Appendix A

Discussion Guide and Feedback Form

Prepared by
Kirk & Co. Consulting Ltd.

Public Consultation: Transmission Line Relocation — George Massey Tunnel

NOVEMBER 2 — NOVEMBER 20, 2015

Welcome

In September 2013, the Province of B.C. announced that the George Massey Tunnel will be replaced with a new bridge. As one of our transmission lines runs through the tunnel, we need to relocate it. We're looking at alternatives to relocate this transmission line to ensure the power supply remains reliable for our customers in the surrounding areas.

This transmission line is a critical part of our network, supplying power to Richmond, Delta and other parts of the Lower Mainland. It's an important piece of infrastructure that helps us keep the lights on for tens of thousands of customers in your area.

Some sections of the existing overhead transmission line, running adjacent to Highway 99 on either side of the tunnel, also need to be moved before bridge construction and highway modifications begin. This can be done mostly within existing provincial highway and BC Hydro rights-of-way.

This Discussion Guide contains information about moving the overhead transmission line along Highway 99. It also outlines the three alternatives we're considering to relocate the transmission line out of the tunnel.

The Feedback Form on pages 16–19 asks for your input about these three alternatives.

Please provide your feedback by FRIDAY, NOVEMBER 20, 2015

How your input will be used

What we hear from you about the three alternatives during consultation, along with input from First Nations, and our study results, will be considered as we assess the feasibility of the alternatives and determine a preferred alternative.

We want to hear from you

You can provide your feedback and learn more by:

- ✓ Reading this Discussion Guide and completing the Feedback Form
- ✓ Coming to a small group meeting (please RSVP; see details to the right)
- ✓ Coming to an open house (schedule to the right)
- ✓ Completing an online feedback form: **bchydro.com/gmtt**
- ✓ Emailing us: **stakeholderengagement@bchydro.com**
- ✓ Visiting our website: **bchydro.com/gmtt**
- ✓ Talking to BC Hydro project team members in person at one of our scheduled drop-in events in Richmond (see details to the right)

Small Group Meeting Schedule

Small group meetings are scheduled for two hours and will be a sit-down meeting format. Our project team will provide an overview of the relocation and alternatives under consideration, and answer questions. To attend a small group meeting in your community, please email **stakeholderengagement@bchydro.com** or call 604.623.4472 with your name, contact information and the meeting you'd like to attend.

DATE	TIME	LOCATION
November 3	10:00 a.m. to 12:00 noon	**DELTA** **Delta Town & Country Inn** 6005 Hwy. 17A, Delta
	1:00 p.m. to 3:00 p.m.	
November 4	10:00 a.m. to 12:00 noon	
November 4	2:00 p.m. to 4:00 p.m.	**RICHMOND** **Richmond Country Club** 9100 Steveston Hwy., Richmond
November 5	10:00 a.m. to 12:00 noon	**RICHMOND** **Holiday Inn Express & Suites Riverport** 10688 No. 6 Road, Richmond
	1:00 p.m. to 3:00 p.m.	

Public Open House Schedule

Open houses are a drop-in meeting format. Project information will be provided, and members of our project team will be available for discussion and to answer questions. No RSVP is required.

DATE	TIME	LOCATION
November 3	5:00 p.m. to 8:00 p.m.	**Delta Town & Country Inn**
November 5	5:00 p.m. to 8:00 p.m.	**Richmond Country Club**

Visit Us

Members of our project team will be available for drop-in discussions during the following times.

DATE	TIME	LOCATION
November 13, 16 and 17	1:00 p.m. to 4:30 p.m.	**George Massey Tunnel Replacement Project Office** (Ironwood Plaza) 2030 – 11662 Steveston Hwy., Richmond

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Keeping the lights on:

A critical part of BC Hydro's transmission system

The transmission line that runs through the George Massey Tunnel is a critical part of our network, supplying power to Richmond, Delta and other parts of the Lower Mainland. It's an important piece of infrastructure that helps us keep the lights on for tens of thousands of customers in your area. With the replacement of the George Massey Tunnel, we need to relocate this transmission line to ensure that the power supply remains reliable for you.

