George Massey Tunnel Replacement Project

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PROJECT DESCRIPTION AND KEY AREAS OF STUDY

DECEMBER 2015

EXECUTIVE SUMMARY

The George Massey Tunnel (Tunnel) is an important link in the regional and provincial transportation system, serving an average of 80,000 vehicles each day and connecting to key gateways that fuel our national, provincial and regional economies. Since the Tunnel opened in 1959, Metro Vancouver's population has grown considerably and is forecast to keep growing by more than one million people over the next 30 years. The B.C. Ministry of Transportation and Infrastructure (Ministry) is proposing the George Massey Tunnel Replacement Project (Project) to meet forecast population and employment growth and ensure Highway 99 continues to serve regional, provincial, and national transportation needs.

The Project involves replacing the Tunnel with a new bridge spanning the Fraser River South Arm and Deas Island, decommissioning the Tunnel, and improving Highway 99 from Bridgeport Road in the City of Richmond to Highway 91 in the Corporation of Delta. The general alignment of the Project will follow the existing Highway 99 corridor, including across the Fraser River.

The Project is designed to reduce congestion and improve travel times and reliability for commuters, transit, commercial vehicles, and tourists; improve safety; provide new travel options for cyclists and pedestrians; and provide capacity for improved transit.

The Ministry proposes to submit the Application for an Environmental Assessment Certificate for the Project in 2016 to support a thorough and timely review, so that construction can begin in 2017 and the new bridge will be ready for use in 2022, after which tunnel decommissioning will commence.

As part of Project planning, the Ministry consulted widely, gaining insight from municipalities, Aboriginal Groups, Metro Vancouver, TransLink, the agricultural community, first responders, recreational groups, local businesses, local residents, cyclists, marine users, other stakeholders, and the general public over a period of more than two years. Based on this consultation, the Ministry identified and considered a diverse range of environmental and social values to guide Project design and support the environmental assessment.

Key values proposed for study as part of the environmental assessment include:

- Environmental values, such as fisheries, wildlife and wildlife habitat
- Human health including influences on health, such as air quality and noise
- Social and community factors including those related to land and water use
- Economic conditions including employment and economic development benefits associated with the Project; and
- Heritage resources such as archaeological values

Studies of these values will assist in identifying potential Project-related effects as well as opportunities to avoid or mitigate such effects and will be reported in the Application for an Environmental Assessment Certificate.

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Acronyms and Abbreviations

Term	Acronym / Abbreviation
Application for an Environmental Assessment Certificate	Application
B.C. Ministry of Transportation and Infrastructure	Ministry
British Columbia	B.C.
British Columbia *Environmental Assessment Act*	B.C. *EAA*
Canadian National Railway	CN
Canadian Transportation Agency	CTA
Draft Application Information Requirements	dAIR
Environmental Assessment	EA
Environmental Assessment Certificate	EAC
Environmental Assessment Office	EAO
Fisheries and Oceans Canada	DFO
George Massey Tunnel	Tunnel
George Massey Tunnel Replacement Project	Project
Gross Domestic Product	GDP
High-Occupancy Vehicle	HOV
Port Metro Vancouver	PMV
Right-of-way	ROW
Valued Component	VC
Vancouver International Airport	YVR

PART 1: PROJECT DESCRIPTION

1.0 General Information and Contacts

The B.C. Ministry of Transportation and Infrastructure (Ministry) is proposing the George Massey Tunnel Replacement Project (Project) to address congestion, meet forecast population and employment growth, and ensure Highway 99 continues to serve regional, provincial, and national transportation needs.

1.1 Purpose of the Project Description

It is anticipated that the Project will be subject to a formal environmental assessment (EA) and review pursuant to the B.C. *Environmental Assessment Act* (B.C. *EAA*), S.B.C. 2002, c. 43. In support of the requirements of the B.C. *EAA* process, the Ministry will prepare an application (Application) for an Environmental Assessment Certificate (EAC).

The Ministry is submitting this Project Description and Key Areas of Study document (Project Description) to the B.C. Environmental Assessment Office (EAO) to initiate the Pre-Application Stage of the B.C. *EAA* process. The Project Description provides Project-related information that will allow the EAO to determine whether the Project triggers a review under the B.C. *EAA*.

The Ministry prepared this Project Description according to guidance provided in the EAO's *Guidelines for Preparing a Project Description for an Environmental Assessment in British Columbia* (EAO 2013 [1]). The Project Description includes:

- General Project information and an overview of the rationale for its development
- Outline of key Project components, and construction and operational activities
- Anticipated Project schedule and estimated capital cost of the Project
- Description of past and proposed engagement with Aboriginal Groups, stakeholders, government agencies, and the general public
- Overview of the environmental and socio-economic setting of the Project
- Outline of the Project's potential effects and regulatory requirements
- A preliminary list of proposed studies that will be used to support the assessment of potential effects of the Project

[1] British Columbia Environmental Assessment Office (EAO). 2013. Guidelines for the Selection of Valued Components and Assessment of Potential Effects. Available at: http://www.eao.gov.bc.ca/pdf/EAO_Valued_Components_Guideline_2013_09_09.pdf. Accessed September 2014

1.2 Project Overview

The Project will replace the George Massey Tunnel (Tunnel) with a new 10-lane (8 lanes plus two dedicated transit high occupancy vehicle lanes) bridge spanning the Fraser River South Arm, decommission the Tunnel, and improve Highway 99 from Bridgeport Road in Richmond to Highway 91 in Delta. Proposed improvements include replacing the Westminster Highway, Steveston Highway and Highway 17A interchanges, widening Highway 99 to accommodate dedicated transit/high-occupancy vehicle (HOV) lanes, and providing a multi-use pathway on the bridge for cyclists and pedestrians to connect with the existing cycling and pedestrian networks on either side. A detailed description of the Project components and activities is provided in **Section 3.0 Project Components and Activities**.

1.3 Project Location

The Project will have the same general alignment as the existing Highway 99 corridor and crossing of the Fraser River South Arm, linking the City of Richmond (Richmond) and the Corporation of Delta (Delta) in southwestern B.C. (latitude of 49° 07' 18.36" N and longitude of 123° 04’32 32" W). The interchange replacements and proposed Highway 99 improvements are wholly located in Richmond and Delta.

Figure 1-1 presents an overview of the geographic extent of the Project as proposed.
A rendering of the potential new bridge configuration over the South Arm of the Fraser River is shown in Figure 1-2.

