENTAL MANAGEMENT PROGRAM

This Chapter describes the environmental management, monitoring and inspection elements to be included in the CEM and OEM Plans to address potential effects from construction and operations of the proposed Highway 99 Pipeline Route Option. **Chapter 9** of the Application describes the environmental protection plans and measures to be included in the CEM and OEM Plans to address all potential effects from and environmental risks associated with overall Project construction and operations, respectively.

The pipeline will be designed, installed, tested, operated and maintained in compliance with the B.C. *Oil and Gas Activities Act*, the Canadian Standards Association standards specific to Pipeline Systems, as well as MoT's *Utility Policy Manual* (MoT 1995).

As described in **Section 9.2** of the Application, VAFFC will retain a suitably qualified and experienced individual or organization to provide environmental management services for the overall Project, which may include but will not be limited to overseeing environmental inspection, audit and monitoring activities and co-ordinating compliance with environmental requirements. Pipeline construction within the Highway 99 right-of-way as well as periodic maintenance activities will have to occur under a special permit or operating agreement with MoT and will conform to guidelines, standards, best practices and regulatory requirements outlined in all pertinent permits, approvals and authorizations.

## 8.1 Construction Environmental Management Plan

The construction plan for the pipeline installation along the Highway 99 corridor will be developed in a way that minimizes the risk of future pipeline relocation due to road upgrades, will not impede highway maintenance activities and will not compromise road safety. Specifically, the proposed Highway 99 pipeline route may at intervals switch from the east side of the highway to the west side (and vice versa), because of the surrounding land base, urban development, and availability of sufficient working space along the highway. All pipeline appurtenances will be installed outside the Highway 99 clear zones and the number of highway crossings will be kept to the minimum number possible. Also, a reduced amount of equipment and manpower will be present on the work site to minimize effects on traffic and not compromise the safety of workers.

Highway 99 is a major provincial transportation corridor with total northbound and southbound traffic counts ranging between 60,000 and 80,000 vehicles per day for the portion of the highway that crosses Richmond (MoT 2011). Therefore, highway motor vehicle and bus traffic will likely be affected during construction activities (e.g.,

directional drilling, auger boring) for pipeline installation and construction of pipeline highway crossings. Effects on traffic may include:

- Potential temporary disruptions (e.g., lane closures, establishment of construction speed zones) to Highway 99 traffic;
- Potential temporary changes in traffic patterns away from Highway 99 to Richmond city streets during construction; and
- Potential temporary disruption to city streets (e.g., Vanguard Road, Patterson Road, St. Edwards Drive) depending on the final choice of alignment.

Traffic management during overall Project-related construction activities and as it relates to construction activities specific to the Highway 99 Pipeline Route Option will be addressed separately in a Traffic Management Plan, which will be a separate component of the CEM Plan. **Section 9.4** of the Application provides an outline of the component plans proposed to constitute the CEM Plan that will be developed prior to the commencement of construction activities. The CEM Plan and its components will be in compliance with applicable legislation, guidelines, and applicable terms and conditions as described in **Section 9.4** of the Application, and will conform to standards and procedures described in MoT's *2009 Standard Specifications for Highway Construction* including its subcomponent plans listed under Section 165: Protection of the Environment MoT's *2001 Traffic Management Guidelines for Work on Roadways* and MoT's *1995 Utility Policy Manual*.

Given the importance of Highway 99 as a provincial transportation corridor, the size of the work zone, work schedule and lane closure requirements during construction activities within the highway right-of-way will likely dictate the structure and content of the Traffic Management Plan. To conform to MoT's standards and procedures for construction within a highway right-of-way, the Traffic Management Plan may need to include the following components (MoT 2011):

- Traffic Control Plan: the Plan will define what traffic control measures will be provided during construction within the Highway 99 right-of-way, how they will be implemented and on what schedule. Traffic control measures may include but will not be limited to work zone size and location, schedule of lane closures, speed advisories throughout the work zone and temporary traffic control signals;
- Public Information Plan: the Plan will identify actions and procedures to inform the travelling public, relevant stakeholders and MoT of planned changes to traffic operations along Highway 99. These may include but will not be limited to notices to

the travelling public in print, on the radio or TV media, project signs and public and stakeholder meetings. The Public Information Plan may be modified throughout pipeline construction activities to address issues as they arise;

- Incident Management Plan: the Plan will identify the Proponent's actions and procedures for detection and response to unplanned events or incidents with the goal of safeguarding the public and restoring traffic flow as quickly as possible. The Incident Management Plan may be modified throughout pipeline construction activities to address issues as they arise; and

- Implementation Plan: the Plan will identify responsibilities and procedures for development and implementation of the traffic management component plans in a coordinated manner. The Implementation Plan will also identify qualifications, duties and responsibilities for supervisory and management personnel responsible for implementing the Traffic Management Plan.

The Traffic Management Plan will consider motor vehicle, bicycle and pedestrian traffic and will include scheduling of construction activities to avoid times when traffic volumes are higher, including seasons, day-of-week and hours of the day, as well as communication strategies to publicize any likely delays, and signage indicating alternate routes if required. A detailed worksite access and egress control plan for construction vehicles and equipment will also be included to minimize traffic disruptions and not compromise the safety of workers.

The Traffic Management Plan will also describe measures to minimize construction-related effects on the neighbourhoods and residents of the City of Richmond that cannot be addressed through careful routing and alignment of the fuel delivery pipeline. Health and safety management will be addressed separately in the Construction Site Safety Manual.

## 8.2 Operations Environmental Management Plan

As described in **Section 9.5** of the Application, the OEM Plan will be developed prior to the commencement of operations and will contain a number of environmental protection plans to address foreseeable operations requirements and procedures with associated environmental risks. The OEM Plan will also describe activities required to complete the post-construction / follow-up monitoring and fulfil any agency or authority reporting requirements. The conceptual outline of the OEM Plan by way of a list of potential environmental protection plans and/or management strategies expected to be developed is provided in **Section 9.5** of the Application. Operations and maintenance activities specific to the Highway 99 pipeline as well as requirements for a special permit

or operating agreement with MoT will be guided by the Pipeline System Operations Manual, which will be used in concert with the OEM Plan.

## 8.3 References

MoT. 1995. Utility Policy Manual. B.C. Ministry of Transportation, Highway Planning Branch. [Online] Available at: http://www.th.gov.bc.ca/permits/Utility%20Permit%20Manual.pdf (Accessed on September 1, 2011).

MoT. 2001. Traffic Management Guidelines for Work on Roadways. B.C. Ministry of Transportation. [Online] Available at: http://www.th.gov.bc.ca/publications/eng_publications/geomet/traffic_mgmt_guidelines.pdf (Accessed on August 11, 2011).

MoT. 2009. 2009 Standard Specifications for Highway Construction. B.C. Ministry of Transportation and Infrastructure. [Online] Available at: http://www.th.gov.bc.ca/publications/const_maint/contract_serv/standardspecs.htm (Accessed on August 11, 2011).

MoT. 2011. Traffic Data Program for 2009 and 2010. B.C. Ministry of Transportation and Infrastructure. [Online] Available at: http://www.th.gov.bc.ca/trafficdata/tradas/tradas.asp?loc=P-16-3B (Accessed on September 1, 2011).

# Chapter 9
## Accidents or Malfunctions

# 9 ACCIDENTS OR MALFUNCTIONS

This chapter identifies potential accidents, malfunctions or unplanned events that could be reasonably foreseen to occur during construction and operation activities specific to the Highway 99 Pipeline Route Option. **Chapter 15** of the Application identifies accidents or malfunctions that could be reasonably foreseen to occur during overall Project construction and operations. Cross-references to sections of the Application with information on measures to prevent, prepare for and/or mitigate adverse effects from potential Project accidents or malfunctions are provided throughout this chapter. Also, additional recommended measures to manage and/or mitigate potential accidents or malfunctions during construction and operations of the fuel delivery pipeline along Highway 99 are described.

## 9.1 Project Construction

Accidents or malfunctions that could be reasonably foreseen to occur during construction of the Highway 99 Pipeline Route Option are the same as described in **Section 15.2.1** of the Application and include the accidental spill of deleterious materials, accidental fire, utility disruption, and third-party damage. Since the Highway 99 Pipeline Route Option involves pipeline installation within the right-of-way of an existing major provincial transportation corridor, accidents involving commercial / construction vehicles related to the construction of the pipeline and private vehicles or other physical obstacles are of interest for this assessment. The likelihood of collisions between commercial / construction vehicles and wildlife is considered to be extremely low.

### 9.1.1 Accidental Spill of Deleterious Material

The accidental discharge of a deleterious substance (e.g., vehicle fuel, oil, lubricants, hydraulic fluids, concrete, and other substances toxic to the surrounding environment) could potentially be associated with construction activities. Possible sources of spills during construction may be failure of equipment and/or operator error during on-site vehicle / equipment refuelling activities, and storage of vehicle / equipment fuel. Compliance with stringent regulations governing the location and implementation of appropriate BMPs will minimize the potential for spills. To avoid environmental effects from spills in or near riparian areas and drainage ditches, sensitive areas will be delineated and clearly marked prior to commencement of works to avoid construction activities being undertaken in or near such areas.

### 9.1.2 Accidental Fire

Welding is the only spark-producing activity expected to take place during pipeline installation and may be a source of an accidental fire. However, the highway right-of-way is an area characterized by a high percentage of hard, asphalt surfaces, and a low percentage of vegetation and other organic fuel sources. As such, the likelihood of initiating localized fires during pipeline construction is considered extremely low. Such localized fire would be expected to have minimal, temporary effects on surrounding vegetation and terrestrial wildlife. Measures to prevent, prepare for and respond to the unlikely event of an accidental fire will be outlined in the Fire Prevention, Preparedness and Emergency Response Plan (see **Chapter 18** of the Application) and the CEM Plan (see **Chapter 9** of the Application and **Chapter 8** of the Addendum).

### 9.1.3 Accidental Third-Party Damage

During pipeline construction, third-party damage may 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 considered low provided the appropriate communications and security measures are in place. Third-party damage at the construction site may be potentially harmful to the persons involved and may result in property damage and financial loss. A Construction Site Safety Manual (see **Chapter 9** of the Application) will be developed and will include measures to secure and monitor the construction site along the highway and reduce the risk of accidental damage caused by unauthorized entry or vandalism.