Some sections of the existing overhead transmission line, running adjacent to Highway 99 on either side of the tunnel, also need to be moved, before bridge construction and highway modifications begin. This can be done mostly within existing provincial highway and BC Hydro rights–of–way. The map to the right illustrates the sections of the existing transmission line that we need to move.

SECTIONS OF EXISTING BC HYDRO TRANSMISSION LINE TO BE RELOCATED

- EXISTING OVERHEAD TRANSMISSION LINE
- RELOCATION OF SECTIONS MOSTLY WITHIN EXISTING RIGHTS-OF-WAY
- EXISTING TRANSMISSION LINE IN TUNNEL TO BE RELOCATED

We're looking at three alternatives for relocating the transmission line out of the tunnel:

- **Alternative 1:** an overhead transmission line crossing the Fraser River, which would be aligned beside the new bridge
- **Alternative 2:** an underground transmission line running under the Fraser River through a borehole path created using horizontal directional drilling (HDD)
- **Alternative 3:** a transmission line located on the new bridge

A description of each of the alternatives can be found on pages 5–12.

We're working on the conceptual designs for all three alternatives and have completed a desktop assessment of the technical feasibility of each. This looks at factors such as safety, environmental impacts, visual impacts, maintenance, repairability, cost and schedule.

Based on our work to date, Alternative 1, the overhead alternative, appears to be a technically leading alternative for a number of reasons, including a high level of safety and reliability of service. Your input from this consultation, along with input from other stakeholders and our study results, will be considered as we determine a preferred alternative. Input from First Nations is being gathered in a parallel process and will also be considered as we determine a preferred alternative.

Alternative 1: Overhead Transmission Line

DESCRIPTION

For the overhead transmission line alternative, two steel lattice towers, approximately 120 metres in height (approximately half the height of the proposed new bridge towers), would support the overhead 230–kilovolt line crossing the Fraser River. One transmission tower would be located on Deas Island and the other in Richmond, to the west of the new bridge. BC Hydro would place these towers in line with the proposed new bridge towers, and the conductor lines would hang at approximately the same height as the bridge deck to mitigate visual and potential avian impacts. A second, smaller steel lattice tower, approximately 75 metres in height, would also be required on Deas Island.

Rendering of the proposed tower and bridge concept. The two steel lattice towers on either side of the Fraser River would be approximately 120 metres in height (approximately half the height of the proposed new bridge towers).

PROPOSED LOCATION OF STEEL LATTICE TOWERS

PROPOSED LOCATION OF OVERHEAD TRANSMISSION LINE

PROPOSED LOCATION OF NEW BRIDGE AND HWY. 99 IMPROVEMENT PROJECT

Locations are approximate/structures not to scale.

Alternative 1: Overhead Transmission Line

CONSIDERATIONS

Based on our work to date, the overhead transmission line appears to be a technically leading alternative. It provides a high level of worker safety during construction and operation, and has the fewest construction risks. It's also the most reliable alternative, as it's most easily maintained and repaired after completion.

Key considerations of this alternative include:

Safety: Safety is our key priority in every decision we make. We've safely built many overhead transmission lines across water, including a transmission line crossing the Fraser River at Annacis Island. This alternative would be the safest and easiest to access and maintain following installation. Transmission towers would be located approximately 70 metres from the new bridge towers to ensure safety during bridge construction and operation for both workers and the public.

Visual impacts: There would be visual impacts from the new transmission towers and lines crossing the Fraser River. These would be mitigated by placing the transmission towers in line with the proposed new bridge towers and by placing the transmission line at approximately the same height as the bridge deck.

Environmental impacts: The primary potential impacts would be ground disturbance at the site of the transmission towers and potential impacts on birds. A study is underway to help us further assess any potential impacts on birds for this alternative.

Seismic: Overhead lines and structures can be built to withstand seismic events. The overhead alternative would be designed to withstand a 1-in-2,475 year event, which is consistent with the latest building code requirements for critical infrastructure.

