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Reference: George Massey Crossing – Environmental Technical Summary 2019 – Final Draft

The George Massey Tunnel, constructed between 1957 and 1959, is a 630-meter long immersed tube tunnel (ITT) crossing the Fraser River. Now 60 years old, the tunnel does not meet current highway design or seismic standards. Plans to develop a replacement crossing were first announced in 2012, and in 2015 the Province of British Columbia released a project definition report and business case for a 10-lane cable-stayed bridge to be funded by user tolls. In response to concerns about the proposed project size and tolling, the Ministry of Transportation and Infrastructure (the Ministry) commissioned an Independent Technical Review of the crossing **Invalid source specified**, which concluded that there are other, less costly options for a replacement that would be more in keeping with regional plans. In July 2019, the Ministry retained COWI North America Ltd. (COWI) to provide feasibility level technical services and conceptual level design to define the technical elements of different crossing methods to support the Ministry's short-listing of George Massey Crossing (GMC) options and, ultimately, selecting a preferred option.

Stantec, as a subconsultant to COWI, has prepared this memorandum to summarize the environmental and regulatory inputs to the technical services contract. A total of 18 design options, based on three main crossing technologies (deep bored tunnel (DBT), immersed tube tunnel (ITT) and long span bridge) were initially considered. This was reduced in July 2019 to six-lane and eight-lane options for each crossing method (i.e., six short-listed options). Associated with all six-lane crossing options and the eight-lane DBT, was retrofitting of the existing tunnel to provide two traffic lanes for public transit vehicles and/or multi-use paths (MUPs) for pedestrians and cyclists. The existing tunnel does not meet current seismic standards and will require ground improvements along its entire tunnel and portal length, including in the Fraser River.

An initial regulatory review of the environmental assessment and permitting requirements found no substantive difference between the smallest crossing size and the largest crossing size when including consideration of the associated ground improvements for the existing tunnel (i.e. the number of lanes did not affect the regulatory process of any of the three crossing technologies). As such, the environmental and regulatory requirements for each of the three main crossing options can be compared without any confounding variables due to the scale of the crossing. The environmental assumptions and other design considerations reported in this memorandum are preliminary and should be further refined following selection of a preferred option and engagement with stakeholders.

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PROPOSED GMC OPTIONS

The GMC site is located along the existing Highway 99 corridor and parallels the existing tunnel alignment. The three main crossing options include the following general physical and environmental characteristics:

- Deep Bored Tunnel (DBT)
 - 3.5 km tunnel length, 4.4 km including on-land tunnel portals
 - Approximately 6.0 km of new roadworks
 - Anticipated in-water footprint in the Fraser River for ground improvements for retrofitting the existing George Massey Tunnel (for both the six-lane and eight-lane DBT options)
 - Sensitive species / habitats identified in the Fraser River, roads and tunnel portal footprint
 - Limited visual presence
 - Additional lands required for new roadways and tunnel portals
- Immersed Tube Tunnel (ITT)
 - Approximately 1.2 km tunnel length, 1.5 km including portals and ramps, plus a new longer bridge over Deas Slough
 - The bridge over Deas Slough includes in-water piers
 - Approximately 3.5 km of new roadworks
 - Anticipated footprint in the Fraser River for dredging and installation of tube tunnels below the channel surface of the river and connection for shore-based portals
 - Anticipated in-water footprint in the Fraser River for ground improvements for retrofitting the existing tunnel (for the six-lane option)
 - Sensitive species / habitats identified in the Fraser River, roads and tunnel portal footprint
 - Limited long-term visual presence
 - Additional lands required for new roadways
- Long Span Bridge (bridge)
 - 2.6 km bridge length
 - Approximately 3.5 km of new roadworks
 - No anticipated footprint in the Fraser River mainstem but the bridge over Deas Slough may include in-stream piers
 - Anticipated in-water footprint in the Fraser River for ground improvements for retrofitting the existing tunnel (for the six-lane option)
 - Sensitive species / habitats identified in the bridge and road footprint, including airspace for migratory waterfowl, bats and raptors
 - Long-term visual presence
 - Additional lands required for new roadworks, ramps and bridge

TECHNICAL SUMMARY

This section provides a summary of the environmental input provided to the COWI/Stantec team for the Project for each of the three main crossing options including:

- Permitting and regulatory considerations
- Expected environmental indicators for planning and assessment
- Environmental assessment overview
- Environmental opportunities (habitat benefits and enhancements)

