TABLE OF CONTENTS

General 3
Financial and Economics 7
Consultation 14
Aboriginal Matters 27
Socio-economic 31
Lands 39
Environment 46
Emergency Management (Marine) 283
Engineering and Safety 287

LIST OF ATTACHMENTS

NEB IR No.2.001b - Attachment 1
NEB IR No.2.001b - Attachment 2
NEB IR No.2.003d - Attachment 1
NEB IR No.2.005d - Attachment 1
NEB IR No.2.005d - Attachment 2
NEB IR No.2.006a - Attachment 1
NEB IR No.2.007a - Attachment 1
NEB IR No.2.008a - Attachment 1
NEB IR No.2.011c - Attachment 1
NEB IR No.2.013a - Attachment 1
NEB IR No.2.014a - Attachment 1
NEB IR No.2.044a - Attachment 1
NEB IR No.2.047a - Attachment 1
NEB IR No.2.052a - Attachment 1
NEB IR No.2.063a - Attachment 1
NEB IR No.2.063a - Attachment 2
NEB IR No.2.063a - Attachment 3
NEB IR No.2.063a - Attachment 4
NEB IR No.2.063a - Attachment 5
NEB IR No.2.066 - Attachment 1
NEB IR No.2.069 - Attachment 1
NEB IR No.2.069 - Attachment 2
NEB IR No.2.069 - Attachment 3
NEB IR No.2.071b - Attachment 1
NEB IR No.2.073b - Attachment 1
NEB IR No.2.073d - Attachment 1
NEB IR No.2.076a - Attachment 1
NEB IR No.2.103a - Attachment 1
NEB IR No.2.105b - Attachment 1
NEB IR No.2.105c - Attachment 1
NEB IR No.2.106b - Attachment 1
NEB IR No.2.106b - Attachment 2

NEB IR No.2.107 - Attachment 1
NEB IR No.2.107 - Attachment 2
NEB IR No.2.107 - Attachment 3
NEB IR No.2.107 - Attachment 4
NEB IR No.2.129a - Attachment 1
NEB IR No.2.130a - Attachment 1
NEB IR No.2.131c - Attachment 1
NEB IR No.2.131c - Attachment 2
NEB IR No.2.131c - Attachment 3
NEB IR No.2.134a - Attachment 1

Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
NEB Hearing Order OH-001-2014
Responses to Information Request from
National Energy Board

General

2.001 Relief being sought

Reference:

A3S0Q7, Application Volume 1, Summary:

i) PDF page 27 of 113
ii) PDF pages 45 and 46 of 113

Preamble:

Reference i) indicates that Trans Mountain is applying to the Board pursuant to section 52 of Part III of the *National Energy Board Act* for a certificate of public convenience and necessity and related approvals for the Project.

Reference ii) provides an overview of the Project description, including the following components:

- installing new pipeline segments and reactivating existing lines that are currently maintained in a deactivated state;
- constructing pump stations;
- expanding existing terminals by adding new tanks and other infrastructure;
- constructing a new dock complex at the Westridge Marine Terminal;
- installing new mainline block valves; and
- adding new power lines under the jurisdiction of the appropriate provincial authorities.

Reference ii) also states that the Project will result in two continuous pipelines between Edmonton and Burnaby:

- Line 1 will have a sustainable capacity of 55,640 cubic metres (350,000 barrels) per day; and
- Line 2 will have a sustainable capacity of 85,850 cubic metres (540,000 barrels) per day.

The Board issued the original certificate of public convenience and necessity for the existing pipeline in August 1960 (OC-2). Since then, the Board has issued numerous legal instruments to construct and operate, modify, deactivate, and reactive parts of the pipeline system.

Request:

Please provide a detailed description of the relief that Trans Mountain is seeking in its Application, including, but not limited to:

a) the existing legal instruments Trans Mountain is seeking to amend or revoke, and the Project components applicable to each (provide a list and copies of all existing legal instruments referenced by Trans Mountain in its response);

b) any existing legal instruments that would remain in force and applicable to Lines 1 or 2 that Trans Mountain is not seeking to amend or revoke (provide a list and copies of all existing legal instruments referenced by Trans Mountain in its response); and

c) any new legal instruments that Trans Mountain is seeking, and the Project components applicable to each.

Response:

a) Trans Mountain is seeking to reactivate certain pipeline assets which are currently being maintained in a deactivated state. As detailed in the application, Trans Mountain is proposing to reactivate a 150 km NPS 24 pipeline segment from Hinton, AB, to Hargreaves, BC, and a 43 km NPS 24 pipeline segment from Darfield, BC, to Black Pines, BC. Trans Mountain is also proposing to reactive a pump station located at Niton, AB. Trans Mountain expects that it will file separate applications for the deactivation or decommissioning of existing assets that will not be required for the expanded pipeline system in due course.

   Trans Mountain is currently undertaking a search of its historical records and will file in August 2014 the requested list and copies of the existing legal instruments Trans Mountain is seeking to amend or revoke, and the Project components applicable to each.

b) Trans Mountain has been issued two certificates of public convenience and necessity since its inception. The first being OC-2 issued in August 1960 which provided for the original construction of the pipeline including two eighty kilometre pipeline loops (NEB IR No. 2.001b - Attachment 1) and the second being OC-49 issued in November 2006 which provided for the construction of the NPS36 Anchor Loop (NEB IR No. 2.001b – Attachment 2). Of the existing pipeline assets constructed pursuant to the reference certificates, Trans Mountain plans to utilize the Anchor Loop segment and the active NPS30 segment between Darfield, BC, and Black Pines, BC, on Line 2. The remaining segments will be used on Line 1 including the proposed reactivation of 150 km NPS 24 pipeline segment from Hinton, AB, to Hargreaves, BC, and a 43 km NPS 24 pipeline segment from Darfield, BC, to Black Pines, BC.

   Trans Mountain is not proposing to change the maximum operating limits for the existing active pipeline segments and therefore the existing licensing will remain in force.

   Trans Mountain is currently undertaking a search of its historical records and will file in August 2014 the requested list and copies of existing legal instruments that would remain in force and applicable to Lines 1 or 2 that Trans Mountain is not seeking to amend or revoke.

c) Trans Mountain is seeking a Certificate of Public Convenience and Necessity pursuant to Section 52 of the *National Energy Board Act* for the construction of new facilities to expand the capacity of the existing Trans Mountain Pipeline system. The conceptual design of the new pipeline assets are described in detail in the application, the major Project components can be summarized as follows:

New Construction – Pipeline

Approximate Length	Pipeline Diameter	Location
339 km	NPS 36 (914 mm)	Edmonton, AB to Hinton, AB
279 km	NPS 36 (914 mm)	Hargreaves, BC to Darfield, BC
368 km	NPS 36 (914 mm)	Black Pines, BC to Burnaby, BC
8 km (2 x 4 km)	NPS 30 (762 mm)	Burnaby Terminal to Westridge Marine Terminal

New Construction – Pump Stations

Trans Mountain will construct 11 new pump stations to support line 2 and 1 new pump station to support Line 1. The details regarding the new pump stations are provided in Volume 4A, Section 3.3 of the Application (Filing ID A3Y0S8).

New Construction – Tanks

Trans Mountain will construct a total of 20 new tanks, 5 in Edmonton, 1 in Sumas, and 14 in Burnaby. The details regarding the new tanks are provided in Volume 4A, Section 3.3 of the Application (Filing ID A3Y0S8).

New Construction – Westridge Marine Terminal

Trans Mountain will construct one new dock complex with three berths, each capable of loading up to Aframax class vessels and one berth capable of receiving jet fuel, and one small utility dock with multiple berths all of which is further described in Volume 4A, Section 3.4.4.1.4 of the Application (Filing ID A3Y0S9).

New Construction – all other facilities

Volume 4A, Section 3 of the Application provides preliminary details of the new supporting facilities that will be constructed to facilitate the operation of the major Project components noted above (Filing ID A3Y0S8).

Summary of New Commitments:

- Trans Mountain will file in August 2014 the requested list and copies of existing legal instruments Trans Mountain is seeking to amend or revoke, and the Project components applicable to each.

- Trans Mountain will file in August 2014 the requested list and copies of existing legal instruments that would remain in force and applicable to Lines 1 or 2 that Trans Mountain is not seeking to amend or revoke.

Financial and economics

2.002 Insurance

Reference:

A3W9H8, Trans Mountain response to Board IR No. 1:

i) IR 1.8b, PDF page 28 of 421
ii) IR 1.8d, PDF pages 28 and 29 of 421
iii) IR 1.8g.3, PDF pages 29 and 30 of 421
iv) IR 1.8f, PDF page 29 of 421
v) A3S4W8, Application Volume 7, Risk Assessment and Management of Pipeline and Facility Spills, Appendix G – Potential Cleanup and Damage Costs of a Hypothetical Oil Spill: Assessment of Trans Mountain Expansion Project, PDF page 9 of 28.

Preamble:

In Reference i), Trans Mountain described the two components of its insurance coverage:

1. $150 million General Liability insurance component, which covers all of the Kinder Morgan assets located in Canada, except for the Canadian section of the Kinder Morgan Cochin Pipeline, and the Puget Sound Pipeline; and

2. $600 million of coverage for all of the entities in the Kinder Morgan (North America) group of companies.

In Reference ii), Trans Mountain provides examples of standard exclusions typical for a company in the liquid pipeline industry.

In Reference iii), Trans Mountain states that, if a specific claim or claims within a policy year result in significant erosion of the $750 million aggregate limit, Kinder Morgan would immediately seek to reinstate the limits for the balance of the insurance year.

In Reference iv), Trans Mountain states that "it is important to note that the amount of insurance available to an insurance program is subject to the market conditions at the time the insurance is placed. Market conditions such as loss history in a particular industry, a change in an insurance underwriter's allocation of risk within their portfolio, a change in re-insurance conditions or an underwriter's appetite for a specific class of business or merger activity within the marketplace can all have an impact on the amount of insurance coverage available."

In Reference v), Trans Mountain states that it is generally acknowledged that, in the event of a spill, it is important to return to operations as soon as practically and safely possible.

Request:

a) With regard to the $150 million policy in Reference i), please:
   a.1) list all operations covered by this policy;
   a.2) list all exclusions, both standard and non-standard, in this policy;

a.3) specify which corporate entity holds the insurance in the policy; and
a.4) specify the insurer for the policy.

b) Please describe the $600 million coverage for all entities in the Kinder Morgan (North America) group of companies in detail. In this description, please:
b.1) specify if this a General Liability policy;
b.2) list all operations covered by this policy;
b.3) list all exclusions, both standard and non-standard, in this policy;
b.4) specify the insurer for this policy; and
b.5) specify which corporate entity holds the insurance for this policy.

c) Please specify the corporate entity that has authority over decisions on the insurance coverage on the Trans Mountain pipeline.

d) Please explain how Trans Mountain LP can ensure that it will maintain sufficient insurance coverage, if it is not the corporate entity making the decisions.

e) Please indicate the commitments that Trans Mountain will provide that it will maintain sufficient insurance coverage.

f) If a specific claim or claims within a policy year result in significant erosion of the $750 million aggregate limit, as described in Reference iii):
f.1) please describe how Kinder Morgan would reinstate the limits for the balance of the insurance year; or
f.2) if limits could not be reinstated, please describe how Trans Mountain proposes to provide the Board with financial commitments.

g) Please explain how Trans Mountain would ensure sufficient financial assurances in the event that market conditions, as described in Reference iv), change to decrease the amount of insurance available.

h) Please explain how Trans Mountain would pay for costs associated with a spill if the pipeline was unable to return to service for an extended period of time.

i) Please discuss whether or not Trans Mountain (or the corporate entity procuring insurance for the Trans Mountain pipeline) would be able and willing to obtain a stand-alone, third party insurance policy for the Trans Mountain pipeline, and the amount of such insurance. If Trans Mountain is not able or willing to obtain such insurance, please explain why.

Response:

a.1) The referenced policy covers all the current operations of Kinder Morgan in Canada including the operations of Kinder Morgan Canada Inc., all of the regulated and merchant operations of Trans Mountain Pipeline ULC on behalf of Trans Mountain Pipeline L.P., the Jet Fuel pipeline owned by Trans Mountain (Jet Fuel) Inc, the North 40 merchant tank terminal located in Edmonton, Alberta, the Vancouver Wharves terminal located in Vancouver, BC as well as the Puget Sound pipeline located in Washington State, USA and

owned by Trans Mountain Pipeline (Puget Sound) LLC. The policy will also cover the Edmonton Rail Terminal being constructed near Edmonton, Alberta.

a.2) It is important to note that an insurance policy is a commercially negotiated agreement between a company and its insurance providers and is subject to dynamic market conditions at the time of negotiation. The specific terms of coverage such as exclusions are reviewed and negotiated annually as part of the placement of the insurance program and the public disclosure of this information could have a detrimental impact on future negotiations. In addition, there are numerous Kinder Morgan entities that are not affected by this proceeding that are named insureds under this policy and the public disclosure of the specific terms could result in economic harm to the commercial activities carried out by these entities. Finally, the exclusions of an insurance policy are not static from one policy year to the next and Trans Mountain is unable to confirm that the exclusions in place today will remain in effect for the life of the project. Trans Mountain is willing to provide the exclusions to the Board along with a request that they be filed confidentially pursuant to Section 16.1 of the *National Energy Board Act,* if requested.

a.3) Kinder Morgan, Inc. holds the insurance policy. Trans Mountain Pipeline ULC on behalf of Trans Mountain Pipeline L.P. and Kinder Morgan Canada Inc. are named entities insured under the insurance policy.

a.4) Consent of the insurance providers is required before Trans Mountain can release their names as participants in the program. Trans Mountain will endeavour to obtain the consent and report back to the Board by August 15, 2014. The size of the referenced insurance program is such that there are a number of insurance providers that participate in the program. The insurance program can be parsed into four layers of participation as follows:

General/Excess Liability Insurance Program Layer	**# of Insurance Provider Participants**	**$ Amount of Coverage**	**Participation Rates**
First	1 insurance provider	$8 million	100%
Second	7 insurance providers	$25 million	4% to 33%
Third	2 insurance providers	$15 million	33% to 66%
Fourth	1 insurance provider	$100 million	100%
Total		$150 million	

There are some insurance providers that participate in multiple layers such that across all of the layers there are 10 unique insurance providers that participate in the Kinder Morgan $150 million General/Excess Liability insurance program all of whom have a rating of A or better.

b.1) The referenced insurance policy is a General/Excess Liability policy.

b.2) The referenced insurance program is an omnibus insurance program that covers Kinder Morgan's legal liabilities arising from all wholly owned operations (including the operation of the Trans Mountain pipeline), all operations where Kinder Morgan has a contractual obligation to provide insurance and to the extent of Kinder Morgan's ownership interest, those legal liabilities arising from joint venture operations. From a geographic perspective

this component of the insurance program covers all of Kinder Morgan's operations located in Canada, United States and Mexico.

b.3) It is important to note that an insurance policy is a commercially negotiated agreement between a company and its insurance providers and is subject to dynamic market conditions at the time of negotiation. The specific terms of coverage such as exclusions are reviewed and negotiated annually as part of the placement of the insurance program and the public disclosure of this information could have a detrimental impact on future negotiations. In addition, there are numerous Kinder Morgan entities that are not affected by this proceeding that are named insureds under this policy and the public disclosure of the specific terms could result in economic harm to the commercial activities carried out by these entities. Finally, the exclusions of an insurance policy are not static from one policy year to the next and Trans Mountain is unable to confirm that the exclusions in place today will remain in effect for the life of the project. Trans Mountain is willing to provide the exclusions to the Board along with a request that they be filed confidentially pursuant to Section 16.1 of the *National Energy Board Act,* if requested.

b.4) Consent of the insurance providers is required before Trans Mountain can release their names as participants in the program. Trans Mountain will endeavour to obtain the consent and report back to the Board by August 15, 2014. The size of the referenced insurance program is such that there are a number of insurance providers that participate in the program. The insurance program can be parsed into seven layers of participation as follows:

General/Excess Liability Insurance Program Layer	**# of Insurance Provider Participants**	**$ Amount of Coverage**	**Participation Rates**
First	10 insurance providers	$100 million	4% to 25%
Second	9 insurance providers	$100 million	4% to 25%
Third	2 insurance providers	$25 million	40% to 60%
Fourth	8 insurance providers	$100 million	5% to 20%
Fifth	6 insurance providers	$140 million	4% to 46%
Sixth	4 insurance providers	$100 million	10% to 60%
Seventh	1 insurance provider	$35 million	100%
Total		$600 million	

There are some insurance providers that participate in multiple layers such that across all of the layers there are 25 unique insurance providers that participate in the Kinder Morgan $600 million General/Excess Liability insurance program all of whom have a rating of A- or better.

b.5) Kinder Morgan, Inc. holds the insurance policy. Trans Mountain Pipeline ULC on behalf of Trans Mountain Pipeline L.P. and Kinder Morgan Canada Inc. are named entities insured under the insurance policy.

c) The Board of Kinder Morgan, Inc. delegates the authority to execute the Kinder Morgan insurance program (including the insurance coverage on the Trans Mountain pipeline) to the senior management of the Kinder Morgan companies and then to the Vice President of Insurance/Risk Management. The Vice President of Insurance/Risk Management is the

head of the Kinder Morgan insurance department which oversees the placement and administration of all insurance programs for Kinder Morgan's operations throughout North America with insurance department employees located in Houston, TX and Lakewood, CO.

d) Trans Mountain relies on the expertise and experience of the Kinder Morgan insurance department and the responsibility delegated to this department to ensure the insurance coverage provided is prudent and reasonable given the risks associated with the operation of all of the assets under the Kinder Morgan umbrella including the operation of the Trans Mountain pipeline. The Kinder Morgan insurance department works with Kinder Morgan Canada personnel on a regular basis to review the operations of Trans Mountain and identify any changes that may have an impact on the insurance program. Having the responsibility for placing insurance at Trans Mountain Pipeline ULC would not change the risks associated with the operation of the Trans Mountain pipeline nor would it change market conditions under which the insurance is placed therefore in Trans Mountain's view the current approach to managing the Kinder Morgan insurance program is reasonable and appropriate. Trans Mountain will commit to having access to insurance as a component of an overall financial assurance package over the life of the Project as further described in Trans Mountain's response to NEB IR No. 2.002g.

e) As indicated in Trans Mountain's response to NEB IR No. 1.08f, the amount of insurance available to an insurance program is subject to the market conditions at the time the insurance program is placed. Due to the vulnerability to market conditions, Trans Mountain is unable to commit to providing a specific amount of insurance over the life of the Project, however, Trans Mountain will commit to having access to insurance as a component of an overall financial assurance package over the life of the Project as further described in Trans Mountain's response to NEB IR No. 2.002g. Kinder Morgan is a prudent and responsible operator of its assets and the annual placement of insurance is one of the risk management tools Kinder Morgan relies on and will continue to rely on in the future.

f.1) Kinder Morgan would go out to the insurance market with a request to reinstate limits and obtain a quote of the cost for such reinstatement. The insurance markets response to the request will depend on the unique circumstances at the time the request is made. In some cases a full reinstatement of the limits may be possible, however, the premium required for the reinstatement would almost certainly be higher than the amount paid for the original placement of the insurance program. In other cases the additional premium may be so high that it may economically prohibit a full reinstatement of the limits or the capacity of the insurance market simply won't be available to achieve a full reinstatement in either case Kinder Morgan may choose instead to use other financial means to backstop the reduced amount of insurance available.

f.2) Please refer to Trans Mountain's response to NEB IR No. 2.002g.

g) If, as a condition of approval, Trans Mountain is required to provide financial assurance in the event of a spill of a specified dollar amount over the life of the Project then Trans Mountain expects it will use a layered approach to providing the financial assurance with the first layer being cash and/or accessible cash, the second layer being General/Excess Liability insurance coverage accessible by Trans Mountain through the Kinder Morgan

corporate insurance program and the third layer (and only to the extent required) being the provision of a parental guarantee. The sum of the three layers would be equal to or greater than the required financial assurance amount. If, due to a change in market conditions, the amount of General/Excess Liability insurance available declines resulting in the sum of the layers being below the required financial assurance threshold then the difference would be made up with an increase in one of the other financial assurance components. Trans Mountain commits that the sum of the three layers would provide financial assurance at an amount the Board deems appropriate as a condition of approval for the Project.

h) For the first thirty days of any loss period, Trans Mountain would absorb the costs directly. Subsequent to the initial thirty day period and for twelve months thereafter, Trans Mountain would have access to Business Interruption insurance through the Kinder Morgan property insurance program. This insurance provides reimbursement of lost profits and any expenses that continued during the loss period. Please also refer to Trans Mountain's response to NEB IR No. 1.09d.

i) It is possible that Trans Mountain could obtain a stand alone, third party insurance policy for the Trans Mountain pipeline, however, the amount of insurance Trans Mountain may be able to obtain on a stand-alone basis would likely be lower than what it has access to under the Kinder Morgan corporate program, conditions of coverage would likely be more narrow in scope and the premium payable to establish the stand alone policy would also likely be greater than what Trans Mountain is allocated as a participant in a corporate program. The specific amounts and associated premiums on a stand alone basis would have to be tested in the insurance market. A corporate insurance program such as Kinder Morgan's allows for the spreading of risk across a variety of operations and geographical locations whereas a stand alone program for a single entity provides limited opportunity to spread risk resulting in lower limit availability, narrower coverage conditions and generally higher premiums. Essentially, while it may be possible to establish a stand alone, third party insurance program Trans Mountain would lose the synergistic benefits of participating in a large corporate program. Trans Mountain is concerned that if the requirement for stand alone insurance for NEB regulated projects becomes standard practice that there will not be enough capacity available in the insurance market to accommodate all of the needs and/or the cost of obtaining insurance may become economically prohibitive.

In addition to the above, the Canadian market for insurance has a limited amount of capacity available to insure pipeline risks which would almost certainly result in Trans Mountain pursuing insurers that are not licensed in Canada.

2.003 Parental guarantee

Reference:

A3W9H8, Trans Mountain response to Board IR No. 1, IR 1.79c, PDF page 22 of 421

Preamble:

In the reference, Trans Mountain states that, to the extent that the Board determines as a condition that Trans Mountain should have a financial backstopping arrangement in place between Trans Mountain Pipeline ULC and its parent, Trans Mountain would accept an appropriate condition.

Request:

a) Please confirm that this would be a guarantee from Kinder Morgan Canada Company.

b) If a) is confirmed, please discuss whether or not Kinder Morgan Canada Company would provide a parental guarantee for all spill and pollution costs. Include details on whether or not Kinder Morgan Canada Company would ensure funds dedicated for this purpose would be isolated from day-to-day operating and capital accounts.

c) If a) is not confirmed, please discuss which corporate entity would provide the parental guarantee. Include details on whether or not this parental guarantee would be for all spill and pollutions costs and if funds dedicated for this purpose would be isolated from day- to-day operating and capital accounts.

d) Please provide a sample parental guarantee.

Response:

a) Not confirmed. The guarantee would be from Kinder Morgan Energy Partners, L.P., Trans Mountain's ultimate parent.

b) As noted in the response to a) above, the entity would be Kinder Morgan Energy Partners, L.P. Trans Mountain is of the view that the funds would not need to be segregated, as discussed in further detail in the response to NEB IR No. 2.003c.

c) If, as a condition of approval, a parental guarantee is required it would likely be provided by Kinder Morgan Energy Partners, L.P., Trans Mountain's ultimate parent, as the top layer of a financial assurance package and would cover spill and pollution costs which could not otherwise be provided for by Trans Mountain's accessible cash or through Trans Mountain's access to insurance. Trans Mountain does not expect that funds dedicated for this purpose would be isolated from day-to-day operating and capital accounts. Kinder Morgan Energy Partners, L.P., has access to significant sources of liquidity such that the requirement for a segregation of funds to support the guarantee would not be necessary or economically efficient.

d) Please refer to NEB IR No. 2.003d - Attachment 1.

Consultation

2.004 Consultation with landowners and potentially affected stakeholders no longer on the preferred or alternate pipeline corridors

Reference:

i) A3W9H8, Trans Mountain response to Board IR No. 1, IR 1.12, PDF
ii) pages 40 to 107 of 421 A3X2K8, Trans Mountain Response to Board IR No. 1 Clarification & Errata, Point 5 – Lougheed Highway, PDF page 2 of 3

Preamble:

References i) and ii) identify several proposed pipeline corridor deviations that have been revised or realigned from the previously proposed pipeline corridor. They also identify several alternate pipeline corridors that are no longer being considered as they do not currently meet Trans Mountain's routing objectives and criteria.

Request:

Please confirm whether or not all landowners and other potentially affected stakeholders no longer directly affected by the Project as a result of changes to the proposed or alternate routes have been notified of the route changes;

a) If confirmed, please provide the notification date(s) and method(s) (e.g., telephone, personal meeting, email, letter mail).

b) If no notification occurred, or if certain landowners and other potentially affected stakeholders were not notified, please provide an explanation for why notification was considered unnecessary.

Response:

a) As a result of changes to Trans Mountain's proposed or alternate pipeline corridors, Trans Mountain has commenced the process of identifying and notifying landowners who have lands that are no longer within the proposed pipeline corridor, and therefore no longer directly affected by the Project. Trans Mountain recognizes that until the Project receives approval for the detailed route authorized under Section 34 of the NEB Act, the TMEP alignment could change based on interventions, and directions or decisions by the NEB. Because of that uncertainty, Trans Mountain has delayed notifying these landowners. However, rather than wait until the route is certain and authorized under Section 34, Trans Mountain has began notifying those landowners whose lands are no longer directly affected by the proposed pipeline corridor. Notification will be completed by August 22, 2014 and details of the notification schedule, process, and methods of and will be provided to the NEB in a future update.