Reliability and maintenance: Providing you with reliable power is our primary business and you count on us to keep outage times to a minimum. The overhead alternative would be quicker and easier to maintain or repair than the other alternatives, as the lines would be easier to see and access. In the case of a fault on the overhead line, or damage from a storm or other incident, repairs could be done relatively quickly and the line would typically be back in service in a short time, maintaining the reliability in your area. System reliability, potential outage lengths in your area and maintenance are critical considerations to us when looking at the three alternatives.

Schedule: This alternative has the shortest implementation schedule. If this alternative is selected, it's anticipated that construction of the overhead line from Richmond to Deas Island could be completed before the anticipated start of bridge construction. If needed for scheduling reasons, temporary infrastructure could be put in place to allow bridge construction to start (see "Potheads: Moving from Overhead Transmission Lines to Underground Transmission Lines" on page 10).

An example of a similar lattice tower can be found on Annacis Island in the Fraser River. This tower supports a 230-kilovolt line spanning the Fraser River.

Alternative 1: Overhead Transmission Line

Below are renderings to show what the overhead transmission line alternative would look like from two viewpoints in Delta.

Rendering of the Overhead Transmission Line Alternative from Captain's Cove Marina, Delta (looking East–Northeast)

Rendering of the Overhead Transmission Line Alternative from Millennium Trail near Captain's Cove Marina, Delta (looking northeast)

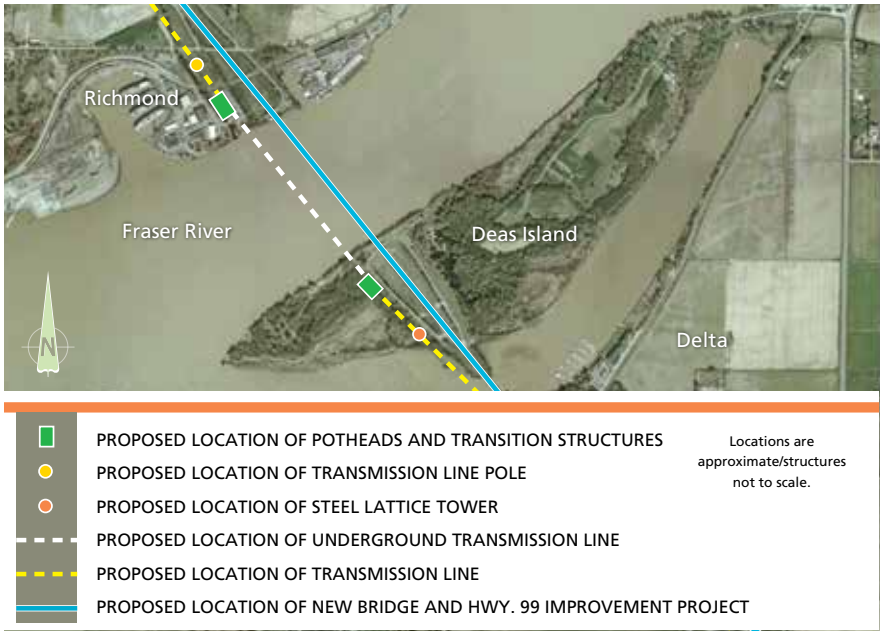
These renderings are based on the conceptual design for the transmission line alternatives and include the preliminary bridge designs for the George Massey Tunnel Replacement Project as provided by the Ministry of Transportation and Infrastructure. The final bridge design, and the transmission line alternatives, are subject to change as design and engineering progresses.

Alternative 2: Underground Transmission Line

DESCRIPTION

This alternative would consist of a transmission line running under the Fraser River, parallel to the new bridge, from Richmond to Deas Island. A borehole path would be created using horizontal directional drilling (HDD). Once a borehole path is drilled, conduits would be installed, through which the transmission cables would be pulled.

The cables would terminate on either side of the river, at a transition infrastructure, called a pothead, where they would transition from underground cables to an overhead line (see “Potheads: Moving from Overhead Transmission Lines to Underground Transmission Lines” on page 10). A steel lattice tower, approximately 75 metres in height, would also be required on Deas Island.