### 9.1.4 Accidental Disruption of Utilities

B.C. Hydro high voltage power lines run parallel to the east boundary of the Highway 99 right-of-way from the Mylora Golf Course at Williams Road to Bridgeport Road. Accidental disruption of power line utilities may occur during construction equipment access to and egress from the worksite, as well as during operation and manoeuvring of pipeline installation equipment. Also, utilities that may be buried underground have the potential to be disrupted by construction activities associated with excavation, trenching, boring and directional drilling. Effects from utility disruption are expected to be localized in nature and temporary in duration. Pipeline installation will employ standard construction techniques and protocols and will be undertaken after consulting with the City of Richmond and B.C. One Call. In the event of utility disruption, emergency response will proceed as described in the CEM Plan (see **Section 9.4** of the Application).

### 9.1.5 Vehicle Accidents

Delivery of materials and machinery required for construction activities associated with the Highway 99 Pipeline Route Option, as well as equipment staging will use Highway 99 and adjacent public roadways. In particular, continuous movement of flat-bed pipe trucks will be required to string the pipe along the work site prior to welding. Movement of trucks to haul in and out fill material will also be required because of limited workspace available for stockpiling along the highway. As a result, commercial motor vehicle and truck traffic is expected to increase in the vicinity of the highway during pipeline construction and thereby increase the possibility of vehicle accidents. However, effects on traffic are expected to be similar in scope and scale to most infrastructure engineering projects and pose little risk with adequate mitigation during construction. To minimize traffic disruption and traffic pattern changes on Highway 99 and adjacent city streets, measures and traffic management solutions will be provided in the Traffic Management Plan and the CEM Plan (see **Chapter 9** of the Application and **Chapter 8** of the Addendum), in compliance with MoT's standards and traffic management guidelines for construction on roadways.

## 9.2 Project Operations

### 9.2.1 Accidental Spill of Deleterious Material

During pipeline operations, an accidental upland spill may potentially occur because of a pipeline accident or malfunction. Upland spills may adversely affect human health due to contact with or inhalation of spilled material, ignition of spilled fuel, or consumption of water or agricultural products that have come in contact with spilled fuel. Riparian areas adjacent to Highway 99 and the aquatic flora and fauna they support may also be adversely affected due to coating or ingestion of spill material and/or consumption of biota that has come in contact with the spilled fuel (see **Section 15.3.1.2** of the Application).

The likelihood of upland spills is considered low because the pipeline system will be designed, installed, tested, operated and maintained in compliance with the B.C. *Oil and Gas Activities Act*, current Canadian Standards Association standards and applicable Reference Publications. The pipeline design methodology is elaborated in the **Chapter 2** of the Application and **Chapter 2** of the Addendum, together with a list of BMPs, codes and standards that will be utilized during detailed engineering and design (see **Appendix 2C** of the Application). Moreover, the entire pipeline system will utilize a number of measures to prevent, prepare for and respond to a spill, included in the Pipeline System Operations and Maintenance Manual (see **Chapter 17** of the

Application) and the OEM Plan (see **Chapter 9** of the Application and **Chapter 8** of the Addendum).

### 9.2.2 Accidental Fire

Due to the buried nature of the pipeline and the lack of oxygen available within the pipeline, the possibility of fire being initiated along its length is considered minimal. During standard operations, fuel within the delivery pipeline is not typically exposed to the amounts of oxidizers and ignition sources sufficient to initiate combustion. Nevertheless, preparedness and emergency response measures in relation to a fire incident during pipeline operations will be included in the Fire Safety Plan, as described in **Chapter 18** of the Application.

### 9.2.3 Accidental Third-Party Damage

Third-party damage to the fuel pipeline during excavations is the only reasonable circumstance of external party interference on the pipeline delivery system. Under the B.C. *Oil and Gas Activities Act*, all activities occurring around the pipeline will be monitored and any ground disturbance within 40 metres of the pipeline will be reported to the pipeline company. Since the pipeline will be located within the Highway 99 right-of-way, the likelihood of third-party damage due to excavations will be restricted to Highway 99 maintenance and/or upgrade activities undertaken by MoT. Most often, third-party interference to pipelines is due to damages caused by human error or mechanical malfunction during digging, boring, and drilling activities. To manage and mitigate effects from third-party damage to the proposed fuel delivery pipeline, the Pipeline System Operations and Maintenance Manual will also include a System Integrity Management Program (see **Chapter 17** of the Application) consistent with B.C. Oil and Gas Commission regulations.

### 9.2.4 Vehicle Accidents

To minimize the potential for vehicle accidents after the completion of pipeline construction, the pipeline along Highway 99 will be installed underground in compliance with MoT standards and guidelines for construction within a highway right-of-way. Moreover, all pipeline appurtenances will be installed outside the Highway 99 clear zones to avoid compromising road safety. Nevertheless, the installed pipeline will be subject to periodic maintenance activities that require construction equipment and personnel to work within the highway right-of-way. This may result in a slight highway traffic disruption and may slightly increase the likelihood of vehicle collisions. With the implementation of appropriate mitigation measures (see **Chapter 9** of the Application and **Chapter 8** of the Addendum) and considering the low amounts of vehicles and

equipment and infrequent need for pipeline maintenance along Highway 99, the likelihood of vehicle accidents during pipeline operations is considered very low.

# Chapter 10
## Cumulative Environmental Effects Assessment

# 10 CUMULATIVE ENVIRONMENTAL EFFECTS ASSESSMENT

## 10.1 Approach to Cumulative Environmental Effects Assessment

This chapter provides an assessment of cumulative environmental effects for the Highway 99 Pipeline Route Option in accordance with federal requirements. The assessment of potential cumulative impacts to meet provincial requirements is integrated within each of the discipline-specific effects assessments for this Addendum (**Chapters 4, 5, 6** and **7**).

The methodology used in this Addendum to assess cumulative environmental effects is consistent with the methodology described in **Chapter 4** and **Chapter 22** of the Application and follows the five-step framework (i.e., scoping, effects analysis, mitigation identification, significance evaluation, and follow-up monitoring) developed by Hegmann et al. (1999).

Effects associated with past and present land use activities along the Highway 99 Pipeline Route Option are captured in the baseline conditions of each effects assessment.

Past, present and future reasonably foreseeable projects and activities that are sufficiently certain to proceed were considered in the assessment if they were within the RSA and could be reasonably expected to result in an effect to environmental, social, economic, health or heritage VCs identified in the Addendum effects assessments. To maintain consistency with the Application, the list of other projects to include in this assessment was sourced from the list that was developed for the Application (**Section 22.3.4, Table 22.3.4**); this list was then modified for relevance to the Highway 99 Pipeline Route Option.

## 10.2 Step 1: Scoping

### 10.2.1 Spatial and Temporal Boundaries

#### *10.2.1.1 Spatial Boundaries*

**Regional Study Area**

The RSA for this assessment is the same as that outlined in the Application and includes the South Arm of the Fraser River, the Moray Channel, City of Richmond, and the Corporation of Delta (see **Figure 22.3.1** of the Application).

**Local Study Area**

The LSA for this assessment is limited to 100 metres on either side of the Highway 99 and the extent of any potential residual effects.

#### *10.2.1.2 Temporal Boundaries*

The temporal scope of this assessment includes construction and operations phases of the pipeline. Project operations are assumed to be for an indefinite life span. Decommissioning and abandonment is not within the scope of the assessment.

### 10.2.2 Selection of Valued Components

As described in the Application, VCs were included or excluded from the assessment based on whether an adverse effect resulting from Project construction or operations was identified in the effects assessments. Any positive or beneficial residual effects were not considered in the assessment. **Table 10.2.1** below shows the inclusion or exclusion of VCs identified in the effects assessments.

**Table 10.2.1 Decision Pathways for Selection of Valued Components of Concern to the Cumulative Environmental Effects Assessment**

| Valued Component | Chapter / Section | Project Phase | Potential Adverse Residual Effect (Rationale for Inclusion / Exclusion as a VC of concern) | Included | Excluded |
|---|---|---|---|---|---|
| Provincially Red- and Blue-listed Fish Species | Section 4.1 | Construction, Operations | No anticipated adverse residual effects | | X |
| Fish Species Identified by COSEWIC to be Endangered, Threatened, or of Special Concern | Section 4.1 | Construction, Operations | No anticipated adverse residual effects | | X |
| Fish Species of Special Concern Under SARA Schedule 1 | Section 4.1 | Construction, Operations | No anticipated adverse residual effects | | X |
| SAR Requiring Protection Under the Provincial Identified Wildlife Management Strategy | Section 4.1 | Construction, Operations | No anticipated adverse residual effects | | X |
| Fish Species of Regional Importance | Section 4.1 | Construction, Operations | No anticipated adverse residual effects | | X |
| Surface Water Quality | Section 4.1 | Construction, Operations | No anticipated adverse residual effects | | X |
| Terrestrial Vegetation | Section 4.2 | Construction | Terrestrial vegetation will be affected during the construction of the pipeline through habitat alteration, loss or destruction | X | |
| | | Operations | Potential habitat alteration, loss or destruction during vegetation maintenance along the pipeline | | |
| Plant Species and Plant Communities at Risk | Section 4.2 | Construction | Pending the outcome of a pre-construction rare plants survey, residual effects may include habitat alteration, loss or destruction | X | |
| | | Operations | Potential residual effects to rare / at-risk terrestrial plant species are unknown for periodic maintenance clearing of vegetation clearing along the pipeline | | |
| Aquatic Birds | Section 4.2 | Construction | Possible dispersion of aquatic birds due to noise disturbance | X | |
| Terrestrial Wildlife | Section 4.2 | Construction | Possible dispersion of terrestrial wildlife due to noise disturbance, and possible wildlife mortality for amphibians, reptiles or small mammals | X | |
| | | Operations | Periodic vegetation maintenance along the pipeline may result in habitat alteration, loss or destruction, or temporary or permanent displacement or mortality of wildlife | | |
| Bird Species at Risk | Section 4.2 | Construction, Operations | No anticipated adverse residual effects | | X |
| Non-avian Species at Risk | Section 4.2 | Construction, Operations | No anticipated adverse residual effects | | X |