   With respect to potentially affected stakeholders no longer affected by the Project as a result of changes to the proposed or alternate routes, Trans Mountain began notifications utilizing the following methods:

Date	Method	Recipient
March 11, 2014	Mail drop to residents and landowners: Invitation to Community Routing Workshop in Hope, BC	Othello Road residents and landowners, and landowners no longer affected by the Project
March 14, 2014	Community Routing Workshop in Hope, BC	Othello Road residents and landowners, landowners no longer affected by the Project, Othello Road Neighbourhood Association, District of Hope, Fraser Valley Regional District
May 22, 2014	Email	City of Edmonton
May 22, 2014	Email	Strathcona County
May 26, 2014	Web Story in Trans Mountain Updates http://www.transmountain.com/updates/routing-optimization-updates	137 page views between May 26, 2014 – July 17, 2014 Average time spent on page was 6:02 mins
May 26, 2014	Updated the Interactive Maps on transmountain.com to reflect routes no longer under consideration http://application.transmountain.com/interactive-map	1,749 page views between May 26, 2014 – July 17, 2014 Average time spent on page was 3:55 mins
May 28, 2014	Email	Marcie Kroeker, key contact for 173rd Street area residents in Surrey
May 28, 2014	Email	City of Surrey
May 29, 2014	Story in Trans Mountain Today, weekly e-newsletter **GETTING TO THE ROUTE** **Learn More About Recent Routing Updates** Since filing our Application in December 2013, our work to optimize the proposed pipeline route has continued. As a result of stakeholder feedback and our ongoing studies and fieldwork, Trans Mountain has made some updates to routing and filed them with the NEB through the regulatory process. *See the map* illustrating the corridors no longer being considered and those still under consideration. *Learn more* about our routing process in this video.	Subscriber list – 1,500+ contacts, comprised of contacts from: Jobs Registry Procurement Database Shippers & Industry Partners TMEP & TMPL Suppliers Project Updates Subscribers
June 9, 2014	Email	City of Coquitlam
July 11, 2014	Email	City of Burnaby
July 11, 2014	Email	Township of Langley
July 16, 2014	Email	City of Chilliwack
July 16, 2014	Email	Fraser Valley Regional District

In addition, Trans Mountain will place notifications in the local community newspapers before August 22, 2014 in communities were stakeholders are no longer affected by the Project as a result of changes to the proposed or alternate routes.

b) Please refer to the response to part a), above.

Summary of New Commitments:

- Trans Mountain will provide notification in community newspapers before August 22, 2014.

2.005 Consultation with Crown tenure and disposition holders

Reference:

i) A3S0V2, Application Volume 3C, Landowner Relations, PDF page 26 of 103

A3S2J5, Application Volume 5D, Environmental and Socio-Economic Assessment – Socio-Economic Technical Reports, TR 5D-2 – Socio- Economic Technical Report:

ii) Table B-3 – Forest Grazing Licenses, Grazing Leases and Grazing Permits Crossed by the Proposed Pipeline Corridor in Alberta, PDF page 186 of 274
iii) Table B-4 – Range Tenures Crossed by the Proposed Pipeline Corridor in BC, PDF pages 187 and 188 of 274
iv) Table B-5 – Grazing Leases Crossed by the Proposed Pipeline Corridor in BC, PDF pages 188 to 190 of 274
v) Table B-8 – Commercial Recreation Use Areas in the Proposed Pipeline Corridor and Human Occupancy and Resource Use Local Study Area in Alberta, and Table B-10 – Commercial Recreation Tenures in the Proposed Pipeline Corridor and Human Occupancy and Resource Use Local Study Area in BC, PDF pages 192 and 194 of 274
vi) Table B-13 – Registered Trapping Areas Crossed by the Proposed Pipeline Corridor and Human Occupancy and Resource Use Local Study Area in Alberta. and Table B-16 – Registered Trapping Areas Crossed by the Proposed Pipeline Corridor and Human Occupancy and Resource Use Local Study Area in BC, PDF pages 199 and 211 of 274
vii) Table B-17 – Guide Outfitters Operating in the Corridor and Human Occupancy and Resource Use Local Study Area in BC, PDF page 212 of 274
viii) Tables B-19 – Active Mineral and Aggregate Tenures Crossed in the Proposed Pipeline Corridor and Human Occupancy and Resource Use Local Study Area of Alberta, and Table B-20 – Active Mineral Tenures in the Proposed Pipeline Corridor and Human Occupancy and Resource Use Local Study Area in BC, PDF pages 214 to 221 of 274

Preamble:

Reference i) states that a mail-out was conducted with select Crown tenure holders with interests crossed by the proposed pipeline corridor. The mail- out was not intended to meet regulatory requirements pertaining to landowner/occupant notification in advance of Project construction activities, but was to inform the issues-identification process. The

reference further states that, if the Project is approved, formal notification to all directly affected tenure and disposition holders will take place in advance of construction activity.

Reference ii) lists the forest grazing licenses, grazing leases, and grazing permits crossed by the proposed pipeline corridor in Alberta.

Reference iii) lists the range tenures crossed by the proposed pipeline corridor in British Columbia.

Reference iv) lists the grazing leases crossed by the proposed pipeline corridor in British Columbia.

Reference v) lists the commercial recreation tenures in the proposed pipeline corridor and human occupancy and resource use local study area in Alberta and British Columbia.

Reference vi) lists the guide outfitters operating in the corridor and human occupancy and resource use local study area in British Columbia.

Reference vii) lists the registered trapping areas crossed by the proposed pipeline corridor and human occupancy and resource use local study area in Alberta and British Columbia.

Reference viii) lists the active mineral and aggregate tenures crossed by the proposed pipeline corridor and human occupancy and resource use local study area in Alberta and British Columbia.

Request:

Please provide:

a) confirmation that Trans Mountain has provided notice of the Application filed with the Board to all potentially affected Crown tenure and disposition holders, including those identified in References ii) to viii);

b) the notification method(s) and date(s);

c) confirmation that notification included:
   c.1) a description of the Project, including the location, start and end points, route, and main components of the Project;
   c.2) information on how to raise outstanding Project-related concerns with the Board; and
   c.3) a copy of the Board's brochure Information for Proposed Pipeline or Power Line Projects, What You Need to Know;

d) [Trans Mountain has designated this Information Request as "NEB IR No. 2.005d" as it was the second usage of 2.5c in this Information Request list.]

   a detailed summary of all consultation activities undertaken with all potentially affected Crown tenure and disposition holders along the preferred pipeline or alternate route corridors, including a description of any issues and concerns raised and the steps Trans Mountain has taken or will take to address them, or, if it will not take steps to address any particular concerns, an explanation why; and

e) [Trans Mountain has designated this Information Request as "NEB IR No. 2.005e" as it was the second usage of 2.005d in this Information Request list.]

   if consultation activities have not been undertaken with the Crown tenure holders, please provide an explanation for why it was considered unnecessary.

Response:

a) As part of data collection on land ownership for the Trans Mountain Expansion Project (TMEP), Trans Mountain collected information on all landowners, private leases, Crown

rights holders, and any other interest holder that might have an interest affected by development of the Project. As part of this process, all Crown rights holders whose rights could potentially be affected by the Project were contacted to inform them of the Project and our proposed activities on the affected parcels. These Crown rights holders were also included in the mail-out of the Notice of Application to Participate completed for the Project in January 2014. For those Crown rights holders whose rights may be affected by the Project, Trans Mountain intends to obtain their consent as part of the National Energy Board and British Columbia Provincial land grant process.

Identification of owners and interest holders was completed for the proposed pipeline corridor which would encompass, and extend beyond, those lands that we believe would be directly impacted by the new pipeline and temporary workspace. During these contacts, interest holders were asked to provide survey consent to enable TMEP environmental and engineering crews to conduct the necessary surveys for the Project. At that time, Crown interest holders were also provided with the same information package provided to all Freehold/Private owners that included:

- Overall Project Map (dates of mapping may vary as revisions were issued)
- Field Program Description June 2012 Brochure
- Trans Mountain Project Update June 2012 Issue
- Trans Mountain Project Update September 2012 Issue
- Trans Mountain Project Update March 2013 Issue
- Trans Mountain Project Update August 2013 Issue
- Trans Mountain Project Update March 2014 Issue
- KM In Canada July 2012
- NEB Pipeline Regulations In Canada: A Guide For Landowners and the Public (Revised September 2010)
- NEB A Proposed Pipeline or Power Line Project, What you Need to Know
- TMEP Ruler

In Alberta, FMA (Forest Management Areas) will be notified as part of Trans Mountain's application for new PLAs. Trappers will be notified at that time, as well. Trappers and tenures such as Mineral Placers or Claims in BC will be notified as part of applications to the OGC. Applications to OGC will require confirmation that Trans Mountain has consulted with these groups and document any concerns or issues raised by affected tenures.

In addition to contacts by land agents, project representatives also facilitated a mail-out to several categories of tenure holders, including those that had not been contacted through

other means, to provide them with the opportunity to provide input into the socio-economic assessment of human occupancy and resource use. The mail out focused on:

- Agricultural tenure holders (*e.g.*, agricultural crown lease holders, agricultural crown grant holders, grazing license holders);
- Commercial recreation tenure holders and guide-outfitters; and
- Registered trapline tenure holders in key areas where contact had not been established.

Additional information on these contacts is contained within Volume 3C in the Application (Filing ID A3S0V2).

Contacts with crown right holders were made using a variety of methods including personal visits for grazing lease holders, agriculture lease holders and similar rights holders with land specific rights. For rights holders with more generalized rights, contact methods included letters, email, and telephone calls. Contacts with crown rights holders commenced at the same time as contacts with landowners in May 2012 and have continued to the present. These contacts are ongoing, and will continue through project development.

b) Please refer to the response to part a) above.

c) Confirmed. Please refer to the response to part a), above.

d) The crown rights holder line lists for Alberta (NEB IR No. 2.005d - Attachment 1) and British Columbia (NEB IR No. 2.005d – Attachment 2) provide details on the consultation activities with individual crown rights holders with land specific rights on crown properties within the proposed pipeline corridor. The line list includes comments and concerns obtained from each crown rights holder, where comments were provided. Where concerns were identified, or specific requests were made, the comments provided were incorporated into the information provided to engineering and environmental survey teams and Trans Mountain operations as appropriate for follow-up or incorporation into survey plans.

e) Please refer to the response to parts a) and d), above.

2.006 Consultation with federal, provincial, and municipal authorities

Reference:

A3S1R5, Application Volume 5B, Environmental and Socio-Economic Assessment – Socio-Economic, Tables 3.1-10 to 3.1-15, PDF pages 80 to 106 of 137

Preamble:

The reference provides summary tables of consultation activities with federal, provincial, and municipal authorities throughout the proposed pipeline corridor regarding socio-economic elements during the period from 1 June 2012 to 31 July 2013.

Request:

Please provide:

a) an update to the tables in the reference above that includes Trans Mountain's additional consultation activities with federal, provincial, and municipal authorities since 31 July 2013;

b) a summary of any issues and concerns that have been raised and the steps Trans Mountain has taken or will take to address these issues and concerns; and

c) if Trans Mountain will not take steps to address any particular concerns, an explanation why.

Response:

a) The tables noted in the preamble summarize the consultation conducted by specific socio-economic disciplines with federal, provincial, regional and municipal regulatory authorities in the course of conducting the socio-economic assessment filed in Volume 5B of the application. The noted socio-economic disciplines are: heritage resources; social and cultural well-being; human occupancy and resource use; infrastructure and services; navigation and navigation safety; employment and economy; forestry; agriculture; community health; and human health risk.

   Table 2.006A-1 (NEB IR No. 2.006a – Attachment 1) provides an update to Tables 3.1-10 to 3.1-15 of Volume 5B (Filing ID A3S1R5) by summarizing additional consultation activities conducted by or involving the noted socio-economic disciplines with federal, provincial and municipal authorities since July 31, 2013, related to finalizing the socio-economic assessment of the proposed pipeline and facilities, as well as that related to follow-up on assessment-specific questions outside of the National Energy Board (NEB) regulatory review process or on-going study components.

   Given the completion of the socio-economic assessment and given that Trans Mountain Expansion Project (Project) details pertinent to many aspects of the socio-economic assessment are subject to detailed engineering design and construction planning and have not evolved notably since filing the Application in December 2013, follow-up with many of authorities noted in Tables 3.1-10 to 3.1-15 of Volume 5B (Filing ID A3S1R5) has not been

required. All engagement events in the tables referenced in the preamble are considered complete.

Stakeholders noted in Tables 3.1-10 to 3.1-15 of Volume 5B (Filing ID A3S1R5) have been included in on-going Project updates (*e.g.*, email blasts, notifications of key Project milestones) and will continue to be included in Project updates going forward if, as per Canadian Anti-Spam Legislation (CASL), they have consented to receive on-going communication from Trans Mountain Pipeline ULC (Trans Mountain).

Trans Mountain has continued its broader Project engagement with municipal, provincial and federal authorities. Updates on, and future plans for, broader Project engagement are summarized in Consultation Update No. 1 & Errata (Filing ID A59343) and the forthcoming Consultation Update No. 2, which will be provided to the NEB in Q3 2014. Broader Project consultation events have continued which include Emergency Management Stakeholder Workshops, BC Parks Workshops, Routing Optimization Workshops and Open Houses, presentations to local Chambers of Commerce, as well as municipal-level meetings regarding community benefits initiatives, development of employment and training initiatives, and Project updates. As noted in the response to NEB IR No. 1.16 (Filing ID A3W9H8), Trans Mountain anticipates initiating Community Readiness Engagement in Q4 of 2014, which will focus on engaging local First Nations, community interest groups, economic development organizations, local governments, and municipal or provincial authorities in communities most closely linked to workforce hosting. This engagement, which is anticipated to extend through 2015 and into construction, should the Project be approved, will involve further consultation on socio-economic matters including: worker accommodation planning, worker integration and support, jobs and procurement opportunities, and opportunities related to workforce hosting.

b) Please refer to the response to NEB IR. No. 2.006a, in particular Table 2.006A-1 (NEB IR No. 2.006a – Attachment 1), which summarizes socio-economic issues and concerns raised. The mitigation that Trans Mountain has taken or will take to address each noted issue is found in the cross-referenced sections of the Facilities Application.

c) All noted issues are being addressed by Trans Mountain.

2.007 Consultation regarding marine commercial, recreational, and tourism use

Reference:

A3S4K4, Application Volume 8B, Marine Environmental and Socio- Economic Technical Reports, TR 8B-6 – Marine Commercial, Recreational and Tourism Use – Marine Transportation Technical Report, Table 2.1-1 – Summary of Consultation Activities Related to Marine Commercial, Recreational and Tourism Use, PDF pages 18 to 21 of 30

Preamble:

The reference provides a summary table of consultation activities with potentially affected stakeholder groups regarding marine commercial, recreational, and tourism use during the period from 25 September 2012 to 31 October 2013.

Request:

Please provide:

a) an update to the table in the reference above that includes Trans Mountain's additional consultation activities with potentially affected stakeholder groups since 31 October 2013;

b) a summary of any issues and concerns that have been raised and the steps Trans Mountain has taken or will take to address these issues and concerns; and

c) if Trans Mountain will not take steps to address any particular concerns, an explanation why

Response:

a) The table noted in the preamble summarizes the consultation conducted by the socio-economic discipline with regulatory authorities and other marine use organizations in the course of conducting the marine commercial, recreational and tourism use assessment in Volume 8B.

   Table 2.007A-1 (NEB IR No. 2.007a – Attachment 1) provides an update to Table 2.1-1 of Volume 8B (Filing ID A3S4K4) by summarizing additional consultation activities conducted by the socio-economic discipline since October 31, 2013 related to finalizing the marine commercial, recreational and tourism use assessment, as well as consultation followed-up directly on assessment-specific engagement.

   Given the completion of the marine transportation assessment and given details regarding Project-related marine vessels have not changed since filing in December 2013, discipline-specific follow-up with the stakeholders noted in Table 2.1-1 of Volume 8B has not been required. All engagement events in the table referenced in the preamble are considered complete.

   Stakeholders noted in Table 2.1-1 of Volume 8B have been included in on-going Project updates (*i.e.*, email blasts, notifications of key Project milestones) and will continue to be

included in Project updates going forward if, as per *Canadian Anti-Spam Legislation (CASL),* the stakeholders have consented to receive on-going communication from Trans Mountain.

Trans Mountain has continued its broader Project engagement with municipal, provincial and federal authorities and other stakeholders in relation to marine transportation. Updates on, and future plans for, broader Project engagement are summarized in Consultation Update No. 1 & Errata (Filing ID A59343) and the forthcoming Consultation Update No. 2, which will be provided to the NEB on August 1, 2014. Broader Project consultation events related to marine transportation include emergency management stakeholder workshops, environmental protection and marine fisheries offset workshops, routing and terminal updates, and community benefits as well as municipal-level meetings.

b) As noted in Table 2.007-1 of NEB IR No. 2.007a, there have been no new issues or concerns raised, regarding marine commercial, recreational, and tourism.

c) Please refer to the responses to parts a) and b) above.

2.008 Consultation with schools

Reference:

i) A3S1S4, Application Volume 5B, Environmental and Socio- Economic Assessment – Socio-Economic, PDF pages 76 and 77 of 175
ii) A3S1R5, Application Volume 5B, Environmental and Socio- Economic Assessment – Socio-Economic, PDF pages 68 and 69, 93, and 131 of 137
iii) A3S0R5, Application Volume 3A, Public Consultation, PDF pages 11, 21, 45, 48, 64, and 133 of 156

Preamble:

Reference i) lists four schools whose property is crossed by the proposed pipeline corridor. The reference also lists five schools that are close to, but not crossed by, the proposed pipeline corridor.

References ii) and iii) indicate concerns raised by interested stakeholders regarding proximity to schools. Trans Mountain states that it is open to working with individual schools or districts to fully support their safety efforts and ensure their emergency response plans and Trans Mountain's are coordinated.

Request:

a) Please provide a detailed summary of all consultation activities undertaken with the relevant administrations of schools listed in Reference i). This must include a description of any issues and concerns raised and the steps Trans Mountain has taken or will take to address them, or, if it will not take steps to address any particular concerns, an explanation why.

b) If consultation activities have not been undertaken with the administrations of schools listed in Reference i), please provide an explanation why it was considered unnecessary.

Response:

a) Trans Mountain is committed to respectful, transparent and collaborative interactions with communities. Trans Mountain has been engaging with communities along the pipeline and marine corridor since 2012 and the Project team will continue to engage, share updated project information and address concerns about the proposed Trans Mountain Expansion Project as they arise. Trans Mountain's engagement is ongoing.

   Since filing the Application in December 2013, Trans Mountain has continued to reach out to schools. Although not exclusively, Trans Mountain has focused the majority of its ongoing interactions with schools in the Lower Mainland/Fraser Valley region, where concerns regarding the routing of pipelines near schools have been most frequently raised.

   On February 20, 2013 at the request of School District 41 (Burnaby), Kinder Morgan and Trans Mountain Expansion Project team made a presentation to senior staff. The School District expressed an interest in an annual meeting to touch bases on topics of mutual interest.

Trans Mountain has met with the following School District to discuss access for survey and obtain consent:

- July 27, 2012, with School District No. 73 (Kamloops/Thompson) which includes Clearwater Secondary School, David Thompson Elementary School, Raft River Elementary School.
- October 10, 2012, with School District No. 33 (Chilliwack) which includes Watson Elementary School.
- November 20, 2012, with School District No. 33 (Chilliwack) which includes Vedder Middle School.

Details of these discussions and the Project information provided at each meeting are captured in Table 2.008A-1 in NEB IR No. 2.008a – Attachment 1.

As a result of interest in the Lower Mainland-Fraser Valley region and prior to the Application being filed, on April 22, 2013 Hugh Harden, Vice President of Operations and Engineering with Trans Mountain sent letters offering to meet with the following four School Boards: School District No. 43 (Coquitlam), School District No. 36 (Surrey), School District No. 35 (Langley) and School District No. 33 (Chilliwack). Following that communication, presentations were made to Coquitlam School District staff on May 29, 2013. Trans Mountain also met with the Watson School in Chilliwack on February 14, 2014. See Table 2.008A-1 in NEB IR No. 2.008a – Attachment 1 for a summary of engagement activities with schools.

Kinder Morgan Canada has had multiple discussions with School District 34 (Abbotsford) on a range of topics, as a result of an incident at Sumas Terminal in January 2012.

In addition Trans Mountain mailed the Project information described in Table 2.008A-1 in NEB IR No. 2.008a - Attachment 1 on August 13, 2013, to the Board of School Trustees of School District No. 73 (Kamloops/Thompson) and hand delivered Project information on August 22, 2013 to the Board of School Trustees of School District No. 41 (Burnaby).

Other schools listed in Volume 5B, section 5.5.5 which are crossed by or close to the proposed pipeline corridor where no issues have been identified to date, will be part of ongoing engagement. Trans Mountain will continue to reach out to schools offering presentations or meetings to discuss potential concerns.

b) Refer to the response to part a) above.

Summary of New Commitments:

- Trans Mountain will continue to reach out to schools offering presentations or meetings to discuss potential concerns.

Aboriginal matters

2.009 Consultation with schools

Reference:

i) A3V3L9, Consultation Update No. 1 & Errata for the Trans Mountain Expansion Project (March 2014), Part 3 – Aboriginal Engagement Update No. 1 – October 1 to December 31, 2013, PDF page 17 of 334 and Appendix A – Engagement Logs
ii) A3W9H8, Trans Mountain response to Board IR No. 1, IR 1.26, PDF page 165 of 421

Preamble:

Reference i) is an update on Trans Mountain's Aboriginal engagement, including a log of consultation activities up to 31 December 2013. Trans Mountain states that future filings will provide updates regarding its Aboriginal Engagement Program, including:

- Aboriginal interests and concerns raised;
- executed agreements;
- Project benefits provided, such as employment, training, procurement, and community investments;
- response and mitigation plans and strategies; and
- traditional land use, traditional marine use, and traditional ecological studies.

Reference ii) notes that Trans Mountain will file information from ongoing traditional land use, traditional marine use, and traditional ecological studies in Q3 2014.

Request:

Please provide an update on consultation activities with all Aboriginal groups from 1 January 2014 onward, including, but not limited to:

a) a summary of all consultation activities, including the date(s), and method(s) of contact;

b) a list of Aboriginal groups that Trans Mountain has executed agreements with;

c) a summary of all issues and concerns raised by Aboriginal groups during consultation activities;

d) requests or concerns that have been raised and how Trans Mountain has addressed or proposes to address them;

e) if Trans Mountain did not take steps to address any concerns or requests raised, an explanation why; and

f) an estimate of the date in Q3 2014 that Trans Mountain will file an update on traditional land use, traditional marine use, and traditional ecological studies

Response:

a) Trans Mountain will include a summary of all consultation activities between January 1, 2014 and April 30, 2014 in Part 7, Appendix A of Consultation Update #2, to be filed with the National Energy Board on August 1, 2014.

   Trans Mountain intends to file Consultation Update #3, including a summary of all consultation activities between May 1, 2014 and October 31, 2014 in Q4, 2014 or Q1, 2015.

b) Trans Mountain will include a list of the Aboriginal groups which executed agreements with Trans Mountain between January 1, 2014 and April 30, 2014 in Part 7 of Consultation Update #2, to be filed with the National Energy Board on August 1, 2014.

   Trans Mountain intends to file Consultation Update #3, including a list of the Aboriginal groups which executed agreements with Trans Mountain between May 1, 2014 and October 31, 2014 in Q4, 2014 or Q1, 2015.

c) Trans Mountain will include a summary of all issues and concerns raised by Aboriginal groups during consultation activities between January 1, 2014 and April 30, 2014 in Part 7 of Consultation Update #2, to be filed with the National Energy Board on August 1, 2014.

   Trans Mountain intends to file Consultation Update #3, including a summary of all issues and concerns raised by Aboriginal groups during consultation activities between May 1, 2014 and October 31, 2014 in Q4, 2014 or Q1, 2015.

d) Trans Mountain will include requests or concerns that have been raised and how Trans Mountain has addressed or proposes to address them during consultation activities between January 1, 2014 and April 30, 2014 in Part 7, Appendix A of Consultation Update #2, to be filed with the National Energy Board on August 1, 2014.

   Trans Mountain intends to file Consultation Update #3, including requests or concerns that have been raised and how Trans Mountain has addressed or proposes to address them during consultation activities between May 1, 2014 and October 31, 2014 in Q4, 2014 or Q1, 2015.

   Additionally, as included in NEB IR No. 2.010, under separate cover to the response to NEB IR No. 2, Trans Mountain has provided a supplemental Traditional Land and Resource Use (TLRU) Technical Report and a supplemental Traditional Marine and Resource Use (TMRU) Technical Report which provides further information about requests or concerns that have been raised and how Trans Mountain has addressed or proposes to address them.

e) Trans Mountain is committed to working with Aboriginal groups to address interests and concerns. This is an ongoing and iterative process that is part of the ongoing dialogue with Aboriginal groups. Through the Aboriginal Engagement Program, Trans Mountain will continue to address concerns and requests and interests raised.

f) As included in NEB IR No. 2.010, under separate cover to the response to NEB IR No. 2, Trans Mountain has provided a supplemental Traditional Land and Resource Use (TLRU)

Technical Report and a supplemental Traditional Marine and Resource Use (TMRU) Technical Report.

2.010 Update on the Marine Environmental and Socio-Economic Assessment

Reference:

i) A3S4Y3, Application, Volume 8A, Marine Transportation, PDF page 281 of 294
ii) A3W9H8,Trans Mountain response to Board IR No. 1, IR 1.26, PDF page 165 of 421

Preamble:

Reference i) states that Trans Mountain will provide an update to its Environmental and Socio-Economic Assessment to the Board in Q2 2014. Trans Mountain stated that updates would pertain to the environmental and socio-economic setting and the effects assessment, including any new mitigation and cumulative effects assessment based on additional Traditional Marine Resource Use (TMRU) study information collected, as well as consultation and engagement conducted, as necessary.

Reference ii) states that Trans Mountain will provide the Board with a supplemental report in Q3 2014 containing information collected regarding additional traditional use sites or features identified through ongoing traditional land use studies.

Request:

Please provide the timeframe when Trans Mountain will file an update to the environmental and socio-economic setting and effects assessment, including new mitigation and cumulative effects assessment based on additional TMRU study information.

Response:

Under separate cover with the responses to NEB IR No. 2, Trans Mountain provided a supplemental Traditional Land and Resource Use (TLRU) Technical Report and a supplemental Traditional Marine and Resource Use (TMRU) Technical Report.

The results of the supplemental TLRU and TMRU Technical Reports confirm the assessment of traditional uses provided in the Application. Any new site-specific mitigation measures identified in the supplemental TLRU and TMRU Technical Reports will be included in the Environmental Protection Plans (EPPs), which are to be filed with the NEB for approval in accordance with NEB draft condition #29 (Filing ID A3V8Z8) and on the Environmental Alignment Sheets.