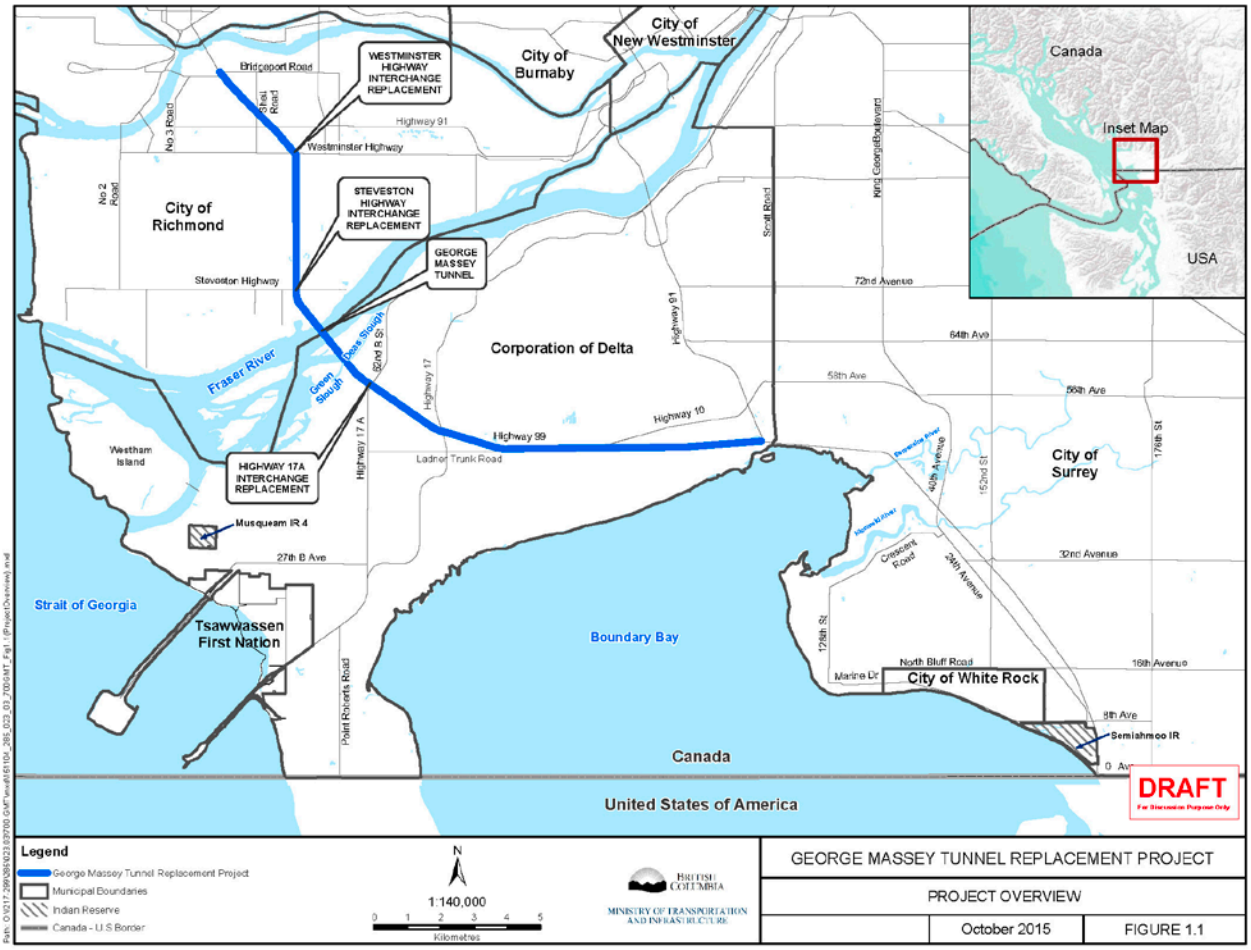


Figure 1-1 Project Location



Figure 1-2 Rendering of the Potential New Bridge Configuration Over the Fraser River South Arm

1.4 Proponent Information

The Project proponent is the B.C. Ministry of Transportation and Infrastructure working on behalf of the Province of British Columbia. If approved, the EAC and operational permits for the Project will be held by the Ministry.

Name of Proponent:	B.C. Ministry of Transportation and Infrastructure
Primary Contact:	Geoff Freer
Title:	Executive Project Director
Address:	2030 - 11662 Steveston Highway
	Richmond, BC V7A 1N6
Telephone:	604-660-8282
Email:	masseytunnel@gov.bc.ca
Project Website:	masseytunnel.ca

2.0 Project Rationale, Goals, and Benefits

The Tunnel is an important link in the regional and provincial transportation system, carrying an average of 80,000 vehicles each day. It connects to key gateways, including Vancouver International Airport (YVR), the Peace Arch and Pacific Canada–United States (U.S.) border crossings, BC Ferries' Tsawwassen terminal, Deltaport, and Boundary Bay Airport. It is a vital goods movement route that fuels our national, provincial and regional economies, and a key access point for businesses in Richmond, Delta, Tsawwassen First Nation, Surrey, and White Rock.

Metro Vancouver's population, employment and economy have grown considerably since the Tunnel opened in 1959 and population is forecast to continue to grow by more than one million people over the next 30 years. Without improvements to this crossing, economic growth and regional liveability will be constrained by congestion and increased travel times for commuters, goods movers, commercial, and other traffic.

With growing concerns about safety and traffic congestion in and near the Tunnel, in 2012 the government of B.C. commenced a study of options to address the Highway 99 corridor. After analysis and consultation, a new bridge to replace the Tunnel emerged as the most appropriate and supported solution. Construction is expected to begin in 2017.

2.1 Project Rationale

Addressing safety and traffic congestion issues associated with the existing Tunnel are the primary reasons for the Ministry's decision to proceed with the proposed Project.

2.1.1 Safety

The Tunnel was built to the engineering standards of the 1950s. While operationally safe, it does not meet current highway and seismic standards, though some deficiencies have been addressed through lighting, ventilation and structural upgrades. With narrow lanes and multiple merge points, crashes in and around the Tunnel happen with higher frequency than along other parts of the Highway 99 corridor. The Tunnel's design constraints (no shoulders and limited access between northbound and southbound lanes) also make it difficult for first responders to access and clear emergencies.

An analysis of traffic collision patterns along the Highway 99 corridor shows that vehicle collisions are highest at merge points leading to the Tunnel entrances, and at the Highway 17A and Steveston Highway interchanges. According to Insurance Corporation of British Columbia (ICBC) records, the Steveston Highway interchange is the worst crash site in Richmond, and in Delta, the Highway 17A interchange is the third-worst crash site[2]. This is in part due to the large volume of vehicles making multiple merges as Highway 17A connects with Highway 99, combined with heavy congestion and related queues in the morning rush period. In addition to safety and property damage concerns, these crashes affect travel times and corridor reliability.

2.1.2 Traffic Congestion

The Tunnel has been congested during the weekday morning and afternoon rush hours for decades, with combined queues from all directions now regularly as long as five kilometres[3]. When there is a crash or vehicle breakdown, these queues can be much longer.

TransLink's Regional Transportation Model indicates that, with continuing economic development north and south of the Fraser River, and population and employment forecast to increase in the communities of Richmond, Delta, Tsawwassen First Nation, Surrey and White Rock, traffic volumes through the Tunnel will grow over time[4]. This includes significant growth in truck traffic, which is expected to more than double by 2045. Since there is no additional capacity available at the Tunnel to accommodate this additional traffic, peak periods will extend beyond current rush hour at the Tunnel and the Alex Fraser Bridge, resulting in heavy congestion in all traffic flow directions.

2.2 Project Goals

Based on the Ministry's mandate and results of consultation to date, six key goals have been identified for the Project:

1. **Reduce congestion:** Improve travel times and reliability for all users.
2. **Improve safety:** This includes improving traffic and seismic safety, as well as emergency-response capabilities.
3. **Support trade and commerce:** Improve access to local businesses and gateway facilities, and improve travel time reliability for goods movers and service providers.

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2 Lower Mainland – Crashes at Intersections 2009 to 2013, Insurance Corporation of British Columbia. Retrieved May 15, 2014

3 Ministry of Transportation and Infrastructure Traffic Data Program

4 Forecast by TransLink's Regional Transportation Model and based in part on changes in land use as per Metro Vancouver's Regional Growth Strategy, and on projected growth in truck volume at special generators

4. **Support increased transit on the Highway 99 corridor:** Provide dedicated transit/HOV lanes on the new bridge and Highway 99 to improve travel time reliability and add capacity for long-term transit improvements.
5. **Support options for pedestrians and cyclists:** Provide a multi-use pathway on the new bridge to connect cycling and pedestrian corridors in Richmond and Delta.
6. **Enhance the environment:** Enhance the environment under the new bridge and in the Project right-of-way on Deas Island.