Staging areas would be needed to set up HDD drill rigs on either side of the crossing; these staging areas would need to be large enough to lay out the conduits before they are installed. We have engineering and geotechnical assessments underway to determine the cable entry and exit locations, the staging area dimensions and the depth of the borehole needed.

HDD rig and staging area on the Vancouver City Central Transmission (VCCT) Project in David Lam Park, Vancouver

Some construction risks have been identified with this alternative, including:

- **Limited flexibility in the bore path:** HDD provides very limited flexibility during installation. For example, if an obstruction, such as a large boulder, which wasn’t identified before drilling started, is encountered, the bore hole tunnel will need to be re-drilled. These unknowns increase the construction risk associated with this alternative.
- **Soil conditions:** Based on the geotechnical work we’ve completed to date, local soil conditions appear to be loose and sandy. To minimize risk of liquefaction, drilling would need to be at least 12 metres below the river bed, adding to the overall length of the crossing and increasing the difficulty of construction.

Alternative 2: Underground Transmission Line

CONSIDERATIONS

Considerations of this alternative include:

Safety: During construction, careful planning would be implemented to avoid other infrastructure, such as water mains, or utility lines in work areas. Following installation, underground lines aren't accessible by the public and interactions can be avoided.

Visual impact: This alternative would be visually similar to existing infrastructure. The permanent potheads on either side of the Fraser River would have a footprint approximately 25% larger than the existing pothead structures.

Environmental impacts: This alternative would have additional ground disturbance, compared to the overhead transmission line alternative, to allow for the temporary and permanent potheads and the HDD drilling staging areas. With HDD construction, there is a potential for the unexpected release of the fluid into the drill hole. This potential is increased when drilling through highly variable soil conditions like those found in the local area. The release of this drill fluid into the river can potentially impact fish habitat.

Seismic: Underground lines have a higher risk of being compromised during seismic events than overhead lines, for example, due to damage from shifting earth. Access and repair following a seismic event would be much more difficult than for the other alternatives, resulting in longer outage times for our customers.

Reliability and maintenance: Providing you with reliable power is our primary business and you count on us to keep outage times to a minimum. Of the three alternatives, the underground alternative would be the most difficult to access and repair, meaning maintenance and repair would take longer, perhaps weeks or even months, depending on the problem. This would leave our overall power system in your area at a higher risk, increasing the potential of an impact to your electrical supply. The transmission line running through the tunnel is one of only two circuits supplying 35,000 Richmond customers, making this a critical consideration.

Service life: Underground transmission cables have a shorter lifespan than overhead lines. Replacement may need to be considered after 40 years, as compared to 70 years on average for overhead lines

Schedule: This alternative would take longer to implement than an overhead transmission line alternative. The existing potheads would need to be moved temporarily, allowing the transmission line to stay in the tunnel during bridge construction. Once the bridge construction is complete, the underground cable installation would begin and the potheads would be permanently relocated.

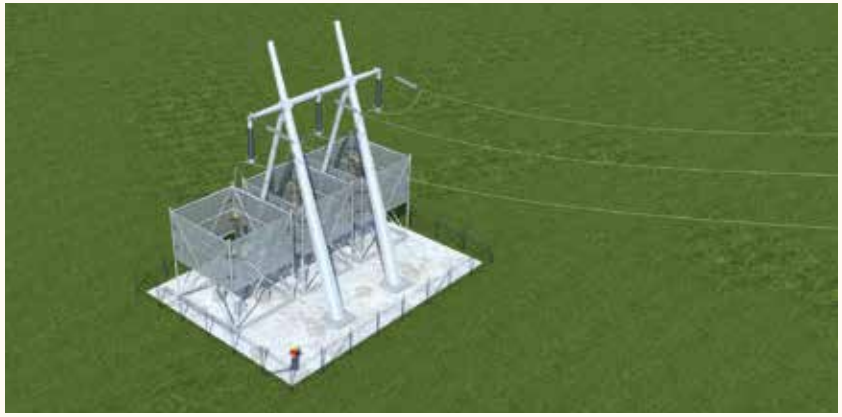
Potheads: Moving from overhead transmission lines to underground transmission lines

Special infrastructure called a pothead is needed to transition transmission lines from overhead to underground. For the existing transmission line running through the George Massey Tunnel, the pothead structures are located at each end of the tunnel, in Richmond and on Deas Island.