Trans Mountain will not be submitting an updated environmental and socio-economic assessment (ESA), as the results of the supplemental TLRU and TMRU Technical Reports confirm the conclusions reached in the ESA submitted in December 2013.

Socio-economic

2.011 Salvageable timber

Reference:

i) A3S0U6, Application Volume 3B, Aboriginal Engagement, Appendix A – Engagement Logs
ii) A3S1L3, Application, Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, Table 3.2-2 - Summary of Interests or Concerns Identified through Engagement Activities with Aboriginal Communities for the Project, PDF page 135 of 150

A3S2S3, Application Volume 6B, Pipeline Environmental Protection Plan:

iii) Table 8.1-1 – Timber Salvage Requirements – Alberta, and Table 8.1-2 – Timber Salvage Requirements - BC, PDF pages 74 and 75 of 461
iv) Appendix C – Management Plans, Timber Salvage Management Plan, PDF page 267 of 461
v) NEB Filing Manual, Table A-5 – Filing Requirements for Socio- Economic Elements

Preamble:

In Reference i), harvesting salvageable timber is identified as an unresolved concern or a request requiring follow-up.

In Reference ii), Trans Mountain states that timber harvesting and/or land clearing and debris disposal activities will be coordinated through provincial legislation or agreements.

Reference iii) states that a Timber Salvage Management Plan is to be prepared by the salvage contractor prior to commencing cleaning operations.

Reference iv) is a place-holder in the Application for the Timber Salvage Management Plan to be developed prior to construction.

The NEB Filing Manual (Reference v)) provides filing guidance concerning human occupancy and resource use.

Request:

Please provide the following regarding salvageable timber concerns raised by Aboriginal groups:

a) how opportunities to salvage timber will be made available;

b) how Trans Mountain will communicate the opportunities in a);

c) a summary of requests or concerns that have been raised and how Trans Mountain has addressed or proposes to address them; and

d) if Trans Mountain did not take steps to address any concerns or requests raised, please explain why.

Response:

a) Prior to clearing work commencing, a scope of work will be drafted for clearing activities, including the Timber Salvage Management Plan. A Request for Proposal will be issued to interested Aboriginal groups. Proposal evaluations and awards will be in accordance with the Aboriginal Procurement Policy, Volume 3B Appendix G (NEB ID A3S0V1, page 35-36) which provides for flexibility through either limited competitive bid or direct award. Through ongoing consultation with Aboriginal groups, Trans Mountain is seeking feedback on interest and capacity, including clearing and timber harvest, and is encouraging aboriginal contractors or joint venture partnerships to register on the TMEP procurement registry as an initial step in identifying prospective contractors.

In areas where no Aboriginal interest has been noted, proposals will be requested from Aboriginal, local and regional contractors in accordance with the Project specific Procurement Policy. All work may be either directly contracted through Trans Mountain or as a sub-contractor through a General Contractor.

b) Opportunities will be communicated with Aboriginal groups through procurement workshops, one on one meetings and through a Request for Proposal process in accordance with the Project-specific Procurement Policy and the Aboriginal Procurement policy.

The schedule and agenda for upcoming Aboriginal Procurement workshops are as follows:

Procurement Workshop Schedule

Dates and Locations:

Date	Location
July 22, 2014	Edmonton
July 23, 2014	Chilliwack
July 29, 2014	Kamloops
July 30, 2014	Merritt
July 31, 2014	Burnaby
September, 2014 - TBC	Vancouver area - TBC

Procurement Workshop Agenda

8:00 a.m. Registration and Continental Breakfast

9:00 a.m. Introduction and Opening Remarks

9:20 a.m. Pipeline and Facility Construction
- Project Overview
- Project Status
- Pipeline
- Facilities

9:45 a.m. Procurement
- Construction and Procurement Schedule
- Contracting, Sub-contracting and Material Supply Opportunities
- Procurement Policy
- Contractor Requirements
- Capacity and Capability
- Registering Your Business
- Contractor Data Base
- Contractor Selection

10:15 a.m. Contracting and Safety

10:30 a.m. Coffee Break

10:45 a.m. Employment Opportunities
- Skills Inventory – Community
- Training Resources

12:00 p.m. Lunch

1:00-4 p.m. One-on-One meetings

c) The attached summary of requests or concerns raised by Aboriginal groups regarding salvageable timber have been extracted from the Aboriginal Engagement log filed with the Facility Application, Consultation Update No. 1 and Consultation Update No. 2 (NEB IR No. 2.011c – Attachment 1).

The common interest of the concerns raised are specific to economic opportunities associated with timber salvage as part of the clearing of the right-of-way and temporary workspace. Trans Mountain is aware of the stated interests and will address them through pursuing opportunities with the Aboriginal groups in accordance with the process described in NEB IR No. 2.011a, 2.011b and 2.011d.

All Aboriginal Groups that expressed an interest or concern will be included in the scheduled procurement workshops referenced in NEB IR No. 2.011b and contacted individually prior to June 30, 2015 to discuss opportunities specific to Salvageable Timber in their territory.

d) Trans Mountain is taking steps to address the concerns and requests specific to salvageable timber. As indicated in the response to NEB IR No. 2.011c, concerns or requests have been noted and will be addressed through scheduled Procurement workshops with Aboriginal groups and one-on-one meetings. Aboriginal group contracting companies have been identified and documented in the Trans Mountain Procurement database, and this identification process will continue through to the issue of Request for Proposals.

Summary of New Commitments:

- All Aboriginal Groups that expressed an interest or concern will be contacted prior to June 30, 2015 to discuss how an opportunity could be developed for Salvageable Timber in their territory.

2.012 Lighting at the Westridge Marine Terminal during operations

Reference:

i) A3S1S9, Application Volume 5B, Environmental and Socio- Economic Assessment – Socio-Economic, PDF page 26 of 109
ii) A3S2S9, Application Volume 6D, Westridge Marine Terminal Environmental Protection Plan, PDF page 40 of 165

Preamble:

Reference i) states that the expanded docks at the Westridge Marine Terminal will be lit throughout the night after completion, for navigation safety, and this may contribute to increased nuisance light disturbance for land-based residents and marine users. The reference further states that lighting will be directional to reduce nuisance lighting.

Reference ii) states that Trans Mountain will design lighting requirements at the Westridge Marine Terminal to meet the Canada Occupational Health and Safety Regulations and the International Ship and Port Facility Security Code (for compliance) for worker safety and terminal security during construction, while minimizing environmental and socio- economic effects.

Request:

Please provide:

a) a summary of any applicable (municipal, provincial, federal, or other) regulations, guidelines, or policies that Trans Mountain will comply with in order to limit the amount of obtrusive light being emitted at the Westridge Marine Terminal and to reduce nuisance light disturbance for land-based residents and marine users; or

b) an explanation why Trans Mountain will not comply with any applicable regulations, guidelines, or policies.

Response:

a) As noted in the preamble, Trans Mountain will design lighting at Westridge Marine Terminal (WMT) to meet the Canada Occupational Health and Safety Regulations and the International Ship and Port Facility Security Code (for compliance), for worker safety and terminal security during construction. Trans Mountain did not identify any City of Burnaby by-laws related to nuisance light disturbance of an industrial use area (the only City of Burnaby requirement identified on lighting relates to an off-street loading and parking area). Port Metro Vancouver (PMV) does not have specific lighting regulations or policies but typically requires proponents, as part of its permitting process, to provide a lighting design stamped by a qualified engineer indicating that best practices are adhered to in order to eliminate and minimize lighting pollution (Natland pers. comm.). As noted in the response to Belcarra IR No. 1.8, Trans Mountain will conduct an area lighting study when the detailed design of WMT has progressed to the point where lighting can be selected. While the purpose of area lighting is operational safety, impact to the surrounding communities will be

given due consideration. The results will be used to inform the locations and types of lighting selected. Trans Mountain will apply industry best practices in the selection of lighting types and fixtures at WMT that minimize extraneous light pollution, including the use of LED (light-emitting diode) technology. This will help achieve a fully Dark Sky compliant installation, with photometric qualities meeting or exceeding recommended qualities of the Illuminating Engineers Society (IES) and Occupational Health and Safety requirements per Labour Canada.

Reference:

Natland, J. Manager, Development Strategies. Port Metro Vancouver. Vancouver, British Columbia.

b) Refer to the response to NEB IR No. 2.012a.

Summary of New Commitments:

- Trans Mountain will apply industry best practices in the selection of lighting types and fixtures at WMT that minimize extraneous light pollution, including the use of LED (light-emitting diode) technology.

2.013 Disruption to rail traffic on CN Rail bridge at Second Narrows

Reference:

A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 178 of 294

Preamble:

The reference states that the operator of the CN Rail bridge at Second Narrows is expected to make the bridge available to marine traffic with the lift span elevated within 30 minutes prior to the estimated time of arrival of a marine vessel. The reference further states that increased Project- related marine vessel traffic in the Second Narrows will cause an increase in the number of bridge lift span elevations, which may cause delays for freight trains using the bridge.

Request:

Please provide:

a) Please provide a detailed summary of all consultation activities undertaken with CN Rail regarding the bridge at Second Narrows. This must include a description of any issues and concerns raised and the steps Trans Mountain has taken or will take to address them, or, if it will not take steps to address any particular concerns, an explanation why.

b) If consultation activities have not been undertaken with CN Rail, please provide an explanation why it was considered unnecessary.

Response:

a) Trans Mountain Pipeline ULC (Trans Mountain) has been engaging with CN Rail (CN) since early 2013 on the Project and has provided information about the anticipated increase in tanker traffic volume through the Second Narrows of Burrard Inlet as a result of the proposed expansion.

   CN has provided Trans Mountain with information regarding bridge lifts and rail car movements over the rail bridge.

   See Table 2.013A-1 (NEB IR No. 2.013a - Attachment 1) for details of the consultation undertaken to date with CN regarding the rail bridge, as well as the issues raised and Trans Mountain's response.

   As indicated in Table 4.3.11.2 in Volume 8A (Filing ID A3S4Y3), Trans Mountain will continue to remain in contact with CN and provide Project-related information in order for CN and Port Metro Vancouver to coordinate efforts towards efficient management of any effect from increase in marine traffic as a result of the Project.

b) Please refer to the response to NEB IR No. 2.013a.

2.014 Disruption to Merritt Airport (Saunders Field)

Reference:

A3S1S7, Application Volume 5B, Environmental and Socio-Economic Assessment – Socio-Economic, PDF pages 133 and 134 of 245

Preamble:

The reference states that the proposed pipeline corridor crosses the edge of the Merritt Airport (Saunders Field) runaway and that physical disturbance during pipeline construction could restrict the ability for flights to take off. It could also cause a disruption of services to those businesses and services tied to airport operations. The reference further states that Trans Mountain will work with the airport owner to coordinate construction activity around periods of airport use.

Request:

a) Please provide a detailed summary of all consultation activities undertaken with the owner of the Merritt Airport. This summary must include a description of any issues and concerns raised and the steps Trans Mountain has taken or will take to address them, or, if it will not take steps to address any particular concerns, an explanation why.

b) If consultation activities have not been undertaken with the owner of the Merritt Airport, please provide an explanation why it was considered unnecessary.

Response:

a) A summary of initial consultation activities undertaken with the City of Merritt, owner of Merritt Airport (Saunders Field), is available in NEB IR No. 2.014a - Attachment 1.

   The preamble refers to a section of the Socio-Economic Effects Assessment reviewing Physical Disturbance to Airports. As routing and engineering design have evolved, Trans Mountain has identified potential impacts to Kamloops Airport (Fulton Field) and Blue River Airport not previously discussed in the referenced section of the Application. This response to NEB IR No. 2.014a has been expanded to include a detailed summary of all consultation activities undertaken with the owners and operators of the Kamloops and Blue River airports, in addition to the Merritt Airport as requested.

   A description of the physical disturbance to airport lands in Kamloops and Blue River will be completed and filed with the NEB as detailed design and engineering planning progress.

   Consultation activities undertaken with the owners of the Kamloops Airport (Fulton Field) and the Blue River Airport are also reported in NEB IR No. 2.014a - Attachment 1. Although runways in these locations are not directly impacted by construction or the proposed pipeline corridor, preliminary assessment has revealed that there may be potential construction impacts to airport access or operations.

The Kamloops Airport is a public facility, owned and operated by the Kamloops Airport Authority Society. The Blue River Airport is a public facility operated by Mike Wiegele Helicopter Skiing (Cariboo Helicopter Skiing (88) Ltd).

Additional information about potential impacts to airports will be identified during the detailed design and engineering phase of the Project. Consultation with owners and operators of Merritt, Kamloops and Blue River airports will be included as part of Community Readiness Engagement in Q4 of 2014 described in NEB IR No. 1.16 (Filing ID A3W9H8 Page 121 to 125 of 421 pages) and will continue throughout the Project planning and potential construction phases as more information becomes available.

b) Please refer to the response to NEB IR No. 2.014a and NEB IR 2.014a - Attachment 1.

Summary of New Commitments:

- A description of the physical disturbance to airport lands in Kamloops and Blue River will be completed and filed with the NEB as detailed design and engineering planning progress.
- Consultation with owners and operators of Merritt, Kamloops and Blue River airports will be included as part of Community Readiness Engagement in Q4 of 2014 described in NEB IR No. 1.16 (Filing ID A3W9H8 Page 121 to 125 of 421 pages) and will continue throughout the Project planning and potential construction phases as more information becomes available.

Lands

2.015 Final site selection for Black Pines Pump Station

Reference:

A3S0R0, Application Volume 2, Project Overview, Economics and General Information, PDF page 34 of 43

Preamble:

The reference states that Trans Mountain has investigated the availability of three possible site locations for the new Black Pines Pump Station on freehold lands located approximately 28 kilometres north of the city of Kamloops, British Columbia. The reference further states that final site selection has not been completed and negotiations for land acquisition have not concluded.

Request:

a) Please provide an update on the location selection for the new Black Pines Pump Station, including the status of Trans Mountain's negotiations or acquisitions of lands.

b) If the final site selection has been completed, please provide a description of any issues and concerns raised with respect to the selected site and the steps Trans Mountain has taken or will take to address them, or, if it will not take steps to address any particular concerns, an explanation why.

c) If the final site selection has not been completed, please indicate when it will be.

Response:

a) Trans Mountain has identified a proposed location for Black Pines Pump Station and has had preliminary discussions with the landowner. No land negotiations have occurred and no agreement is in place for the proposed site. Prior to any agreement, Trans Mountain will provide a notice to the landowner in compliance with the NEB Act, Section 87.1.

b) As indicated in the response to NEB IR No. 2.015a, preliminary discussions have been held with the landowner. Discussion topics have included land requirements, pump station siting, timing, and compensation principles. No specific issues have been raised by the landowner. Trans Mountain anticipates that further discussions will lead to a voluntary sale and purchase of the site and that should any specific issues be raised by the owner, they will be addressed through the negotiation process.

c) Refer to the response to NEB IR No. 2.015a.

2.016 Third party crossings

Reference:

A3S1S4, Application Volume 5B, Environmental and Socio-Economic Assessment – Socio-Economic, PDF page 58 of 175

Preamble:

The reference states that there are numerous pipeline and subsurface linear rights-of-way in areas along the proposed pipeline corridor and, depending on right-of-way finalization, there may be multiple right-of-way or easement crossings for which their use will need to be negotiated for the Project. The reference further states that an inventory of potential subsurface linear infrastructure crossings will be developed for land-access and acquisition purposes upon right-of-way finalization. At that time, Trans Mountain will engage in a notification and consultation process with stakeholders to ensure appropriate and mutually agreeable crossing and use agreements are in place.

Request:

Please provide confirmation that all necessary third party crossing agreements will be obtained prior to construction.

Response:

Trans Mountain confirms that all necessary third party crossing agreements will be obtained prior to construction.

2.017 Applied-for route and alternate routes

Reference:

i) A3S0R0, Application Volume 2, Project Overview, Economics and
ii) General Information, PDF page 20 of 43 A3W9L7 to A3W9Q8, Response to Board IR No. 1, IR 1.84a, Attachments 1 to 12 of 12

A3W9H8, Response to Board IR No. 1:

iii) IR 1.40, Table 1.40A-1 – Alternative Route Deviations from the Proposed Pipeline Corridor, PDF pages 239 to 245 of 421
iv) IR 1.12b, PDF page 108 of 421

Preamble:

Reference i) indicates that Trans Mountain decided to study and apply for a corridor of generally 150 metres in width along the entire length of the pipeline.

Reference ii) illustrates, in pink, the proposed revised pipeline corridor being considered by Trans Mountain and, in orange, all proposed alternative pipeline corridors.

Reference iii) lists all alternative route deviations from the previously proposed pipeline corridor and the revised proposed pipeline corridor that are currently being considered by Trans Mountain.

Reference iv) states that Trans Mountain commits to providing more details on the routing optimization in Q3 2014.

Request:

a) Please confirm whether or not Trans Mountain is still applying for a corridor of generally 150 metres in width along the entire length of the pipeline;

b) Please confirm whether or not the proposed revised pipeline corridor illustrated in pink in Reference ii), with revisions and realignments described in Reference iii), is indeed the corridor for which Trans Mountain is requesting approval;

c) Please provide specifics as to when Trans Mountain will submit its proposed preferred corridor to the Board if a finalized preferred corridor has not been decided on;

d) Please confirm that, when the preferred corridor has been finalized, Trans Mountain will file with the Board:
   d.1) a summary of the preferred corridor that is being applied for that clearly identifies and describes its location, form, and width(s), including a map at an appropriate scale that clearly depicts the form and dimensions of this preferred corridor;
   d.2) rationale and justification for the width(s) of the preferred corridor being applied for;
   d.3) a percentage breakdown of the geographic distribution of Crown land and private land, by reference kilometre, for the entire preferred corridor being applied for; and

d.4) updated alignment sheets, should the distributions and locations of Crown and private lands for the preferred corridor described above are different from those depicted in the environmental alignment sheets already filed; and

e) Please clarify to whether Trans Mountain will be requesting approval of any alternate pipeline corridors. If so, provide details as to the specific timing when such a request will be made. Please also confirm that, when the alternate pipeline corridors have been finalized, Trans Mountain will file with the Board:
   e.1) all information contained in d.1) to d.4) as it pertains to the alternate pipeline corridors; and
   e.2) a detailed evaluation from an environmental and socio- economic perspective of the circumstances under which Trans Mountain would propose to construct the pipeline using each alternate rather than the preferred pipeline corridor.

Response:

a) Confirmed. Generally in rural areas Trans Mountain is applying for a corridor 150 m in width and in urban areas 60 m in width.

   In rural areas some locations have a narrower corridor where existing linear infrastructure (including TMPL) and physical features limit the width available. In urban areas some locations are narrower where there is no possibility of additional work space or the pipeline has to locate in or near an existing easement. Some locations are wider where the corridor is on one parcel of land and the Project will review with the landowner his preference for pipeline centreline location.

b) The proposed revised corridor shown in pink in Reference ii) with revisions and realignments described in Reference iii) defines the corridor for which Trans Mountain is requesting approval. Subsequently some corridor adjustments have been reviewed and will be proposed in a subsequent filing. These are referred to and conceptually described in the pending Technical Update No.1 to be submitted August 1, 2014.

c) Trans Mountain anticipates the finalized preferred corridor to be submitted to the Board by August 22, 2014.

d) Trans Mountain confirms that after the proposed corridor has been finalized, the following information will be submitted to NEB:

   d.1) a summary of the preferred corridor that is being applied for that clearly identifies and describes its location, form, and width(s), including a map at an appropriate scale that clearly depicts the form and dimensions of this preferred corridor;

   d.2) rationale and justification for the width(s) of the preferred corridor being applied for;

   d.3) a percentage breakdown of the geographic distribution of Crown land and private land, by reference kilometre, for the entire preferred corridor being applied for; and

   d.4) the revised environmental alignment sheets will be filed with the NEB 90 days before the commencement of construction should the distributions and locations of Crown

and private lands for the preferred corridor described above be different from those depicted in the environmental alignment sheets already filed.

e) Trans Mountain will be requesting approval of a limited number of alternate pipeline corridors. In some cases the alternate corridors will be applied for as a contingency where the primary stream crossing method is identified as a Horizontal Direction Drill (HDD) and the alternative is a conventional installation method requiring a separate corridor for technical reasons. In other cases the alternate corridor is specific to specialized land use areas such as Provincial Parks and First Nations Reserve Lands, where the final routing decision is subject to agreement outside of the NEB regulatory jurisdiction. The following table, Table 2.017E-1, provides a listing of the alternate corridors for which Trans Mountain will be seeking approval.

TABLE 2.017E-1

ALTERNATE PIPELINE CORRIDORS

Proposed Alternate Corridors	Rationale for Applying for Alternate Corridor	Timing of Trans Mountains Decision	Applying to NEB for Proposed and Alternate Corridor
River Crossing Contingencies 1. Pembina River 2. Raft River	In the event of a potential failure of the proposed HDD installation, an alternate is required at separate locations to meet the technical requirements of conventional installation methods	Based on detailed engineering and construction planning and construction schedule. Timing will not be known until execution of the HDD stream crossing.	Yes
BC Provincial Parks 1. Finn Creek 2. North Thompson 3. Lac du Bois	Subject to the approval and subsequent approval of the Stage II Boundary Amendment application to BC Parks and a legislated Boundary Amendment through the BC Government. In the event the Boundary Amendment is not approved, an alternate corridor is required outside of the Park boundaries	Based on decision from BC Parks and BC Provincial Government Legislative amendment; application to be submitted August 2014	Yes
Indian Reserves 1. Zoht 5 2. Zoht 4 3. Joeyaska 2 4. Coldwater 1 5. Ohamil 1 6. Grass 15 7. Popkum 2 8. Tzeachten 13	Subject to the acceptance or agreement by the applicable First Nations group(s) for authorization to access their reserve lands, proposed alternate corridors are required to either 1. traverse the Indian Reserve, or 2. route around the reserve lands; the proposed corridor currently traverses the reserve lands where consultation has provided positive indication of routing on reserve	Based on obtaining authorization or agreements allowing access to reserve lands	Yes

When the alternate pipeline corridors have been finalized, Trans Mountain will file with the Board:

e.1) all information contained in NEB IR No. 2.017d.1 to 2.017d.4 as it pertains to the alternate pipeline corridors; and

e.2) Please refer to the response to NEB IR No. 2.035.

2.018 Route through Matsqui Main Indian Reserve No. 2

Reference:

A3W9H8, Response to Board IR No. 1:

i) IR 1.12a, PDF page 90 of 421
ii) IR 1.40, Table 1.40A-1 – Alternative Route Deviations from the Proposed Pipeline Corridor, PDF page 244 of 421
iii) A3W9Q7, Response to Board IR No. 1, IR 1.84a, Attachment 11, PDF page 4 of 5

Preamble:

Reference i) and ii) state that Trans Mountain has realigned the previously proposed pipeline corridor to the south and west to bypass the Matsqui Main Indian Reserve No. 2 and developments on lands within the previously proposed pipeline corridor.

Reference ii) illustrates the proposed revised pipeline corridor being considered by Trans Mountain. It appears to the Board that a route through the Matsqui Main Indian Reserve No. 2 is no longer being considered.

Request:

Please provide confirmation that a preferred or alternate route through the Matsqui Main Indian Reserve No. 2 is no longer being considered.

Response:

Trans Mountain confirms that at the present time TMEP is no longer considering a preferred or alternate corridor through the Matsqui Main Indian Reserve No. 2. Trans Mountain continues to engage with the Matsqui First Nation, and routing of the proposed pipeline will be the subject of future discussion. Any amendment to the routing will be filed immediately should it be necessary.

Environment

2.019 Construction greenhouse gas (GHG) emissions

Reference:

i) A3W9H8, Trans Mountain response to Board IR No. 1, IR 1.32, PDF pages 186 and 193 of 421
ii) A3S1U0, Application Volume 5C, Biophysical Technical Reports, TR 5C-4 – Air Quality and Greenhouse Gas Technical Report, PDF page 83 of 105

Preamble:

Reference i) states that the largest source of GHGs during construction will be from land clearing (removal and burning of vegetative waste, site preparation, and/or transportation of vegetative waste) along the pipeline right-of-way and at facility locations, such as terminals and pump stations.

Reference i) further states that construction-related emissions are not reportable to any federal or provincial GHG reporting or reduction programs.

Reference ii) states that, in the absence of any information about potential re-foresting and any planned salvage logging or harvesting during Project construction, it is conservatively assumed that all the biomass content of the cleared lands will be burnt.

Reference ii) further states that no information was provided regarding land-clearing activities for pump station construction, tank installation, and the Westridge Marine Terminal expansion and that therefore, the corresponding emissions were not estimated.

The Board requests a more accurate estimate of the construction GHG emissions and a plan to offset these emissions.

Request:

a) Please provide a revised and a more accurate estimate of the construction GHG emissions, including:
   a.1) emissions from land clearing activities at pumps stations, tank installations, and terminals;
   a.2) a discussion of the potential net reduction of construction- related GHG emissions due to revegetation/reforestation of temporary work space and of the appropriateness of including any such reduction in the calculation of construction GHG emissions; and
   a.3) a discussion of all potential uses or disposal methods for vegetative waste (such as mulching and combustion), a comparison of the estimated GHG emissions from each, an estimate of the extent to which each will be used, and how these different methods have been incorporated into the calculation of construction GHG emissions.

b) If the net construction GHG emissions are estimated to be more than 50,000 tonnes per year for one or more of the years anticipated for construction, please provide an offset plan for these emissions.

Response:

a.1) Construction greenhouse gas (GHG) emissions from land clearing activities at pump stations, tank installations, and storage terminals are conservatively estimated to total 23,955 tonnes of carbon dioxide equivalent (CO_{2e}). Relative to the construction GHG estimates provided in Section 6.1 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013; Filing ID A3S1U1), this revised total is much smaller, which reflects a better understanding of the amount of land to be cleared in support of the Project. Details are provided below.

To accommodate expansion activities, the Project will include:

- adding 12 new pump stations, 10 at existing pump station sites and 2 at a new common pump station site at Black Pines;
- reactivating the existing pump station at Niton, AB;
- re-connecting the existing Jasper Pump Station;
- adding one new pump unit at Sumas Pump Station;
- adding 20 new storage tanks, 5 at Edmonton Terminal, 1 at Sumas Terminal, and 14 at Burnaby Terminal; and
- constructing one new dock complex at the Westridge Marine Terminal.