2.3 Project Benefits

The following benefits are expected to result from the Project:

- **Reduced congestion:** The new bridge will meet current and forecast travel demand with no significant congestion to at least 2045; the average commuter will save about 25 to 35 minutes a day when the bridge is complete in 2022. This includes traffic that currently uses the Tunnel, forecast traffic growth at this crossing, and the potential for some travellers who avoid the Tunnel today to switch to the new bridge. Dedicated transit/HOV lanes will encourage transit and carpooling to help manage growth in auto traffic. Travel time savings and reliability benefits are expected to be more than $70 million in the first full year of operation, increasing over time[5].
- **Improved safety:** The Project is expected to provide more than a 35 per cent decrease in the frequency of collisions[6]. The new bridge will have more lanes and wider shoulders than the Tunnel. This will make it easier for traffic to continue moving in the event of an incident, and will facilitate first responder access. Additional lanes will make it safer to merge onto Highway 99 from the Steveston Highway and Highway 17A interchanges and to avoid slower-moving trucks. The seismic safety of this river crossing will also be significantly improved.
- **Improved trade and commerce:** Growth in international trade through Metro Vancouver has contributed significantly to the economy of B.C. and has increased traffic along major trade routes such as Highway 99, which is also a popular commuter and tourist route. Addressing traffic congestion will benefit goods movers and trade in B.C. and Canada by improving travel times, reliability and agricultural access. It will also improve access within and between municipalities. This will provide greater flexibility in

[5] Based on vehicle demand growth forecasts derived from TransLink's Regional Transportation Model, and applying the Ministry of Transportation and Infrastructure's standard values of travel time, plus an allowance for the value of travel time reliability.
[6] Forecast crash reduction, based on an analysis of ICBC and Ministry of Transportation and Infrastructure records of collision frequencies by type of collision and severity, 2014.

scheduling service and deliveries, and support overall growth in truck traffic, which is expected to double by 2045[7].

- **Improved transit:** Dedicated transit/HOV lanes will ensure more reliable, free flowing transit trips across the river and a dedicated Highway 99 transit-only ramp will connect to Bridgeport Road. The new bridge will also be built to accommodate future rapid transit.
- **Improved cyclist/pedestrian access:** Cyclists and pedestrians will be able to use the bridge at all times using a new multi-use pathway.
- **Enhanced environment:** Potential Project-related environmental improvements include reconnecting portions of Deas Island that are currently separated by Tunnel infrastructure, lower per-trip fuel consumption, lower idling-related greenhouse gas emissions, and improved local trail access.

2.4 History of the Tunnel

The Deas Island Tunnel was built in 1957-59 to cross the Fraser River South Arm. Tolls were collected at this crossing until 1964. In 1967 it was renamed the George Massey Tunnel. The current alignment of Highway 99 between 8th Avenue in South Surrey and the Fraser River North Arm opened in 1962 and was called the Deas (Island) Throughway. Between 1964 and 1973, the freeway alignment of Highway 99 was designated Highway 499.

The approximately 630 m long George Massey Tunnel was the first project in North America to use immersed-tube technology. Six concrete segments, each measuring 105 m in length and weighing 18,500 tons, were constructed in a dry dock on the Fraser River shore, then sealed and floated to the site, where they were sunk into place, secured together, and readied for use (Figure 2-1).

In 1982, counterflow measures were introduced using a reversible-lane system, which continues to operate today, to help maintain traffic flow in both directions during the morning and afternoon rush hours. Seismic upgrades, including installation of an advance-warning system, were made in 2006.

[7] Forecast by TransLink's Regional Transportation Model and based in part on changes in land use as per Metro Vancouver's Regional Growth Strategy, and on projected growth in truck volume at special generators



Figure 2-1 **Historic photos of the George Massey Tunnel construction. City of Richmond Archives, Photograph #1984 31; 1984 613**

3.0 Project Components and Activities

This section provides a summary of the Project schedule and an overview of the permanent physical components of the Project. It also describes the various life-cycle phases of the Project, including activities that will occur during its construction, operation, and decommissioning phases.

3.1 Project Components

The Project is supported by technical studies conducted on existing infrastructure within the Highway 99 corridor, as well as through engagement with Aboriginal Groups, municipalities, TransLink, Metro Vancouver, the farming community, marine users including Port Metro Vancouver (PMV), Vancouver International Airport, Boundary Bay Airport, and the public. The Ministry has also undertaken some preliminary discussions with adjacent property owners.

Locations of the new bridge, the interchanges that will be replaced, and the core highway improvement works are shown in Figure 3-1, Figure 3-2, and Figure 3-3. Permanent Project components and related activities are listed below each figure.



Figure 3-1 Project Components – Bridgeport Road to Westminster Highway

1. Construct dedicated transit/HOV lanes between Bridgeport Road in Richmond and Highway 91 in Delta.
2. Construct a transit-only ramp at Bridgeport Road.
3. Replace the Westminster Highway interchange to efficiently accommodate all connections.

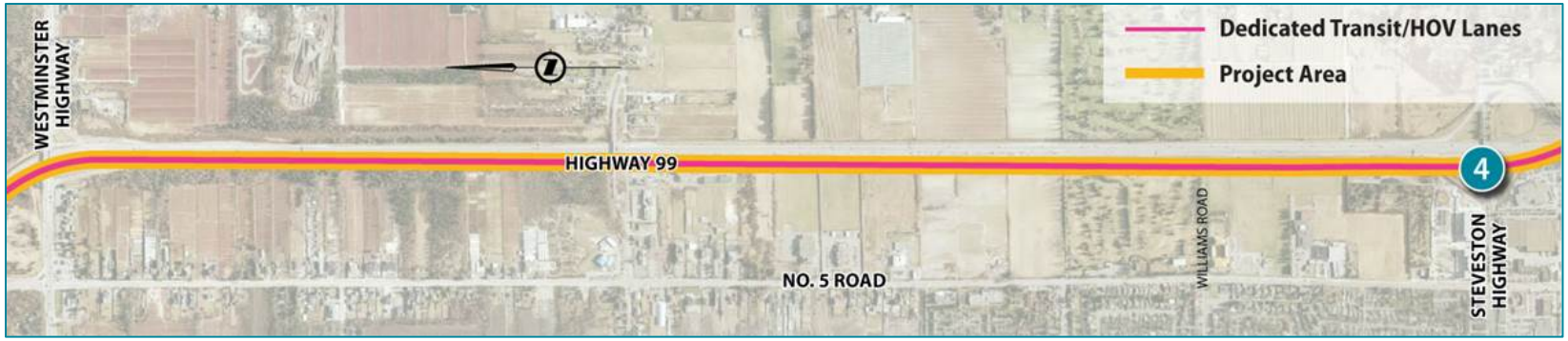


Figure 3-2 Project Components – Westminster Highway to Steveston Highway

4. Replace the Steveston Highway interchange to improve traffic flow into and out of Richmond, as well as along Steveston Highway. New, integrated transit stops will be constructed within the interchange, with safe and convenient walkways to access them.