The existing potheads need to be moved before the start of bridge construction, as they're located where the foundations for proposed new bridge towers are expected to be placed.

New potheads would be required if either the underground transmission line or transmission line on the bridge alternatives were selected as the preferred alternative.

Below is a rendering of a pothead structure, similar in design to those that would be needed for this relocation. These potheads would be located on Deas Island and in Richmond.



This rendering shows a proposed pothead concept from Rice Mill Road, Richmond. It is shown in yellow as some of the components could be obscured by trees in this viewpoint. Another pothead would be located on Deas Island.

BC Hydro pothead at English Bluff, Tsawwassen. Potheads for this relocation would likely be similar in appearance to this pothead.

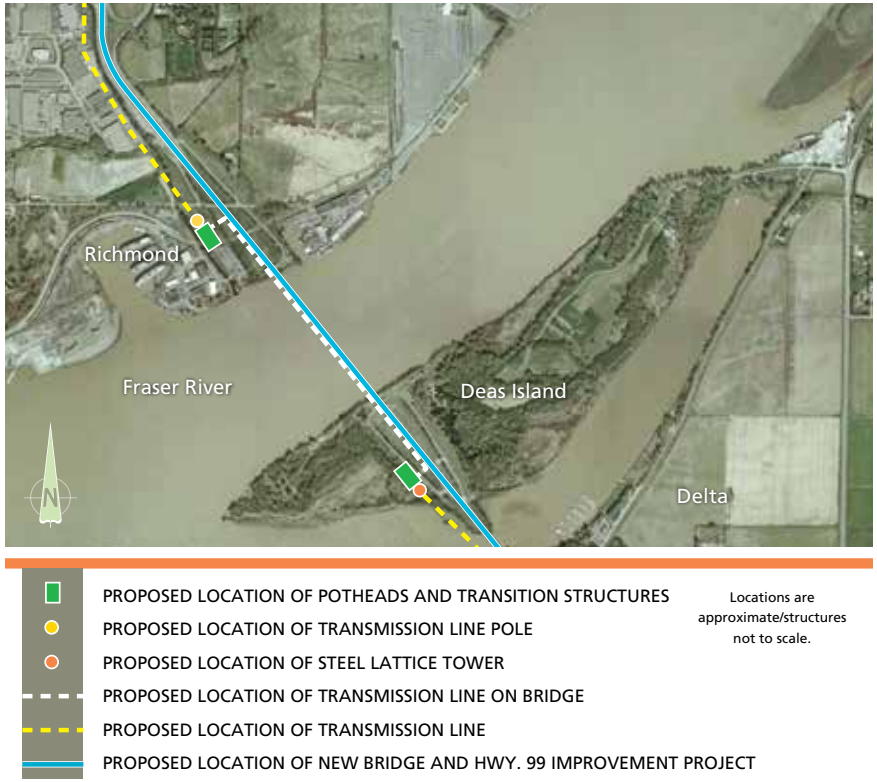
Alternative 3: Transmission Line on the Bridge

DESCRIPTION

This alternative would include installation of the transmission line on the new bridge. We've based our initial design of this alternative on the Ministry of Transportation and Infrastructure's conceptual bridge design, assuming a cable–stayed bridge with a box girder supporting the bridge deck, allowing for a transmission line to run through the bridge section.

If the bridge design concept changes substantially as the George Massey Tunnel Replacement Project design progresses, this would impact our design of this alternative. As such, the design of this alternative can't be finalized until more advanced bridge designs are available.

This alternative requires a steel lattice tower, approximately 75 metres in height, on Deas Island and a pothead on either side of the Fraser River. The transmission cables would run from the ground in vertical shafts up the bridge, on either end of the bridge, and through a box girder within the main bridge deck.