| Valued Component | Chapter / Section | Project Phase | Potential Adverse Residual Effect (Rationale for Inclusion / Exclusion as a VC of concern) | Included | Excluded |
|---|---|---|---|---|---|
| Ambient Air Quality | Section 4.3 | Construction | Construction activities will result in an increase of CAC emissions through: use of fossil-fuelled equipment, vehicle traffic, fugitive dust emissions, and production of cement | X | |
| GHG Emissions | Section 4.3 | Construction | Construction activities will result in GHG emissions through: use of fossil-fuelled equipment, vehicle traffic, fugitive dust emissions, and production of cement | X | |
| Noise Sensitive Land Uses | Section 4.4 | Construction | Construction noise may cause temporary “annoyance” to nearby residents | X | |
| Soil and Groundwater Contamination (Pre-existing) | Section 4.5 | Operations | Possible creation of a preferred groundwater flow pathway over time that may conduct contaminants into the water table<br><br>Degradation of anti-corrosion coating in areas of high contamination may increase risk of pipeline leak | X | |
| Economic Development | Chapter 5 | Construction, Operations | No anticipated adverse residual effects | | X |
| Land Use | Chapter 5 | Construction, Operations | No anticipated adverse residual effects | | X |
| Property Acquisition and Property Value | Chapter 5 | Construction | Potential short-term, low adverse residual effects on property values may occur as a result of construction activities along the pipeline route alignment | X | |
| Motor Vehicle Traffic and Mobility | Chapter 5 | Construction | Highway 99 is a major transportation corridor and any disruption to traffic (including bus and HOV lanes) would be significant. Industrial businesses along Vanguard Road have a single access point under Highway 99 near Shell Road; any disruption to traffic flow on Vanguard Road could be significant | X | |
| On-street Parking | Chapter 5 | Construction | Short-term adverse residual effects may occur as a result of the Project’s effects on roadside parking availability during the construction of the pipelines | X | |
| Bicycle and Pedestrian Traffic and Mobility | Chapter 5 | Construction | Short-term adverse residual effects to existing routes may occur as a result of fuel delivery pipeline construction | X | |
| | | Operations | Long-term maintenance activities may require periodic access restriction | | |
| Schools, Recreation Areas and Other Community Features | Chapter 5 | Construction | Effects due to Project construction on schools, recreation areas and other community features are likely to be temporary and relate to motor vehicle access, pedestrian and non-motorized traffic mobility, noise, dust, parking access including on-street parking, and tree and vegetation removal | X | |
| Street and Trail Trees | Chapter 5 | Construction | Trees, shrubs, or landscaping hedges may be removed during construction, resulting in a short-term adverse residual effect | X | |
| | | Operations | Some trees may be removed and not replaced from the Highway 99 ROW near the Richmond Nature Park to retain maintenance access to the pipeline | | |

| Valued Component | Chapter / Section | Project Phase | Potential Adverse Residual Effect (Rationale for Inclusion / Exclusion as a VC of concern) | Included | Excluded |
|---|---|---|---|---|---|
| Aesthetic Values / Visuals | Chapter 5 | Construction | Potential short-term adverse effects may occur as a result of construction machinery required to complete the fuel delivery pipeline and the trenchless pipeline construction techniques required in several locations near Highway 99 | X | |
| Railway Right-of-Way | Chapter 5 | Construction | Trenchless pipeline construction will likely be used for crossings under active railway tracks. Crossing the CNR right-of-way at the Shell Road / Highway 99 overpass is unlikely to have any effect on existing railway traffic | | X |
| Utilities | Chapter 5 | Construction | Short-term adverse residual effects may occur as a result of utility crossings associated with fuel delivery pipeline construction - the construction of the pipeline will involve several utility crossings | X | |
| Paleontological Sites | Chapter 6 | Construction | No anticipated adverse residual effects | | X |
| Archaeological Sites | Chapter 6 | Construction | No anticipated adverse residual effects | | X |
| Traditional Places and Traditional Land Use | Chapter 6 | Construction | No anticipated adverse residual effects | | X |
| Historic and Heritage Sites or Properties | Chapter 6 | Construction | No anticipated adverse residual effects | | X |
| Human Health Effects from Noise | Chapter 7 | Construction | Short-term and medium-term noise effects for local residents in close proximity to the pipeline | X | |
| Human Health Effects from Air Quality | Chapter 7 | Construction | Medium-term exposure of local residents and recreational users in close proximity to the fuel receiving facility to fugitive dust | X | |
| Human Health Effects from Road Traffic | Chapter 7 | Construction | Medium-term disruption to traffic during the construction of the pipeline, which may increase exposure to public safety risk, although less so when compared to other routing options described in the Application | X | |
| Human Health Effects from Contaminated Sites | Chapter 7 | Construction | No anticipated adverse residual effects | | X |

VCs that were excluded from the assessment as a result of having no anticipated adverse residual effects (shown above in **Table 10.2.1**) were:

- Provincially Red- and Blue-listed fish species;
- Fish species identified by COSEWIC to be endangered, threatened, or of special concern;
- Fish species of special concern under SARA Schedule 1;
- Species at risk requiring protection under the provincial Identified Wildlife Management Strategy;
- Fish species of regional importance;
- Surface water quality;
- Bird species at risk;
- Non-avian species at risk;
- Economic development;
- Land use;
- Archaeological sites;
- Paleontological sites;
- Traditional places and traditional land use;
- Historic and heritage sites of properties; and
- Human health effects from contaminated sites.

### 10.2.3 Potential Residual Effects

Potential residual effects resulting from the Project's construction and operations phases are identified in each of the effects assessments. Conclusions on the significance of any residual effects were determined using the significance criteria determined in each effects assessment. **Table 10.2.2** and **Table 10.2.3** below show the results of this analysis. Results that were considered "Not Significant" were not considered further in the assessment as there was no potential for an interaction of effects with other relevant projects in the RSA that would result in a cumulative effect. A summary of all potential residual effects, mitigation measures and their significance with respect to VCs is detailed in **Chapter 11** of the Addendum.

**Table 10.2.2 Potential Adverse Residual Effects on Valued Components during Project Construction**

| Valued Component | Potential Residual Effect | Section | Significance Criteria | | | | | | | | Overall Significance Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Direction | Duration | Frequency | Reversibility | Ecological Context | Probability | |
| Terrestrial Vegetation | Depending on the extent to which vegetation can be restored following the construction of the pipeline, habitat alteration, loss or destruction may occur | Section 4.2 | Low | Sub-regional | Negative | Short-term | Once | Irreversible | Disturbed | High | Low Significance |
| Plant Species and Plant Communities at Risk | Residual effects are considered unlikely in the presence of mitigation measures. Any potential residual effect (in the form of habitat alteration, loss or destruction) is pending the outcome of a field survey for rare or at risk plant species / communities | Section 4.2 | Low | Sub-regional | Negative | Short-term | Once | Irreversible | Disturbed | Uncertain | Unknown Significance |
| Terrestrial Wildlife | Any wildlife displaced from adjacent areas during construction will likely return when equipment operation and associated elevated noise levels cease (i.e., sensory disturbance). | Section 4.2 | Low | Sub-regional | Negative | Short-term | Once | Reversible | Disturbed | High | Not Significant |
| | Some wildlife mortality is expected for amphibians, reptiles, and small mammals, depending on the final routing alignment | | Low | Sub-regional | Negative | Short-term | Once | Irreversible | Disturbed | High | Low Significance |
| Aquatic Birds | Quality habitat for aquatic birds in the vicinity of Highway 99 is limited (e.g., ditches and agricultural areas). Any birds that are dispersed from this area due to elevated noise levels during construction will likely return when noise disturbance ceases | Section 4.2 | Low | Local | Negative | Short-term | Once | Reversible | Disturbed | High | Not Significant |
| Ambient Air Quality | Any increase in CACs represents less than a 1% increase in the LSA for all contaminants, and be temporary in nature, as it will cease after construction is complete | Section 4.3 | Low | Local | Negative | Short-term | Frequent | Reversible | Disturbed | Low | Not Significant |

| Valued Component | Potential Residual Effect | Section | Significance Criteria | | | | | | | | Overall Significance Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Direction | Duration | Frequency | Reversibility | Ecological Context | Probability | |
| GHG Emissions | GHG emissions are expected to increase less than 0.1% in the RSA, and be temporary in nature, as it will cease after construction is complete | Section 4.3 | Low | National / Global | Negative | Short-term | Frequent | Reversible | Disturbed | Low | Not Significant |
| Noise Sensitive Land Uses | “Annoyance” due to pipeline construction for residents or businesses in close proximity to construction | Section 4.4 | Low | Local | Negative | Short-term | Once | Reversible | Disturbed | High | Not Significant |
| Property Acquisitions and Property Value | May affect liquidity during construction period; some short-term use of private property may be required | Section 5 | Low | Local | Negative | Short-term | Ongoing | Reversible | N/A | Low | Not significant |
| Motor Vehicle Traffic and Mobility | Changes in motor vehicle traffic flows and access – significance depends on specific alignment, construction methods and feasibility of mitigation measures | Section 5 | Moderate / High | Region | Negative | Short-term | Ongoing | Reversible | N/A | High | Potentially significant |
| On-street Parking | Changes to roadside parking availability | Section 5 | Low | Local | Negative | Short-term | Ongoing | Reversible | N/A | High | Not significant |
| Bicycle / Pedestrian Traffic and Mobility | Changes to bicycle and pedestrian access | Section 5 | Low | Local | Negative | Short- term | Ongoing | Reversible | N/A | High | Not Significant |
| Schools / Recreation Access and Other Community Features | Changes to access and enjoyment - effects depend on final alignment within Highway 99 right-of-way; west side alignment may impact B.C. Muslim Association facilities | Section 5 | Low / None | Local | Negative | Short-Term | Ongoing | Reversible | N/A | High | Not significant |
| Street / Trail Trees | Changes to street or trail trees - effects depend on final alignment within Highway 99 right-of-way; potential effects near Richmond Nature Park, trees lining Mylora golf courses | Section 5 | Low / Moderate | Local | Negative | Short-term | Once | Reversible | N/A | High | Not significant |