Figure 3-3 Project Components – Steveston Highway to Highway 17A

5. Build a new bridge that will have four lanes in each direction, plus a dedicated transit/HOV lane in each direction. The new bridge will be built to accommodate potential future rapid transit and will provide navigational clearances similar to those at the Alex Fraser Bridge.
6. Construct a multi-use pathway for cyclists and pedestrians on the bridge, connecting to Steveston Highway and River Road South.
7. Decommission the Tunnel.
8. Replace the Deas Slough Bridge with the Delta approach to the new bridge. The Delta approach will be significantly higher than the Deas Slough Bridge, allowing a wider range of boats to pass underneath.
9. The new bridge will include a southbound ramp exit connecting to River Road South. It will allow the Corporation of Delta to extend River Road South eastward under the Delta approach ramp, improving connectivity between Ladner and North Delta.
10. Replace the Highway 17A interchange to efficiently accommodate all connections. New, integrated transit stops will be constructed within the interchange, with safe and convenient walkways to access them.



Figure 3-4 Project Components – Highway 17A to Highway 91

11. Construct dedicated transit/HOV lanes between Bridgeport Road in Richmond and the Highway 91 in Delta.

3.2 Construction Facilities

The Ministry will retain its Project Office in Richmond throughout the duration of construction. Additional Project support facilities will be confirmed once a construction contract is awarded. Such facilities are expected to include:

- Temporary laydown, storage, staging, fabrication, and construction equipment routing areas
- Temporary barge access structures along the Fraser River South Arm
- Construction of temporary site offices

3.3 Proposed Construction Activities

Project construction activities are anticipated to involve:

- Site preparation
- Relocation of existing utilities within the Project alignment
- Ground improvements
- Highway improvements and construction of new structures, including interchanges and the new bridge.
- Traffic management during construction
- Decommissioning of existing structures, including the Tunnel and Deas Slough Bridge
- Waste disposal

3.3.1 Site Preparation

Site preparation activities are anticipated to include:

- Additional site investigations such as a geotechnical drilling programs.
- Installation of temporary roads and bridges, traffic control measures and detours to access construction areas, separate construction areas from traffic, and maintain existing traffic patterns and property access.
- Construction of temporary barging facilities to allow materials to be brought to the site via the river.
- Vegetation clearing and grubbing, mainly within the Highway 99 ROW.
- Installation of laydown areas for equipment and materials and temporary facilities for fabrication of bridge elements.
- Installation of temporary lighting for construction safety.

3.3.2 Utility Relocation

Existing utilities along the Highway 99 corridor include power transmission, communications, water, natural gas, and sewer services which may need to be temporarily or permanently relocated or protected during construction. The Ministry will work with utility providers to avoid or minimize any potential for service disruptions during such relocation.

3.3.3 Preloading and Other Ground Improvements

Embankment and highway construction may involve preloading to allow adequate time for ground stabilization and minimize future settlement. It is also anticipated that ground improvements such as soil stabilization, soil compaction, or soil reinforcement may be required to enhance the seismic performance of proposed structures.

3.3.4 Highway Improvements and Installation of New Structures

3.3.4.1 Highway Improvements

Highway improvements will include building subgrade and relocating ditches, soil excavation and placement, embankment construction, gravel placement and compaction, paving, installation of roadside barrier, painting and installing road signs and lighting.

Embankment construction will require a combination of clean mineral fill and light-weight fill materials, and will typically be preceded by preloading.

3.3.4.2 Highway Structures

Proposed new highway structures include overpasses, underpasses, drainage channel crossings, retaining walls, sign structures, and foundations for signs and poles within the improved sections of the highway.

Conventional construction methods and sequencing will be used to construct all highway structures. Pile foundations are anticipated in areas with soft or highly compressible soils. Where soils are firmer and less compressible, shallow (spread-footing) foundations may be practical. For structures in areas prone to liquefaction, ground improvements may be required. The Ministry anticipates using steel or concrete girders and reinforced concrete deck slabs for all highway structures.

3.3.4.3 New Bridge and Approaches

The new bridge is anticipated to be a cable-stayed bridge. The south approach structure (Delta) will replace the existing Deas Slough Bridge. Air and marine clearance requirements for the bridge and approaches will be addressed through design specifications in accordance with regulatory agency requirements.

Foundations of the new bridge and approaches will likely consist of augured cast-in-place concrete piles or driven steel piles filled with reinforced concrete. The Ministry anticipates that foundation construction will be undertaken from land or in the case of the Deas Slough span, barge piling equipment.

The bridge pylons (towers) will likely be constructed using cast-in-place concrete. Land-based equipment, including tower cranes, will be used to construct the towers.

The deck will accommodate 10 lanes of traffic and a multi-use pathway, and will likely be made of steel with concrete elements. Pre-assembled deck segments will be hoisted from barges in the river and/or from land-based equipment for connection to the cables and previously installed deck elements. Approach spans will consist of concrete deck slabs on steel or concrete girders.

Bridge construction will include extensive traffic management and construction staging to ensure public and worker safety and keep traffic moving efficiently on Highway 99 with minimal disruption.

3.3.5 Decommissioning of Existing Structures

3.3.5.1 Tunnel

The Tunnel crossing is made up of six concrete sections, two ventilation buildings, and north and south retaining wall-supported approaches. The Tunnel rests in a trench dug into the riverbed and is covered by a protective layer of rock and stone, as shown in Figure 3-5.

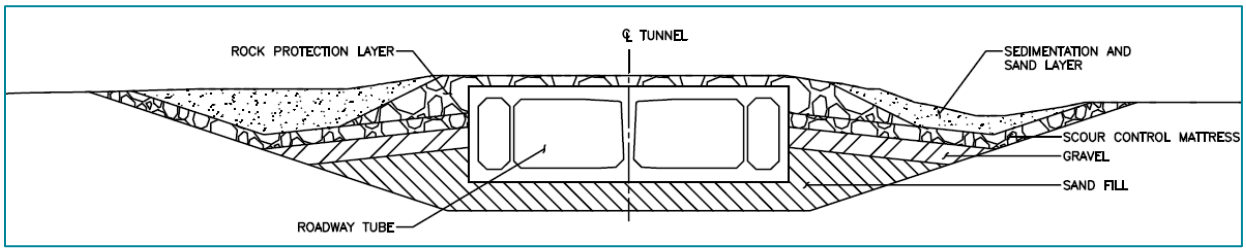


Figure 3-5 Tunnel Segment Cross-Section

The Tunnel will be decommissioned after the new bridge becomes operational. Information about the proposed method for decommissioning the Tunnel will be included in the Application; the Ministry is exploring several options for decommissioning the Tunnel, based on the following considerations:

- Maintaining long-term stability and hydrology of the Fraser River, including flow regimes and local ecological conditions
- Maintaining navigation
- Best management practices
- Regulatory requirements

For the purposes of the Project Description and determination of values to be assessed as part of the EA, it is assumed that the in-stream sections of the Tunnel will be removed as part of the decommissioning.

3.3.5.2 Other Structures

The Project will include decommissioning the Deas Slough Bridge (including existing piers within the slough), the Westminster Highway underpass, Steveston Highway underpass, and the Highway 17A underpass. These structures will be removed and recycled or disposed of, as appropriate.

3.3.6 Waste Disposal

The Project will be managed in a manner that minimizes construction-generated waste, including demolition waste from the decommissioning of roadways and structures, as well as excavated material that cannot be reused. Where waste disposal is necessary, such activities will be conducted in accordance with applicable regulations.

3.3.7 Traffic Management

A Traffic Management Plan that includes appropriate communication strategies, and is informed by engagement with adjacent communities, will be developed prior to the start of Project construction. This plan will incorporate performance objectives set by the Ministry, including maintaining traffic flow and access to existing developments, minimizing disruptions and delays, and public notifications.