Alternative 3: Transmission Line on the Bridge

CONSIDERATIONS

Considerations of this alternative include:

Safety: With this alternative, the transmission line would run through the main bridge structure. This arrangement means maintenance and repair activities would be done in a confined space, making it more difficult and increasing risk to workers. Also, workers other than BC Hydro employees may need to access this space and work in the vicinity of the transmission cables.

The design of this alternative would have to take into account the potential for possible impacts to the bridge such as induced currents into the metal structure of the bridge.

While highly unlikely, a more severe fault on the transmission line could cause a fire that might impact the main bridge deck or potentially introduce a public safety hazard. We must consider this unlikely scenario, and the associated response, when looking at this alternative, to ensure public and worker safety.

Visual impacts: This alternative would be visually similar to existing infrastructure. The permanent potheads on either side of the Fraser River would have a footprint approximately 25% larger than the existing pothead structures.

Environmental impacts: This alternative would have additional ground disturbance for the temporary and permanent potheads, compared to the overhead transmission line alternative.

Seismic: This alternative would be designed to withstand a 1–in–2,475 year seismic event but remains dependent on the bridge integrity following an event.

Cable interactions: This alternative must be designed to allow for natural bridge movement and traffic vibrations, so the cables are not damaged by twisting or moving resulting in a more complex design. A fibre optic cable would be needed to monitor strain and the surface temperature of the transmission cable.

Reliability and maintenance: Providing you with reliable power is our primary business and you count on us to keep outage times to a minimum. A key consideration with this alternative is the need for maintenance and repair access while maintaining public and worker safety. Depending on the final bridge design, access for maintenance and repair could be challenging, extending possible outage times in your area following an electrical problem on the transmission line. In the case of an electrical problem on the line, bridge traffic may be impacted to allow for emergency vehicle access to perform repairs.

Schedule: This alternative would be installed after the bridge is substantially complete. The existing potheads would need to be moved temporarily, allowing the transmission line to stay in the tunnel during bridge construction. Once the bridge construction is substantially complete, the permanent pothead structures would be built and the transmission cables installed on the bridge structure.

Service life: The lifespan of this alternative is similar to the underground alternative, as both use the same type of transmission cables. Replacement may need to be considered after 40 years, as compared to 70 years on average for overhead transmission lines.

For your information: Relocation of existing transmission line and poles along Highway 99 in Richmond and Delta

The following elements are consistent for all three alternatives. Note that final locations will be determined based on discussions with with the Ministry of Transportation and Infrastructure.