| Valued Component | Potential Residual Effect | Section | Significance Criteria | | | | | | | | Overall Significance Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Direction | Duration | Frequency | Reversibility | Ecological Context | Probability | |
| Aesthetic Values / Visuals | Visuals associated with trenchless pipeline construction and other construction equipment | Section 5 | Low | Local | Negative | Short-term | Ongoing | Reversible | N/A | High | Not significant |
| Railway Rights-of-Way | Railway Right-of-Way and crossing of tracks near Shell Road and the Moray Channel | Section 5 | Low | Local | Negative | Short-term | Ongoing | Irreversible | N/A | High | Not significant |
| Utilities | Pipeline corridor utility crossings and/or utility displacement | Section 5 | Low | Local | Negative | Long-term | Ongoing | Irreversible | N/A | High | Not significant |
| Human Health Effects from Noise | Annoyance for nearby residents and sensitive populations for short-term (1-2 days) duration | Section 7 | Low | Local | Negative | Short-term | N/A | N/A | N/A | N/A | Not Significant |
| Human Health effects from Air Quality | Temporary and localized exposures to CACs and fugitive dust, as experienced with standard construction activities | Section 7 | High | Regional | Negative | Medium-term | N/A | N/A | N/A | Moderate | Not Significant |
| Human Health Effects from Traffic | Pedestrians and cyclists on other alignment route options will avoid construction traffic related safety hazards. Road users on No. 5 Road, Sidaway Road and No. 6 Road may be exposed to increased traffic and delays due to drivers using these alternate routes to Hwy 99 | Section 7 | Moderate | Local | Negative | Medium-term | N/A | N/A | N/A | Low | Not Significant |

**Table 10.2.3 Potential Adverse Residual Effects on Valued Components during Project Operations**

| Valued Component | Potential Residual Effect | Section | Significance Criteria | | | | | | | | Overall Significance Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Direction | Duration | Frequency | Reversibility | Ecological Context | Probability | |
| Terrestrial Vegetation | Potential habitat alteration, loss or destruction during vegetation maintenance of the pipeline | Section 4.2 | Low | Sub-regional | Negative | Long-term | Sporadic and Intermittent | Irreversible | Disturbed | High | Negligible to Low Significance |
| Plant Species and Plant Communities at Risk | Potential habitat alteration, loss or destruction during vegetation maintenance of the pipeline | Section 4.2 | Low | Sub-regional | Negative | Long-term | Sporadic and Intermittent | Irreversible | Disturbed | Uncertain | Unknown Significance |
| Terrestrial Wildlife | Potential wildlife habitat alteration, loss or destruction during vegetation maintenance along the pipeline | Section 4.2 | Low | Sub-regional | Negative | Long-term | Sporadic and Intermittent | Irreversible | Disturbed | High | Negligible to Low Significance |
| | Temporary or permanent displacement or accidental mortality of amphibians, reptiles and small mammals during periodic vegetation maintenance along the pipeline | | Low | Sub-regional | Negative | Long-term | Sporadic and Intermittent | Irreversible | Disturbed | High | Not Significant |
| Ambient Air Quality | CAC emissions may increase, but will represent less than a 1% change for all pollutants with respect to total emissions in the LSA | Section 4.3 | Low | Regional | Negative | Medium-Term | Frequent | Reversible | Disturbed | Low | Not Significant |
| Soil and Groundwater Contamination[3] (Pre-existing) | Creation of a preferred groundwater flow pathway over time that may conduct contaminants into the water table | Section 4.5 | N/A | N/A | Negative | N/A | N/A | N/A | N/A | N/A | Not Significant |
| | Degradation of anti-corrosion coating in areas of high contamination may increase risk of pipeline leak | Section 4.5 | N/A | N/A | Negative | N/A | N/A | N/A | N/A | N/A | Not Significant |
| Property Acquisitions and Property Value | Possible temporary low negative effect to property value adjacent to the proposed pipeline due to changes in public perceptions from time to time; Highway 99 Pipeline Route Option is adjacent to fewer residential properties than other options | Section 5 | Low | Local | Negative | Short-term | Infrequent | Reversible | N/A | Uncertain | Not Significant |
| Bicycle / Pedestrian Traffic and Mobility | Changes to bicycle and pedestrian access from need to access pipeline for maintenance; Highway 99 does not allow bicycles / pedestrians except near Oak Street Bridge | Section 5 | Low | Local | Negative | Long-term | Infrequent | Reversible | N/A | Low | Not Significant |

[3] Determining significance of potential residual effects identified in the Screening Level Contaminated Sites Assessment (**Section 4.5**), using the evaluation criteria described in **Chapter 4** of the Application was not appropriate for the scope and nature of the assessment, as the purpose of the assessment was to provide an overview of potential pre-existing contamination risks for the Project. Nonetheless, the potential residual effects identified in **Section 4.5** are presented.

| Valued Component | Potential Residual Effect | Section | Significance Criteria | | | | | | | | Overall Significance Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Magnitude | Geographic Extent | Direction | Duration | Frequency | Reversibility | Ecological Context | Probability | |
| Street / Trail Trees | Possible permanent tree removal near Richmond Nature Park depending on final route alignment within Highway 99 right-of-way | Section 5 | Low / Moderate | Local | Negative | Long-Term | Ongoing | Reversible | N/A | Uncertain | Not Significant |

Table 10.2.3VCs that are not considered further in the assessment as a result of having no potential residual effects, and potential residual effects of a beneficial or positive nature or having residual effects that were deemed “Not Significant” (shown in **Table 10.2.1**, **Table** 10.2.2 and Table 10.2.3) include:

- Provincially red- and blue-listed fish species;
- Fish species identified by COSEWIC to be endangered, threatened, or of special concern;
- Fish species of special concern under SARA Schedule 1;
- Species at risk requiring protection under the provincial Identified Wildlife Management Strategy;
- Fish species of regional importance;
- Surface water quality;
- Bird species at risk;
- Non-avian species at risk;
- Aquatic birds;
- Ambient air quality;
- GHG emissions;
- Noise sensitive land uses;
- Soil and groundwater contamination (pre-existing);
- Economic development;
- Land use;
- Property acquisitions and property value;
- On-street parking;
- Bicycle / pedestrian traffic and mobility
- Schools / recreation access and other community features;

- Street / trail trees;
- Aesthetic values / visuals;
- Railway rights-of-way;
- Utilities;
- Paleontological sites;
- Archaeological sites;
- Traditional places and traditional land uses;
- Historic and heritage sites or properties;
- Human health effects from noise;
- Human health effects from air quality;
- Human health effects from traffic; and
- Human health effects from contaminated sites.

VCs that are considered further in the assessment (VCs of concern) include:

- Terrestrial vegetation (construction and operations);
- Plant species and plant communities at risk (construction and operations);
- Terrestrial wildlife (construction and operations); and
- Motor vehicle traffic and mobility (construction only).

### 10.2.4 Identification of Past, Present and Reasonably Foreseeable Future Projects and Activities for Consideration in the Assessment of Cumulative Environmental Effects

Consistent with the Application, projects and activities were considered for this assessment if they were within the RSA and had spatial and temporal overlap with the environmental effects of the construction and operations of the Highway 99 Pipeline Route Option. Current land use activities were considered part of the baseline conditions of the assessment.

**Section 22.3.4** of the Application describes in detail the methods (i.e., consultation) undertaken to develop a complete list of projects to include in the assessment. Federal,

provincial and municipal agencies, authorities and departments were consulted for assistance in identifying projects for consideration in the assessment. **Chapter 4** (**Table** 4.3.2) of the Application lists all parties consulted.

**Table 22.3.4** in the Application details other projects within the RSA that were considered for inclusion in the assessment of cumulative environmental effects. These projects remain applicable for consideration for the Highway 99 Pipeline Route Option.

After review of **Table 22.3.4** of the Application, no projects included therein and their associated residual effects were determined to have an overlap with the Highway 99 Pipeline Route Option. **Section 10.3** below explains this finding in detail.

## 10.3 Step 2: Effects Analysis

The effects analysis addresses potential interactions between other projects and land use activities which may lead to cumulative environmental effects, with regard to VCs that may incur adverse residual effects during Project construction and operations.

As described in the Application, to be considered relevant to the assessment of potential cumulative environmental effects, other projects and land use activities must meet the following criteria:

(1) Temporal overlap: the effects of a project or activity must occur or be expected to occur to have partial or total overlap with the time that the effects of the Project will occur;

(2) Spatial overlap: the effects of a project or activity must occur or be expected to occur totally or partially in the same geographic area as the Project; and

(3) Type: the environmental effects of a project or activity must be relatively similar to the Project, or capable of interacting with the Project's potential residual effects to produce a cumulative environmental effect.

Although potential residual effects of negligible to low or unknown significance were identified for Project construction or operations, the extent of these potential residual effects did not overlap spatially, temporally, or in effect type with any of the other projects identified in **Table 22.3.4** of the Application. For this reason, no cumulative effects are anticipated for the Highway 99 Pipeline Route Option for identified VCs of concern (i.e., terrestrial vegetation; plant species and plant communities at risk; terrestrial wildlife; and motor vehicle traffic and mobility). Cumulative environmental effects identified for the Project remain limited to those described in the Application (**Chapter 22**, **Part B**).

## 10.4 Step 3: Mitigation Identification, Step 4: Significance Evaluation, and Step 5: Follow-up Monitoring

No potential cumulative effects were identified in the effects assessment; therefore, no mitigation is prescribed. Consequently, since no cumulative effects were identified, no significance value can be applied, and no follow-up monitoring is required.

## 10.5 Conclusions

The cumulative environmental effects assessment evaluated potential residual effects of significance resulting from the Project's Highway 99 Pipeline Route Option, as they relate to other identified residual effects of the same type from past, present and future projects and land use activities that are reasonably foreseeable and sufficiently certain to proceed in the RSA.

VCs of concern for the assessment were chosen based on their having "significant" adverse residual effects (identified in the effects assessments) as a result of the construction or operations of the Highway 99 Pipeline Route Option. Projects and land use activities within the RSA deemed reasonably foreseeable and sufficiently certain to proceed were selected for preliminary inclusion in the assessment. The spatial overlap with the Highway 99 Pipeline Route Option and temporal overlap with the construction and/or operations phases were then evaluated to see if these projects had further relevance to the assessment. No projects were found to have either spatial or temporal overlap, consequently no cumulative effects were identified.