Of the 15 pump station locations which will have modifications (additional pump stations, relocations, reactivations or new sites) nine are located on currently disturbed industrial lands. For these facilities, no disturbance of previously undisturbed lands is proposed and all activities are confined to the existing station boundaries. This includes the following pump station locations: Edmonton, Niton, Wolf, Edson, and Jasper in Alberta; and Blue River, Blackpool, Kamloops, and Sumas in British Columbia.

The Project includes six pump station locations that will require clearing of previously undisturbed land (Gainford, Hinton, Black Pines, Kingsvale, Rearguard and Sumas). The Gainford, Sumas, Rearguard, Kingsvale and Hinton pump stations will require minimal clearing of existing trees and are located adjacent to several other disturbances such as roads and existing rights-of-way. Therefore, activities at these pump stations are not expected to have a notable effect on vegetation. The Kingsvale power line and the Black Pines Pump Station and associated power line will require substantial clearing, and therefore, have the potential to affect vegetation (from Section 7.4.9.1 of Volume 5A; Filing ID A3S1Q9). Table B-1 of Volume 6C, Facilities Environmental Protection Plan (Filing ID A3S2S6) lists the technical details of the pump station activities including the current land use and land acquisition requirements. Existing access will be utilized for all pump

stations with the exception of Black Pines, which will require construction of a permanent 5 m wide gravel access road approximately 25 m in length, subject to final site selection and detailed engineering and design. Conservatively assuming the entire area to be acquired must be cleared and applying the provincial biomass density averages 38.45 tonnes of biomass per hectare for Alberta and 84.5 tonnes of biomass per hectare for British Columbia (from Appendix A.2 of Technical Report 5C-4; Filing ID A3S1U3) results in the total GHG emissions from land clearing at these six locations of 23,955 tonnes of CO_{2e}. Approximately 90% of these total emissions are associated with land clearing for the Kingsvale power line.

The addition of new storage tanks at Edmonton and Sumas terminals will be conducted within the existing disturbed fenced area. For these two terminals, no disturbance of previously undisturbed lands is proposed. The proposed activities are within the existing Burnaby Terminal property boundary on previously disturbed industrial lands with some vegetation. Any vegetation removed from the Burnaby Terminal will be mulched in place or slash will be shipped/hauled to an approved disposal location (Section 7.2.4.4 of Volume 5A; Filing ID A3S1Q9).

Construction activities at the Westridge Marine Terminal include the construction of one new dock complex with a total of three Aframax-capable berth faces and a utility dock at the Westridge Marine Terminal. No native vegetation is anticipated to be disturbed by the construction at the Westridge Marine Terminal and no land-clearing is required.

a.2) In the calculation of total construction GHG emissions from land clearing in response to NEB IR No. 2.19a1, it was assumed that there will be no net GHG emissions reductions. On the other hand, it was assumed that all GHG emissions associated with land clearing of temporary workspace will be reduced to zero over the lifetime of the Project and therefore, were not included in the totals reported in Section 6.1.1 of Technical Report 5C-4 in Volume 5C (Filing ID A3S1U1). The following provides the rationale:

GHG emissions from land clearing are largely from carbon released by trees, which, because of their large mass, account for most of the lost biomass. This lost biomass cannot be replaced on land surfaces that remain managed by Trans Mountain during operations, such as the pipeline easement, and access to facilities, pipeline, power lines, and permanent access roads.

On the other hand, it was assumed that temporary workspaces, in particular areas disturbed for pipeline construction, and temporary facilities such as construction camps and temporary access roads, can be restored such that all associated GHG emissions are offset by appropriate reclamation efforts on the same land. There are two aspects to support this assumption: a high-level discussion of the science of forest carbon stock changes; and the establishment of a framework to ensure that the appropriate reclamation efforts are implemented.

The guidelines for national GHG inventories by the International Panel on Climate Change (IPCC 2006) provide scientific information on the carbon stock balance for land-use

disturbances of forest land. According to equation 2.3 in IPCC (2006), carbon stock changes are comprised of changes in the following carbon pools:

- above- and below-ground biomass;
- deadwood;
- litter;
- soils; and
- harvested wood products.

The goal is to achieve zero (or positive) carbon stock changes over the decades following the land disturbance (gain-loss method, equation 2.4). The individual carbon pools are discussed in the following paragraphs.

As a first-order estimate (Tier-1), it is assumed that below-ground biomass is a fixed fraction of above-ground biomass. The latter is a good approximation if re-established vegetation is similar to previous vegetation. Forest land that is re-established with native and non-native trees similar to pre-construction conditions can be assumed to build up similar amounts of deadwood and litter over time. Therefore, carbon stock changes in deadwood and litter will be negligible in those areas.

Carbon stock in soil changes slowly; for example, a typical transition period of 20 years is recommended in IPCC (2006) for transition to forest soils. If the disturbance period is short or previous soil characteristics are re-established during reclamation, it can be assumed that net carbon stock changes in the soil are negligible. If it is conservatively assumed that none of the timber is turned into harvested wood products, then the change in the carbon pool of harvested wood products originating from timber associated with the Project is zero. Otherwise, some of the removed carbon is permanently stored and additional carbon from the atmosphere could be captured over the following decades as the original forest land is re-established.

Overall, the above assumptions lead to the following carbon accounting depending on the use of land during and after construction. On temporary workspaces and facilities over the lifetime of the Project, there will be negligible changes in the deadwood, litter, soils, and harvested wood products carbon pool. The initial rapid reduction in the above- and below-ground biomass will be replenished over several decades. Therefore, over the course of the Project, net GHG emissions from these areas are approximately zero. Converting some of the timber into harvested wood products will cause a net uptake of GHGs. In contrast, on land surfaces that remain managed by Trans Mountain during operations, lost above- and below-ground tree biomass cannot be replaced. In the absence of detailed site-specific information, a Tier-1 approach was taken (IPCC 2006) assuming that the carbon pool changes in below-ground biomass, deadwood, litter, and soils are negligible compared to above-ground biomass loss due to tree clearing. It was assumed that these areas are fully forested and that all carbon stock changes are due to above-ground biomass loss of cleared trees. In the absence of detailed information it was conservatively assumed that no timber is converted into harvested wood products.

The second aspect is the establishment of a framework to ensure that the appropriate reclamation efforts are implemented. Applicable commitments by Trans Mountain were included in the Project Application (Volume 6B – Pipeline Environmental Protection Plan [EPP]). Examples for commitments are provided in Sections 8.1 and 8.2 and Appendix C, Section 7.3 (Filing ID A3S2S3). Particularly relevant is the Reclamation Management Plan in Section 7.0 of Appendix C which notes:

"Construction reclamation activities are measures conducted as part of the main construction program. The primary goal of reclamation is to reduce adverse effects of pipeline construction and return the affected lands to a stable, non-erosive condition that will promote the re-establishment of land productivity. This process involves measures such as: topsoil and root zone material salvage; subsoil conditioning and grade and drainage re-establishment; topsoil and root zone material replacement; installation and maintenance of temporary and permanent erosion and sediment control measures; and revegetation. This reclamation plan includes construction reclamation measures that will be implemented prior to, during and following pipeline installation in order to assist in successfully reclaiming land."

A Reclamation Management Plan is also provided in Volume 6C – Facilities EPP (Filing ID A3S2S6).

a.3) The total GHG emissions (899,500 tonnes CO_{2e}) from land clearing (removal of vegetative waste, site preparation) associated with the construction of pipeline segments presented in Table 6.1 of Technical Report 5C-4 in Volume 5C (Filing ID A3S1U1) conservatively assumed that all vegetative waste will be burned openly. Land clearing along the pipeline right-of-way and at facility locations such as terminals and pump stations will account for over 90% of all estimated construction GHG emissions due in large part to burning of vegetative waste. Therefore, alternative disposal methods associated with lower GHG emissions are preferred. In addition, Trans Mountain will avoid burning slash in the Lower Mainland where air quality is an issue as noted in Section 8.0 of Volume 6B (Filing ID A3S2S3). Instead, mulching will be performed in place or slash will be transported to an approved disposal location. Disposal methods for vegetative waste from land-clearing along the pipeline right-of-way and at facility locations such as terminals and pump stations include:

- Recovery of salvageable timber (in accordance with the Timber Salvage Management Plan);
- Combustion of slash;
- Mulching in place; and
- Slash disposal at approved disposal location.

However, GHG emissions associated with the alternative disposal methods listed above are difficult to quantify because detailed information is unavailable. Therefore, only a

qualitative discussion is provided in the following paragraphs and no potential net reductions were included in the calculation of total GHG emissions from land clearing.

Recovery of Salvageable Timber

At this time, an estimate of how much timber will be salvaged is not possible. A Timber Salvage Management Plan is to be prepared by the salvage Contractor prior to the commencement of clearing operations. Timber salvage operations in Alberta will be conducted in accordance with the *Timber Management Regulations* in the *Province of Alberta Forests Act*, the *Forest and Prairie Protection Act Regulations* (Parts 1 and 2), and *Alberta Timber Harvest Planning and Operating Ground Rules* (Alberta Environmental Protection 1994) as they pertain to site clearing, debris disposal, and required firefighting equipment (Table 8.1-1 in Volume 6B – Pipeline EPP; Filing ID A3S2S3). Timber salvage operations in British Columbia will be conducted in accordance with the *British Columbia Forest and Range Practices Act* and in coordination with the Ministry of Forests, Lands and Natural Resource Operations District Managers (Table 8.1-2; Filing ID A3S2S3).

Recovery of salvageable timber in Alberta and BC will reduce but not eliminate GHG emissions. The guidelines for national GHG inventories by the International Panel on Climate Change (IPCC 2006) do not provide a binding approach to estimating the GHG emissions from harvested wood products. However, it is assumed that the amount of woody material in use declines in time (*i.e.,* some GHG emissions are associated with salvaged wood over time). In addition, the manufacturing of wood products is associated with GHG emissions. However, for a national bottom-up accounting approach, the GHG emissions from manufacturing processes and wood-product decay would typically be accounted for at the facilities where the emissions occur. It is also to be noted that any use of salvageable timber avoids GHG emissions elsewhere, or in other words, causes emissions that would occur regardless of Project construction.

Combustion of Slash

Rather than burning slash openly, wood residue can be combusted in a controlled environment for electricity generation or cogeneration. A similar result is achieved by producing wood pellets for wood stoves and fireplaces, although additional manufacturing emissions are associated with the process. As in the case of harvested wood products, this use of slash avoids GHG emissions elsewhere. In the particular case of electricity generation, combustion of Project-related slash avoids the GHG emissions associated with burning fossil fuels. How many emissions are avoided depends on which source of electricity generation is effectively replaced. In BC, if electricity generated through slash combustion replaces baseline hydroelectric energy then no GHG emissions are avoided. On the other hand, if it replaces coal-generated electricity that is imported because of peak demand or economic reasons then roughly half of the GHG emissions are avoided. The reason for this partial offset is that wood has roughly half the heating value of coal but a similar CO_2 emission factor.

Mulching in Place

The use of mulch in place will reduce but not eliminate GHG emissions. Part of the mulch will be permanently embedded as soil carbon while the remainder will decay aerobically and be released as CO_2. It is expected that the emissions associated with the mulching equipment are comparatively small.

As explained in Sylvis Environmental (2008), wood wastes typically have high carbon-to-nitrogen ratios (C:N >100:1) and serve as soil conditioner rather than sources of nutrients. They are used to increase soil organic matter content and improve soil physical characteristics such as water holding capacity, structure, and nutrient holding capacity. Because wood wastes are typically very low in all nutrients, the receiving site may require fertilization to avoid nutrient deficiencies in soil and on-site vegetation. That might cause additional GHG emissions in the form of nitrous oxide (N_2O).

Slash Disposal at an Approved Disposal Location

The disposal of slash at approved disposal locations in the Lower Mainland might not lead to a net reduction of GHG emissions and could even cause a net increase depending on the waste management at the disposal location. GHG emissions will be released in the decomposition of the slash. If left in place or allowed to decay under aerobic conditions, much or all of the wood will eventually decay and be released as CO_2, and therefore, no net reduction is achieved. Under anaerobic conditions, as are typically the case in landfills, the carbon contents will be converted mostly to methane (CH_4) which has a lower density and higher global warming potential (per unit of mass) than CO_2. If a substantial amount of this CH_4 is not captured and used for electricity or cogeneration, this disposal method leads to a net increase of CO_2e emissions compared to open burning of slash.

References:

International Panel on Climate Change. 2006. Guidelines for National Greenhouse Gas Inventories; Volume 4; Agriculture, Forestry and Other Land Use.

Sylvis Environmental. 2008. Land Application Guidelines for the Organic Matter Recycling Regulation and the Soil Amendment Code of Practice; Best Management Practices. New Westminster, BC, March 2008.

b) The response to NEB IR No. 2.019a.1 provides an estimate of roughly 24,000 tonnes carbon dioxide equivalent (CO_{2e}) emissions from land clearing for facilities only. This does not include greenhouse gas (GHG) emissions from the operation of construction equipment or from land clearing for pipeline construction because a finalized footprint is not yet available. It is possible that total construction GHG emissions will exceed 50,000 tonnes of CO_{2e} per year for one or more of the construction years.

Trans Mountain does not intend to develop an offset plan for Project-related construction emissions. While Trans Mountain is committed to complying with all regulatory requirements regarding GHG emissions, no regulatory requirements concerning GHG emissions, including those from construction, in BC or Alberta apply to the Project. Of all

applicable jurisdictions, only the Province of Alberta has regulatory offset requirements (Province of Alberta 2013). Temporary construction emissions and indirect emissions (Scope Numbers 2 and 3) are excluded from these requirements. Alberta's offset requirements apply to facilities with direct operational GHG emissions exceeding 100,000 tonnes of CO_{2e}, which is much higher than direct emissions estimated for the Project. While the construction or operation of the Project is not subject to offset requirements, Trans Mountain commits to common energy pipeline industry practices to minimize direct GHG emissions during construction and operation of the pipeline.

Reference:

Province of Alberta. 2013. Specified Gas Emitters Regulation139/2007 with amendments up to and including Alberta Regulation 89/2013. Edmonton, AB.

2.020 Tank roof types and emission control technologies

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF pages 76, 89, and 101 of 110
ii) A3W9H8, Trans Mountain response to Board IR No. 1, IR 1.34, PDF page 209 of 421
iii) A3S1U0, Application Volume 5C, Biophysical Technical Reports, TR 5C-4 – Air Quality and Greenhouse Gas Technical Report, PDF page 6 of 105
iv) NEB Filing Manual, Section 4.2.2, Filing Requirements – Alternatives, PDF pages 47 and 48 of 258

Preamble:

Reference i) states that the scope of the Project includes five new external floating roof tanks at Edmonton Terminal; 1 new tank with an internal floating roof, a fixed roof, and a tank vapour adsorption unit (TVAU) at Sumas Terminal; and 14 new tanks with internal floating roofs at Burnaby Terminal.

Reference ii) states that TVAUs were not considered at the Edmonton Terminal since the predicted concentrations were well below the Alberta Ambient Air Quality Objectives and odour detection thresholds.

Reference iii) states that no exceedances are predicted to occur at Sumas Terminal.

It is unclear to the Board why Trans Mountain is proposing TVAUs at Sumas and Burnaby Terminals and not at Edmonton Terminal.

Reference iv) outlines the requirement to describe any alternative designs evaluated, a comparison of the environmental and socio-economic effects for the design options, and the rationale for the chosen design.

The Board notes that Trans Mountain has not indicated any consideration of alternative tank roof design options with a view toward minimizing air emissions, and it is unclear how the particular roof designs and emissions control technologies were selected.

Request:

Please provide:

a) a list of alternative roof designs available (e.g., external floating roof, internal floating roof with fixed roof, and domed or covered roof);

b) a list of alternative tank emission control technologies available (e.g., tank vapour adsorption unit [TVAU]);

c) a list of potential combinations of roof design and emission control technologies (e.g., internal floating roof with and without a TVAU);

d) a comparison of the quantities of predicted air emissions associated with each combination in c); and

e) a description of the process that Trans Mountain followed to determine the tank roof design and emission control technologies for the proposed Project, including, but not limited to:
   e.1) which alternative roof designs and emission control technologies, and combinations of the two, Trans Mountain considered;
   e.2) which alternatives and combinations were not considered by Trans Mountain, and a rationale for why not;
   e.3) the factors considered when determining the proposed tank roof design and emission control technologies; and
   e.4) the rationale for the proposed tank roof designs and emission control technologies chosen for this Project.

Response:

a) The alternative tank roof designs that are available from an emissions control perspective and the EPA classification for emissions calculations are:

- External floating roof (steel pontoon) (EFR);
- Internal floating roof
  - light-weight aluminum or steel pontoon floating roof plus steel cone fixed roof (with support columns) (IFR);
  - light-weight aluminum or steel pontoon floating roof, aluminum dome fixed roof (without support columns) (DIFR).

b) The term tank vapour adsorption unit (TVAU) has been used generically in the Facilities Application to describe a unit which removes odorous compounds in the vapour stream extracted from the vapour space above a storage tank floating roof and below the fixed roof. Trans Mountain continues to investigate, through discussions with and requests for proposals to technology vendors, the available variations of the specific designs for these units. Based on preliminary information received to date, Trans Mountain believes these units will contain a medium, such as activated carbon, which may be specially modified to efficiently remove odorous compounds such as H_2S and mercaptans. Once the vapour stream passes through the medium and the odorous compounds are removed, it will be exhausted to atmosphere. Trans Mountain intends to select the technology vendor for the TVAUs in Q4 2014.

c) As discussed in the response to NEB IR No. 2.020b, active tank odour control technology, such as the use of a tank vapour adsorption unit (TVAU) relies on the capture of vapours from above the floating roof. A fixed roof is required to ensure that the majority of the vapours can be captured and directed to the TVAU, rather than escaping to directly to the atmosphere above the tank. The specific types and combinations of fixed and floating roofs in the internal floating roof (IFR) configuration do not materially affect the application of odour control technology. Odour control technology cannot be effectively applied to an external floating roof (EFR) tank. Trans Mountain notes that both EFR and IFR tanks are

highly effective at minimizing overall emissions and odours without active controls, with IFR tanks being somewhat more effective than EFR tanks. Application of active odour control (i.e. TVAUs) may not be necessary on all IFR tanks, depending on their locations and the types of products that they are intended to handle. The final determination of the need for TVAUs will be determined based on the results of iterative air quality modelling assessments in Q4 2014.

d) As noted in the response to NEB IR No. 2.020c, Trans Mountain is considering alternative tank designs such as: external floating roof (EFR) tanks, internal floating roof (IFR) tanks, and IFR tanks with active odour control, such as tank vapour adsorption units (TVAUs). The final determination of the new tank design and need for emission control technology like TVAUs will be determined based on the results of iterative air quality modelling currently in progress.

Total emission rates from tanks are comprised of storage losses (from holding a product) and working losses (from the tank filling and emptying). They vary depending on the product stored, the size and dimensions of a tank, the annual throughput of product, and the ambient meteorological conditions (*e.g.*, ambient temperature and barometric pressure). Preliminary modeling results for the new storage tanks at Burnaby show a range of emissions depending on the above listed variables.

EFR and IFR tanks have the same working losses for either design. EFR tanks have the highest storage loss emissions. Table 2.020D-1 below shows a range of total (standing and working) annual emission reductions associated with IFR relative to the EFR tank emissions. Table 2.020D-2 below shows a range of hourly storage loss emission reductions associated with IFR tanks relative to the EFR tank emissions. All VOC emissions were estimated using the US EPA TANKS model.

Table 2.020D-1: Comparison of Annual VOC Emissions

Option	Tank Type	Odour Control Technology	Annual Total Loss VOC Emission Rates Expressed as Percentage of External Floating Roof (EFR)[1]
1	External floating roof (EFR)	None	100%
2	Fixed and floating roofs in the Internal Floating Roof (IFR) Configuration	None	72% to 85%

Note: [1] A range of values are presented for the IFR tanks as the VOC reductions vary with tank size, product stored and other factors.

Table 2.020D-2: Comparison of Maximum Hourly Standing Loss VOC Emissions

Option	Tank Type	Odour Control Technology	Hourly Standing Loss VOC Emission Rates Expressed as Percentage of External Floating Roof (EFR)[1]
1	External floating roof (EFR)	None	100%
2	Fixed and floating roofs in the Internal Floating Roof (IFR) Configuration	None	51% to 61%

Note: [1] A range of values are presented for the IFR tanks as the VOC reductions vary with tank size, product stored and other factors.

As discussed in the response to NEB IR No. 2.020b, Trans Mountain is continuing to evaluate, through discussions with and requests for proposal to technology vendors, odour abatement technology for IFR tanks. While primarily intended to remove odourous compounds, these units may also remove VOCs from the vapour stream. The potential efficiency of these units at VOC removal has yet to be determined.

e.1) Please refer to the responses to parts a), b), c), and d) above. Trans Mountain considered and is continuing to consider external floating roof (EFR) tanks, internal floating roof (IFR) tanks, and IFR tanks with active odour control, such as tank vapour adsorption units (TVAUs) for various tanks.

e.2) Trans Mountain has not considered the application of TVAUs to EFR tanks as this cannot be done effectively.

e.3) Trans Mountain is committed to meeting the applicable ambient air quality objectives at each terminal and this is the primary criterion for determining tank design and the need for active odour control. The extent to which Trans Mountain will design to reduce emissions below the applicable ambient air quality objective levels will depend on the value (benefit versus cost) and the practical limitations of the technology. Trans Mountain continues to use air quality modelling results to determine tank design configuration (EFR or IFR) and the application of TVAUs. This is an iterative process whereby various tank designs, configurations (*i.e.*, some EFR, some IFR), and TVAUs (on some IFR tanks) are modelled. The results are reviewed and used to develop additional options for modelling.

e.4) The selection of tank design configurations and the application of TVAUs, as described in the Facilities Application, is preliminary and was established to provide a basis for the initial air quality modelling.

2.021 Air emissions from Sumas and Burnaby Terminals

Reference:

A3S1U1, Application Volume 5C, Biophysical Technical Reports, TR 5C-4 – Air Quality and Greenhouse Gas Technical Report

i) PDF page 104 of 160
ii) PDF page 126 of 160

Preamble:

With regard to the proposed new tank at Sumas Terminal, Reference i) states that there are no British Columbia objectives for benzene, toluene, ethylbenzene and xylene (BTEX), whereas, in the absence of an objective for mercaptans, the predicted concentration of total mercaptans is compared to the 10-minute Ontario Ambient Air Quality Criteria.

Reference ii) states that there are no relevant ambient objectives for BTEX at the Burnaby and Westridge Marine Terminals.

The Board notes that for some pollutants where a guideline or an objective is not available, Trans Mountain has compared modelled concentrations to other relevant provincial guidelines or objectives, whereas in other cases it has not.

Request:

For each of the above-mentioned pollutants for which there is no guideline or objective in the province in question and for which a guideline or objective from another province has not been used, please choose the most appropriate guideline or objective, if available from another jurisdiction, and use it for comparison with the modelled concentrations from the Base Case (with background), Application Case (with background), and Project conditions.

Response:

Alberta's Ambient Air Quality Objectives (AAAQO) for benzene, toluene, ethyl benzene, and xylene (BTEX) have been adopted by Trans Mountain for the Project. The modelled concentrations from the Base Case (with background), Application Case (with background), and Project conditions are compared to the AAAQO for the applicable averaging periods in Tables 2.021-1 (Sumas Terminal) and 2.021-2 (Westridge Marine Terminal and Burnaby Terminal). Table 2.021-1 is similar to Table 5.20 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013) (Filing ID A3S1U1) with the AAAQO being inserted for BTEX.

TABLE 2.021-1

MODELLED CONCENTRATIONS AT SUMAS TERMINAL – EXISTING AND PROJECT CONDITIONS (in µg/m³)

Pollutant	Averaging Period	Base Case (With Background)	Application Case (With Background)	Project Only	Alberta's AAQO
Benzene	1-hour	3.3	3.3	0.09	30
	Annual	0.43	0.43	-4.1E-07	3
Ethyl benzene	1-hour	1.2	1.2	2.6E-03	2,000
Toluene	1-hour	11.8	11.7	0.07	1,880
	24-hour	4.7	4.7	0.02	400
Xylenes	1-hour	5.5	5.5	0.02	2,300
	24-hour	2.2	2.2	5.6E-03	700

Table 2.021-2 is similar to Table 5.21 of Technical Report 5C-4 (Filing ID A3S1U1) with the AAAQO for BTEX being inserted.

TABLE 2.021-2

COMBINED MODELLED CONCENTRATIONS AT BURNABY TERMINAL AND WESTRIDGE MARINE TERMINAL – EXISTING AND PROJECT CONDITIONS (in µg/m³)

Pollutant	Averaging Period	Base Case (With Background)	Application Case (With Background)	Project at Burnaby Terminal	Project at Westridge Terminal	Alberta's AAQO
Benzene	1-hour	13.8	41.6	1.7	34.3	30
	Annual	0.58	1.2	0.02	0.60	3
Ethyl benzene	1-hour	55.3	55.7	0.50	0.84	2,000
Toluene	1-hour	134	144	7.1	24.3	1,880
	24-hour	39.1	40.6	1.4	4.3	400
Xylenes	1-hour	111	115	2.4	8.1	2,300
	24-hour	32.7	33.1	0.48	1.4	700

2.022 Polycyclic aromatic hydrocarbons (PAHs) in air quality assessment

Reference:

i) A3W9H8, Trans Mountain response to Board IR No. 1, IR 1.37, PDF page 226 of 421
ii) Ontario Ambient Air Quality Criteria, Ontario Ministry of the Environment, April 2012, PDF page 3 of 15
iii) A3W9H8, Trans Mountain response to Board IR No. 1, IR 1.34, PDF page 212 of 421

Preamble:

Reference i) states that PAHs were not considered as an air quality indicator for the Project since there are few applicable ambient air quality objectives to compare them to. The reference also states that the only applicable Alberta ambient air quality objective is Benzo(a)pyrene for the annual averaging period. Further, there are no substantial PAH emissions sources associated with the Project and the primary concern associated with PAHs is human health.