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PERMITTING AND REGULATORY CONSIDERATIONS

Based on the understanding of the physical footprints and operations of the three main crossing options (bridge, DBT, ITT), each crossing option would require some level of environmental assessment as well as both federal and provincial approvals prior to construction. The following are the major certificates, licenses, permits and authorizations are likely to apply to each crossing method based on the general characteristics and assumption considered for each of the three main crossing options:

- British Columbia *Environmental Assessment Act* (BCEAA)
- British Columbia *Water Sustainability Act*
- British Columbia *Agricultural Land Commission Act*
- British Columbia *Environmental Management Act* (Contaminated Sites Regulation)
- *Fisheries Act*
- *Canadian Navigable Waters Act*
- *Species At Risk Act*

The applicability of these pieces of legislation are briefly summarized below. Additional, less complex, approvals would also be required but are not identified here and are not expected to influence the project schedule.

Based on the forthcoming version of BCEAA (to be in effect on December 16, 2019) and COWI/Stantec team's experience on major projects that require the same federal and provincial certificates, licenses, permits and authorizations, the regulatory timeline for the DBT, and ITT options is expected to be approximately three to four years. The timelines for a bridge would be shorter than the DBT and ITT related to the expected amendment of the environmental assessment certificate issued for the bridge option under the George Massey Tunnel Replacement Project on February 8, 2017 (# T17-01).

- BCEAA regulates the preliminary approval for major capital projects that meet the definition of a reviewable project under the Reviewable Projects Regulation. Projects that are subject to the Act will require an environmental assessment certificate from the BC Environmental Assessment Office (EAO) for the reviewable project, or an exemption order. The thresholds applicable to the GMC project are set out Table 9, Row 5 (Shoreline Modification Projects) of the Regulation and states:
“a new facility, or a new activity unrelated to the construction of a new facility, that (a) results in changes in or about a stream, marine coastline or estuary, and (b) entails dredging, filling or other direct physical disturbance of (i) > 1 000 m of linear shoreline, or (ii) > 2 hectares of foreshore or submerged land, or a combination of foreshore and submerged land, below the natural boundary of a stream, marine coastline or estuary.”
- The British Columbia *Water Sustainability Act* (WSA) regulates the management, diversion and use of water resources. Projects and activities working in and about a stream or river, of use of water resources, require approval under the Act.
- The federal *Fisheries Act* prohibits any work, undertaking or activity that results in death of fish, or the harmful alteration, disruption or destruction of fish habitat (HADD). Projects will require authorization for all in-water project constructions and operation activities which are likely to cause the death of fish or a HADD.
- The *Canadian Navigable Waters Act* protects the public right of navigation by regulating work that may interfere with navigation. Any project work potentially affecting the marine waters of British Columbia must be reviewed and approved by Transport Canada's Navigation Protection Program.

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- The federal *Species at Risk Act* (SARA) is intended to protect animal and plant species at risk in Canada. Under SARA it is an offence to kill, harm, harass, capture or take an individual of a species listed under Schedule 1 of the Act. Any project work potentially affecting Species at Risk will require approval under the Act.
- The DBT crossing option will require large land-based portals for construction and access of the tunnel. The six-lane and eight-lane bored tunnel options require ground improvement within Fraser River river-bed to upgrade seismic requirements for the existing tunnel. The installation of the ground improvement will require access and construction activities within the Fraser River. Geotechnical construction to support the DBT may require review and assessment through BCEAA if project requirements exceed threshold for disturbance in the river as per the *Reviewable Project Regulations* under the Act discussed above.
- The ITT crossing option will require construction within the Fraser River and along its banks. Construction of the ITT option will require review and assessment through BCEAA since the project requirements exceed two-hectare threshold for disturbance in the Fraser River as per the *Reviewable Project Regulations* under the Act.
- The bridge crossing option has been previously assessed and certified under the BCEAA and revisions to the project design, construction execution and schedule and operation may require an amendment of the existing Environmental Assessment Certificate (# T17-01).
- The existing tunnel may be maintained as a sub-group crossing option. If the existing tunnel is kept and maintained for public use, additional in-river project improvements will be needed to support the seismic and structural integrity of the existing tunnel.

ENVIRONMENTAL ASSESSMENT OVERVIEW

As noted above, the DBT and ITT main crossing options are expected to trigger an environmental assessment under the BCEAA due to the in-river footprints of the work. This is based on the current and forthcoming Reviewable Projects Regulation under the new Act. There is an existing environmental assessment certificate (# T17-01) for the replacement of the tunnel with a new bridge. Material changes to the bridge design (from that considered in the assessment), may require a certificate amendment but it would not be subject to a new assessment. Timelines for amendments commonly range from 4 months to 12 months; however, given the complexity of the project and the level of public interest, the amendment timeline for this project could be up to 18 months.