3.3.8 Workforce Accommodation and Logistics

The Project is located in a densely populated urban area with an available workforce and a wide range of existing accommodations. For similar projects, special workforce accommodations or logistics were not required and are not anticipated for this project.

3.4 Project Operation and Maintenance

Services associated with ongoing operation and maintenance activities will be provided in accordance with defined performance measures as outlined in the Ministry's highway maintenance agreement(s) and in a manner consistent with the Ministry's *Environmental Best Practices for Highway Maintenance Activities* (B.C. MOTI 2010).

All activities will be carried out in accordance with established environmental best practices, as described in environmental management and environmental protection plans that will be listed in the Application.

3.5 Project Decommissioning

As discussed in Section 3.3.5, the Tunnel and Deas Slough Bridge will be decommissioned as part of the construction phase of the Project.

The new bridge and upgraded segments of the highway are intended as permanent components of the regional and provincial transportation system, with a 100-year service life for the new bridge. Decommissioning of any new Project components is not anticipated for the foreseeable future. The Ministry's contractor will undertake regular maintenance and rehabilitation, such as pavement reconditioning, required to ensure the design life of the Project. Some upgrades or rehabilitation of Project components may be required during the design life and will be undertaken in accordance with the prevailing environmental requirements at that time.

3.6 Project Schedule

The Ministry proposes to submit the Application for an EAC for the Project in 2016 to support a thorough and timely environmental review and enable construction to start in 2017. Pending Project-specific agreements and required approvals, the new bridge is scheduled to open in 2022, after which Tunnel decommissioning will commence. Major elements of the Project schedule are shown in Table 3-1.

Table 3-1 Project Schedule

Stage	Proposed Schedule
Project Planning	2013 to 2015
Environmental Assessment – Pre-Submission Activities	2013 to 2015
Environmental Assessment – Application Review	2016
Procurement	2016 to 2017
Detailed Design and Construction	2017 to 2022
Operation and Maintenance	Ongoing from 2022
Tunnel Decommissioning	After bridge opening in 2022

3.7 Project Costs

The capital cost of the Project is estimated at approximately $3.5 billion. As Project development progresses, the estimated capital costs will be refined to reflect any scope changes as applicable.

4.0 Consultation Activities

In developing the Project, the Ministry consulted widely over a period of more than two years, gaining insight from Aboriginal Groups, government departments and agencies, including local municipalities, Metro Vancouver, TransLink, and other stakeholders, including the agricultural community, first responders, recreational groups, local businesses, local residents, cyclists, marine users, and the general public.

4.1 Stakeholder and Community Consultation

Public consultation for the Project was held in two phases between November 2012 and April 2013. More than 2,000 participants provided input on the need for transportation improvements for all users (Phase 1), and on five options for the replacement crossing (Phase 2). The Ministry provided a variety of ways for people to participate, including online through the GovTogetherBC platform. The Ministry has also held several small group meetings and eight open houses in Delta, Richmond, and Surrey. The Consultation Summary Reports for both phases are available at the Project's website (masseytunnel.ca). Key findings were as follows:

- Strong support for additional capacity.
- A clear preference for a new bridge to replace the Tunnel and to construct the improvements along the existing Highway 99 corridor, citing various reasons including safety and attractiveness for pedestrians and cyclists, and environmental effects.
- Desire for transit, cycling, and pedestrian improvements, including protecting the Highway 99 corridor for future rapid transit.
- Questions about potential changes in the locations of population and employment growth.
- Questions about potential view and noise effects.
- Questions about Project cost and funding, including potential for tolling.

When planning for the Tunnel replacement was announced in November 2012, the Ministry established a Project website (masseytunnel.ca), information line (1.855.562.7739), and email address (masseytunnel@gov.bc.ca) to keep people informed, and to respond to questions about the Project. In January 2014 a Project Office was established in Richmond. The Project Office has received more than 3000 visitors to date.

The ever-growing database of people who have signed up for Project updates exceeds more than 1,600. Since 2012, the Project team has responded to hundreds of inquiries and requests for information.

Introductory meetings were held with local governments and agencies, including Delta, Richmond, Surrey, Vancouver, TransLink, and Metro Vancouver in fall 2012. Since then, regular meetings with Delta, Richmond, Tsawwassen First Nation, Surrey, Metro Vancouver, and TransLink are ongoing.

The Ministry has also met with interested stakeholders, including community groups, business associations, local residents living near the proposed Project, cycling groups, Richmond Farmers Institute, Delta Farmers' Institute, commercial and recreational marine users, PMV, YVR, Boundary Bay Airport, and BC Trucking Association. To date, the Project team has held more than 300 meetings with more than 40 stakeholder groups, including dozens of businesses. In addition, the Project team meets with or presents to local residents, interested stakeholders, business organizations, and has made more than 40 presentations to date.

Ongoing community engagement, including additional public consultation, is planned for the Pre-Application and Application review phases of the EA, in conjunction with the EAO-managed process and required public comment period. The Ministry will engage the community to seek input on the Project during the next phase of consultation in early 2016.

As required by the EAO under the EA review process, a tracking table that identifies interests and issues raised by the public, local governments and stakeholders, and a summary of how these issues have been, or will be, addressed by the Ministry will be included in the Application.

4.2 Regulatory Engagement

Engagement with Provincial and Federal regulatory agencies was initiated by the Ministry in 2013, and is ongoing. The purpose of the engagement to date has been to assess replacement options for the Tunnel and to receive feedback on the Project. Discussions have focused on gaining an understanding of Project components and activities that relate to the regulatory environment. To date, the following regulatory agencies have been engaged:

- B.C. Environmental Assessment Office
- B.C. Ministry of Environment
- B.C. Ministry of Forest, Lands, and Natural Resource Operations
- Port Metro Vancouver
- Canadian Environmental Assessment Agency

- Environment Canada
- Fisheries and Oceans Canada
- Transport Canada

A summary of advice provided and requirements identified by these agencies, and a description of how they have been or will be incorporated into Project planning, design and implementation, will be included in the Application.

4.3 Aboriginal Group Engagement

The Ministry understands that Aboriginal Groups have strong interests within the Project alignment, and will continue to consult with the Aboriginal Groups listed below, identified by the EAO as having Aboriginal Interests that may be affected by the Project.

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

The Ministry has met with all Aboriginal Groups listed above. At initial meetings with Aboriginal Groups, the Ministry provided introductory information regarding the Project scope and schedule, and sought input with respect to Aboriginal Groups' current use of the Project alignment for traditional purposes, as well as any concerns related to the exercise of Aboriginal and Treaty rights. The Ministry also sought to determine community-specific preferences with

respect to participation in Project consultation and the EA review, and arranged for the sharing of Aboriginal Groups Project-related studies (e.g. Traditional Use or Project Impact Study).

In an effort to provide advance opportunities to review key Project-related documents, the Ministry provided Aboriginal Groups with a draft copy of the Project Description. Initial feedback received on the draft has been incorporated into this document. The Ministry also undertook a series of follow up meetings with Aboriginal Groups and shared Project-related materials, such as the draft Application Information Requirements (dAIR) document and draft Heritage Resources Overview Assessment, for review and comment.

During the EA review, the Ministry and EAO will consult with the Aboriginal Groups identified above as per the consultation requirements outlined in the order issued by EAO under Section 11 of the B.C. *EAA*. Through consultation, the Ministry will seek to identify measures to avoid or mitigate any potential adverse effects and/or to otherwise address or accommodate the concerns of Aboriginal Groups, as appropriate. The Ministry will also undertake studies to assess potential effects on Aboriginal Groups resulting from Project-related changes to the physical environment, cultural heritage, or to any known structure, site or thing that is of historical, archaeological, paleontological or architectural significance. Consultation will include gathering information regarding potential Project-related effects that may result in environmental change.