Reference ii) outlines Ontario's ambient air quality criteria for several contaminants. Benzo(a)pyrene is listed as a surrogate for all PAHs and criteria are available for both annual and 24-hour averaging periods.

Reference iii) describes the methods, schedule, monitored parameters, and air contaminants from the Clean Air Strategic Alliance and National Air Pollution Surveillance ambient air quality monitoring stations near the Edmonton Terminal. PAHs are listed under the contaminants monitored from the Edmonton East National Air Pollution Surveillance station.

The Board requests clarification on the purpose of monitoring PAHs and what the levels are compared to.

Request:

Please provide:

a) justification as to why PAHs cannot be compared to the Alberta ambient air quality objective or to Ontario's ambient air quality criteria for Benzo(a)pyrene, as a surrogate for all PAHs; and

b) the purpose of monitoring PAH emissions from the Edmonton East station, including identifying the source and what the levels are compared to.

Response:

a) Polycyclic aromatic hydrocarbons (PAHs) can be compared to the Alberta Ambient Air Quality Objectives (AAAQO) which Trans Mountain has agreed to adopt for the Project. In the Trans Mountain response to NEB IR No. 1.37 (Filing ID A3W9H8), the maximum annual concentration of benzo(a)pyrene was compared to the annual AAAQO in Table 1.37B-2. As noted, the AAAQO for PAHs is provided by a surrogate objective for benzo(a)pyrene of 0.0003 $\mu g/m^3$ for the annual averaging period (Alberta Environment and Sustainable Resource Development 2013).

The maximum predicted concentrations for PAHs are listed in Table 2.022a-1 for the four Project storage terminals below along with the annual AAAQO.

TABLE 2.022A-1

MAXIMUM (1st HIGHEST) PREDICTED ANNUAL AMBIENT CONCENTRATIONS FOR POLYCYCLIC AROMATIC HYDROCARBONS AT THE MAXIMUM POINT OF IMPINGEMENT FOR THE PROJECT CASE (in µg/m^3)[1]

Chemical of Potential Concern	Edmonton Terminal	Sumas Terminal	Burnaby Terminal	Westridge Marine Terminal	Westridge Marine Combined[2]	Alberta's AAQO
Aromatics C_9-C_{16}	0	4.30E-06	7.30E-02	4.00E-02	7.30E-02	Not Applicable
Aromatics C_{17}-C_{34}	0	0	0	2.20E-03	2.30E-03	
Acenaphthene	1.20E-08	3.20E-10	1.60E-09	1.00E-06	1.10E-06	
Acenaphthylene	0	0	0	2.60E-07	3.60E-07	
Anthracene	0	0	0	2.60E-07	3.60E-07	
Benzo(a)anthracene	0	0	0	2.80E-07	3.90E-07	
Benzo(a)pyrene	0	0	0	9.10E-08	1.30E-07	3.00E-04
Benzo(b)fluoranthene	0	0	0	1.80E-07	2.60E-07	Not Applicable
Benzo(g,h,i)perylene	0	0	0	6.30E-08	8.80E-08	
Benzo(k)fluoranthene	0	0	0	4.80E-08	6.70E-08	
Biphenyl	3.00E-06	7.90E-08	3.90E-07	2.50E-04	2.50E-04	
Chrysene	0	0	0	4.90E-08	6.90E-08	
Dibenzothiophene	0	0	0	0	0	
Fluoranthene	0	0	0	1.50E-07	2.20E-07	
Fluorene	0	0	0	3.40E-07	4.80E-07	
Indeno(1,2,3,c,d)pyrene	0	0	0	1.80E-07	2.60E-07	
Naphthalene	4.30E-07	1.10E-08	5.60E-08	6.00E-05	6.50E-05	
Phenanthrene	0	0	0	3.90E-07	5.50E-07	
Pyrene	0	0	0	2.70E-07	3.80E-07	

Notes:

1 With scientific notation, values are expressed either to the negative power (*i.e.,* E-x) or to the positive power (*i.e.,* E+x). For example, the peak predicted air concentration of aromatics C9-C16 in the Screening Level Human Health Risk Assessment (SLHHRA) Local Study Area (LSA) for the Westridge Marine Terminal is 4.00E-02 or 0.04 µg/m^3.

2 The Westridge Marine Combined represents the predicted air concentrations associated with the Burnaby Terminal (if applicable), Westridge Marine Terminal and the Project-related increase in marine vessel traffic combined.

Reference:

Alberta Environment and Sustainable Resource Development. 2013. Alberta Ambient Air Quality Objectives and Guidelines Summary.

b) As noted in Reference iii) above, the Edmonton East ambient air quality monitoring station monitors polycyclic aromatic hydrocarbons (PAHs). The station is operated by Alberta Environment and Sustainable Resource Development and is part of the National Air Pollution Surveillance (NAPS) network. The Edmonton East ambient air quality monitoring station is sited within a heavily industrialized area of Edmonton. The Strathcona Industrial Association operates an additional five ambient air quality stations surrounding the Edmonton East station. The Strathcona Industrial Association is made up of 12 member companies with heavy industry operations in east Edmonton and west Strathcona County. The operations of the Strathcona Industrial Association include home insulation, oil refining, polymer manufacturing, engine oil and gasoline additives production, recycled steel as well as waste management and wastewater treatment services. The Edmonton East station is intended to measure ambient air effects from all surrounding heavy industries.

A review of the 2013 National Pollutant Release Inventory (NPRI) data shows three facilities within a 3 km radius of the Edmonton East (NAPS) station reported emissions to air of either benzo(a)pyrene or general un-speciated PAHs. The two facilities reporting benzo(a)pyrene air emissions were responsible for emitting over 50 per cent of the total benzo(a)pyrene emissions in Alberta released in 2013.

Trans Mountain Edmonton Terminal is one of the nearby industrial operations; however, as there are no major sources of combustion at this facility and any product-related PAHs would have a tendency to remain in solution, PAH emissions to air are expected to be negligible.

Ambient air quality monitoring stations are sited to fulfill air shed monitoring objectives including measuring compliance with provincial or national standards, comparing changes to air quality over time, measuring the highest possible pollutant concentrations, and informing the public and raising awareness of air quality. The monitoring objectives for the Alberta Capital Airshed and associated monitoring stations are determined by Alberta Capital Airshed and Alberta Environment and Sustainable Resource Development. Any measured ambient PAHs could be compared to applicable ambient objectives for PAHs such as the Alberta Ambient Air Quality Objectives, where available.

2.023 2007 spill near the Westridge Marine Terminal

Reference:

A3S4X1, Application Volume 7, Risk Assessment and Management of Pipeline and Facility Spills, TR 7-2 – Ecological Risk Assessment of Westridge Marine Terminal Spills Technical Report, PDF page 66 of 116

Preamble:

The reference states that the models used in the stochastic oil spill modelling have been developed over many years to include as much information as possible to simulate the fate and effects of oil spills in a realistic manner. The reference further states that there are limits to the complexity of processes that can be modelled, as well as gaps in knowledge regarding the environment that is affected and the behaviour of specific organisms and ecosystems.

The reference states that the outcomes of the oil spill stochastic simulations are consistent with the behaviour and fate of crude oil that was accidentally released into Burrard Inlet in 2007.

Request:

Please provide:

a) a summary of any research studies or initiatives that have been conducted following the 2007 Westridge spill;

b) how Trans Mountain has considered the results of such research in conducting the ecological risk assessment for Westridge Marine Terminal spills; and

c) a comparison of the environmental effects monitoring and recovery from the 2007 Westridge spill to the modelled results of the ecological risk assessment for each assessed indicator, including a likely effects and recovery assessment and a discussion on the extent to which such a comparison validates or draws into question the accuracy of the model.

Response:

a) A summary of the long term effects monitoring studies which were completed following the 2007 Westridge spill is provided as Appendix B of the Detailed Quantitative Ecological Risk Assessment for Loading Accidents and Marine Spills (Stantec Consulting Ltd. May 2014) (Filing ID A3W9K8, beginning at PDF page 31).

Reference:

Stantec Consulting Ltd. 2014. Detailed Quantitative Ecological Risk Assessment for Loading Accidents and Marine Spills. May 2014. Prepared for the Trans Mountain Pipeline ULC. Fredericton, NB.

b) Section 4.5 in the Detailed Quantitative Ecological Risk Assessment for Loading Accidents and Marine Spills (Stantec Consulting Ltd. May 2014) provides validation of the ecological

risk assessment modelling studies against the measured effects following the 2007 pipeline spill which discharged to Burrard Inlet (Filing ID A3W9K4 in A3W9K1 through A3W9K9).

Reference:

Stantec Consulting Ltd. 2014. Detailed Quantitative Ecological Risk Assessment for Loading Accidents and Marine Spills. May 2014. Prepared for the Trans Mountain Pipeline ULC. Fredericton, NB.

c) Please refer to Sections 4.5 and 8.1.3 of the Detailed Quantitative Ecological Risk Assessment for Loading Accidents and Marine Spills (Stantec Consulting Ltd. May 2014) (Filing IDs A3W9K4, PDF page 2 to 10 and A3W9K7, PDF pages 44-45, respectively).

Reference:

Stantec Consulting Ltd. 2014. Detailed Quantitative Ecological Risk Assessment for Loading Accidents and Marine Spills. May 2014. Prepared for the Trans Mountain Pipeline ULC. Fredericton, NB.

2.024 Westridge Marine Terminal air dispersion

Reference:

A3S5I3, Application Volume 8C, TERMPOL Reports, TR 8C-12 – TERMPOL 3.15 – General Risk Analysis and Intended Methods for Reducing Risk, S10 – Modelling the Fate and Behaviour of Marine Oil Spills for the Trans Mountain Expansion Project Summary Report, PDF pages 37 and 38 of 49

Preamble:

The reference states that, for the Westridge spill scenario, Trans Mountain assumed a hypothetical incident to occur at 22:00 on 21 August 2012, which was based on the environmental conditions from the 368 stochastic modelling for a summer spill event. The reference further states that the summer season was selected for the deterministic modelling because warmer water and air temperatures would facilitate more rapid dissolution and/or volatilization of lighter pseudo-components into water or air, respectively.

The reference states that the majority of benzene is transported to the west of the terminal, due to the predominance of easterly winds at the beginning of the spill when fluxes were highest.

The Board notes that the deterministic simulation for CALPUFF air dispersion modelling considered a single moment in time with an assumption of easterly winds to predict the amount of exposure that could happen. The Board is concerned that the modelling does not consider other scenarios, such as westerly winds, that could drive airborne concentrations toward residential areas.

Request:

Please provide:

a) provide the rationale for considering a single moment in time (late evening in the summertime, with easterly winds) for the CALPUFF air dispersion modelling; or

b) re-run the model with additional wind conditions and provide the results.

Response:

a) The evaporation of toxic compounds such as benzene, which presents high risks to human health, occurs mainly during the first hour for small spills such as this. The specific start time for the simulation was selected so as to be coincident with the ecological risk assessment. The area in which the evaporated benzene concentration exceeded the one-hour acute inhalation exposure limit for benzene (580 µg/m^3, TCEQ 2007) was confined within a radius of 800 m. Over the second hour, the radius of exceedance was 350 m from the terminal. Over the third hour, it was 260 m, meaning that the largest portion of benzene evaporated within the first hour following the hypothetical Westridge spill.

   Thus, it was apparent that transport processes (advection by wind) was less important than the spread of the source slick and the evaporation process in determining human health

exposure, additional simulations were not contemplated. The simulation, with consistent winds from the east, represents the predominant wind conditions in the vicinity of the Westridge site.

b) As noted in the response to NEB IR No. 2.024a, the scenario presented in the Application corresponds to the predominant wind conditions around Second Narrow Bridge and in the vicinity of the site. Two other wind conditions can be investigated: winds from the west (9.4% of occurrence) and winds from the north-northeast coming down from Indian Arm. North-northeast winds represent a large proportion of winds occurring at the site (18.2% of occurrence), however characterized by weak winds; 94% of the north-northeast winds are below 3 m/s. As a result, two additional modelling scenarios will be undertaken and filed by August 22, 2014.

Summary of New Commitments:

- Two additional modelling scenarios will be undertaken and filed by August 22, 2014

2.025 Residual PAHs in the environment

Reference:

A3S4X1, Application Volume 7, Risk Assessment and Management of Pipeline and Facility Spills, TR 7-2 – Ecological Risk Assessment of Westridge Marine Terminal Spills Technical Report:

i) PDF page 29 of 116
ii) PDF page 63 of 116

Preamble:

Reference i) states that sediment in the Westridge area has likely been affected by the 2007 oil release, as well as by historic shipping activity and other sources of PAHs. Reference i) also states that an analysis of mussels collected throughout the eastern part of the inlet indicated that only in the Westridge area could the amount and distribution pattern of PAHs be associated with the release.

Reference ii) states that sediment from sites such as Maplewood Flats, Deep Cove, Cates Park, Belcarra, Port Moody Flats, and Barnet Marine Park also contain measurable PAHs, but their chemical fingerprint did not match that of the released oil.

It is unclear to the Board whether Reference ii) implies that these measurable PAHs likely did not come from the 2007 spill or that the source of the PAHs is simply unknown. It is also unclear whether fingerprinting is a reliable method of determining the effects of a spill.

Request:

a) Please discuss how long it takes until the PAH fingerprint can no longer be recognized or be linked to the specific source it came from;

b) Please discuss how long it takes until PAHs become harmless or not measurable; and

c) If PAHs continue to be measurable and harmful after they have lost their fingerprint, please:
   c.1) clarify what can be drawn from the statement made in Reference ii) that the chemical fingerprint did not match that of the released oil from 2007; and
   c.2) explain how Trans Mountain would be able to distinguish residual PAHs from any new PAHs resulting from any potential future spill.

Response:

a) Text on PDF pages 29 and 63 of the Ecological Risk Assessment of Westridge Marine Terminal Spills Technical Report (Volume 7, Technical Report 7-2, Stantec Consulting Ltd. December 2013, Filing ID A3S4X1) refer to conditions immediately following the spill. The text on PDF page 63 (polycyclic aromatic hydrocarbons [PAHs] in sediment samples collected away from the affected Westridge area soon after the spill not reflecting the fingerprint of the released oil) indicates both that the PAHs are unlikely to be related to the spill (given the short time following the spill, there would be high confidence in the

"fingerprinting" analysis) **and** that the source of PAHs is unknown (presumably air deposition, stormwater runoff, and general vessel activities).

Subsequent remediation activities reduced hydrocarbon levels and PAH concentrations in sediment, mussels, and crabs. Long-term monitoring reports prepared annually from 2008 through 2013 document conditions for sediment, mussels, crabs, water, and *Fucus* communities (for more detail see Technical Report 5C-12 in Volume 5C, Marine Sediment and Water Quality – Westridge Marine Terminal Technical Report [Stantec Consulting Ltd. 2013], Filing ID A3S2R6). Endpoints for recovery were met in 2007 (water), 2011 (sediment, crabs, *Fucus* community), and 2012 (mussels).

A variety of fingerprinting techniques are used to identify specific hydrocarbon sources and to distinguish pyrogenic (combustion) and petrogenic (fossil fuel) sources of PAHs. Fingerprinting techniques include use of the chemical profile of parent and alkylated PAHs (correlation analyses) and use of various indices to distinguish combustion and fuel sources (Wang and Stout 2007) to compare the source (oil) and the receiving environment (sediment, tissue). Effectiveness of these techniques in distinguishing a specific source of oil decrease over time as weathering and biodegradation processes decrease the PAH concentrations. The presence of other sources of PAHs is a confounding factor in distinguishing PAHs in oil originating in an accidental release from those due to other sources (*e.g.,* atmospheric deposition, vessel traffic, and stormwater runoff from urbanized, residential and industrial areas), as is the case for Burrard Inlet and the Westridge area. Organisms can also metabolize PAHs (crabs to a greater extent than bivalves such as mussels), which introduces some uncertainty in defining a specific source of hydrocarbons.

The fingerprinting techniques using direct correlation of released oil and sediment or mussels are most effective for several months following a release and become less effective over time, as the natural degradation processes occur. The use of various hydrocarbon indices ("fossil fuel pollution indices") continues to be useful over time in distinguishing whether a source is primarily petrogenic, pyrogenic or a mixture. The indices are considered as multiple lines of evidence, in conjunction with measured concentrations, in a weight of evidence approach, although it becomes more difficult to confirm a specific source.

The residence time of PAHs in the environment can be highly variable, so it is not possible to provide an explicit response to this question. Taking the Exxon Valdez oil spill (EVOS) as an example, many areas that were heavily oiled as a result of that spill recovered quickly, so that residual hydrocarbon concentrations (with an associated PAH fingerprint) declined to non-detectable levels within a few years. On the other hand, some beaches that contained deeply porous substrates retained (sequestered) crude oil below the surface. This sequestered oil was protected from the more usual weathering and degradation processes, so that examples of crude oil that have experienced only slight weathering can still be found at some isolated locations in Prince William Sound. For sequestered oil, the PAH fingerprint would be virtually unchanged since the time of the spill.

Reference:

Wang, Z. and S. Stout. 2007. Oil spill environmental forensics: fingerprinting and source identification. Academic Press. 554 pp.

b) As explained in the response to part a) above, the stability of hydrocarbons in the environment, including polycyclic aromatic hydrocarbons (PAHs), depends upon the specific conditions at the site where they reside. However, hydrocarbons that become sequestered are generally isolated from the biosphere, and as a result have low potential to cause harm as long as they are not disturbed.

More generally, hydrocarbons that are exposed to light are subject to photodegradation. Therefore, hydrocarbons that are visible on the surface of the water or stranded on shorelines are subject to fairly rapid degradation. Similarly, hydrocarbons that are exposed to oxygen (even small amounts of oxygen in water) can be degraded by microorganisms. For PAHs, these degradation rates also depend on their solubility in water, so degradation rates are often linked to solubility through the octanol-water partitioning coefficient, or Kow value, which is a physical property of the individual chemical substance.

Hydrocarbons that are deposited in sediment can persist for long periods of time, and in some cases burial is a mechanism that leads to their isolation from the biosphere. Sediments tend to preserve hydrocarbons (including PAHs) because of the limited availability of oxygen.

As noted in the response to part a) above, long term monitoring following the 2007 oil release indicate that through clean-up, subsequent remediation activities, and natural attenuation processes, PAH concentrations in sediment, mussels, and crabs have decreased to meet endpoints for recovery in 2007 (water), 2011 (sediment, crabs, *Fucus* community), and mussels (2012).

c.1) Polycyclic aromatic hydrocarbons (PAHs) appear to be ubiquitous in areas where human activities using fossil fuels (oil, wood, coal) occur or where they are transported to and settle in sediment. Ambient PAH levels in Burrard Inlet, for example, reflect historical and current activities, resulting from atmospheric deposition, runoff from the land, and vessel traffic, as well as accidental releases (from burning of fossil fuels, use of fuels and lubricants, presence of creosote as a wood preservative). Ambient conditions are described in Technical Report 5C-12 in Volume 5C, Marine Sediment and Water Quality – Westridge Marine Terminal Technical Report (Stantec Consulting Ltd. December 2013; Filing ID A3S2R6). Immediately after the 2007 spill, PAH levels in sediment were measured at Westridge (the main affected area) and other areas throughout eastern Burrard Inlet. At that time, PAHs were present at all sites, but only the samples at the Westridge area had PAH composition that could be attributed to the spill. PAHs at other areas were attributable to other, not identified, general sources. These general sources would also be present at Westridge (reflecting baseline conditions) but their concentrations would have been low compared to the contributions from the oil release.

The important conclusion here is that prompt and appropriate spill response measures put in place following the 2007 spill resulted in the recovery of much of the spilled crude oil, so

that the residual oil in the environment did not become the overwhelming chemical signature for hydrocarbons present in Burrard Inlet.

PAH levels that may be of concern are identified through water and sediment quality guidelines for individual PAH compounds and for total PAHs (*e.g.,* generic British Columbia sediment quality guidelines [Nagpal *et al*. 2006] and draft objectives for Burrard Inlet [Swain 2009]).

c.2) There is presently baseline information available regarding the concentrations and characteristics of hydrocarbons present in the sediments of Burrard Inlet, in the vicinity of the Westridge Marine Terminal and elsewhere in the eastern portion of the Inlet (east of Second Narrows). In the unlikely event of a spill in the future, the characteristics of the spilled oil would be determined from samples that would be collected and analyzed. As was the case following the 2007 spill, regular monitoring during and after the oil spill response activities would be able to determine the concentrations and characteristics of spill-derived hydrocarbons in the environment until such time as it was determined (through consultation with the appropriate regulators) that further monitoring was not required.

References:

Nagpal, N.K., L.W. Pommen and L.G. Swain. 2006. A Compendium of Working Water Quality Guidelines for British Columbia.

Swain, L. 2009. Draft Sediment PAH Guidelines and Objectives. Provided by Ministry of Environment to Kinder Morgan in communication dated May 2010.

2.026 Cumulative effects for odours at Edmonton Terminal

Reference:

A3S1U1, Application Volume 5C, Environmental and Socio-Economic Assessment – Biophysical Technical Reports, TR 5C-4, Air Quality and Greenhouse Technical Report:

i) PDF page 144 of 160
ii) PDF page 109 of 160

Preamble:

Reference i) states that cumulative effects were modelled only for the Burnaby and Westridge areas, and that, although increased production of potential odourous compounds is possible in areas such as Edmonton, the changes are expected to be small.

Reference ii) states that concentrations of hydrogen sulphide were highest in Edmonton, with modelled concentrations at 95 per cent of the Alberta Ambient Air Quality Objectives.

Request:

Please provide a cumulative effects assessment for odours at the Edmonton Terminal, or provide a detailed justification for not conducting one.

Response:

Table 5.25 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013) (Filing ID A3S1U1) provides a summary of predicted 3-minute maximum concentrations of speciated volatile organic compounds (VOCs) and reduced sulphur species in relation to published odour detection thresholds for the Application Case (combined effect of existing emissions and the Project). The results for Edmonton Terminal show predicted hydrogen sulphide (H_2S) concentrations up to 229.8% of the odour detection threshold largely due to other (non-Kinder Morgan Canada) industrial facilities.

A cumulative effects assessment for odours at the Edmonton Terminal was not completed as the predicted emissions of H_2S and mercaptans from both the Project only (see Table 5.23 of Technical Report 5C-4 [Filing ID A3S1U1]) and the changes approved to the nearby Enbridge Edmonton Terminal were small. No details were provided in the Enbridge air quality assessment for nuisance odour potential based on speciated VOCs and reduced sulphur species so they could not be accounted for in the Trans Mountain odour assessment. No other reasonably foreseeable or publicly announced projects of interest were identified so the Cumulative Case results were deemed to be the same as the Application Case results as noted in Section 7.1 of Technical Report 5C-4 (Filing ID A3S1U1). The maximum predicted concentrations of H_2S for the Project and for the Enbridge Edmonton Terminal were below their applicable Alberta Ambient Air Quality Objectives (AAAQO).

At their Edmonton Terminal (South), Enbridge received approval (July 26, 2013) from the NEB to construct and operate five new storage tanks as part of the Edmonton Terminal (South) Expansion Project (Table 8A.1-5 of Appendix 8.1 in Volume 5A [Filing ID A3S1R3, PDF page

110). This Enbridge terminal is located approximately 2 km southeast of the Edmonton Terminal. These storage tanks are expected to receive and store crude oil and have the potential to create fugitive emissions of VOCs. An air quality assessment of the proposed upgrade was completed and filed with the NEB (NEB 2013). The results indicated that the maximum predicted concentrations for all air contaminants were below their applicable AAAQO (Section 8.4.3.1 of Volume 5A [Filing ID A3S1R1).

Reference:

National Energy Board. 2013. Regulatory Document Index – 2013-02-15 Application for the Edmonton Terminal (South) Expansion.

2.027 Regulatory air permits, approvals, and/or authorizations

Reference:

A3S0Q8, Application Volume 2, Project Overview, Economics and General Information, PDF pages 33 to 37 of 45

Preamble:

The reference lists the potential federal and provincial environmental permits, approvals, authorizations, and/or notifications required for the Project from provincial regulatory agencies.

It is unclear to the Board what activities or triggers would require federal or provincial regulatory permits, approvals, authorizations, and/or notifications in relation to the air emissions from the Project and/or marine shipping.

Request:

Please provide a list of all activities or triggers that may require relevant federal or provincial regulatory permits, approvals, authorizations, and/or notifications in relation to the air emissions from the Project and/or marine shipping. Please also identify the name of the regulatory agency; the relevant legislation; and the type of permit, approval, authorization, and/or notification required.

Response:

Trans Mountain will work with various provincial and federal agencies with responsibilities related to air emissions from the Project components. Table 2.027-1 provides a list of provincial and federal permits and approvals that may be required for the Project.

TABLE 2.027-1

POTENTIAL PERMITS/APPROVALS IN RELATION TO AIR EMISSIONS

Regulatory Agency	Legislation	Permit, Approval, Authorization and/or Notification	Activity/Trigger
BC Ministry of Environment	*Waste Discharge Regulation under the BC Environmental Management Act*	Waste Permit	Introduction of air (waste) contaminants into the environment in the course of petroleum storage (prescribed industry)
Alberta Energy Regulator	*Environmental Protection and Enhancement Act*	Facility Approval	The construction, operation or reclamation of a pipeline, or bulk distribution facilities
Metro Vancouver (Greater Vancouver Regional District)	*Air Quality Management Bylaw No. 1082,2008*	Permit (for discharge of air contaminant)	Discharge of any air contaminant not covered by an existing emission regulation or other exclusions and greater than 100 kg/day carbon monoxide, greater than 5 kg/day nitrogen oxides, or greater than 5 kg/day sulphur oxides

TABLE 2.027-1

POTENTIAL PERMITS/APPROVALS IN RELATION TO AIR EMISSIONS (continued)

Regulatory Agency	Legislation	Permit, Approval, Authorization and/or Notification	Activity/Trigger
Transport Canada	*Canada Shipping Act, 2001 Vessel Pollution and Dangerous Chemicals Regulations*	Issue or endorse International Air Pollution Certificates for Canadian Vessels (over 400 gross tonnage) Examine International Air Pollution Certificates for (non-Canadian) Vessels (over 400 gross tonnage)	Operation of a vessel in a Canadian Port

2.028 Mature/old growth forest habitat for bats and birds

Reference:

A3S1Q9, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical:

i) PDF page 273 of 403
ii) PDF page 296 of 403
iii) PDF pages 261 and 262 of 403

Preamble:

Reference i) states that direct habitat disturbance associated with clearing mature and old forests is likely the primary mechanism of Project interaction with bats. It further states that direct habitat disturbance associated with clearing mature and old forests will be reduced by mitigation that includes reclaiming the footprint to natural vegetation. The reference predicts a low magnitude of residual Project effects on bats, including several bat species of conservation concern that occur in the wildlife local study area (LSA).