## 10.6 References

Hegmann, G., C. Cocklin, R. Creasey, S. Dupuis, A. Kennedy, L. Kingsley, W. Ross, H. Spaling, D. Stalker and AXYS Environmental Consulting Ltd. 1999. "Cumulative Effects Assessment Practitioners Guide. Prepared for the Canadian Environmental Assessment Agency by The Cumulative Effects Assessment Working Group". [Online] Available at: http://dsp-psd.pwgsc.gc.ca/Collection/En106-44-1999E.pdf (Accessed 14 April 2010).

# Chapter 11
## Summary of Potential Project Effects, Recommended Mitigation Measures and Potential Residual Effects

# 11 SUMMARY OF POTENTIAL PROJECT EFFECTS, RECOMMENDED MITIGATION MEASURES AND POTENTIAL RESIDUAL EFFECTS

## 11.1 Introduction

**Chapter 4** assesses potential environmental effects resulting from construction and operation of the Highway 99 Pipeline Route Option. Social and economic, heritage, and human health effects are described in **Chapter 5**, **6**, and **7**, respectively. This Chapter provides a summary of the information of each of those assessments, including: potential effects, recommended mitigation measures, and the significance of any identified potential residual effects. Key residual effects are identified in **Section 11.2** below.

## 11.2 Key Residual Effects

### 11.2.1 Vegetation, Wildlife and Wildlife Habitat Assessment

This assessment identified potential residual effects for the following VCs of concern: terrestrial vegetation, plant species and plant communities at risk, and terrestrial wildlife.

During construction, potential effects to terrestrial vegetation are related to the alteration of terrestrial habitats during pipeline site preparation, excavation and installation. Disturbance of the land during pipeline construction increases the risk of introduction, establishment and spread of invasive plant species within the construction footprint. Recommended mitigation measures to limit any effects include: minimizing the spread of invasive plants, minimizing the Project footprint, and restoring vegetation following construction. Following mitigation, residual effects to terrestrial vegetation were deemed to be of low significance. During operations, potential habitat, alteration, loss or destruction may occur due to periodic vegetation maintenance along the pipeline. This residual effect was deemed to have negligible to low significance.

Effects to plant species and plant communities at risk were unknown for construction and operations. This is because no rare plant surveys were conducted during the wildlife transect surveys undertaken during June / July 2011 for the purposes of this Addendum. A review of background information revealed no plant species and plant communities at risk present within the Highway 99 right-of-way. Nonetheless, the following mitigation is recommended for the construction phase of the Highway 99 Pipeline Route Option: undertake a rare plant survey prior to commencement of construction activities along Highway 99, limit construction footprint, identify location of

species at risk, create a buffer area, conduct plant salvage, and limit spread of noxious weeds. During operations, if plant species and plant communities at risk are discovered, they should be avoided during vegetation maintenance activities. Residual effects were deemed unknown for construction and operations.

Potential effects to terrestrial wildlife during construction is related to the displacement of certain species in adjacent habitats due to construction noise levels, and the potential mortality of amphibians, reptiles or small mammals during pipeline installation. Recommended mitigation measures to reduce these effects during construction include: limit disturbance within and minimize the Project footprint, conduct nest surveys prior to construction, prevent the discharge of deleterious substances and sediment laden water, and salvage and replace coarse woody debris. Mitigation for operations includes: undertake vegetation maintenance during "least risk" windows, and design maintenance access points to avoid sensitive features. Residual effects were deemed to be of negligible to low Significance.

### 11.2.2 Assessment of Social and Economic Effects

Social and economic effects associated with the Highway 99 Pipeline Route Option that were deemed potentially significant related to motor vehicle traffic and mobility during construction as well as during periodic pipeline maintenance activities. Depending on the final pipeline alignment, traffic disruption could be significant. A Traffic Management Plan will be developed in consultation with MoT to mitigate construction effects. Time of day, weekday, and seasonal sensitivities will be considered and where required, special provisions will be made for businesses or residences with single access points.

## 11.3 Summary of Findings

The potential effects, recommended mitigation measures and the significance of the residual effects of the discipline assessments are summarized below in **Table 11.3.1** through **Table 11.3.8**.

### 11.3.1 Fisheries, Aquatics and Surface Water Quality Assessment

**Table 11.3.1 Fisheries, Aquatics and Surface Water Quality Assessment – Summary of Potential Effects, Recommended Mitigation, and Significance of Residual Effects**

| Valued Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| **Construction Phase** | | | |
| Provincially red- and blue-listed fish species<br><br>Fish species identified by COSEWIC to be endangered, threatened, or of special concern<br><br>Fish species of special concern according to the SARA<br><br>Species at risk requiring protection under the provincial Identified Wildlife Management Strategy<br><br>Fish species of regional importance | **No identified potential effects** - None of the fisheries VECs have been recorded in the drainage ditches along Highway 99 Pipeline Route Option. Recent field surveys failed to find any listed species, species of management concern or species of regional importance. | Although no potential effects to the fisheries VECs are anticipated, protocols will be implemented that are consistent with BMPs and provincial and federal guidelines, as will be described in the CEM Plan (see **Chapter 9** of the Application and **Chapter 8** of the Addendum). Also see below under "Surface Water Quality" for the mitigation measures relating to surface water quality protection. | **No adverse residual effects are anticipated.** |

| Valued Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| Surface Water Quality | Erosion and sedimentation from exposed soil and soil piles, resulting in the degradation of surface water quality, accidental discharge of deleterious materials to surface waters, or temporary fragmentation or loss of habitat for aquatic species during the installation of water crossings.<br><br>Potential accidental release drilling fluids into the environment either at the construction site during drilling activities, or during disposal of excavated material.<br><br>Potential release of iron rich groundwater if dewatering of pipeline trench is required to facilitate pipeline construction. | Each watercourse crossing will be constructed within the appropriate fisheries timing window, as approved by the MoE and DFO, as well as following BMPs including:<br><br>• Minimize duration of instream works;<br><br>• Utilize appropriate erosion and control measures;<br><br>• Temporarily isolate the ditch channel on either side of the crossing site;<br><br>• Salvage fish and other aquatic species present at the crossing site;<br><br>• Temporarily divert the watercourse during excavation of the pipeline trench, laying of the pipe and placement of backfill; and<br><br>• Return the watercourse to its pre-Project streambed and restore any affected riparian areas.<br><br>In the event that dewatering pipeline trench is required, test for iron levels and treat as appropriate prior to discharging to the sanitary sewer.<br><br>Specific environmental management planning will be undertaken to manage the containment and disposal of drilling fluids and excavated materials. | Following mitigation, **no adverse residual effects are anticipated.** |

| Valued Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| **Operations Phase** | | | |
| Provincially Red- and Blue-listed fish species<br><br>Fish species identified by COSEWIC to be endangered, threatened, or of special concern<br><br>Fish species of special concern according to the SARA<br><br>Species at risk requiring protection under the provincial Identified Wildlife Management Strategy<br><br>Fish species of regional importance | **No identified potential effects** – effects due to accidents or malfunctions, such as leaks or spills, are addressed in **Chapter 15** of the Application and **Chapter 9** of the Addendum. | N/A | **No adverse residual effects are anticipated.** |
| Surface Water Quality | **No identified potential effects** – effects due to accidents or malfunctions, such as leaks or spills, are addressed in **Chapter 15** of the Application and **Chapter 9** of the Addendum. | N/A | **No adverse residual effects are anticipated.** |

### 11.3.2 Vegetation, Wildlife and Wildlife Habitat Assessment

**Table 11.3.2 Vegetation, Wildlife and Wildlife Habitat Assessment – Summary of Potential Effects, Recommended Mitigation, and Significance of Residual Effects**

| Valued Ecosystem Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| **Construction Phase** | | | |
| Terrestrial Vegetation | Temporary and/or permanent alteration of terrestrial habitats adjacent to the pipeline trench during site preparation (i.e., clearing and grubbing), excavation, and installation.<br><br>Potential introduction, establishment and spread of invasive plant species within the construction footprint. | To the extent possible, avoid construction activities in riparian habitats in the vicinity of watercourses, including drainage ditches.<br><br>Flag or fence environmentally sensitive areas prior to commencement of clearing and grubbing.<br><br>Implement measures to minimize the establishment and spread of non-native invasive plant species through the CEM Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum).<br><br>Stabilize soils and restore vegetation in disturbed areas within one growing season of construction completion.<br><br>Use a native seed mixture to hydroseed disturbed areas.<br><br>To the extent possible, revegetate the pipeline right-of-way with plant species that do not require frequent maintenance (e.g., mowing) during the operations phase. | Depending on the extent to which vegetation can be restored following construction, **residual effects were deemed to be of "Low Significance".** |
| Plant Species and Plant Communities at Risk | No rare and/or at risk terrestrial plant species and/or communities were identified during the review of background information. No rare / at risk plant species surveys were conducted during the June / July 2011 wildlife transect surveys. Nonetheless, potential disturbance or destruction of plant species and/or plant communities at risk during site preparation (i.e., clearing and grubbing) in terrestrial areas could occur in the event that at risk plants are present. | Identify those parts of the Project footprint where plant species at risk have the potential of occurring and conduct a rare / at risk plant species survey in those areas prior to commencement of construction.<br><br>Demarcate (i.e., flag or fence) buffer areas surrounding any identified rare / at-risk plant species prior to clearing.<br><br>If rare / at-risk plant species cannot be avoided, conduct salvage, in consultation with the B.C. Ministry of Forests, Lands and Natural Resource Operations.<br><br>Implement measures to limit the construction footprint and control the establishment and spread of noxious weed species through implementation of the CEM Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum). | Residual effects are considered unlikely following mitigation measures. Pending the outcome of a rare / at risk plant survey to be conducted during the detailed design stage and prior to commencement of construction, **residual effects were deemed to be of "Unknown significance".** |