The Ministry has been working with Aboriginal Groups to develop a consultation plan to acquire additional information regarding potential Project-related effects on Aboriginal interests and established Aboriginal treaty rights. The consultation plan will be subject to EAO's approval. As required by the EAO, a tracking table that identifies issues and concerns raised by Aboriginal Groups, and a discussion on how the Ministry has addressed or will address the issues, will be included in the Application.

The scope and extent of consultation with the Aboriginal Groups identified above will vary depending on the scope of Aboriginal Interests and the degree to which the Project may potentially affect their respective Aboriginal Interests. In the case of Tsawwassen First Nation, consultation will be undertaken in accordance with the requirements specified under the Tsawwassen Final Agreement as well as those outlined in the Section 11 Order. The Ministry will receive regulatory input and guidance from the EAO with respect to groups to be consulted, the level of consultation required, and the proposed GMT Aboriginal consultation plan.

PART 2: KEY AREAS OF STUDY

5.0 Environmental Assessment and Key Areas of Study

Based on issues identified by the public, Aboriginal Groups, regulators, and local and regional governments during consultation to date, and the Ministry's experience on comparable projects in the Lower Mainland, the following key areas of study have been identified to support the assessment of potential environmental, economic, social, heritage, and health effects of the Project:

- River hydraulics and morphology
- Sediment quality and water quality
- Underwater noise
- Fish and fish habitat
- Marine mammals
- Vegetation
- Amphibians
- Terrestrial wildlife
- Land and Water Use
  - Marine use
  - Land use
  - Agricultural use
- Visual quality
- Air quality
- Atmospheric noise
- Human health
- Heritage resources

An overview of studies being undertaken, including background and anticipated Project-related effects that are considered, is provided in this section. Further detail on studies, including how they are used to describe existing conditions and predict potential Project-related effects on specific valued components of the natural and human environment in the Application, will be provided in the dAIR submitted to the EAO as part of the pre-Application process.

The EA process will include further opportunities for consultation and input by regulatory agencies, Aboriginal Groups, governments, other stakeholders, and the public. The list of key areas of study presented here may be refined based on the results of feedback on this Project Description and guidance from the EAO.

5.1 River Hydraulics and Morphology

5.1.1 Background

The Highway 99 corridor within the Project alignment crosses the Fraser River South Arm, which supports a number of ecological, social, and commercial values. These values, including fish and fish habitat, marine mammals, marine use, and agricultural use, are influenced by water levels, flow conditions, turbidity, salinity, sediment deposition patterns and other factors related to hydraulics and morphology of the river.

The Fraser River South Arm is a single, meandering, sand-bed channel. Dunes, characteristic features of a sand-bed channel, occur on the riverbed within a 1.2 km stretch centered over the Tunnel and typically vary in height from 0.5 m to 2.0 m, although individual dunes can be considerably larger. Fraser River flows are dominated by snowmelt, with discharge typically rising in April, peaking between May and July during freshet, and receding during autumn and winter.

Salinity in the lower Fraser River is influenced by the presence of a salt wedge[8], the location of which moves in response to daily tidal variations, and seasonally in response to variations in freshwater river discharge. During winter low flows, the salt wedge can travel as much as 30 km upstream from the mouth of Fraser River. During freshet high flows, the maximum extent of saltwater intrusion is less than 15 km. The location of this salt wedge in relation to irrigation intakes in the river influences salinity of water available for agricultural use in the adjacent communities of Delta and Richmond.

5.1.2 Preliminary Overview of Potential Effects

Project-related changes in river hydraulics are expected to be limited to those associated with decommissioning the Tunnel. Activities associated with Tunnel decommissioning may temporarily affect water levels, river velocity, sediment transport and turbidity, as well as erosion

[8] Freshwater from the river floats on top of seawater in a layer that gradually thins toward the sea. The denser seawater moves upstream along the bottom of the river estuary, forming a wedge-shaped layer that is thinner as it moves upstream. A difference in velocity occurs between the two layers, which acts against the mixing tendency of tide- and wind-induced turbulence.

and deposition patterns, and result in changes to flow patterns and scour. These potential changes are expected to be limited to the location of the Tunnel. The absence of the Tunnel is expected to result in minimal change in sediment deposition and erosion patterns in the area, and on the tidally induced movement of saltwater in the Fraser River.

5.1.3 Studies

The Ministry is studying river hydraulics and morphology in the Fraser River and Deas Slough to inform the assessment of potential Project-related effects on environmental, social, and economic values, including agricultural values such as influence of salt wedge, supported by these water bodies. River velocity, water levels, and flow patterns and their influence on sedimentation and erosion in the Fraser River form the focus of these studies.

Results of the river hydraulics and morphology studies will be used to support the assessment of potential effects of the Project on fish and fish habitat, marine mammals, agricultural use, and marine use.

5.2 Sediment and Water Quality

5.2.1 Background

In addition to the Fraser River South Arm, Deas Slough, and Green Slough, the Project alignment crosses roadside drainage and irrigation ditches, most of which support ecological values in addition to agriculture and stormwater management purposes. The quality of water and sediment in these water courses determine their ability to support these values.

Water quality in the lower Fraser River is influenced by mixing of silt-laden freshwater and tidal saltwater with water quality characteristics changing due to tidal and seasonal factors.

5.2.2 Preliminary Overview of Potential Effects

Potential Project-related changes in surface water and sediment quality are expected to be limited and associated with Tunnel decommissioning activities, and may include temporary redistribution of riverbed sediments.

The impervious surface area created by the new bridge and associated approaches will generate additional stormwater runoff, which may affect water quality in receiving streams. Stormwater management infrastructure or catchment areas (such as biofiltration areas) will be incorporated in the Project design, and will minimize the potential for stormwater to directly enter watercourses.

5.2.3 Studies

The quality of water and sediment in the Fraser River, and Deas Slough in and around the Project alignment, form the focus of Project-related studies on sediment and water quality. The results of these studies will be used to support the assessment of environmental values such as fish and fish habitat, and marine mammals.

5.3 Underwater Noise

5.3.1 Background

The underwater noise environment in the Fraser River's main channel is dominated by noise generated from shipping traffic, such as tugs and ships transiting the river, as well as machinery noise. Ambient noise levels in Deas Slough are substantially lower than in the main channel, because vessel traffic in the slough consists primarily of smaller, slow-moving recreational vessels transiting to and from the marinas.

5.3.2 Preliminary Overview of Potential Effects

Project-related changes in underwater noise with the potential to result in disturbance to fish and marine mammals are expected to be limited to those associated with underwater Project construction activities such as pile driving, and ground improvements, Tunnel decommissioning, and operation of vessels supporting construction works.

Construction activities with the potential to exceed established thresholds, such as pile driving, will be predominantly land based, limiting the potential for substantial changes in existing underwater noise conditions.

Project-related activities associated with the operational phase of the Project are not anticipated to generate underwater noise.

5.3.3 Studies

The Ministry is studying underwater noise in the Fraser River South Arm and Deas Slough to assess potential Project-related effects on fish and fish habitat, and marine mammals. Underwater noise studies are focusing on measuring baseline levels to provide a quantitative description of the underwater ambient noise. Underwater acoustic modelling is also being undertaken to predict underwater sound levels expected to be generated by noise-producing Project activities. The results of these studies will be used to support the assessment of environmental values such as fish and fish habitat, and marine mammals.