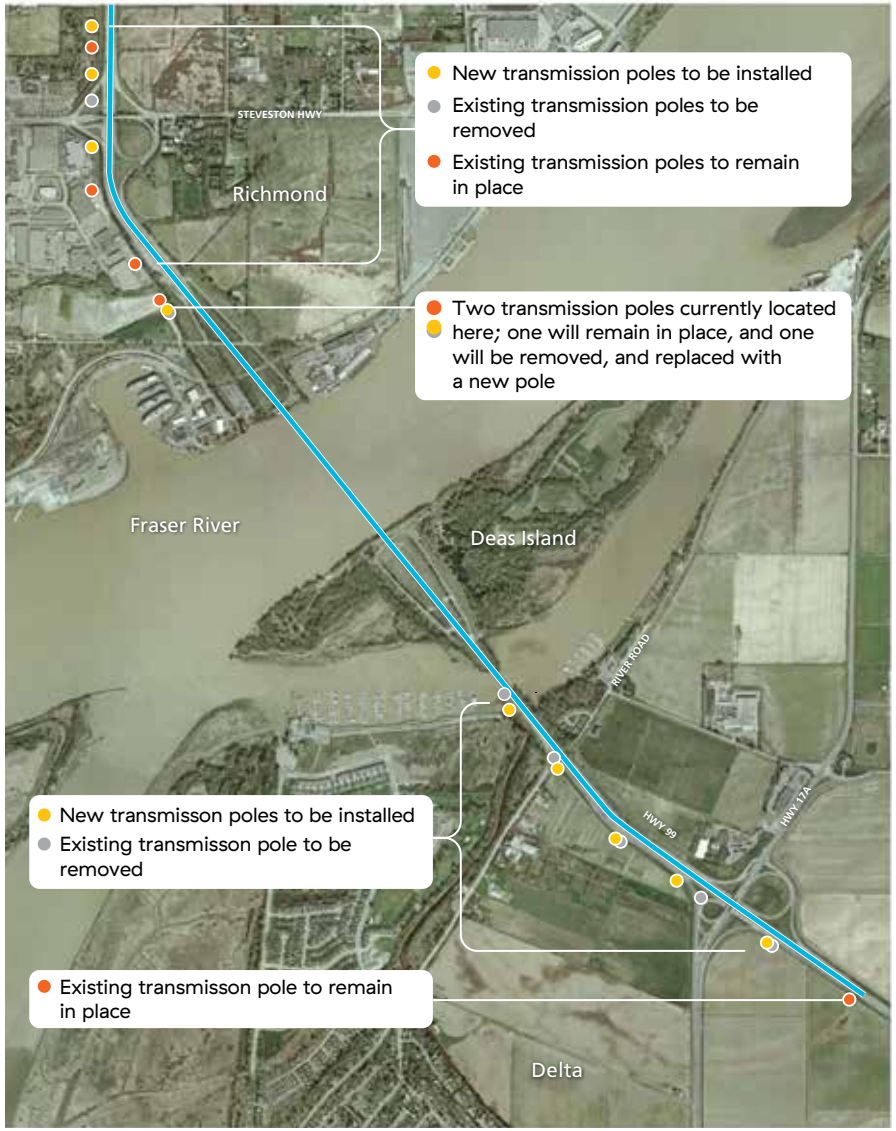
RICHMOND

In Richmond, the overhead transmission line and poles along Highway 99 from the Fraser River to Steveston Highway need to be moved. This can be done mostly within existing provincial highway and BC Hydro rights–of–way, allowing for highway widening and interchange work.

DELTA

In Delta, the overhead transmission line and poles along Highway 99 between River Road and east of the Highway 17A Interchange need to be moved. This can be done mostly within existing provincial highway and BC Hydro rights–of–way, allowing for highway widening and interchange work.

The replacement poles will be the same type as the steel poles that are currently in place but some will be taller.



PROPOSED LOCATION OF NEW BRIDGE AND HWY. 99 IMPROVEMENT PROJECT

Locations are approximate/structures not to scale.

We'd like your input

Please complete the Feedback Form on pages 16–19 to share your thoughts on these three alternatives.

What we hear from you about these alternatives during consultation, along with input from other stakeholders, and our study results, will be considered as we assess the feasibility of the alternatives and determine a preferred alternative.

Input from First Nations is being gathered in a parallel process and will also be considered as we determine a preferred alternative.

HOW WILL BC HYDRO DETERMINE A PREFERRED ALTERNATIVE?

To evaluate alternatives, we use the structured decision–making (SDM) approach, which assesses the social, economic and environmental aspects of each alternative.

Key aspects include:

- Safety
- System reliability
- Environmental impacts
- First Nations effects and input
- Stakeholder effects and input
- Constructability and maintenance of alternatives
- Visual impacts
- Property requirements and impacts
- Cost to the ratepayer
- Schedule

What's next?

Once the consultation period is complete, we'll use the structured decision-making (SDM) process to determine a preferred alternative.

We plan to share that decision in early 2016.

We'll continue to provide information and engage with you throughout this relocation project, through email and our website: **bchydro.com/gmtt.**

If you'd like to be added to our email update list, please call 604.623.4472 or email: **stakeholderengagement@bchydro.com.**

Milestones*

ONGOING – First Nations and local government/stakeholder engagement

NOVEMBER 2015	EARLY 2016	2016	FALL 2016	2017
Public consultation sessions	Communicate the preferred alternative for relocation of the 230-kilovolt transmission line	Detailed design and material procurement	Construction to start	Anticipated start of bridge construction

* This schedule is subject to change.