Table 1 provides an overview of the new BCEAA assessment process, as well as the key activities, proponent deliverables and EAO timelines. This process differs from the previous environmental assessment and project certificate completed for the George Massey Tunnel Replacement Project.

Stantec also reviewed federal *Impact Assessment Act* and regulations to determine whether any of the GMC options would meet the definition of a designated project (Physical Activities Regulations: SOR/2019-285) or otherwise be subject to a federal impact assessment. None of the crossing technologies are listed on Schedule 1 of the Physical Activities Regulations under the *Impact Assessment Act* and the crossing location is not within the Vancouver Fraser Port Authority's federal land / water boundaries; therefore, a federal impact assessment is not anticipated.

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Table 1. New BC *Environmental Assessment Act* process and key activities

BCEAA Process Step and Timelines	Key Activities and Deliverables
Early Engagement (90 days)	<ul style="list-style-type: none"> • Proponent submits Initial Project Description and Engagement Plan • EAO conducts 30-day public comment period on Initial Project Description • EAO engages Indigenous nations • EAO produces an Engagement Summary that identifies information to be provided in the Detailed Project Description (DPD) and confirms participating Indigenous nations
EA Readiness Decision (target timeline of 90 days but this is not legislated)	<ul style="list-style-type: none"> • Proponent submits Detailed Project Description including recommended valued components (VCs), technical study plans for baseline field work and any modelling (e.g., air dispersion modelling), and proposed information to be provided in the environmental assessment • EAO confirms requirement for an assessment
Process Planning (120 days)	<ul style="list-style-type: none"> • EAO prepares Process Order, Assessment Plan, and Information Requirements • EAO conducts 30-day public comment period on Initial Project Description • Process Order to be issued by day 120
Application Development & Review (proponent has up to 3 years to prepare draft application; EAO leads 180-day review period following acceptance of draft application)	<ul style="list-style-type: none"> • Proponent develops undertakes technical studies, consultation and prepares its environmental assessment certificate application in accordance with the Process Order • Initial drafts expected to be reviewed with Indigenous groups and regulatory agencies • Final draft application to be submitted to EAO within 3 years of the Process Order • 180-day review period by EAO, Technical Advisory Committee, and Indigenous nations (proponent to respond to information requests from EAO during this period) • Following review period proponent revises the draft application and submits a final application that addresses all comments from the review period
Effects Assessment and Recommendation (120 days)	<ul style="list-style-type: none"> • EAO and Indigenous nations prepare the environmental assessment report for submission to the Ministers • EAO conducts 30-day public comment period on draft Assessment Report • EAO prepares decision package for Ministers
Decision (30 days)	<ul style="list-style-type: none"> • Ministerial decision on issuing an environmental assessment certificate • Certificate must be issued in 30 days

PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT

The COWI/Stantec team reviewed the previous George Massey Tunnel Replacement Project environmental assessment application and certificate (# T17-01) and other recent project environmental assessments. This review identified at least twelve (12) likely regulatory, environmental and socio-economic indicators for consideration for each of the three main crossing options including:

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- Sensitive species of management concern and habitats (aquatic and terrestrial)
- Air emissions
- Risk of contamination
- Land traffic
- Marine use
- Visual aesthetics
- Land use (including Agricultural Land Reserve)
- Indigenous interests
- Regulatory complexity
- Regulatory uncertainty
- Permitting costs
- Construction environmental management issues

Using these key environmental and regulatory indicators, the following high-level sustainability, environmental and permitting assessment of the three potential eight-lane crossing methods (bridge, DBT, ITT) was conducted to assist the COWI/Stantec team in identifying overall risk for each of the options. Results are as follows in the table below (Table 2). This preliminary review suggests that all three main crossing options have pros and cons from an environmental-social perspective, and no single option has a clearly defined issue which may impede the assessment certification and permitting approvals. It is expected that when a preferred crossing option is selected, a series of specific valued components will be appropriately developed and assessed based on regulatory assessment process. Some of the indicators listed above are expected to be identified as valued components if the crossing option is subject to an environmental assessment.