| Valued Ecosystem Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| Aquatic Birds | Elevated noise levels during directional drilling and trenching along the Highway 99 right-of-way may cause temporary local sensory disturbance to aquatic birds. | N/A | Any birds that are dispersed from this area due to elevated noise levels during construction will likely return when noise disturbance ceases. Given the existing high levels of noise from aircraft and vehicle traffic, the effect associated with noise from construction activities is expected to be negligible.<br><br>**Residual effects were deemed to be "Not Significant".** |
| Terrestrial Wildlife | Temporary displacement of certain species in adjacent habitats by elevated noise during construction | Minimize Project footprint during detailed design stage.<br><br>Demarcate (i.e., flag or fence) boundaries on construction drawings and on-site.<br><br>Limit disturbance to construction footprint.<br><br>If clearing is to occur in spring or summer, conduct a nest survey to detect protected raptor or heron nests, and active nests.<br><br>In the event that raptor or heron nests are found, either delay clearing or establish appropriate buffers around nest sites to avoid disturbance of breeding, pre-fledgling and fledgling birds.<br><br>Prevent discharge of sediment-laden water to environmentally sensitive areas, including riparian zones and watercourses through implementation of the CEM Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum).<br><br>In the event of accidental discharge of a deleterious substance implement emergency response through a CEM Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum) to control the discharge and apply immediate clean-up protocols.<br><br>Within one growing season of construction completion, stabilize soils and restore disturbed areas along pipeline corridor, hydroseed and revegetate with native plant species characteristic of the site where possible and as appropriate for pipeline security and integrity.<br><br>Salvage and replace coarse woody debris, as appropriate, within or adjacent to pipeline right-of-way to provide habitat for wildlife. | Few wildlife or signs of wildlife were recorded along the Highway 99 Pipeline Route Option**;** therefore, **residual effects were deemed to be "Not Significant".** |
| | Potential wildlife mortality for amphibians, reptiles and small mammals during pipeline installation | | **Residual effects were deemed to be of "Low Significance".** |

| Valued Ecosystem Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| Bird Species at Risk | Potential effects as a result of pipeline construction are unlikely because of lack of suitable habitat along Highway 99. | Undertake field surveys during detailed design in areas that may support wildlife species at risk.<br><br>Implement appropriate measures (e.g., salvage, establishment of buffer zones) during construction.<br><br>Minimize footprint during detailed design stage and limit disturbance to footprint during construction.<br><br>Demarcate (i.e., flag or fence) boundaries on construction drawings and on-site. | **No residual effects are expected.** |
| Non-Avian Species at Risk | No non-avian species at risk were recorded along Highway 99 during the June / July 2011 field surveys, so effects are considered unlikely. | Undertake field surveys during detailed design in areas that may support wildlife species at risk.<br><br>Implement appropriate measures (e.g., salvage, establishment of buffer zones) during construction.<br><br>Minimize footprint during detailed design stage and limit disturbance to footprint during construction.<br><br>Demarcate (i.e., flag or fence) boundaries on construction drawings and on-site. | **No residual effects are expected.** |
| **Operations Phase** | | | |
| Terrestrial Vegetation | Periodic habitat alteration, loss or destruction due to periodic vegetation maintenance. | N/A | **Residual effects were deemed to be of "negligible to low significance".** |
| Plant Species and Plant Communities at Risk | Periodic habitat alteration, loss or destruction due to periodic vegetation maintenance. | If plant species at risk are found along pipeline right-of-way adjust maintenance to avoid them, as per the CEM Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum). | **Residual are considered unlikely and were deemed to be of "Unknown Significance".** |
| Aquatic Birds | **No identified potential effects.** | N/A | **No anticipated residual effects.** |
| Terrestrial Wildlife | Potential wildlife habitat alteration, loss or destruction during vegetation maintenance along the Highway 99 Pipeline Route Option. | Undertake vegetation maintenance or other disturbance during identified timing or "least risk" windows to minimize risks to wildlife.<br><br>Avoid vegetation maintenance or other disturbance during breeding, nesting, or seasonal migrations of wildlife.<br><br>Design maintenance access points to avoid sensitive features including critical habitats, nesting sites, denning and basking sites, | **Residual effects were deemed to be "Negligible to Low Significance".** |
| | Temporary or permanent displacement and accidental mortality of amphibians, reptiles and small mammals during periodic vegetation maintenance along the Highway 99 Pipeline Route Option. | | **Residual effects were deemed to be "Not Significant".** |

| Valued Ecosystem Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| | | and known wildlife corridors. | |
| Bird Species at Risk | **No identified potential effects.** | N/A | **No residual effects are expected.** |
| Non-Avian Species at Risk | Certain non-avian species at risk (i.e., amphibians, small mammals) may occur along the Highway 99 Pipeline Route Option and may be affected during vegetation maintenance. | Known or suspected locations of non-avian species at risk will be mapped and included in the CEM Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum) so that appropriate mitigation measures are implemented during periodic pipeline maintenance activities. | **No residual effects are expected.** |

### 11.3.3 Local and Regional Air Quality and Climate Assessment

**Table 11.3.3 Local and Regional Air Quality and Climate Assessment – Summary of Potential Effects, Recommended Mitigation, and Significance of Residual Effects**

| Valued Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| **Construction Phase** | | | |
| Ambient Air Quality | Short-term increase in CAC (i.e., $PM_{2.5}$, $PM_{10}$, $NO_x$, $SO_2$ and VOC) levels within the LSA (i.e., Richmond) due to:<br>• CAC emissions from operation of fossil-fuelled equipment;<br>• CAC emissions from operation of delivery trucks and service vehicles; and<br>• Fugitive dust from the handling of rock and soil. | Inspection and maintenance of construction vehicles and equipment to reduce fuel consumption and reduce exhaust emissions of particulate matter and VOCs.<br><br>Installation of diesel particulate matter filters in construction equipment and vehicles to reduce diesel particulate matter emissions.<br><br>Use of fuel additives, catalysts and oxidizers for diesel fuel to reduce $CO_2$, $SO_2$ and $NO_x$ emissions.<br><br>Application of water during non-freezing, dry weather conditions to minimize fugitive dust emissions associated with the use of construction vehicles and equipment on unpaved roads, the handling of rock and soil at the construction site and with other construction activities (i.e., site preparation, pipeline construction etc.).<br><br>Implementation of vehicle idling restrictions to reduce combustion-related emissions. | Total CAC emissions expected for construction represent less than a 1% increase in the LSA for all contaminants, and are reversible once construction is complete.<br><br>**Residual effects were deemed to be "not significant".** |
| GHG Emissions | Short-term increase in GHG levels within the RSA (i.e., Richmond, Surrey and Delta) due to:<br>• Emissions from fossil-fuelled construction equipment;<br>• Emissions from project-generated vehicle traffic (excluding personal employee vehicles); and<br>• Indirect emissions from the production of cement for use in concrete. | Inspection and maintenance of construction vehicles and equipment to reduce fuel consumption.<br><br>Use of fuel additives, catalysts and oxidizers to reduce emissions.<br><br>Implementation of vehicle idling restrictions to reduce combustion-related emissions. | Total GHG emissions estimated for construction represent a less than 0.1% increase to the annual GHG emissions in the RSA and are reversible once construction is complete.<br><br>**Residual effects were deemed to be "not significant".** |

| Valued Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| **Operations Phase** | | | |
| Ambient Air Quality | Change in CACs (including $PM_{2.5}$, $PM_{10}$, $NO_x$ and VOC) levels within LSA and RSA as a result of the Project | Maintenance of vapour-tight conditions in the pipeline; and<br><br>Implementation of a leak detection and repair program | Project operations are expected to result in an overall decrease in regional particulate matter and $NO_x$ emissions. For VOCs, Project operations is expected to result in an increase in emissions based on the present (i.e., 2007) fuel requirements at YVR and, based on forecast (i.e., 2016) fuel requirements at YVR. The direction of effect is positive for particulate matter and $NO_x$ emissions; and either positive or negative for VOCs depending on the fuel requirements at YVR.<br><br>The magnitude of Project effects for all pollutants is rated low because the emissions expected during operations represent less than a 1% change with respect to total emissions in the LSA, and less than a 0.1% change with respect to total emissions in the RSA, or maximum predicted ambient air concentrations are less than half the ambient objective.<br><br>**Residual effects were deemed to be "not significant".** |
| GHG Emissions | An overall decrease in regional GHG emissions resulting from the Project. | N/A | An overall decrease in regional emissions of GHG emissions is expected. The decrease represents approximately 0.03% of total annual RSA emissions. Net GHG emissions due to Project operations represent a 0.002 to 0.003% decrease in total provincial emissions and a 0.0002% decrease in total national emissions. Thus, the direction of effect is positive.<br><br>**Residual effects are of a positive nature and were deemed to be "not significant".** |

### 11.3.4 Noise Assessment

**Table 11.3.4 Noise Assessment – Summary of Potential Effects, Recommended Mitigation, and Significance of Residual Effects**

| Valued Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| **Construction Phase** | | | |
| Noise-sensitive land uses | "Annoyance" due to pipeline construction for residents or businesses in close proximity to construction. | Implement appropriate BMPs.<br><br>Manage interactions between employees / contractors and local communities.<br><br>Minimize duration of construction. | Potential residual effects are predicted to be low in magnitude, short-term in duration and localized; however, reversible once construction is complete. **Residual effects were deemed to be "Not Significant**". |
| **Operations Phase** | | | |
| Noise-sensitive land uses | No potential noise effects were identified. | N/A | **No anticipated residual effects**. |

### 11.3.5 Screening Level Contaminated Sites Assessment

**Table 11.3.5 Screening Level Contaminated Sites Assessment – Summary of Potential Risks, Recommended Mitigation, and Significance of Residual Effects**

The purpose of the Screening Level Contaminated Sites Assessment was to provide an overview of potential pre-existing contamination risks for the Project. This differs slightly than the other effects assessments presented in **Chapter 4** of the Addendum, where potential residual effects were evaluated for VECs / VCs, and significance was determined. For the purpose of this summary, and **Chapter 10** of the Addendum, "Soil and Groundwater Contamination (Pre-existing)" is considered to be a VC.