5.4 Fish and Fish Habitat

5.4.1 Background

The Fraser River, Deas Slough and Green Slough support fish communities that include all five species of Pacific salmon, trout, char, sturgeon and eulachon. The quality of aquatic habitats that overlap the Project alignment varies widely. In general, high fish and aquatic values are present where Highway 99 intersects Deas Slough and the Fraser River South Arm. However, the majority of the Project alignment is characterized by lower fish and aquatic habitat values associated with man-made ditches.

Man-made ditches in and around the Project alignment are typically located upland of flood-control infrastructure, limiting access to the Fraser River, and therefore have lower fish and aquatic habitat values.

5.4.2 Preliminary Overview of Potential Effects

Potential Project-related effects on fish in the Fraser River and Deas and Green Sloughs include exposure to underwater noise and elevated suspended sediment levels during in-water construction activities. Changes in fish habitat quality may occur as a result of changes in ambient water quality and underwater noise levels, and through fish habitat alteration. There may also be a small loss of fish habitat within Deas Slough in areas that overlap the Project footprint; however, removal of the Deas Slough Bridge is expected to offset this loss and result in a benefit to fish and fish habitat.

Vegetation clearing along upland watercourses during construction will result in a temporary loss of habitat. It is expected that, post construction re-vegetation of riparian areas will address the temporary effects of vegetation clearing and ensure that long term habitat benefits are achieved.

With Project-related construction and operation activities occurring primarily within the Highway 99 ROW, implementation of standard practices, such as adherence to least-risk timing windows, and procedures to minimize underwater noise and suspended sediment concentrations, Project-related effects to fish and fish habitat can be avoided or effectively mitigated.

5.4.3 Studies

Studies are being undertaken to determine fish habitat values, and fish species' use of watercourses, and assess the quality and quantity of fish habitat within the Project alignment. To facilitate the assessment of potential effects on fish and fish habitat, the Ministry selected five representative fish groups that have different habitat needs and use the river at different times of the year: five species of Pacific salmon, two species of sturgeon, eulachon, two species of trout, and two species of char.

5.5 Amphibians

5.5.1 Background

Riparian habitat associated with watercourses along the Project alignment and wetland habitats in and around the Project alignment have the potential to support amphibians, including the red-legged frog, which is considered an at-risk species.

5.5.2 Preliminary Overview of Potential Effects

Vegetation clearing along the Deas and Green Sloughs and upland watercourses during construction may result in a potential loss of amphibian habitat; however, it is expected that post construction re-vegetation of riparian area will address the temporary effects of vegetation clearing and ensure that long term benefits are achieved.

5.5.3 Studies

A study is being undertaken to identify wetlands in and around the Project alignment with potential at-risk amphibian habitat, and to determine at-risk amphibian presence, if any, in those wetlands. The study focuses on habitat of northern red-legged frog, which is provincially Blue-listed and designated as of Special Concern under the federal Committee on the Status of Endangered Wildlife in Canada.

5.6 Marine Mammals

5.6.1 Background

The Fraser River South Arm, in the vicinity of the Project, is used by some marine mammal species, particularly harbour seal, year-round. The presence of marine mammals such as whales and dolphins in the Fraser River near the Project alignment is considered rare.

5.6.2 Preliminary Overview of Potential Effects

Underwater noise generated by pile driving, vibrodensification, and Tunnel decommissioning activities may affect marine mammals.

5.6.3 Studies

A desktop review is being undertaken of existing information on marine mammals that are likely to be present in and around the Project alignment (specifically, harbour seals and sea lions).

5.7 Vegetation

5.7.1 Background

As currently proposed, works will occur almost entirely within the existing Highway 99 ROW, which consists mainly of grassy areas adjacent to the highway. Land uses adjacent to the corridor are predominantly agriculture or urban development. Areas close to the Fraser River and along drainage ditches that run alongside or across Highway 99 may support rare or at-risk riparian species.

5.7.2 Preliminary Overview of Potential Effects

Wherever possible, vegetation removal will be limited to the Highway 99 ROW. Where permanent loss of vegetation will result from increased road surface, opportunities for re-vegetation in other areas of the corridor will be explored to minimize effects on wildlife habitat.

5.7.3 Studies

The Ministry is studying the type, amount, and distribution of vegetation along the Project alignment to better understand its wildlife habitat value and to determine the presence of at-risk plant species and ecological communities.

Available databases and results of previous studies are being reviewed to develop a list of at-risk plant species and ecological communities that are likely to be present along the Project alignment. Field surveys are being undertaken to determine the presence or absence of these species and communities.

5.8 Terrestrial Wildlife

5.8.1 Background

Terrestrial wildlife along Highway 99 consists primarily of common species of raptors, riverine birds, and small mammals. Some suitable barn owl and Pacific water shrew habitat has been identified along vegetated sections of Highway 99; however, barn owl nesting and Pacific water shrew occurrence has not been confirmed. Barn and cliff swallow nesting activity has been documented under the Deas Slough Bridge.

Grassy areas adjacent to the highway provide habitat for small mammals, such as voles, and foraging habitat for raptors and other birds that prey on small mammals. Large mammals, specifically black-tailed deer live in areas adjacent to the highway (Burns Bog); however, monitoring of the existing collision impacts of Highway 99 by the Ministry indicates limited impacts along the portion of the highway that is proposed to be upgraded as part of the Project.

5.8.2 Preliminary Overview of Potential Effects

Habitat of terrestrial wildlife may be lost during vegetation clearing and grubbing, while habitat may be altered due to noise levels, temporary presence and movement of crews, and machinery and equipment that may disturb wildlife. Wildlife mortality (small mammals) may occur during vegetation clearing and grubbing, soil stripping, and excavation, as well as during Deas Slough Bridge demolition. Decommissioning of the south portal of the Tunnel will make some additional area available to re-establish wildlife connectivity on Deas Island.

5.8.3 Studies

The Ministry is studying terrestrial wildlife along the Project alignment to document the presence of marsh birds, raptors and herons, establish the presence of breeding birds in areas proposed for clearing or construction, map the presence of swallow nests in structures proposed to be removed or altered by the Project, identify the collision risk for bird species due to construction of the new bridge and associated infrastructure, and determine how suitable the habitat along Highway 99 is for small mammals, and foraging raptors.

5.9 Air Quality

5.9.1 Background

Although air quality along the Project alignment is generally good, traffic congestion at the Tunnel has generated increased emissions and reduced air quality around the crossing. Vehicle idling and slower movements during periods of traffic congestion produces greater per-vehicle emissions of air contaminants such as fine particulate matter, nitrogen oxide (NO_X), and sulfur dioxide (SO_2) when compared to uncongested conditions.

5.9.2 Preliminary Overview of Potential Effects

The Project is expected to result in an improvement in air quality, especially in the vicinity of the Tunnel, as a result of improved traffic flow, since vehicles driving at highway speeds consume less fuel and generate lower emissions. In addition, the new bridge is elevated above ground level, allowing airflow over the top and beneath the bridge, which contributes to improved dispersion of pollutants.

5.9.3 Studies

Metro Vancouver operates a large network of air quality stations in the Lower Mainland, each of which monitors a specific set of pollutants focused on criteria air contaminants. The National Air Pollution Surveillance network in turn collects data on non-criteria air contaminants. The Ministry has analyzed data from these sources to develop a baseline of existing conditions for the pollutants in the area surrounding the Project.