Reference ii) states that several mature/old forest bird species with conservation status of concern occur in the wildlife LSA. It further states that proposed mitigation, including reclaiming the Project footprint to natural vegetation, is expected to reduce the magnitude of residual Project effects to low for most species in the mature/old forest bird community.

Reference iii) states that temporary construction workspace will be allowed to regenerate to natural vegetation communities. It further states that the permanent pipeline right-of-way (approximately 18 metres wide) and power line rights-of-way will be periodically maintained to low vegetation heights over the life of the operating pipeline, which will result in the long-term maintenance of forest habitat in earlier seral stages (herbaceous and shrub stages) within a portion of the Project footprint.

Request:

Please clarify if the mention in References i) and ii) of reclaiming areas to natural vegetation means reclaiming to mature/old forest. If so, please reconcile this with the statement in Reference iii) that the permanent right- of-way and power line rights-of-way will be maintained to early seral stages. If reclaiming areas to natural vegetation does not mean reclaiming to mature/old forest, please explain how reclaiming areas to natural vegetation would lessen effects on bats and bird species dependent on mature/old forest habitat.

Response:

Trans Mountain confirms that References i) and ii) regarding reclaiming areas to natural vegetation refer to the eventual revegetation of the Project Footprint to mature/old forest (where natural conditions allow). As noted in Reference iii), portions of the permanent pipeline right-of-way and power line rights-of-way will be periodically maintained to low vegetation heights over the life of the operating pipeline. However, following decommissioning and abandonment the permanent pipeline right-of-way and power line rights-of-way will be allowed to fully regenerate.

It follows that References i) and ii) are consistent with Reference iii) since the permanent pipeline right-of-way and power line rights-of-way will eventually be allowed to regenerate to mature/old forest (where natural conditions allow) following the decommissioning and abandonment phases of the Project. According to the assessment method set out in Section 7.1 of Volume 5A (Filing ID A3S1Q9), the assessment characterizes the residual effect (*i.e.*, following implementation of all mitigation measures, including reclamation and following provincial guidelines for replacement of disturbed Old Growth Management Areas and Wildlife Tree Patches). The assessment acknowledges that although mitigation to reclaim disturbed areas to natural vegetation is expected to effectively reverse the residual effect of clearing on mature and old forest habitats, the effect will occur for an extended period (*i.e.*, decades after the abandonment and final reclamation of the Project). Using the criteria defined in Section 7.1.4 of Volume 5A (Filing ID A3S1Q9), the reversibility of residual effects on wildlife indicators that require old forest habitats is long-term.

2.029 Amphibian hibernation habitat and mortality risk

Reference:

A3S1Q9, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical:

i) PDF page 305 of 403
ii) PDF pages 306 and 307 of 403
iii) PDF page 308 of 403
iv) PDF page 247 of 403
v) PDF page 303 of 403

Preamble:

Reference i) states that pond-dwelling amphibians may stay in or near the same waterbody during their lifetime, or may migrate seasonally, sometimes for extended distances.

Reference ii) states that amphibians that would potentially interact with the Project are not freeze-tolerant, and require thermally stable retreat habitat to overwinter, such as abandoned small mammal burrows, cover objects, or soil of texture loose enough to allow burrowing. Reference ii) further states that mitigation measures include amphibian salvage at known sensitive amphibian breeding locations if construction is scheduled during breeding season, moving amphibians observed on the construction right-of-way, and packing snow or using mats to avoid excessive soil compaction on the footprint, in proximity to wetlands and watercourses. The reference states that this mitigation is expected to reduce the potential residual effects of the Project on amphibian mortality risk as a result of hibernation habitat disturbance.

Reference iii) states that supplemental field surveys will be conducted for pond-dwelling amphibians to collect additional information on amphibian occurrence along the final pipeline alignment, which will inform the development of mitigation and increase prediction confidence.

Reference iv) refers to recommended setback distances as mitigation for amphibian breeding ponds.

Reference v) references a study that demonstrated that wetland-based buffers are not sufficient or realistic for protecting some pond-dwelling amphibian hibernation sites, since individuals can move long distances from breeding ponds to hibernation sites..

Request:

a) Please explain how amphibian salvage at known sensitive amphibian breeding locations is expected to reduce Project effects on amphibian mortality risk as a result of hibernation habitat disturbance.

b) Please confirm whether the supplemental planned field surveys to collect additional information on amphibian occurrence along the final pipeline alignment will include hibernation use by amphibians. If not, explain how mitigation measures will be applied to reduce Project effects on mortality risk to hibernating amphibians.

c) Please explain how Trans Mountain expects the application of setbacks at amphibian breeding ponds to reduce Project effects on hibernation site use by pond-dwelling amphibians. Please also discuss whether Trans Mountain commits to setback distances beyond recommended setbacks to provide protection to amphibian hibernation sites.

Response:

a) To clarify, the use of an amphibian salvage is recommended at known sensitive amphibian breeding ponds in the event that construction is scheduled during the amphibian breeding season to reduce the potential residual effect of the Project on amphibian mortality risk. Amphibian salvage during the period when amphibians are hibernating is not a common practice. The likelihood of finding and successfully relocating an amphibian during this period is extremely low. BC *Wildlife Act* permits are not issued for salvage operations scheduled to occur when amphibians are overwintering.

b) No field work is planned to study hibernation use by amphibians. Information on the hibernation habitats of the pond-dwelling amphibians that may be encountered within the proposed pipeline corridor is provided in Section 7.2.10.11 of Volume 5A under Change in Movement and Increased Mortality Risk (Filing ID A3S1Q9). Measures to reduce Project effects on mortality risk of hibernating amphibians include measures such as packing snow or using mats to avoid excessive soil compaction within the Project footprint in the area of a known breeding pond.

c) The setback distances and timing windows used for pond-dwelling amphibians are those provided by provincial and federal guidelines which are based on species knowledge and existing published research and literature. Setback distances for amphibians range from 30 m to 400 m depending on the species and are in place to provide protection to the species and their habitat. Setback distances beyond these to protect the hibernation sites of amphibians that hibernate away from breeding ponds (*e.g.,* western toad) have not been provided by regulatory authorities. Mitigation for amphibian breeding ponds was provided in Table 6.1.1 of Technical Report 5C-10 in Volume 5C, Wildlife Technical Report (TERA Environmental Consultants December 2013; Filing ID A3S2Q3), and does not include additional setbacks beyond those provided by provincial and federal guidelines.

2.030 Cumulative effects assessment – woodland caribou

Reference:

A3W9H8, Trans Mountain response to Board IR No. 1, IR 1.42, PDF pages 254 and 255 of 421

Preamble:

The reference states that cutblocks are the only reasonably foreseeable development identified within the caribou Regional Study Area (RSA). The reference further states that spatial data were not available for future cutblocks or their associated access roads at the time of the assessment; therefore, the quantitative assessment of corridor density includes only the interaction of the Project with existing activities in the caribou RSA.

Request:

a) Please provide the reasons why cutblock and associated access road spatial data was not available for the quantitative cumulative effects assessment for woodland caribou mortality risk.

b) If spatial data is expected to be available by the end of September 2014, confirm that Trans Mountain will file with the Board an updated quantitative cumulative assessment of woodland caribou mortality risk that includes cutblock and associated access road spatial data.

c) If spatial data is not expected to be available by the end of September 2014, please provide a best estimate of how future cutblock development would change the quantitative cumulative assessment.

Response:

a) Spatial data were not available for future cutblocks or their associated access roads since forestry companies do not typically delineate and disclose specific harvest areas until closer to the commencement of harvest activities. Forest licences are generally granted based on volume so forestry companies are not required to identify spatially-explicit plans for future cutblocks or their associated access roads in advance. Refer to Trans Mountain's response to the SIMPCW F N IR No. 1.131a (Filing ID A3Y3Q5) for additional information.

b) Spatial data for future cutblocks or their associated access roads is not expected to be available by the end of September 2014. Please refer to the response to part a) above for justification.

c) Trans Mountain does not have detailed information regarding potential future cutblocks and their associated access roads in the Caribou Regional Study Area (RSA) (*i.e.*, amount, extent, distribution, timing, mitigation, harvest technology, etc.). Therefore, it is difficult to provide a meaningful numerical estimate of how future cutblock development would change the quantitative cumulative effects assessment for caribou. However, Trans Mountain notes that future cutblock development within the Caribou RSA has the potential to increase both the amount of habitat disturbance and the corridor density within the Caribou RSA. There is

a moderate level (approximately 31.6%) of existing functional habitat disturbance within the Caribou RSA, and the Project is predicted to contribute to the cumulative functional disturbance in the Caribou RSA by a negligible amount (< 0.01%) (Section 8.9.6.1 of Volume 5A [Filing ID A3S1R2]). Since functional disturbance includes direct anthropogenic disturbance buffered by 500 m (Environment Canada 2012), future cutblock development would increase the amount of functional habitat disturbance under the cumulative scenario if disturbances (*i.e.*, cutblocks and access roads) are placed more than 500 m away from existing anthropogenic disturbance. The average corridor density under existing and Project conditions in the Caribou RSA is 0.4 km/km², and therefore in the low risk category (*i.e.,* < 0.6 km/km²) (Athabasca Landscape Team 2009) (see response to NEB IR No. 1.42 [Filing ID A3W9H8]). New access roads required for future cutblock development may increase the corridor density in the Caribou RSA under the cumulative scenario if the access roads do not parallel an existing linear disturbance.

Within the Caribou RSA the Project parallels the existing Trans Mountain Pipeline (TMPL) right-of-way, Highway 5 and an existing railway. Although future cutblock development within the Caribou RSA has the potential to increase both the amount of habitat disturbance and the corridor density within the Caribou RSA, the Project's incremental contribution to cumulative effects is still expected to be relatively small and assessment conclusions are not expected to change.

As noted in Section 8.9.6.4 of Volume 5A [Filing ID A3S1R2], Trans Mountain acknowledges that caribou are sensitive to human disturbance, and research has demonstrated adverse interactions between linear disturbance, primary prey and predator response, and caribou mortality. Given the sensitivity of woodland caribou, regulatory guidelines, and recovery objectives, mitigation beyond standard measures is warranted to address the Project's residual and incremental contribution to cumulative effects on woodland caribou. Trans Mountain is committed to implementing additional mitigation developed in consultation with appropriate regulatory agencies (Section 8.9.6 of Volume 5A [Filing ID A3S1R2]). Measures may include additional access control and habitat restoration both on the Project footprint and the existing TMPL right-of-way.

References:

Athabasca Landscape Team. 2009. Athabasca Caribou Landscape Management Options Report.

Environment Canada. 2012. Recovery strategy for the woodland caribou (R*angifer tarandus caribou*), boreal population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada. Ottawa, ON. 138 pp.

2.031 Wildlife models

Reference:

A3S2R5, Application Volume 5C, Environmental and Socio-Economic Assessment – Biophysical Technical Reports, TR 5C-1 – Wildlife Modelling and Species Accounts Technical Report:

i) PDF page 19 of 162
ii) PDF page 36 of 162
iii) PDF page 13 of 162

Preamble:

In Reference i), the footnote to Table 2.9-1 states that bald eagle, great blue heron, wolverine, and woodland caribou are included as indicators, but are not modelled.

Reference ii) states that wolverine were not modelled due to their wide- ranging and opportunistic habitat use patterns, which limit the usefulness of habitat models.

In Reference iii), the footnote to Table 2.3-2 states that great blue heron and bald eagle are not well-suited to the use of habitat suitability models to estimate changes resulting from the Project.

The Board notes that Trans Mountain does not appear to provide a rationale as to why woodland caribou habitat was not modelled and how great blue heron and bald eagle are not well suited to use of habitat suitability models to estimate changes resulting from the Project.

Request:

Please provide:

a) a detailed explanation of why great blue heron and bald eagle are not well suited to the use of habitat suitability models.

b) a rationale for why woodland caribou habitat was not modelled and an explanation of how the lack of modelling affects the significance evaluation for woodland caribou.

Response:

a) Great blue herons are colonial breeders. There is a degree of nest site fidelity, and males will reclaim nesting sites used in the previous year and defend their territory. Great blue heron nesting sites are typically located in mature forested areas that are located within 10 km of a marsh or wetland that is used for foraging. Black cottonwood trees are preferred, although both live and dead mature deciduous and coniferous trees may be used. As most existing breeding colonies have known locations, modelling of potential nesting habitat would not accurately capture the nesting distribution of this species, nor the potential Project effects on great blue heron habitat.

Habitat requirements of bald eagles vary widely, and bald eagle populations in Canada appear to be increasing. Nest site selection appears to be dependent on structural characteristics of an individual tree (*e.g.*, tallest tree in area, clear flight path to nearby water, view of surrounding area, and proximity to food source) rather than tree species, structural stage or composition of the surrounding area. Habitat modelling of bald eagle habitat is likely of little value, as individual or anomalous trees may not be captured in the spatial vegetation data, and therefore, nesting habitat cannot be accurately quantified.

Great blue heron nesting colony locations and active nests of both species will be identified during pre-construction surveys. Proposed mitigation, provided in Section 7.2, Table 7.2.10-3 in Volume 5A (Filing IDA3S1Q9), includes alignment of the final Project route to avoid known heron nesting colonies and active nests, minimizing the Project footprint, applying appropriate minimum disturbance buffers, and scheduling clearing and construction outside sensitive time periods. With the implementation of mitigation, the residual Project effects on great blue heron and bald eagle are expected to be of low magnitude.

b) Trans Mountain determined that modelling of caribou habitat would provide redundant and less reliable information than the regional-scale metrics selected to evaluate Project effects on caribou habitat. The approach used for quantitative assessment of changes in caribou habitat included metrics relevant to the caribou ranges potentially affected by the Project. Provincially, caribou (herds) are managed at the range scale. Scientific research and analyses identify range-scale metrics for determining the interaction between anthropogenic disturbance and caribou population response. Therefore, the quantitative analysis (*i.e.,* change in undisturbed habitat defined as the reciprocal of functional disturbance, and quantified as direct and indirect habitat disturbance) was completed to support the assessment of effects on caribou habitat within the Regional Study Area, which is delineated by the relevant caribou ranges (Wells Gray and Groundhog). Section 8.9.6.1 in Volume 5A [Filing ID A3S1R2] describes the method used to quantify potential changes in habitat for caribou as a result of the Project and other existing and reasonably foreseeable developments that will interact with the Project.

Further, the Province of BC has delineated habitats within the Wells Gray and Groundhog caribou ranges (*i.e.*, Ungulate Winter Ranges), based on the best available scientific information. These identified habitat areas were also used in the quantification of change in habitat to inform the assessment of Project effects on caribou habitat.

Trans Mountain is aware that since the filing of the Application for the Project, Environment Canada has released the Recovery Strategy for the Woodland Caribou, Southern Mountain population (*Rangifer tarandus caribou*) in Canada (Environment Canada 2014). The Recovery Strategy includes partial mapping of critical habitat for caribou in the Wells Gray and Groundhog caribou ranges (Wells Gray – Thompson Local Population Unit). Based on the information available in the Recovery Strategy, Trans Mountain anticipates that the Project will affect critical habitat designated as matrix range. Trans Mountain has requested spatial data from Environment Canada, which if available, will be used to further inform Project planning and mitigation to reduce effects on caribou habitat.

Reference:

Environment Canada. 2014. Recovery Strategy for the Woodland Caribou, Southern Mountain population (*Rangifer tarandus caribou*) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment Canada. Ottawa, ON. 68 pp.

2.032 Follow-up program for Project effects

Reference:

A3S1R3, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical, PDF page 130 of 133

Preamble:

The reference states that, based on Project knowledge and comprehensive field studies to date, the need for follow-up programs under the *Canadian Environmental Assessment Act, 2012* has been identified for select wildlife species at risk.

The Board notes that there is no discussion of the need for follow-up programs for any other environmental elements or indicators.

Request:

Please provide a list of wildlife species, including species at risk, and all other environmental elements or indicators for which Trans Mountain proposes to conduct follow-up programs under the *Canadian Environmental Assessment Act, 2012*, together with a justification for where follow-up programs are not required. Please also provide details of the follow-up programs, including design and implementation, short- and long-term goals, and how the results would be used to implement adaptive management measures.

Response:

Trans Mountain continues to have ongoing discussions with Environment Canada, Port Metro Vancouver, and Fisheries and Oceans Canada as well as the appropriate provincial agencies on species at risk. The need for, and specifics of, follow-up programs will be defined as Project details become more refined and all required spatially-explicit information on critical habitat for species at risk becomes available. Trans Mountain is committed to:

- collaborate with federal and provincial wildlife authorities, Aboriginal communities, non-governmental environmental organizations and universities to support programs to monitor and conserve species at risk that could be affected by Project activities.
- conduct construction and operations monitoring for agreed to species at risk, including monitoring of activity levels in known and predicted high quality habitat, using the appropriate survey methods, and
- where the effectiveness of proposed mitigation or compensation is uncertain, commit to a follow-up program to monitor and assess the effectiveness of its environmental protection plan, including the access management plan and specific mitigation measures proposed for each of the species at risk as outlined in Appendix C of the Management Plans.

Trans Mountain recognizes that follow-up programs could be valuable for select species at risk that have been identified as having low confidence in the assessment results or for proposed mitigation measures that have not been proven or a new technology to be employed. For

species at risk, recovery strategies will further allow for an evaluation or need for a follow-up program once critical habitat is defined and the location of the pipeline to the habitat has been delineated.

Species at Risk

Trans Mountain is committed to NEB Draft Condition #10 for a Caribou Habitat Restoration Plan. For those species at risk that warrant monitoring and follow-up, a similar process and plan will be prepared to include:

- clear objectives for each species at risk;
- a list of criteria used to identify potential site-specific SARA listed species habitat;
- a description of how Trans Mountain has taken available and applicable ATK studies into consideration in identifying site specific habitat;
- a conceptual decision process used to identify any mitigation or restoration measures to be applied at different sites;
- quantifiable targets and performance measures that will be used to evaluate the extent of predicted residual effects, mitigation and restoration effectiveness, the extent to which the objectives have been met, and need for further measures to offset unavoidable and residual effects on habitat;
- a schedule indicating when mitigation measures will be implemented; and
- a summary of Trans Mountain's consultation with appropriate regulatory agencies and any potentially affected Aboriginal groups regarding the plan.

For any site-specific habitats of SARA listed species identified prior to construction, before and after construction studies and surveys will be conducted to determine occupancy of sites and implications of the effectiveness of the mitigation measures as part of its post-construction environmental monitoring program.

Socio-Economic Effects Monitoring

Trans Mountain is committed to meeting NEB Draft Condition #11 and developing a Socio-Economic Effects Monitoring Plan. This follow-up program will allow for the monitoring of potential adverse socio-economic effects of the Project during construction. The plan will include:

- the factors or indicators to be monitored;
- the methods and rationale for selecting the factors and indicators;
- a description of the baseline, pre-construction socio-economic conditions;
- the monitoring methods and schedule, including a third party data source identification;

- data recording, assessment and reporting details;
- a discussion of how measures will be implemented to address any identified adverse effects;
- a summary of Trans Mountain's consultation with potentially affected communities, Aboriginal groups, local and regional authorities, and service providers regarding the Socio-Economic effects monitoring plan; and
- plans for regular consultation and reporting on effects during construction with potentially affected communities, Aboriginal groups, local and regional authorities, and service providers.

Air Quality Monitoring

Trans Mountain is committed to an air quality monitoring program 6 months before commissioning at Edmonton, Sumas, Burnaby and Westridge terminals and at least 1 year after starting terminal operations. Conservative air emission modelling will inform engineering design, technology selection, and operating procedures to ensure that ambient air quality standards are achieved. Air quality monitoring will be conducted to confirm and assess the modelling predictions once the design and engineering details have been completed and the terminals are operational. Monitoring will include: ambient ground-level concentrations of volatile organic compounds (VOCs), ozone concentrations, hydrogen sulphide (H_2S), mercaptans, criteria air contaminants (CACs), secondary ozone and particulate matter; and reduced visibility. The details of these plans will be addressed in meeting the requirements of NEB Draft Conditions #19, 20, 21, and 22 prior to construction.

Adaptive Management

Results of these monitoring and follow-up programs would need to be assessed and discussions with the appropriate regulatory authorities would be held. If there are issues identified, a general stepwise process to assess and define the problem, design, implement, monitor, evaluate, and adjust / review would be employed for each of the respective issues that need to be addressed.

Summary of New Commitments:

- Follow-up programs for select wildlife species and select air emission indicators.
- NEB Draft conditions 10, 11, 19, 20, 21 and 22.
- Employ stepwise approach to adaptive management.

2.033 Assessment of change in habitat, changes in movement, and increased risk of mortality on wildlife

Reference:

A3S1Q9, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical:

i) PDF page 249 of 403
ii) PDF page 262 of 403
iii) PDF pages 270 to 273 of 403
iv) PDF pages 287 and 288 of 403
v) PDF pages 296 to 299 of 403
vi) PDF page 303 of 403
vii) PDF pages 307 and 308 of 403
viii) PDF page 311 of 403
ix) PDF pages 313 and 314 of 403

Preamble:

Reference i) states that the combined suite of potential Project effects on wildlife habitat, movement, and mortality risk constitute the potential residual effect for each indicator.

In Reference ii), Table 7.2.10-6 outlines the significance evaluation of potential residual Project effects on mammal indicators from a combination of habitat loss or alteration, changes in movement, and increased mortality risk. Reference iii) provides a summary of effects characterization rationale for mammal indicators.

In Reference iv), Table 7.2.10-9 outlines the significance evaluation of potential residual Project effects on bird indicators from a combination of habitat loss or alteration, changes in movement, and increased mortality risk. Reference v) provides a summary of effects characterization rationale for bird indicators.

In Reference vi), Table 7.2.10-12 outlines the significance evaluation of potential residual Project effects on amphibian indicators from a combination of habitat loss or alteration, changes in movement, and increased mortality risk. Reference vii) provides a summary of effects characterization rationale for amphibian indicators.

In Reference viii), Table 7.2.10-15 outlines the significance evaluation of potential residual Project effects on the reptile indicator from a combination of habitat loss or alteration, changes in movement, and increased mortality risk. Reference ix) provides a summary of effects characterization rationale for the reptile indicator.

The Board requests a significance evaluation and effects characterization for each individual potential residual effect, such as change in habitat, changes in movement, and increased mortality risk. This assessment is in addition to the significance evaluation of combined Project effects on each of the wildlife indicators already provided in the Application.

Request:

For each of the wildlife indicators, please provide a significance evaluation, effects characterization, and discussion for each individual potential residual effect, such as change in habitat, changes in movement, and increased mortality risk.

Response:

Trans Mountain maintains that assessing the combined suite of potential effects of the Project on wildlife habitat, movement and mortality risk is a more appropriate approach for assessing the potential effects of the Project on wildlife indicators than assessing the potential effects pathways separately. The combined residual effect approach evaluates the effects on the indicator in a holistic fashion, and is both more realistic and conservative than assessing the individual potential residual effects. A significance evaluation and effects characterization for the individual effects pathways would require the simplifying and incorrect assumption that the three effects pathways are independent. This assumption could potentially lead to underestimating potential Project effects.

Section 7.2.10 of Volume 5A [Filing ID A3S1Q9] includes a discussion of each individual potential residual effect pathway for the wildlife indicators along with the mitigation measures proposed to minimize these potential effects. The significance evaluation and effects characterization of the combined suite of residual effects acknowledges the interrelatedness of the effects pathways by considering both the information presented in the discussion and the interactions between effects pathways. Consideration of the interactions between effects pathways is essential for providing an accurate assessment of the potential effects of the Project on wildlife and wildlife habitat. As noted in the response to NEB IR No. 2.041b, this approach is consistent with the *Canadian Environmental Assessment Act, 2012*, objective of providing information sufficient to conclude that wildlife indicators will be protected from significant adverse effects caused by the Project.

2.034 Project effects assessment and cumulative effects significance evaluation and effects summary for grizzly bear population units

Reference:

i) A3S1Q9, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF pages 262 to 271 of 403

A3S1R2, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical:

ii) PDF page 69 of 148
iii) PDF pages 85 and 86 of 148

Preamble:

Reference i) provides an assessment of Project effects on wildlife indicators, including grizzly bear.

In Reference ii), Table 8.9-6 outlines the Project contribution to cumulative effects on mammal indicators, including grizzly bear.

Reference iii) provides the criteria ratings and significance rationale for incremental cumulative effects on grizzly bear.

Request:

a) Please provide separate Project effects assessments, including significance evaluations, for each of the Grande Cache, Yellowhead, Columbia-Shuswap, Wells Gray, Robson, and North Cascades grizzly bear population units potentially affected by the Project, for each of the potential residual Project effects (such as change in habitat, changes in movement and increased mortality risk).

b) Please provide separate cumulative effects significance evaluations and discussions for each of the Grande Cache, Yellowhead, Columbia-Shuswap, Wells Gray, Robson, and North Cascades grizzly bear population units for each of the identified potential residual Project effects (such as change in habitat, changes in movement, and increased mortality risk). The cumulative effects significance evaluations are to include an evaluation of the significance of total cumulative effects for each of the grizzly bear population units, rather than simply the Project's contribution to cumulative effects, as was provided in the Application.

Response:

a) A separate Project effects assessment for each of the Grande Cache, Yellowhead, Columbia-Shuswap, Wells Gray, Robson, and North Cascades Grizzly Bear Population Units (GBPUs) is provided below. Please refer to the response to NEB IR No. 2.033 for information on why Trans Mountain has assessed the combined Project effects on grizzly

bear resulting from habitat loss or alteration, changes in movement and increased mortality risk rather than each effects pathway individually.

Table 2.034A-1 provides a summary of the significance evaluation for the potential residual effects of the Project on grizzly bear overall (*i.e.,* all GBPUs combined) and by GBPU. Supporting details are provided below.