| Valued Component | Potential Risks | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| **Construction Phase** | | | |
| Soil and Groundwater Contamination (Pre-existing) | The risk of encountering contaminants during construction is low to moderate. | The recommended mitigation measures for the Highway 99 Pipeline Route Option remain the same as those described in **Section 5.6.4.3** of the Application. In summary, if contamination is encountered during construction, appropriate mitigation will be implemented using adaptive management strategies. Management for contaminated sites will be developed and included in the CEM Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum) prior to the commencement of construction for areas where encountering contamination is likely (i.e., medium to high risk). | The identification of soil and groundwater contamination is beneficial, as it results in remediation.<br>Any contamination encountered during construction along the Highway 99 Pipeline Route Option is unlikely to be problematic**.**<br>**Residual effects were deemed to be "not significant".** |
| **Operations Phase** | | | |
| Soil and Groundwater Contamination (Pre-existing) | There is an unlikely risk that operations of the Highway 99 Pipeline Route Option will affect baseline conditions in the Study Area, such that contamination would be encountered during the operations phase.<br>There is a low likelihood that the Project would materially increase the migration of existing contamination through the introduction of a new preferred groundwater flow pathway. Finally, the risk of degradation of anti-corrosion coating by contaminants is also considered low. | Implementation of adaptive management strategies if contamination is discovered during operations.<br>Ongoing integrity and corrosion monitoring of anti-corrosion coatings. | None of the areas of risk identified are especially large or problematic, so risk of encountering contaminated sites during operations is a minor concern.<br>**Residual effects were deemed to be "not significant".** |

### 11.3.6 Assessment of Social and Economic Effects

**Table 11.3.6 Assessment of Social and Economic Effects – Summary of Potential Effects, Recommended Mitigation, and Significance of Residual Effects**

| Valued Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| **Construction Phase** | | | |
| Economic Development | Not dependent on the Highway 99 Pipeline Route Option.<br><br>Construction-related jobs are expected to be primarily filled by existing members of the local labour force and are expected to have negligible population or demographic effects. | None | Potential short-term, positive residual effects may arise as a result of labour requirements for Project construction.<br><br>**Residual effects were deemed to be 'not significant'.** |
| Land Use | It is not expected that the Highway 99 Pipeline Route Option will affect future zoning or land use patterns in the area. | N/A | **No anticipated adverse residual effects.** |
| Property Acquisitions and Property Value | Pipeline construction is not expected to require permanent acquisition of properties along the final selected alignment.<br><br>Potential short-term, low adverse residual effects on property values may occur as a result of construction activities along the Highway 99 Pipeline Route Option. | Choosing the Highway 99 Pipeline Route Option would minimize the number of residences adjacent to the pipeline relative to other options assessed in the Application. | **Residual effects were deemed to be 'not significant'.** |
| Motor Vehicle Traffic and Mobility | Bus routes along Highway 99 may be disrupted during construction of Williams Road to Blundell Road segment as one of the HOV / bus lanes (either the east or west side) is likely to be affected.<br><br>Two-lane roadways where traffic could be required to alternate under a single lane of traffic during active pipeline construction may occur (e.g., Vanguard Road, St. Edwards Drive, and/or Patterson Road).<br><br>A cluster of industrial businesses along Vanguard Road have a single access point under Highway 99 near Shell Road. Any disruption to traffic flow on Vanguard Road could be significant to those businesses. | The Traffic Management Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum) will consider motor vehicle, bicycle and pedestrian traffic and include time of day, day of week and seasonal sensitivities, as well as a communication strategy to publicize any likely delays and signage indicating alternate routes if required. Motor vehicle traffic effects may be mitigated by avoiding week days and/or busiest times of day. Some mitigation of effects on Highway 99 motor vehicle traffic may be possible by using the Francis Road option instead of Williams Road. Using the Francis Road option would reduce by half the length of pipeline to be constructed in the relatively narrow part of the Highway 99 right-of-way between Williams Road and Blundell Road.<br><br>Depending on the final pipeline route alignment, special provisions may be required for the businesses on Vanguard Road that have a single access point under Highway 99 near Shell Road. | Highway 99 is a major transportation corridor and any disruption to traffic would be significant. Significant adverse effects possible between Williams Road and Blundell Road where Highway 99 right-of-way is narrowest and construction is likely to require use of Highway 99 shoulder and HOV / bus lane.<br><br>Traffic disruption during construction of the Highway 99 Pipeline Route Option **could potentially be significant,** depending on final pipeline alignment, construction methods and mitigation feasibility. |
| On-street Parking | Possible temporary loss of access to on-street parking opportunities. | To minimize effects of construction on street parking, parking for construction workers is recommended not to occur in areas where curbside parking is in high demand. | **Residual effects were deemed to be 'not significant'.** |

| Valued Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| Bicycle / Pedestrian Traffic and Mobility | Potential disruption of bicycle traffic and pedestrian crossing under Highway 99 near Shell Road, and bicycle and pedestrian traffic going onto the Highway 99 Oak Street Bridge sidewalk from the Patterson Road bicycle path. | Provision for bicycle access across Highway 99 near Shell Road, and across Highway 99 to the Oak Street Bridge sidewalk may be required if existing routes are disrupted. | **Residual effects were deemed to be 'not significant'.** |
| Schools / Recreation Access and Other Community Features | Potential temporary effects relating to motor vehicle access, pedestrian and non-motorized traffic mobility, noise, dust, parking access including on-street parking, and tree and vegetation removal.<br><br>Major community features that may be affected include: the B.C. Muslim Association facilities if the final alignment uses the west side of Highway 99 near Blundell Road; the Mylora Golf Courses along Williams Road; and the Richmond Nature Park. | Major community features, and in particular the B.C. Muslim Association facilities, the Mylora Golf courses, and Richmond Nature Park may need to be considered in construction plans and the Traffic Management Plan depending on the final pipeline alignment. | **Residual effects were deemed to be 'not significant'.** |
| Street / Trail Trees | Potential adverse effect to street / trail trees including trees on either side of Highway 99 north of Williams Road; trees lining several clusters of residential areas between Highway 91 and Bridgeport Trail; and trees near the Richmond Nature Park, particularly if the pipeline route follows the outside edge of the Highway 99 right-of-way rather than closer to the existing travel surface. | Environmental protection for street / trail trees will be incorporated into the CEM Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum) to ensure construction BMPs to minimize effects to surrounding vegetation and tree stands of public value. This protection should include methods to protect trees of high historical value, and a narrowed construction footprint, as appropriate, to minimize effects on greenbelt areas. | Negative effects were deemed to be "low" to "moderate" depending on the final alignment chosen within the Highway 99 right-of-way.<br><br>**Residual effects were deemed to be 'not significant'.** |
| Noise, GHG Emissions and Health Effects | **Section 4.4.4** includes the potential operational noise effects associated with construction of the Highway 99 Pipeline Route Option.<br><br>**Section 4.3.4** includes the potential operational air quality effects associated with construction of the Highway 99 Pipeline Route Option.<br><br>**Section 7.4** discusses the potential human health effects associated with the Highway 99 Pipeline Route Option. | **Section 4.4.4** includes the recommended mitigation measures for noise effects associated with construction of the Highway 99 Pipeline Route Option.<br><br>**Section 4.3.4** includes the recommended mitigation measures for air quality effects associated with construction of the Highway 99 Pipeline Route Option.<br><br>**Section 7.4** discusses the recommended mitigation measures for health effects associated with the Highway 99 Pipeline Route Option. | **Section 4.4.5** includes the potential residual effects associated with noise during construction of the Highway 99 Pipeline Route Option.<br><br>**Section 4.3.5** includes the potential residual effects associated with air quality during construction of the Highway 99 Pipeline Route Option.<br><br>**Section 7.5** includes the assessment of potential residual effects associated with human health effects during construction of the Highway 99 Pipeline Route Option. |
| Aesthetic Values / Visuals | Potential short-term adverse effects may occur as a result of construction machinery required to complete the fuel delivery pipeline and the trenchless pipeline construction techniques required in several locations along Highway 99. | None | **Residual effects were deemed to be 'not significant'.** |

| Valued Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| Railway Rights-of-Way | Trenchless pipeline construction will likely be used for crossings under active railway tracks. Crossing the CNR right-of-way at the Shell Road / Highway 99 overpass is unlikely to have any effect on existing railway traffic. | None | **Residual effects were deemed to be 'not significant'.** |
| Utilities | Pipeline construction will necessitate crossing water and sewage lines in Richmond, as well as natural gas, power lines, control cables, telephone cables, and the existing aviation fuel delivery pipeline operated by Kinder Morgan. Any effects from utility crossings / conflicts are expected to be minor. | The Traffic Management Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum) will include a communication strategy to give advance notice of utility works and any disruptions in services. | **Residual effects were deemed to be 'not significant'.** |
| **Operations Phase** | | | |
| Economic Development | 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. This will be the same regardless of the pipeline route option.<br><br>During operations, the Project will generate approximately 14 full-time equivalent jobs, regardless of the pipeline route option. | None | **Residual effects were deemed to be 'significant', but positive.** |
| Land Use | The pipeline will be built within existing transportation and utility corridors in Richmond. No effects on land use are expected. | N/A | **No anticipated residual effects.** |
| Property Acquisitions and Property Value | It is possible that some short-term negative effects on property values along the proposed Highway 99 Pipeline Route Option could develop under certain circumstances during operations. In the medium to long-term (beyond 3 years of any such effects arising), it is expected that those effects would dissipate. | To the extent that negative residential property value effects could arise, the choice of Highway 99 Pipeline Route Option minimizes the number of residences that would be adjacent to the pipeline route relative to other options considered in the Application. | **Residual effects were deemed to be 'not significant'.** |