5.10 Atmospheric Noise

5.10.1 Background

The existing noise environment in the vicinity of the Project is strongly influenced by traffic on Highway 99 and connecting roadways such as Westminster Highway, Steveston Highway, River Road, and Highways 91, 17A and 17. Changes in the noise environments in this area in recent decades are associated with growth in local and regional traffic volumes.

5.10.2 Preliminary Overview of Potential Effects

Noise-sensitive land uses in the vicinity of the Project alignment may experience an increase in noise over time as vehicle speeds, traffic volumes, and the proportion of heavy trucks increase.

5.10.3 Studies

The Ministry is studying the baseline noise environments at locations representative of all noise-sensitive land uses (e.g., residential, institutional, recreational) where Project-related changes in atmospheric noise are likely to occur.

5.11 Land and Water Use

5.11.1 Background

Most of the Project alignment is on provincial Crown land either within the Highway 99 ROW or the land under water in the Fraser River. Port Metro Vancouver manages navigation within the river channel. Highway 99 accesses and crosses lands owned by Burlington Northern and Santa Fe Railway, BC Rail, and Canadian National Railway. Support structures for the new bridge on Deas Island will be located within the Highway 99 ROW, outside of Metro Vancouver's Deas Island Regional Park.

Land use is predominantly agricultural in areas adjacent to the Highway 99 corridor in Richmond and Delta, in the western portion of Surrey, and on the east side of Highway 99 near the Canada–U.S. border. Most agricultural land adjacent to Highway 99 is within the provincial Agricultural Land Reserve.

Several areas identified as Environmentally Sensitive Areas in the official community plans of Richmond and Delta are located near the Project. The Burns Bog Ecological Conservancy Area (Delta) and the Richmond Nature Park are located in the vicinity of the Highway 99 corridor. The South Arm Marshes Wildlife Management Area is located in the Fraser River South Arm, downstream of the Tunnel. The Richmond Nature Park and Deas Island Regional Park are designated recreational areas.

Industrial uses are primarily located along the northern bank of the Fraser River South Arm in Richmond. Residential uses in the vicinity of the Project in Delta include the marinas in Deas Slough west and east of the Tunnel, and a residential area on River Road South, east of Highway 99. Mixed-use commercial and residential areas are located along the northern portion of Highway 99 in Richmond, near the Steveston Highway interchange.

Tsawwassen First Nation is located approximately six kilometres south of the Project alignment, along the shores of Roberts Bank, between the BC Ferries Tsawwassen Terminal and the Roberts Bank terminals complex.

The Fraser River South Arm is heavily used for navigation and supports upstream industrial and port activities. This portion of the Fraser River is used by Aboriginal and commercial fishers and supports a wide range of recreational activities.

5.11.2 Preliminary Overview of Potential Effects

Construction equipment such as tugs and barges required to facilitate bridge construction and Tunnel decommissioning could have a temporary effect on navigation and other marine uses. Once operational, the Project is not expected to affect navigation or marine use.

Potential effects of the Project on agricultural use include modifications in irrigation and drainage systems, effects on farm utilities services as well as benefits such as improved reliability for the agricultural community in getting goods to market.

Wherever possible, the Project will be constructed within the Ministry's ROW to minimize the amount of agricultural land required. While minor portions of parcels adjacent to the interchanges may be required, it is anticipated that the Project will be completed with no-net - loss of agricultural land. Work is currently underway to identify opportunities for agricultural mitigation measures such as parcel exchanges. Expected benefits include improved cross-highway access between agricultural lands and congestion reduction measures to support improved travel times for farm vehicles.

5.11.3 Studies

To gain a better understanding of land and water use existing conditions, the Ministry is studying marine use, land use, and agricultural use as follows:

- **Marine use:** To fully assess the use of the Fraser River South Arm for marine activity, the Ministry is studying navigation; commercial, recreational, and Aboriginal fish harvesting; and recreational marine activities. These studies will determine marine traffic frequency and volume (including types and number of vessels transiting the river), and existing navigation conditions in the Fraser River South Arm.
- **Land use:** The Ministry is reviewing land use designations, current and proposed land uses in and around the Project alignment, as set out in Official Community Plans and other relevant municipal, regional and PMV planning documents.

- **Agricultural use:** To understand use of land and water for agricultural purposes, the Ministry is studying irrigation and drainage systems, Agricultural Land Reserve land by capability class, and farm infrastructure and operations within Richmond and Delta.

5.12 Visual Quality

5.12.1 Background

The Project is located within an urban transportation corridor that traverses the Fraser River. Views of the river are available upstream and downstream of the Tunnel. Adjacent to Highway 99, the north and south shores of the Fraser River are characterized by extensive industrial development. The south portal of the Tunnel is located within Deas Island Regional Park. On the south shore of Deas Slough, there are recreational, residential, and commercial developments, including the River House Marina, the Riverwoods neighbourhood, and Captain's Cove Marina, all of which overlook the Fraser River at the Tunnel crossing.

5.12.2 Preliminary Overview of Potential Effects

The Project is expected to result in changes to the views near the new bridge, including for residential, commercial, and recreational areas. The effects of this change in views on some receptors are expected to be minimized with the use of vegetation buffers.

5.12.3 Studies

To better understand the visual effects of the Project, the Ministry is studying existing visual conditions from sensitive locations such as residences and recreational areas in the vicinity of the new bridge.

5.13 Heritage Resources

5.13.1 Background

Under the B.C. *Heritage Conservation Act,* heritage resources are defined by the historical, cultural, aesthetic, scientific, or educational worth or usefulness of a site or object. Sites [9] that contain physical evidence of past human activities are known to exist in the vicinity of the Project alignment.

[9] Under the B.C. *Heritage Conservation Act*, a heritage site is, whether designated or not, land, including land covered by water that has heritage value to B.C., a community or an aboriginal people.

While the existing transportation corridor has been substantially altered by development, there are recorded heritage sites within and adjacent to the Project alignment and the potential that additional heritage resources could be identified as a result of the Project.

5.13.2 Preliminary Overview of Potential Effects

Considering the nature of the Project, any adverse effect on heritage resources would be limited to the construction phase. Based on information gathered to date, the potential for Project-related construction activities to interfere with heritage resources is expected to be low.

5.13.3 Studies

The Ministry is confirming the presence of known heritage resources and sites that have potential to contain intact or disturbed archaeological deposits within and directly adjacent to the Project alignment. Heritage sites within the Project alignment that are identified as having archaeological potential will be evaluated further through field investigations.

5.14 Human Health

5.14.1 Background

Human health considerations for the Project are primarily associated with changes in air quality and atmospheric noise levels. The current conditions within the Project alignment, with respect to air quality and noise, are consistent with the current use of this area as an active transportation corridor. Congestion-related idling associated with current traffic conditions, has led to elevated concentrations of air contaminants as compared with areas further away from the highway. Noise conditions along the Project alignment are heavily influenced by the high volumes of vehicle traffic along the highway and feeder routes.

5.14.2 Preliminary Overview of Potential Effects

The Project is generally anticipated to result in improvements in human health with respect to air quality and noise conditions, as well as in consideration of broader determinants of human health (e.g., improved mobility, improved safety, increases in employment and economic development etc.).

5.14.3 Studies

The Ministry is studying ambient air quality and existing noise conditions as they relate to human health conditions in and around the Project alignment as well as key health indicators, available from regional and community health studies, to understand existing human health conditions in local and regional populations.

In addition to human health considerations that are influenced by potential changes in the physical environment (e.g., air quality and noise), social and economic studies underway will assist the Ministry in considering how broader determinants of human health (e.g., changes in social and economic conditions) may be influenced by the Project.