TABLE 2.034A-1

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF PROJECT CONSTRUCTION AND OPERATIONS ON GRIZZLY BEAR BY GRIZZLY BEAR POPULATION UNIT

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Grizzly Bear (overall)									
Combined Project effects on grizzly bear resulting from habitat loss or alteration, changes in movement and increased mortality risk.	Negative	Grizzly Bear RSA	Short -term	Periodic	Long-term	Medium	High	Moderate	Not significant
2. Grizzly Bear – Grande Cache GBPU									
Combined Project effects on grizzly bear in the Grande Cache GBPU resulting from habitat loss or alteration, changes in movement and increased mortality risk.	Negative	Grande Cache GBPU	Short -term	Periodic	Long-term	Medium	High	Moderate	Not significant
3. Grizzly Bear – Yellowhead GBPU									
Combined Project effects on grizzly bear in the Yellowhead GBPU resulting from habitat loss or alteration, changes in movement and increased mortality risk.	Negative	Yellow-head GBPU	Short -term	Periodic	Long-term	Medium	High	Moderate	Not significant
4. Grizzly Bear – Columbia-Shuswap GBPU									
Combined Project effects on grizzly bear in the Columbia-Shuswap GBPU resulting from habitat loss or alteration, changes in movement and increased mortality risk.	Negative	Columbia - Shuswap GBPU	Short -term	Periodic	Long-term	Low	High	Moderate	Not significant
5. Grizzly Bear – Wells Gray GBPU									
Combined Project effects on grizzly bear in the Wells Gray GBPU resulting from habitat loss or alteration, changes in movement and increased mortality risk.	Negative	Wells Gray GBPU	Short -term	Periodic	Long-term	Low	High	Moderate	Not significant
6. Grizzly Bear – Robson GBPU									
Combined Project effects on grizzly bear in the Robson GBPU resulting from habitat loss or alteration, changes in movement and increased mortality risk.	Negative	Robson GBPU	Short -term	Periodic	Long-term	Low	High	Moderate	Not significant
7. Grizzly Bear – North Cascades GBPU									
Combined Project effects on grizzly bear in the North Cascades GBPU resulting from habitat loss or alteration, changes in movement and increased mortality risk.	Negative	North Cascade GBPU	Short -term	Periodic	Long-term	Medium	High	Moderate	Not significant

Notes: 1 The Grizzly Bear RSA is defined by the Grizzly Bear Population Units (GBPUs) traversed by the proposed pipeline corridor.

2 Significant Residual Environmental Effect: defined as a high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

The criteria rating and rationale for duration, frequency, reversibility and probability are similar for grizzly bear (overall) and all of the GBPUs.

- Duration: short-term – the events causing effects are construction and operational activities (*e.g.*, monitoring, vegetation management and site-specific maintenance), the latter of which are limited to any 1 year during operations.
- Frequency: periodic – the events causing effects (*i.e.,* clearing of the Footprint, traffic and activity) will occur during construction and intermittently during operations for monitoring, vegetation control and maintenance.
- Reversibility: long-term – effects are reversible in the long-term following decommissioning and abandonment, once native vegetation regenerates over the Project Footprint.
- Probability: high – the Project will alter habitat, cause sensory disturbance and potentially increase mortality risk for grizzly bear.
- Confidence: moderate – the assessment is based on a good understanding of cause-effect relationships and relevant data. Limitations and uncertainty associated with available data pertinent to the Project area reduce the confidence level to moderate.

The criteria rating and rational for spatial boundary, magnitude and confidence vary, and are provided below for grizzly bear (overall) and each of the GBPUs.

<u>Grizzly Bear (overall)</u>

- Spatial Boundary: Grizzly Bear RSA – habitat changes (*e.g.*, clearing) and alteration of movement (*e.g.*, avoidance of construction) will be limited to the Wildlife Local Study Area (LSA); however, changes in mortality risk (*e.g.*, increased access, traffic) are assessed at the regional scale.
- Magnitude: medium – Grizzly bear is a species of conservation concern provincially and federally, largely due to extensive range and population reductions influenced by habitat development and fragmentation, and human related conflicts and mortality. Clearing for Project construction and operation will create early seral habitat that will have a small increase in suitable foraging habitat for grizzly bear; however, mortality risk is known to be high for grizzly bears along linear corridors and, therefore, the habitat effectiveness is reduced within the Project footprint. The proposed mitigation measures, including development and implementation of a Wildlife Conflict Management Plan, and measures to reduce new access and control access where it cannot be avoided, are consistent with regional resource management objectives and strategies, and will reduce the magnitude of Project effects on grizzly bear to medium.

<u>Grizzly Bear - Grande Cache GBPU</u>

- Spatial Boundary: Grande Cache GBPU – habitat changes (*e.g.*, clearing) and alteration of movement (*e.g.*, avoidance of construction) will be limited to the Wildlife LSA within

the Grande Cache GBPU; however, changes in mortality risk (*e.g.*, increased access, traffic) are assessed at the regional scale.

- Magnitude: medium – Grizzly bears are designated as At Risk in Alberta and are listed as Threatened under the *Alberta Wildlife Act* and Wildlife Regulation (AESRD 2012a, ASRD 2011b). The Alberta Grizzly Bear Recovery Plan 2008-2013 has been implemented within Alberta in an attempt to reduce human-caused mortality of grizzly bears, improve knowledge about the population within Alberta, reduce the number of human-bear conflicts, improve and deliver education programs to the public (*i.e.*, Bear Smart), maintain quality habitat, and improve inter-jurisdictional cooperation (ASRD 2008). A hunting moratorium was also put in place in 2006 and additional conservation initiatives include increasing the maximum poaching fine, delineating Bear Management Areas (comparable to Grizzly Bear Population Units), DNA population censuses in certain Bear Management Areas, financial support for government staff biologists, implementation of the Bear Smart Community Program, and aversive conditioning of grizzly bears in high risk areas (ASRD 2008). Habitat model results for the Foothills and Rocky Mountain Natural Regions, which overlap with the Grande Cache GBPU, were not included in the Application since spatial data was not available at the time of assessment. Refer to the response to NEB IR No. 2.038b for information on when the updated habitat model results will be filed with the Board. The proposed pipeline corridor is located within a secondary area for grizzly bear in the Grande Cache GBPU (Section 4.3.3 of Wildlife Technical Report [TERA Environmental Consultants, December 2013], in Volume 5C, TR5C-10 [Filing ID A3S2Q3]). Approximately 90% of the proposed corridor follows existing linear disturbances, including Highway 16; therefore, the potential changes in effective grizzly bear habitat, movement and mortality risk in the Grande Cache GBPU are expected to be relatively small. The proposed mitigation measures, including aligning the proposed pipeline corridor to parallel existing linear corridors and utilizing existing access to the extent feasible, development and implementation of a Wildlife Conflict Management Plan and measures to reduce new access and control access where it cannot be avoided, are consistent with regional resource management objectives and strategies, and will reduce the magnitude of Project effects on grizzly bear in the Grande Cache GBPU. The residual Project effect on grizzly bear habitat, movement and mortality risk in the Grande Cache GBPU is concluded to be medium.

<u>Grizzly Bear - Yellowhead GBPU</u>

- Spatial Boundary: Yellowhead GBPU – habitat changes (*e.g.*, clearing) and alteration of movement (*e.g.*, avoidance of construction) will be limited to the Wildlife LSA within the Yellowhead GBPU; however, changes in mortality risk (*e.g.*, increased access, traffic) are assessed at the regional scale.

- Magnitude: medium – Grizzly bears are designated as At Risk in Alberta and are listed as Threatened under the Alberta Wildlife Act and Wildlife Regulation (AESRD 2012, ASRD 2011). The Alberta Grizzly Bear Recovery Plan 2008-2013 has been implemented within Alberta in an attempt to reduce human-caused mortality of grizzly

bears, improve knowledge about the population within Alberta, reduce the number of human-bear conflicts, improve and deliver education programs to the public (i.e., Bear Smart), maintain quality habitat, and improve inter-jurisdictional cooperation (ASRD 2008). A hunting moratorium was also put in place in 2006 and additional conservation initiatives include increasing the maximum poaching fine, delineating Bear Management Areas (comparable to Grizzly Bear Population Units), DNA population censuses in certain Bear Management Areas, financial support for government staff biologists, implementation of the Bear Smart Community Program, and aversive conditioning of grizzly bears in high risk areas (ASRD 2008). Habitat model results for the Foothills and Rocky Mountain Natural Regions, which overlap with the Yellowhead GBPU, were not included in the Application since spatial data were not available at the time of assessment. Refer to the response to NEB IR No. 2.038b for information on when the updated habitat model results will be filed with the Board. The proposed pipeline corridor is located within a secondary area for grizzly bear in the Yellowhead GBPU (Section 4.3.3 of Wildlife Technical Report [TERA Environmental Consultants, December 2013], in Volume 5C, TR5C-10 [Filing ID A3S2Q3]). Approximately 53% of the proposed pipeline corridor follows existing linear disturbances in this GBPU, which minimizes the Project's residual effect on effective habitat for grizzly bear. Given the linear nature of pipeline rights-of-way, the Project has potential to affect mortality risk for grizzly bears. The proposed mitigation measures, including aligning the proposed corridor to parallel existing linear corridors and utilizing existing access to the extent feasible, development and implementation of a Wildlife Conflict Management Plan and measures to reduce new access and control access where it cannot be avoided, are consistent with regional resource management objectives and strategies, and will reduce the magnitude of Project effects on grizzly bear in the Yellowhead GBPU. The residual Project effect on grizzly bear habitat, movement and mortality risk in the Yellowhead GBPU is concluded to be medium.

<u>Grizzly Bear - Columbia-Shuswap GBPU</u>

- Spatial Boundary: Columbia-Shuswap GBPU – habitat changes (*e.g.*, clearing) and alteration of movement (*e.g.*, avoidance of construction) will be limited to the Wildlife LSA within the Columbia-Shuswap GBPU; however, changes in mortality risk (*e.g.*, increased access, traffic) are assessed at the regional scale.

- Magnitude: low – The Columbia-Shuswap population is a viable population (BC MOE 2012). The proposed pipeline corridor parallels existing linear disturbances for approximately 77% in the Columbia-Shuswap GBPU. The Project is predicted to affect a small amount (approximately 1.1%) of effective grizzly bear habitat within the Wildlife LSA in the Columbia-Shuswap GBPU. Given the linear nature of pipeline rights-of-way, the Project has potential to affect mortality risk for grizzly bears. The proposed mitigation measures, including aligning the proposed pipeline corridor to parallel existing linear corridors and utilizing existing access to the extent feasible, development and implementation of a Wildlife Conflict Management Plan and measures to reduce new access and control access where it cannot be avoided, are consistent with regional

resource management objectives and strategies, and will reduce the magnitude of Project effects on grizzly bear in the Columbia-Shuswap GBPU to low.

Grizzly Bear - Wells Gray GBPU

- Spatial Boundary: Wells Gray GBPU – habitat changes (*e.g.*, clearing) and alteration of movement (*e.g.*, avoidance of construction) will be limited to the Wildlife LSA within the Wells Gray GBPU; however, changes in mortality risk (*e.g.*, increased access, traffic) are assessed at the regional scale.

- Magnitude: low – The Wells Gray population is a viable population (BC MOE 2012). The proposed pipeline corridor parallels existing linear disturbance for approximately 95% of the route in the Wells Gray GBPU; therefore, potential changes in grizzly bear movement and mortality risk associated with the linear feature during operations are expected to be minor. The Project is predicted to affect a small amount (approximately 0.9%) of effective grizzly bear habitat within the *Wildlife* LSA in the Wells Gray GBPU. The proposed mitigation measures, including aligning the proposed pipeline corridor to parallel existing linear corridors and utilizing existing access to the extent feasible, development and implementation of a Wildlife Conflict Management Plan and measures to reduce new access and control access where it cannot be avoided, are consistent with regional resource management objectives and strategies, and will reduce the magnitude of Project effects on grizzly bear in the Wells Gray GBPU to low.

Grizzly Bear - Robson GBPU

- Spatial Boundary: Robson GBPU – habitat changes (*e.g.*, clearing) and alteration of movement (*e.g.*, *avoidance* of construction) will be limited to the Wildlife LSA within the Robson GBPU; however, changes in mortality risk (*e.g.*, increased access, traffic) are assessed at the regional scale.

- Magnitude: low – The Robson population is a viable population (BC MOE 2012). The proposed pipeline corridor parallels existing linear disturbances for approximately 90% of the route in the Robson GBPU; therefore, potential changes in grizzly bear movement and mortality risk associated with the linear feature during operation are expected to be minor. The Project is predicted to affect a small amount (approximately 1.6%) of effective grizzly bear habitat within the Wildlife LSA in the Robson GBPU. The proposed mitigation measures, including aligning the proposed pipeline corridor to parallel existing linear corridors and utilizing existing access to the extent feasible, development and implementation of a Wildlife Conflict Management Plan and measures to reduce new access and control access where it cannot be avoided, are consistent with regional resource management objectives and strategies, and will reduce the magnitude of Project effects on grizzly bear in the Robson GBPU to low.

Grizzly Bear - North Cascades GBPU

- Spatial Boundary: North Cascades GBPU – habitat changes (*e.g.*, clearing) and alteration of movement (*e.g.*, avoidance of construction) will be limited to the Wildlife

LSA within the North Cascades GBPU; however, changes in mortality risk (*e.g.*, increased access, traffic) are assessed at the regional scale.

- Magnitude: medium – The North Cascades population is a threatened population (BC MOE 2012) and had an estimated population of six individuals in 2012 (BC MFLNRO 2012). Current information suggests that there are only 2 remaining adult female grizzly bears in the North Cascades population unit, and natural mortality rates within the population are very high (Hamilton pers. comm.). The management objective for threatened GBPUs in BC is population recovery to prevent range contraction and to ensure long-term population viability (BC MFLNRO 2012). This population is closed to hunting (BC MFLNRO 2012), and the anticipated threat level for this population is high (Apps 2010). Because of its small size, isolation from other populations, and sensitivity to human impact, the North Cascades population is at risk of extirpation (North Cascades Grizzly Bear Recovery Team 2004). The Project is predicted to affect a small amount (approximately 0.4%) of effective grizzly bear habitat within the Wildlife LSA in the North Cascades GBPU. The proposed pipeline corridor parallels existing linear disturbances for approximately 82% of the route in the North Cascades GBPU, with deviations associated with avoiding existing developments. The proposed mitigation measures, including aligning the proposed pipeline corridor to parallel existing linear corridors and utilizing existing access to the extent feasible, development and implementation of a Wildlife Conflict Management Plan and measures to reduce new access and control access where it cannot be avoided, are consistent with regional resource management objectives and strategies, and will reduce the magnitude of Project effects on grizzly bear in the North Cascades BBPU to medium.

References:

Alberta Environment and Sustainable Resource Development. 2012a. Species Assessed by Alberta's Endangered Species Conservation Committee: Short List. Wildlife Management Branch. Website: http://www.srd.alberta.ca/FishWildlife/SpeciesAtRisk/SpeciesSummaries/documents/SpeciesAssessed-EndangeredSpeciesConservationCommittee-ShortList-Nov06-2012.pdf. Accessed: January 2013.

Alberta Sustainable Resource Development. 2008. Alberta Grizzly Bear Recovery Plan 2008 2013. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Recovery Plan No. 15. Edmonton, AB. 68 pp.

Alberta Sustainable Resource Development. 2011b. General Status of Alberta Wild Species 2010. Website: http://srd.alberta.ca/FishWildlife/SpeciesAtRisk/GeneralStatusofAlbertaWildSpecies/GeneralStatusofAlbertaWildSpecies2010/SearchForWildSpeciesStatus.aspx. Accessed: November 2013.

Apps, C.D., B.N. McLellan, T.A. Kinley, R. Serrouya, D.R. Seip and H.U. Wittmer. 2013. Spatial factors related to mortality and population decline of endangered mountain caribou. Journal of Wildlife Management 77(7):1409-1419.

British Columbia Ministry of Environment. 2012a. Grizzly Bear Population Status in B.C. (2012). Website: http://www.env.gov.bc.ca/soe/indicators/plants-and-animals/grizzly-bears.html. Accessed: November 26, 2013.

British Columbia Ministry of Forests, Lands and Natural Resource Operations. 2012b. British Columbia Grizzly Bear Population Estimate for 2012. April 2012. Website: http://www.env.gov.bc.ca/fw/wildlife/docs/Grizzly_Bear_Pop_Est_Report_Final_2012.pdf . Accessed: November 2013.

Hamilton, A.N. Large Carnivore Specialist, BC Ministry of Environment, Ecosystems Branch. Victoria, BC. Personal communication: phone call June 3, 2014.

North Cascades Grizzly Bear Recovery Team. 2004. Recovery plan for grizzly bears in the North Cascades of British Columbia. 54 pp.

b) For reasons described in the response to NEB IR No. 2.041c, Trans Mountain believes that the cumulative effects assessment (CEA) methodology applied in the Environmental and Socio-Economic Assessment (ESA) is appropriate for considering the variability in total cumulative effects risk between regions/areas/segments and how these differences should inform design and selection of technically and economically feasible mitigation measures that avoid, mitigate, or compensate for any residual Project contribution to cumulative effects. For reasons described in the response to NEB IR No. 2.033, Trans Mountain also believes that evaluation of the significance of combined effects, not individual pathways, is the most defensible approach, particularly for grizzly bear populations where established thresholds calculated at the population unit scale integrate multiple effect pathways. Updated cumulative effects significance evaluations are provided below in Table 2.034B-1 for each grizzly bear population unit (GBPU). These compare the significance of total combined cumulative effects and the Project contribution to those effects, using the same table format provided in the response to NEB IR No. 2.041a.

In all cases, duration is rated as short to long-term, frequency is rated as isolated to continuous and reversibility is rated as medium-term to permanent for total cumulative effects because effects associated with some existing activities (*e.g.,* oil and gas development and forestry) are anticipated to be temporary, while others (*e.g.,* agriculture, communities, and roads and other paved areas) could have continuous, permanent effects on grizzly bear populations. Magnitude of existing cumulative effects is rated as medium to high for grizzly bear population units. Analyses provided in Section 8.9.6 of Volume 5A (Filing ID A3S1R2) and the response to NEB IR No. 1.47 (Filing ID A3W9H8), indicate that the access density threshold of 0.6 km/km^2 is currently exceeded in the Columbia-Shuswap, Wells Gray, Robson, and North Cascades GBPU, and this is considered a high magnitude existing cumulative effect. The access density threshold is not currently exceeded in the Grande Cache and Yellowhead GBPU and this is considered a medium magnitude existing cumulative effect. It is anticipated that best management practices will be applied by reasonably foreseeable developments to minimize their contribution to total cumulative effects on grizzly bear at the GBPU and Grizzly Bear RSA scale. Based on existing cumulative effects risk, total cumulative effects on GBPU could be considered to range from not significant to significant and this is expected to persist with or without the Project.

Due to the existing cumulative effects risk for grizzly bear and management guidance to avoid further effects, Trans Mountain will implement mitigation measures to minimize effects on this species (see response to NEB IR No. 1.47 [Filing ID A3W9H8]). With application of these mitigation and compensation measures, the Project contribution to total cumulative effects on each GBPU encountered by the route is rated as medium magnitude. This translates to a not significant adverse effect for the Project contribution to cumulative effects on grizzly bear.

TABLE 2.034B-1

SUMMARY OF SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON MAMMAL INDICATORS

Potential Cumulative Effects	Impact Balance	Spatial Boundary	Temporal Context			Magnitude[2]	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
1. Wildlife Indicator – Grizzly Bear, Grande Cache population unit									
1(a) Project contribution to cumulative effects on grizzly bear, Grande Cache population unit.	Negative	Grizzly RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
1(b) Total cumulative effects on grizzly bear, Grande Cache population unit.	Negative	Grizzly RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium	High	Moderate	Not significant
2. Wildlife Indicator – Grizzly Bear, Yellowhead population unit									
2(a) Project contribution to cumulative effects on grizzly bear, Yellowhead population unit.	Negative	Grizzly RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
2(b) Total cumulative effects on grizzly bear, Yellowhead population unit.	Negative	Grizzly RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium	High	Moderate	Not significant
3. Wildlife Indicator – Grizzly Bear, Columbia-Shuswap population unit									
3(a) Project contribution to cumulative effects on grizzly bear, Columbia-Shuswap population unit.	Negative	Grizzly RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
3(b) Total cumulative effects on grizzly bear, Columbia-Shuswap population unit.	Negative	Grizzly RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	**High**	High	Moderate	significant
4. Wildlife Indicator – Grizzly Bear, Wells Gray population unit									
4(a) Project contribution to cumulative effects on grizzly bear, Wells Gray population unit.	Negative	Grizzly RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
4(b) Total cumulative effects on grizzly bear, Wells Gray population unit.	Negative	Grizzly RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	**High**	High	Moderate	significant
5. Wildlife Indicator – Grizzly Bear, Robson population unit									
5(a) Project contribution to cumulative effects on grizzly bear, Robson population unit.	Negative	Grizzly RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
5(b) Total cumulative effects on grizzly bear, Robson population unit.	Negative	Grizzly RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	**High**	High	Moderate	significant
6. Wildlife Indicator – Grizzly Bear, North Cascades population unit									
6(a) Project contribution to cumulative effects on grizzly bear, North Cascades population unit.	Negative	Grizzly RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
6(b) Total cumulative effects on grizzly bear, North Cascades population unit.	Negative	Grizzly RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	**High**	High	Moderate	significant
7. Wildlife Indicator – Grizzly Bear									
7(a) Project contribution to cumulative effects on grizzly bear (1[a], 2[a], 3[a], 4[a], 5[a] and 6[a]).	Negative	Grizzly RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
7(b) Total cumulative effects on grizzly bear (1[b], 2[b], 3[b], 4[b], 5[b] and 6[b]).	Negative	Grizzly RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to **high**	High	Moderate	Not significant to significant

Notes: 1 Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
2 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

2.035 Assessment of alternative routes under consideration – pipeline corridor route deviations

Reference:

A3W9H8, Trans Mountain response to Board IR No. 1, IR 1.40, PDF page 238 of 421

Preamble:

Reference i) states that environmental and cultural desktop and baseline field studies, including aquatics, soils, wetlands, wildlife, vegetation, and archaeology, are scheduled to be conducted along the segments of the proposed revised pipeline corridor route deviations throughout 2014.

Reference i) also states that information gathered from baseline studies for the proposed revised pipeline corridor route deviations will be assessed following the same criteria that were used for the assessment of the proposed pipeline corridor in the Environmental and Socio-Economic Assessment that was included in the Application.

Request:

Please indicate when Trans Mountain will file with the Board the baseline field studies and environmental and socio-economic assessment for the proposed revised pipeline corridor route deviations, as referred to in the preamble.

Response:

An update on changes to the proposed pipeline corridor will be provided to the NEB on August 1, 2014. For each change to the proposed pipeline corridor presented in the Application, Trans Mountain has described the change, including the status of ongoing or outstanding desktop studies or field work.

Desktop and field-based studies on revised portions of the pipeline corridor that were not previously assessed in the Application and where access has been granted are ongoing and will continue throughout 2014. Information gathered during these studies will be used to help refine the eventual construction right-of-way, confirm the predictions and conclusions that have been made in the Environmental and Socio-Economic Assessment (ESA) (Volumes 5A/5B) (Filing ID A56004), as well as inform the mitigation measures that will be included in the Pipeline Environmental Protection Plan (EPP) (Volume 6B) (Filing ID A56013).

As the results of the desktop and field-based studies become available, Trans Mountain and its consultants will follow these steps to confirm the conclusions reached in the ESA:

1. Review the results of desktop and field-based studies to confirm if new indicators have been identified.
2. Confirm if new environmental or socio-economic potential effects have been identified.
3. Confirm that any new issues or concerns raised during consultation on routing changes have been addressed in the ESA or would be addressed by an update to the Pipeline EPP.

4. Compare the results of the desktop and field-based studies to the identification and assessment of residual effects.

5. Confirm if the significance conclusions reached in the ESA would change as a result of the desktop and baseline studies.

For the desktop and field studies that have concluded as of June 10, 2014, Trans Mountain confirms that no update to the ESA is necessary. Based on an initial review of the routing changes, Trans Mountain does not anticipate changes to the significant conclusions reached in the ESA as the majority of deviations from the previously assessed corridor are either very close to the previously assessed corridor or are within a similar environmental setting as the previously assessment corridor. The Pipeline EPP will be updated and filed with the NEB in accordance with NEB Draft Condition No. 29 of the NEB's *Letter – Draft Conditions and Regulatory Oversight* (NEB 2014) (Filing ID A3V8Z8) to incorporate any new site-specific mitigation measures identified as a result of the field studies.

For locations where the landowner has refused consent to Trans Mountain's representative carrying out field studies, Trans Mountain will explore the mechanisms available to it under the *NEB Act* to obtain consent to carry out the necessary field studies.

Trans Mountain notes there is flexibility in the process to identify and/or improve site-specific mitigation measures resulting from new information or from new concerns or issues raised during consultation as the Pipeline EPP will be updated and submitted to the NEB for approval pursuant to NEB Draft Condition No. 29 (Filing ID A3V8Z8). Furthermore, Trans Mountain has committed to follow-up programs for certain indicators to confirm the predictions of the ESA (refer to the response to NEB IR No. 2.032), and Trans Mountain will monitor the potential adverse socio-economic effects of the Project during construction pursuant to NEB Draft Condition No. 11 (Filing ID A3V8Z8).

In closing, Trans Mountain does not plan to file the baseline studies related to the proposed revised pipeline corridor and an updated ESA unless the results of the baseline studies indicate a change in the significance conclusions reached in the ESA filed in the Application in December 2013.

2.036 Beaver dams and lodges

Reference:

i) A3S0U6, Application Volume 3B, Aboriginal Engagement Log
ii) A3S1Q4, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical, PDF page 9 of 72
iii) A3S1Q9, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF page 249 of 403

Preamble:

Various pages of Reference i) outline unresolved concerns from various Aboriginal groups. These include avoiding beaver dams as opposed to trapping beavers, and avoiding disturbance to beaver habitat.

In Reference ii), traditional ecological knowledge participants are noted as stating that, typically, if a beaver dam is torn down in the spring, the beaver will relocate and make a new dam; and that fall is thought to be the worst time to tear down a dam since the beaver will have nowhere to rebuild in time for winter.