George Massey Tunnel Replacement Project

In September 2013, the Province of British Columbia announced that the George Massey Tunnel will be replaced with a new bridge to ensure Highway 99 continues to meet the growing needs of the communities, businesses and stakeholders that rely on this crossing.

Subject to environmental review, the Ministry of Transportation and Infrastructure expects construction to begin in 2017.

More information can be found at: **masseytunnel.ca**

Feedback Form

The purpose of this feedback form is to obtain public feedback and opinions on alternatives for the relocation of the transmission line that runs through the George Massey Tunnel. BC Hydro is collecting this information in accordance with its obligations under the *Utilities Commission Act*, to ensure that energy delivery continues once the transmission line has been relocated. If you have privacy questions related to this feedback form, please contact sarah.mckinney@bchydro.com. When responding to the open ended questions in the feedback form, please do not identify or refer to other persons.

We're looking at three alternatives to relocate the transmission line running through the George Massey Tunnel. These are: **Alternative 1:** an overhead transmission line crossing the Fraser River, which would be aligned beside the new bridge (technically leading alternative); **Alternative 2:** a transmission line running under the Fraser River through a borehole path created using horizontal directional drilling; and **Alternative 3:** a transmission line located on the new bridge. Information on these three alternatives is presented on pages 5–12 of this Discussion Guide.

ALTERNATIVE 1: OVERHEAD TRANSMISSION LINE

1 **A)** Please tell us your **level of agreement** with an overhead transmission line crossing the Fraser River, which would be aligned beside the new bridge:

☐ Strongly Agree	☐ Somewhat Agree	☐ Neither Agree Nor Disagree	☐ Somewhat Disagree	☐ Strongly Disagree

B) Use the space below to provide any comments you would like to share about the **reasons** for your agreement or disagreement with Alternative 1.

C) Please provide any **additional comments** on Alternative 1.

ALTERNATIVE 2: UNDERGROUND TRANSMISSION LINE

2 **A)** Please tell us your **level of agreement** with an underground transmission line running under the Fraser River:

☐ Strongly Agree	☐ Somewhat Agree	☐ Neither Agree Nor Disagree	☐ Somewhat Disagree	☐ Strongly Disagree

B) Use the space below to provide any comments you would like to share about the **reasons** for your agreement or disagreement with Alternative 2.

C) Please provide any **additional comments** on Alternative 2.

ALTERNATIVE 3: TRANSMISSION LINE ON THE BRIDGE

3 **A)** Please tell us your **level of agreement** with a transmission line located on the new bridge:

☐ Strongly Agree	☐ Somewhat Agree	☐ Neither Agree Nor Disagree	☐ Somewhat Disagree	☐ Strongly Disagree

B) Use the space below to provide any comments you would like to share about the **reasons** for your agreement or disagreement with Alternative 3.

C) Please provide any **additional comments** on Alternative 3.

ADDITIONAL COMMENTS

I consent to the potential disclosure, storage and access of my feedback form data outside of Canada for the purpose of the use, administration and support of this survey tool. I also consent to BC Hydro sending me updates about Public Consultation: Transmission Line Relocation — George Massey Tunnel, including notification when the Consultation Summary Report is available.

My consent is valid from the date I consent.

☐ Yes I consent Date:

TO RECEIVE UPDATES ABOUT THIS TRANSMISSION LINE RELOCATION, PLEASE COMPLETE THE FOLLOWING INFORMATION:

First Name:

Last Name:

Organization (if applicable):

Position (if applicable):

Email:

Phone (optional):

We want to hear from you

Go to **bchydro.com/gmtt** to fill in the feedback form and provide your feedback.

Feedback will be received from November 2 – 20, 2015

You can provide your feedback and learn more by:

- ✓ Reading this Discussion Guide and completing the Feedback Form
- ✓ Coming to a small group meeting or open house – see the schedule on page 3
- ✓ Completing an online feedback form: **bchydro.com/gmtt**
- ✓ Emailing us: **stakeholderengagement@bchydro.com**
- ✓ Visiting our website: **bchydro.com/gmtt**