Table 2. Preliminary Environmental Risk Assessment

Indicator	Eight-Lane GMC Options			Comment
	Bridge	Bored Tunnel	ITT	
Sensitive Species and Habitats (including Species at Risk)	Negative influence on Deas Island and Fraser River wildlife (e.g., bats and migratory birds) from long term noise and light pollution and as an air draft physical obstruction	Risk from the potential formation of a sinkhole in the river during boring could result in material in-water impacts including changes in flow and water quality	Potential temporary effects on water quality, sensitive terrestrial and aquatic species including numerous migrating fish species	The lower Fraser River is an important migratory corridor and rearing habitat for migratory and resident fish species, including use by eulachon, Pacific salmon and trout, and sturgeon. The lower Fraser River estuary is habitat for migratory seabirds and marine mammals (harbour seals, sea lions, porpoise).
Air quality / emissions	Local construction effort and bridge concrete	Large construction effort and tunnel concrete	Large dredge effort and tunnel concrete	Bored tunnel larger construction effort - greater air and GHG emissions Cement and concrete production and construction emissions
Contamination	Limited	Potential release of bentonite in the event of a sink hole	Limited	No significant areas of known contamination

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Indicator	Eight-Lane GMC Options			Comment
	Bridge	Bored Tunnel	ITT	
Regulatory Complexity	Limited – previously assessed, new BCEAA process may involve an amendment to the previous certificate	Significant - large land-based footprint in ALR lands; risk of sink hole	Moderate – temporary in-river footprint	Environmental assessment process, <i>Fisheries Act</i> authorization and <i>Water Sustainability Act</i> approvals all have complex regulatory processes
Regulatory Uncertainty	Limited	High – due to unknown in-water impacts with sink hole	Moderate – due to in-water impacts	Early engagement with DFO at senior and working levels needed to mitigate risks
Marine Traffic	Limited and temporary in the river; permanent air draft will restrict tall vessels	Significant – in-river stone columns and temporary exclusion zones during construction activities	Significant – dredging and temporary exclusion zones during construction; enhanced vessel draft (water depth) relative to existing tunnel	Marine traffic effects related to deck clearance and in-river construction activities and draft restriction related to existing tunnel
Visual Aesthetics	Significant, long-term visual impact	Low	Low	Visual aesthetics can become a major concern for local residents
Land Use / ALR	Potential high effect on residential areas off River Road and in Marina Garden Estates and Hampton Cove. Limited ALR	Significant	Limited	Bored tunnel has substantially high land expropriation requirements of ALR
Indigenous Interests	Considered in previous BCEAA Replacement Project certificate	TBD	TBD	Fisheries resources, habitats and resource access and use may be key consideration
Construction Issues (disposal of spoils or dredge)	Limited	Significant – disposal of bored tunnel material	Moderate, given that much of the lower Fraser River undergoes regular dredging for marine shipping navigation	Bored tunnel has large amount of soil / material / concrete waste disposal Bridge has large amount of concrete waste disposal

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ENVIRONMENTAL OPPORTUNITIES

A key goal of the project is to support a healthy environment. Within this goal, there are specific objectives related to avoiding loss of fish, wildlife, bird and marine mammal habitats, improving water quality, enhancing land and marine based recreation, and limiting waste materials, reducing GHGs and other air contaminants. Each of the three main crossing options provide unique opportunities to benefit and enhance local habitats and environmental conditions. The environmental benefits and enhancements can be specifically planned and designed as key components of the preferred crossing option and directed with input from consultation and engagement with Indigenous and local communities and stakeholders. Environmental enhancement and benefits will differ between the three main crossing options and each footprint, but may include:

- Development of aquatic habitats through construction and access to project areas to construct new watercourses, connect existing watercourses and link new habitats to the Fraser estuary
- Enhanced local stormwater drainage through new infrastructure connected to drainage and polishing ponds to enhance water quality in local aquatic habitats and drainage into the Fraser River and estuary
- Enhanced local wildlife habitats (birds, bats, pollinators, small mammals) around new infrastructure, including bridge piers or tunnel portals
- Careful planning and enhancement of existing and new roadways and corridors using roadside planting to reduce and limit wildlife and bird collisions
- Use of dredge sediment to support additional reefs and channels in the estuary
- Bird nesting and bat roosting enhancement on tunnel portals and bridge piers

CLOSURE

This memorandum has been prepared for the exclusive use of the Ministry of Transportation and Infrastructure to support the technical assessment of options for the George Massey Crossing. The anticipated environmental approval requirements are based on our experience with environmental assessments for other projects with similar scopes and characteristics. It is assumed that the Ministry will seek feedback from regulatory agencies, Indigenous groups and key stakeholders as part of the formal environmental review of the preferred option.

If you have any questions regarding the content of this memorandum, please contact the undersigned.

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