| Valued Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| Motor Vehicle Traffic and Mobility | Once the pipeline is in operation, it is expected to eliminate the need for tanker trucks, reducing traffic congestion, increasing traffic safety and reducing road maintenance costs. This will be the case regardless of the pipeline route option.<br><br>Highway 99 is a major regional and provincial transportation corridor with ongoing upgrades and long term capacity expansion plans. Known expansion / upgrade plans for Highway 99 may include an interchange at Blundell Road, replacement and/or expansion of the Oak Street Bridge, and replacement and/or expansion of the George Massey Tunnel and the Steveston Highway interchange. | In order to minimize future Highway 99 right-of-way use conflicts, a final alignment for the pipeline within the Highway 99 right-of-way will be selected upon consideration of known expansion / upgrade plans for Highway 99 and in consultation with MoT. | **Residual effects were deemed to be 'not significant'.** |
| On-Street Parking | Once the pipeline is in operation, there will be no or negligible effects on on-street parking along the proposed pipeline corridor. | N/A | **No anticipated adverse residual effects.** |
| Bicycle and Pedestrian Traffic | Once the pipeline is in operation, there are no expected negative effects on pedestrian or bicycle traffic, as the pipeline corridor is expected to be returned to at least pre-construction conditions. Long-term maintenance activities may require periodic access restriction as a result of excavations. | None | **Residual effects were deemed to be 'not significant'.** |
| Schools, Recreation Areas and Community Features | The ongoing operation / maintenance of the pipeline is not expected to have any effects on schools, recreation areas and community features. | N/A | **No anticipated adverse residual effects.** |
| Street / Trail Trees | The ongoing operations / maintenance of the pipeline is not expected to have any effects on street / trail trees with the possible exception of the Highway 99 right-of-way portion that is adjacent to the Richmond Nature Park, as trees removed to create a pipeline corridor in this area would likely not be replaced, in order to retain pipeline maintenance access and not compromise pipeline integrity. | None | **Residual effects were deemed to be 'not significant'.** |

| Valued Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| Noise, GHG Emissions and Health Effects | **Section 4.4.4** includes the potential noise effects associated with operation of the Highway 99 Pipeline Route Option.<br><br>**Section 4.3.4** includes the potential air quality effects associated with operation of the Highway 99 Pipeline Route Option.<br><br>**Section 7.4** discusses the potential human health effects associated with the Highway 99 Pipeline Route Option. | **Section 4.4.4** includes the recommended mitigation measures for noise effects associated with operation of the Highway 99 Pipeline Route Option.<br><br>**Section 4.3.4** includes the recommended mitigation measures for air quality effects associated with operation of the Highway 99 Pipeline Route Option.<br><br>**Section 7.4** discusses the recommended mitigation measures for health effects associated with the Highway 99 Pipeline Route Option. | **Section 4.4.5** includes the potential residual effects associated with noise during operation of the Highway 99 Pipeline Route Option.<br><br>**Section 4.3.5** includes the potential residual effects associated with air quality during operation of the Highway 99 Pipeline Route Option.<br><br>**Section 7.5** includes the assessment of potential residual effects associated with human health effects during operation of the Highway 99 Pipeline Route Option. |
| Aesthetic Values / Visuals | The fuel delivery pipeline will be located underground (with the exception of valve stations) and as a result there are no anticipated visual effects. | N/A | **No anticipated adverse residual effects.** |
| Railways | Once pipeline construction is completed, any rail crossings (i.e., near Shell Road and near the Moray Channel crossing) should not have any effects on rail operations. | N/A | **No anticipated adverse residual effects.** |
| Utilities | Once pipeline construction is completed, the crossings of Richmond utilities, natural gas pipelines, and the existing fuel delivery pipeline should not conflict with the operations of those utilities. | N/A | **No anticipated adverse residual effects.** |

### 11.3.7 Assessment of Heritage Effects

**Table 11.3.7 Assessment of Heritage Effects – Summary of Potential Effects, Recommended Mitigation, and Significance of Residual Effects**

This assessment is pertinent to the construction phase of the Highway 99 Pipeline Route Option only, since any effects would be limited to encountering of undocumented archaeological and historic resources during construction. Once in operation, there is no potential for interaction with heritage VCs, since the pipeline will be in place.

| Valued Component | Potential Effects | Recommended Mitigation Measures | Significance of Potential Residual Effects |
|---|---|---|---|
| Archaeological Sites | Interaction of construction with unknown archaeological sites. | Archaeological Impact Assessment and Mitigation. | No archaeological sites known; to be completed after AIA |
| Historic Heritage Sites | N/A | N/A | N/A |
| Paleontological Sites | N/A | N/A | NA |
| Traditional Land Use | N/A | N/A | N/A |

### 11.3.8 Assessment of Human Health Effects

**Table 11.3.8 Assessment of Human Health Effects – Summary of Potential Effects, Recommended Mitigation, and Significance of Residual Effects**

| Valued Component | Potential Effects | Recommended Mitigation Measures | Potential Residual Effects and their Significance |
|---|---|---|---|
| **Construction** | | | |
| Human Health Effects from Noise | Short-term (1-2 days) annoyance for nearby residents and sensitive populations because of noise from construction activities on Highway 99. | Contractor(s) will be required to meet the City of Richmond bylaw requirements for noise (<80dB).<br><br>Noise control and mitigation measures will be developed and included in the CEM Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum). | Annoyance for nearby residents and sensitive populations of short-term (1-2 days) duration.<br><br>**Potential residual effects deemed to be "Not Significant."** |
| Human Health Effects from Air Quality | Temporary and localized exposures to CACs and fugitive dust, as experienced with standard construction activities. | Construction activities will use accepted mitigation measures as described in the CEM Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum). | Temporary and localized exposures to CACs and fugitive dust.<br><br>**Potential residual effects deemed to be "Not Significant."** |
| Human Health Effects from Road Traffic | Pedestrians and cyclists on other alignment route options will avoid construction traffic related safety hazards. Road users on No. 5 Road, Sidaway Road and No. 6 Road may be exposed to increased traffic and delays due to drivers using these alternate routes to Highway 99. | A Traffic Management Plan will include planned mitigation measures as described in the CEM Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum). | Increased exposure to road safety hazards as a result of rerouting traffic.<br><br>**Potential residual effects deemed to be "Not Significant."** |
| Human Health Effects from Contaminated Sites | Construction activities at contaminated sites present the opportunity for the contamination to be remediated. The likelihood of remobilization of contamination into other environmental media is low. | Appropriate materials handling procedures will be identified using adaptive management strategies as described in the CEM Plan (**Chapter 9** of the Application and **Chapter 8** of the Addendum). | Neutral to positive residual effects.<br><br>**Potential residual effects deemed to be "Not Significant."** |
| **Operations** | | | |
| Human Health Effects from Noise | No potential exposure pathway. No identified potential effects. | N/A | N/A |
| Human Health Effects from Air Quality | No potential exposure pathway. No identified potential effects. | N/A | N/A |
| Human Health Effects from Road Traffic | No potential exposure pathway. No identified potential effects. | N/A | N/A |
| Human Health Effects from Contaminated Sites | No potential exposure pathway. No identified potential effects. | N/A | N/A |

# Chapter 12
## Conclusion

# 12 CONCLUSION

The application for a provincial Environmental Assessment Certificate (the Application) submitted by the Vancouver Airport Fuel Facilities Corporation (VAFFC) for the Vancouver Airport Fuel Delivery Project (the Project), which also serves as the Environmental Impact Statement for a federal environmental assessment decision, was accepted for review by the EAO on 04 February 2011. During the 180-day Application Review stage of a harmonized provincial / federal environmental assessment review process, led and coordinated by the British Columbia (B.C.) Environmental Assessment Office (EAO), VAFFC requested a temporary suspension of the Application Review so that the Highway 99 Pipeline Route Option, a possible alternate route for a section of the fuel delivery pipeline, could be evaluated. The request was accepted by the EAO on 28 April 2011. This Addendum to the Application has been prepared to include the Highway 99 Pipeline Route Option within the scope of the Project's environmental assessment review, similar to the other route options described in the Application.

The Highway 99 Pipeline Route Option is within the Highway 99 right-of-way which is under the jurisdiction of B.C Ministry of Transportation and Infrastructure (MoT). The route commences where the Williams Road easement intersects the highway, north to where the Bridgeport Trail crosses underneath the Oak Street Bridge. The pipeline length within the Highway 99 right-of-way will be approximately 7.7 kilometres. The total pipeline length from the proposed location for the fuel receiving facility (i.e., on land leased from Port Metro Vancouver) to the existing VAFFC fuel facilities at YVR will be approximately 1.5 kilometres shorter than if either the No.5 Road or Shell Road corridors were used instead of the highway.

Construction and operation activities for the Highway 99 Pipeline Route Option are not expected to differ from those described for the other pipeline route options in the Application. However, all these activities will require a permit or operating agreement with MoT.

This Addendum to the Application has considered potential environmental, social, economic, heritage and health effects of Project construction and operations as they relate to the Highway 99 Pipeline Route Option. Consideration has also been given to environmental management planning, accidents or malfunctions and cumulative environmental effects that may be expected in addition to those assessed in the Application. Based on the discipline-specific assessments conducted in support of this Addendum, and following the application of identified mitigation measures, significant adverse environmental, social, health, heritage or economic residual effects resulting

from construction or operations of the Highway 99 Pipeline Route Option are not expected.

Consistent with other pipeline route options, the Highway 99 Pipeline Route Option will be designed, constructed and operated according to the latest regulations, standards, codes, guidelines and best management practices associated with pipelines. VAFFC will work closely with its contractor(s) and operator(s) to verify that the issues identified in **Chapter 11** are understood and that the commitments set out in **Chapter 24** of the Application (which will form the basis for Proponent Commitments if an EAC is issued for the Project) are adhered to during Project construction and operations.

In addition to the economic, social and environmental benefits of the Project to the region as described in the Application (see **Section 2.3.4** of the Application), aligning a major section of the delivery pipeline along the Highway 99 corridor, instead of using the other route options described in the Application, will provide the following benefits:

- Shorten the total length of pipeline between the fuel receiving facility and YVR, providing the most direct route through Richmond;
- Remove significant lengths of pipeline from road and trail corridors under the jurisdiction of the City of Richmond. Richmond has expressed concerns about the use of its streets;
- Lessen the impact of pipeline construction and operations / maintenance activities to the Richmond community, which will be easier to manage and less disruptive to the public;
- Development and activity on the highway right-of-way will be strictly controlled, so the risk to the pipeline from third-party activity is minimized;
- Once constructed, the pipeline will be buried and will have no impact on the highway;
- Offer a greater separation between the pipeline route and the urban development in Richmond;
- Access to the pipeline for maintenance and repair will be easier because it will be located in the highway right-of-way rather than under a city street;
- Avoid complexities with other underground utilities situated in City roads and right-of-ways. Fewer utility crossings will be involved;
- The highway route will result in the smallest environmental footprint; and

- Richmond has expressed opposition to any aviation fuel pipeline through Richmond, but expressed preference for the Highway 99 route if a pipeline is constructed through Richmond.

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 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.