Reference iii) outlines mitigation for beaver dams and lodges as being notification to Fisheries and Oceans Canada and the BC Ministry of Forests, Lands and Natural Resources Operations prior to removing dams and lodges. It states that removals will be conducted in accordance with Fisheries and Oceans Canada's *Alberta Operational Statement for Beaver Dam Removal and the British Columbia Standards and Best Practices for Instream Works*.

The Board notes that specific mitigation measures to protect beavers have not been provided.

Request:

a) Please discuss any options that Trans Mountain has considered to avoid having to remove beaver dams and lodges.

b) Please outline specific mitigation measures (e.g., timing considerations) to minimize effects on beavers from beaver dam and lodge removal.

Response:

a) To the extent feasible, beaver dams and lodges are avoided during selection of the construction footprint during detailed engineering design and construction planning. In most cases, beaver dams and lodges are avoided by the construction right-of-way. However, avoidance is not always feasible given other constraints that may be encountered at the crossings (*e.g.,* existing infrastructure, geotechnical considerations, constructability of the crossing, etc.). When avoidance of a beaver dam or lodge is not feasible, the mitigation measures provided in the "Clearing and Disposal" section of the Pipeline EPP (Section 8.1 of Volume 6B) as well as the "Water Crossing Construction Monitoring Management Plan" (Section 12.0 of Appendix C of Volume 6B [Filing ID A3S2S3]) will be implemented, as warranted.

b) To the extent feasible, beaver dams and lodges will not be removed during winter when conditions prevent beavers from relocating or rebuilding dams and/or lodges. In most cases, dam and lodge removal is not preferred during the winter as a measure to also protect fish. Beaver dam removal during the winter is not preferred given the higher change or loss of overwintering fish habitat and the discharge of water with low dissolved oxygen levels downstream. Mitigation measures for beaver dam/lodge removal are provided in Section 8.1 (Clearing and Disposal) and Section 12.0 (Water Crossing Construction Monitoring Management Plan) of Appendix C of Volume 6B (Filing ID A3S2S3).

2.037 Wildlife dens

Reference:

i) A3S0U6, Application Volume 3B, Aboriginal Engagement Log
ii) A3S1Q9, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical, PDF page 270 of 403

Preamble:

Various pages of Reference i) refer to concerns raised by various Aboriginal groups regarding mammal dens, such as:

- impacts on abandoned badger dens and requests for follow up to have dens checked prior to construction to ensure they are still unoccupied;
- impacts on wolf dens near the right-of-way; and
- impacts on coyote dens.

Reference i) also refers to wildlife studies to determine fox den activity, and a request by various Aboriginal groups to accompany the wildlife crew during the wildlife studies. It also refers to bear den sweeps along the Project corridor.

Reference ii) states that the Project may result in the inadvertent felling of, or disturbance to, occupied fisher or marten natal and maternal dens. It also states that fisher and marten parturition occurs in late winter, and fisher natal dens may be occupied between February and May, after which kits are moved to maternal dens for the summer.

Reference ii) indicates that disturbance of hibernation habitat (e.g., bear dens, bat hibernacula) during winter construction has potential to increase mortality risk for hibernating mammals. It states that the proposed mitigation regarding buffers for bat hibernacula, bat maternity roosts, and bear dens will help minimize mammal mortality from vegetation clearing.

The Board notes that there does not appear to be mitigation specific to fisher and marten natal and maternal dens.

Request:

a) Please confirm whether or not Trans Mountain commits to studies to determine fox den activity. If not, provide a rationale. If so, please indicate:
   a.1) when the wildlife studies to determine fox den activity will take place;
   a.2) if Trans Mountain will invite interested Aboriginal groups to accompany the wildlife crew during the wildlife studies; and
   a.3) when Trans Mountain will file the study results with the Board.

b) Please confirm whether or not Trans Mountain commits to conduct bear den sweeps along the Project corridor. If not, provide a rationale. If so, provide details of the timing and methods of the bear den sweeps.

c) Please identify the mitigation proposed specifically to minimize Project effects on furbearing mammal natal and maternal dens.

Response:

a) As noted in Section 3.7.12 of Wildlife Technical Report (TERA Environmental Consultants December 2013), in Volume 5C, TR5C-10 (Filing ID A3S2Q3), information regarding wildlife habitat features, including fox dens, was collected during the wildlife field surveys. Additionally, incidental information regarding wildlife habitat features was collected by other disciplines (vegetation, wetlands, aquatics, archaeology) conducting field work, and was also collected as part of traditional ecological knowledge (TEK). If an active fox den was identified within the Project corridor during field surveys in 2013 or 2014, the location was recorded. Once the Project footprint is finalized, the location of the fox dens will be reviewed in relation to the footprint (using the recorded GPS coordinates). If a den site is located within the footprint, the site will be revisited if construction is scheduled to occur during the denning/breeding period to determine if the den is active. This process is consistent for other wildlife habitat features (*e.g.,* stick nests) and is not specific to only fox dens. Therefore, this work is considered as part of the pre-construction surveys for wildlife habitat features and should not be considered as a stand-alone survey with separate reporting. Interested Aboriginal groups will be invited to participate in pre-construction surveys. The results of preconstruction surveys and any recommendations for mitigation can be provided to the NEB within 4 – 6 weeks after completion of the field work.

b) In order to be meaningful, den sweeps for both grizzly and black bear dens need to be completed only in the event that construction activity (*e.g.,* clearing/grading) is scheduled to coincide with the period when bears are denning and habitat suitability for denning is high. The need for a bear den sweep and the methods to be used, if one is completed, will be discussed with the appropriate regulatory agency.

c) Recommended wildlife mitigation measures are provided in Volume 5A, Section 7.2, Table 7.2.10-3 (TERA Environmental Consultants December 2013, Filing ID A3S1Q9). Relevant measures to minimize Project effects on furbearing mammal natal and maternal dens includes avoiding activity during sensitive time periods (such as the denning period) to the extent feasible. In the event an active den is found, the appropriate regulatory agency will be contacted to discuss mitigation options. Measures may include implementing a protective buffer, modifying the construction schedule to avoid activity until the den is no longer active, or having an on-site monitor. In Alberta, active mammal dens have a recommended 100 m setback.

Summary of New Commitments:

- Invite interested Aboriginal groups to participate in pre-construction wildlife surveys.
- Provide the results of preconstruction surveys and any recommendations for mitigation to the NEB within 4 – 6 weeks after completion of the field work.
- The need and methods for a bear den sweep will be discussed with the appropriate regulatory agency in the event construction activity is scheduled to coincide with the period when bears are denning and habitat suitability for denning is high.

2.038 Habitat model updates

Reference:

A3S1Q9, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical, PDF page 236 of 403

Preamble:

The reference states that models for habitat suitability and effectiveness will be updated upon completion of the Terrestrial Ecosystem Mapping for the Project in 2014, where warranted.

Request:

a) Please provide the criteria for determining when the habitat models will be updated.

b) Please indicate when Trans Mountain will file the updated habitat model results and resulting updated habitat assessments with the Board.

Response:

a) The habitat models will be updated if the Terrestrial Ecosystem Mapping used for the modelling presented in the Application was incomplete within the range of the modelled species or if model verification results warrant refinement of the model habitat ratings.

b) Trans Mountain will complete the updated wildlife habitat models and review the results to determine if the updated results warrant a change in the significance conclusions reached in the ESA filed in the Application in December 2013. As stated in the response to NEB IR No. 2.035, Trans Mountain does not plan to file the updated wildlife habitat models unless the results indicate a change in the significance conclusions reached in the ESA.

2.039 Long-term marine bird monitoring in Burrard Inlet

Reference:

A3W9H8, Trans Mountain response to Board IR No. 1, IR 1.57, PDF pages 333 and 334 of 421

Preamble:

The reference states that Trans Mountain is supportive of a collaborative approach to long-term monitoring for marine birds in Burrard Inlet and will endeavor to meet with Environment Canada in May 2014 to discuss the potential for developing a long-term marine bird monitoring program in partnership with others.

Request:

Please provide an update on discussions held with Environment Canada on developing a long-term marine bird monitoring program.

Response:

Due to scheduling conflicts, a meeting was not held with Environment Canada in May 2014. A meeting with Environment Canada to discuss the potential development of a long-term marine bird monitoring program is now planned for July or August 2014. An update will be provided to the NEB prior to September 4, 2014.

Summary of New Commitments:

- Trans Mountain will meet with Environment Canada in July or August 2014 to discuss potential development of a long-term marine bird monitoring program and provide an update prior to September 4, 2014.

2.040 Effects on wildlife and marine bird species at risk

Reference:

i) A3W7U4, Environment Canada IR No. 1.023a.1 to Trans Mountain, PDF page 13 of 115
ii) A3Y2K9, Trans Mountain response to Environment Canada IR No. 1.023a.1, PDF page 33 of 241
iii) Species at Risk Act, section 79(2), PDF page 50 of 104

Preamble:

In Reference i), Environment Canada requested that Trans Mountain assess impacts on species individually for all federally listed species potentially impacted by the Project, and provide mitigation plans specific to each species, consistent with subsection 79(2) of the Species at Risk Act (SARA).

In Reference ii), Trans Mountain states that an indicator-based approach was used to focus the assessment of potential Project effects on wildlife and wildlife habitat. Trans Mountain further states that, by using this approach, it is not necessary to assess all species individually. It states this since the potential effects pathways and likely responses to Project disturbance of wildlife species that are not species-specific indicators may be inferred from the assessment for the selected indicators that have similar ecological requirements.

Reference iii) requires the Board, as the responsible authority, to identify the adverse effects of the Project on the listed wildlife species and its critical habitat, to ensure that measures are taken to avoid or lessen those effects, and to monitor them. Reference iii) also states that measures must be taken in a way that is consistent with any applicable recovery strategy and action plans.

The Board notes that the use of indicator-based approach is not appropriate to assess effects on all species at risk, and; therefore, the Board requests species-specific information on wildlife and marine bird species at risk in order to assess potential effects of the Project on those species and its critical habitat, as required under subsection 79(2) of the SARA. In addition, the Board also requests information on the potential effects of an increase in Project-related marine vessel traffic on wildlife and marine bird species at risk and associated mitigation.

Request:

a) Please discuss the potential effects resulting from constructing and operating the Project, including the Westridge Marine Terminal, on each SARA Schedule 1-listed wildlife and marine bird species that may be affected by the Project, including marine bird species with a terrestrial lifecycle component. For species at risk already assessed by Trans Mountain, please provide a reference for that assessment. For each individual species, the discussion must include, at a minimum:
   a.1) The frequency of occurrence within the applicable spatial boundaries (e.g., rare, seasonal);
   a.2) potential habitat use;
   a.3) potential Project effects, including potential effects on population levels;

a.4) species-specific mitigation to be undertaken;
a.5) identification of critical habitat and options for avoidance of that critical habitat; and
a.6) records of engagement with relevant government agencies, stakeholders, and Aboriginal groups.

b) Please discuss the potential effects of an increase in Project-related marine vessel traffic on each SARA Schedule 1-listed marine bird species that may be affected. For species at risk already assessed, please provide a reference for that assessment. For each individual species, the discussion must include, at a minimum:
b.1) The frequency of occurrence within the applicable spatial boundaries (e.g., rare, seasonal);
b.2) potential habitat use;
b.3) potential Project effects, including potential effects on population levels;
b.4) species-specific mitigation to be undertaken;
b.5) identification of critical habitat and options for avoidance of that critical habitat; and
b.6) records of engagement with relevant government agencies, stakeholders, and Aboriginal groups.

Response:

The assessment team met with Environment Canada in April 2013 to review work plans and discuss the environmental assessment approach. Environment Canada endorsed the use of indicators to describe effects of the Project on terrestrial wildlife and marine birds, and was largely in agreement with the species proposed. Environment Canada subsequently submitted to Trans Mountain suggestions for indicators which, in their view, were appropriate to understanding and assessing significance of Project effects. Environment Canada did not, at that time, suggest that an individual assessment of every species at risk potentially affected by the Project was warranted or necessary. In the preamble to GoC EC IR No. 1.029 (Filing ID A3Y2K9), Environment Canada states: 'In an April 2013 meeting with TERA [lead environmental consultant], EC emphasized that species of special conservation status must not be over-stated in the selection of Wildlife Indicators, and that general species more representative on the landscape must not be ignored'. Environment Canada's recommendations were considered and strongly influenced the final selection of indicator species. As such, potential habitat use by *Species at Risk* (*SARA*) Schedule 1-listed wildlife and marine birds, and potential Project effects on them are addressed through the discussion of indicators provided in the Application. Further detail on the assessment of indicator species is provided in the response to GoC EC IR No. 1.023 (Filing ID A3Y2K9).

Records of occurrence for terrestrial wildlife are provided for the Wildlife Local Study Area (LSA) in Technical Report 5C-10 in Volume 5C, Wildlife Technical Report (TERA Environmental Consultants December 2013; Filing ID A3S2Q3). Locations of observations of terrestrial species with special conservation status were provided in the response to GoC EC IR No. 1.051 (Filing ID A3Y2K9). Records of occurrence for all marine birds, including *SARA* Schedule 1-listed species, are provided for the Marine Regional Study Area (RSA) for the Westridge Marine Terminal in Table 4.1 of Technical Report 5C-14 in Volume 5C, Marine Birds – Westridge Marine Terminal Technical Report (Stantec Consulting Ltd. December 2013; Filing ID A3S2R8)

of the Application, and for the Marine RSA for Marine Transportation in Table 4.4 of Technical Report 8B-2 in Volume 8B, Marine Birds – Marine Transportation Technical Report (Stantec Consulting Ltd. December 2013; Filing ID A3S4J6) of the Application. This information will continue to be used to inform Project planning and support the development of appropriate mitigation to address Project effects on all species at risk affected.

Trans Mountain is continuing to collect baseline information and will continue to consult with Environment Canada and provincial regulatory agencies to better understand the interaction of the Project with candidate and proposed critical habitat, and to identify appropriate measures that can be implemented to avoid, minimize and mitigate Project effects on critical habitat. Trans Mountain has committed to the development of mitigation for species at risk in consultation with the appropriate regulatory agencies, and to the implementation and monitoring of mitigation implemented for species at risk. Please see follow-up responses to NEB F-IR No. 1.44 and 1.45 filed with NEB IR Round 2 responses for more information regarding mitigation strategies. Given these commitments, and based on the assessment method described in the Application, Trans Mountain concludes that the effects of the Project on species at risk can be adequately mitigated such that there are no significant residual effects on species at risk that were not explicitly assessed as individual indicators.

The use of indicators to assess potential Project effects on wildlife and other biotic elements is a commonly-employed method in environmental assessment. For example, several recent Section 52 and Section 58 Applications to the National Energy Board (NEB) have used an indicator-based approach, including the recently-approved Enbridge Inc. Edmonton to Hardisty Pipeline Project, the NOVA Gas Transmission Ltd. Northwest Mainline Natural Gas Pipeline Expansion Project, and the NOVA Gas Transmission Ltd. Sunday Creek South Lateral Loop No. 3 Pipeline Project. Trans Mountain is confident that the wildlife and marine bird indicators presented in the Application, Volumes 5A and 8A, are appropriate for assessing potential Project effects on both species at risk and species not at risk. Having followed the guidance provided by Environment Canada, Trans Mountain does not believe that further assessment of additional wildlife and marine species at risk is warranted.

2.041 Cumulative effects assessment methodology

Reference:

i) A3S1R1, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF pages 1 and 34 of 66

ii) A3S1T0, Application Volume 5B, Environmental and Socio- Economic Assessment – Socio-Economic, PDF pages 1 and 32 of 205

iii) A3S4Y3, Application Volume 8A, Marine Transportation, PDF pages 215 and 227 of 294

iv) NEB Filing Manual, Guidance – Applicant's Evaluation of Significance of Cumulative Effects, PDF page 91 of 258

v) A3S1R2, Application Volume 5A, Environmental and Socio- Economic Assessment– Biophysical, PDF pages 38 to 41 of 148

vi) NEB Filing Manual, Table A-2 – Filing Requirements for Biophysical Elements, Species at Risk or Species of Special Status – Guidance, PDF page 100 of 258

vii) A3S1R2, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, Table 8.9-6 – Summary of Significance Evaluation of the Project's Contribution to Cumulative Effects on Mammal Indicators, PDF page 69 of 148

viii) A3S2Q3, Application Volume 5C, Environmental and Socio- Economic Assessment – Biophysical Technical Reports, TR-5C-10 – Wildlife Technical Report, PDF page 61 of 169

ix) A3S1R2, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF page 76 of 148

x) A3S1L6, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF pages 10 to 17, and 20 and 21 of 67

xi) A3S1U0, Application Volume 5C, Environmental and Socio- Economic Assessment – Biophysical Technical Reports, TR-5C-4 – Air Quality and Greenhouse Gas Technical Report, PDF pages 5 and 6 of 105

xii) Alberta Wetland Policy, The Need for a New Provincial Wetland Policy, September 2013, Alberta Environment and Sustainable Resource Development, PDF page 7 of 27

Preamble:

References i), ii), and iii) describe the cumulative effects methodology used throughout the Environmental and Socio-Economic Assessment in Application Volumes 5A, 5B, and 8A. Each states that Trans Mountain determined the significance of the Project's contribution (or the contribution of increased Project-related marine vessel traffic) to cumulative effects.

However, the NEB Filing Manual (Reference iv)) states that "[t]he evaluation of significance must focus on the total cumulative effect that may be created from all physical facilities and activities considered in combination with the proposed project."

For example, Reference v) acknowledges that only 25 to 39 per cent of native vegetation remains in the Vegetation RSA along the Edmonton to Hinton segment, but concludes that the Project's contribution to cumulative incremental change of native vegetation is of low to medium magnitude because the Project is predicted to have a limited (3 per cent) incremental contribution to cumulative alteration of native vegetation in the Vegetation RSA. There is no evaluation of the significance of the total cumulative disturbance (i.e., existing disturbance plus disturbance from the Project plus disturbance from other reasonably foreseeable developments).

The Board notes that, when total cumulative effects are considered, existing exceedances of thresholds can be important.

The NEB Filing Manual (Reference vi)), for example, states that "[m]any rare species (e.g., endangered or threatened species under the SARA [*Species at Risk Act*]) are at risk in large part as a result of the past cumulative effects on their population or habitat. Their inclusion on official lists reflects their status as having crossed a threshold requiring special actions for their protection and recovery. Any additional residual effects have the potential to further contribute to this existing situation. Consequently, proposed projects must preferably avoid, or fully mitigate or compensate for any residual project contribution to cumulative effects."

Wildlife species provide an illustration. Reference vii) summarizes the significance evaluation of the Project's contribution to cumulative effects on mammal indicators, concluding that the magnitude of such contribution ranges from low to medium. This is despite woodland caribou being listed as Threatened on Schedule 1 of the SARA (Reference viii)), and despite the existing average motorized access density in the Columbia-Shuswap, Wells Gray, Robson, and North Cascades grizzly bear population units currently exceeding the threshold of 0.6 km/km2 (Reference ix)).

As another example of thresholds already being exceeded, References x) and xi), in describing existing environmental conditions, note that there exist some exceedances of relevant ambient air quality objectives.

The Board notes that, for a large project crossing a diverse landscape, it may be appropriate to assess the significance of total cumulative effects for a particular ecosystem component separately for certain regions/areas or along certain pipeline segments where the magnitude of existing cumulative effects is substantially higher than in other regions/areas or along other segments. This could avoid 'averaging out' high cumulative effects in one area with low cumulative effects in other far-away areas, and more fairly capture the varying significance of total cumulative effects along the pipeline route.

For example, as noted above, Reference v) states that only 25 to 39 per cent of native vegetation remains in the Vegetation RSA along the Edmonton to Hinton segment, but states the amount of native vegetation in the Vegetation RSA in British Columbia is much higher. The

Board notes that areas of higher native vegetation loss are also likely areas of higher losses of rare ecological communities and of plant and lichen species of concern. Likewise, Reference xii) estimates that Alberta has already lost two thirds of the wetlands in its White Area (settled area) and that these losses are ongoing.

Request:

a) Please provide an evaluation of the significance of total cumulative effects for every cumulative effects assessment in the Environmental and Socio-Economic Assessment (i.e., in Application Volumes 5A, 5B and 8A).

b) Please discuss the appropriate methodology for a consistent evaluation of the significance of total cumulative effects in cases where one or more thresholds are already exceeded to which the Project will add residual effects. In this discussion:
   b.1) include consideration of the implications on the need to consider justification of significant effects under the *Canadian Environmental Assessment Act, 2012*; and
   b.2) identify each evaluation in the response to a) where thresholds are already exceeded.

c) Please discuss an appropriate methodology for determining when separate significance evaluations should be undertaken in cases where cumulative effects are substantially higher in certain regions/areas or along certain segments compared to others, and apply this methodology in the response to a), providing a rationale in each case to explain whether separate evaluations for certain regions/areas or along certain segments are or are not appropriate.

Response:

a) An evaluation of significance conclusions for total cumulative effects (existing activities plus Project plus reasonably foreseeable developments) is provided as requested below in updated significance evaluation tables taken from Section 8.0 in Volume 5A (Filing IDs A3S1R1 and A3S1R2), Section 8.0 in Volume 5B (Filing ID A3S1T0), and Section 4.4 of Volume 8A (Filing ID A3S4Y3). However, Trans Mountain submits that the cumulative effects assessment (CEA) method adopted for the Environmental and Socio-Economic Assessment (ESA) fulfills the project-specific CEA objectives identified in the *Canadian Environmental* Assessment *Act, 2012* (*CEAA, 2012*) without specifically considering the significance of total cumulative effects that are beyond the control of the Applicant and the National Energy Board (NEB). To help illustrate this and provide information relevant to NEB IR No. 2.041b and 2.041c, each table provided below includes significance conclusions for total cumulative effects along with significance conclusions for Project-specific effects. Rationale for the total cumulative effects significance criteria ratings included below are provided only where they differ from those provided in the Application. In some cases, discussion is also included to demonstrate how proposed technically and economically feasible Project mitigation measures properly reflect the predicted current and reasonably foreseeable total future cumulative risk to an indicator.

   There is a difference between project-specific CEAs and CEAs conducted for regional planning or resource management purposes. The accepted emphasis of project-specific

CEAs is on establishing the relative contribution of the applied-for project to predicted total cumulative effects (*e.g.,* Antoniuk 2002, Finley and Revel 2002, Hegmann *et al.* 1999, Kennett 2002), thereby providing a clear rationale to ensure that unjustified significant adverse effects do not occur as a result of the project. The primary stated purpose of the *CEAA, 2012* is to "protect the components of the environment that are within the legislative authority of Parliament from significant adverse environmental effects caused by a designated project" (emphasis added). To achieve this objective, proposed project mitigation measures must adequately reflect the predicted current and reasonably foreseeable future risk to the assessment indicator. Achieving this necessitates a description of existing and reasonably foreseeable future cumulative effects risk along with a description of the relative contribution of the Project to the reasonably foreseeable total future risk. Information on predicted total cumulative effects can assist municipal, provincial, and federal authorities by identifying requirements for additional planning, monitoring, or mitigation that are beyond the direct control of the proponent or regulator and need to be implemented or led by others. This is presumably why another stated purpose of the *CEAA, 2012* is: "to encourage the study of the cumulative effects of physical activities in a region and the consideration of those study results in environmental assessments." This latter objective suggests that there is value in identifying existing or reasonably foreseeable stressors that could interact with those from a proposed project, independent of conclusions on the significance of the total cumulative effects that would occur with or without the applied-for project.

In contrast, regional planning or resource management CEAs are most commonly undertaken to define desired outcomes and associated trade-offs by understanding how all existing and potential future stressors contribute to total cumulative effects on resources of interest. These regional planning or resource management exercises focused on total cumulative effects are best completed by responsible government authorities. They generally do not lead to conclusions on the significance of total cumulative effects, but instead focus on identifying appropriate cumulative effects management measures that can be implemented by all parties contributing to or managing total cumulative effects (Kennett 2002).

The updated cumulative effect significance rating tables provided below are organized by ESA volume and element. Note that a bolded magnitude rating in these tables indicates that an exceedance of an environmental and/or regulatory standard is predicted, as requested by NEB IR No. 2.041b. The assessment conservatively assumes no change in currently available technology, best management practices, or regulatory standards for future projects. Trans Mountain notes that the provincial regulators are currently managing cumulative effects issues in areas of provincial jurisdiction.

Volume 5A ESA - Biophysical

Soil and Soil Productivity

Table 8.2-4 compares significance criteria ratings for total cumulative effects on soil and soil productivity indicators and the Project contribution to these effects. Many criteria ratings for total cumulative effects on soil and soil productivity indicators differ from those for Project-specific ratings. Duration is rated as short to long-term, frequency is rated as isolated to continuous and reversibility is rated as short-term to permanent for total cumulative effects because disturbance associated with some existing developments (*e.g.,* mineral resource exploration) will likely be temporary, while others (*e.g.,* primary roads and other paved areas) are considered to have a permanent effect on soil within their footprint. Total cumulative effect magnitude is rated as medium for each soil and soil productivity indicator. The combined disturbance information summarized in Section 8.2.1 of Volume 5A (Filing ID A3S1R1) and discussed in Sections 8.2.3.1 and 8.2.3.2 of Volume 5A (Filing ID A3S1R1) demonstrate that existing disturbances are much larger than those from the Project. It is anticipated that best management practices for soil conservation will be applied by reasonably foreseeable developments to minimize their contribution to total cumulative effects at the Local Study Area (LSA) scale. Total cumulative effect on soil and soil productivity indicators is rated as not significant. The Project contribution to total cumulative effects is rated as low magnitude and not significant following application of proposed mitigation measures.

TABLE 8.2-4

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON SOIL AND SOIL PRODUCTIVITY

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Soil Indicator – Soil Productivity									
1(a) Project contribution to cumulative change in soil productivity.	Negative	LSA	Short-term	Periodic	Short to medium-term	Low	High	High	Not significant
1(b) Total cumulative effect on soil productivity.	Negative	LSA	Short- to long-term	Isolated to continuous	Short-term to permanent	Medium	High	High	Not significant
2. Soil Indicator – Soil Degradation									
2(a) Project contribution to cumulative change in soil degradation.	Negative	LSA	Short-term	Periodic	Short to medium-term	Low	High	High	Not significant
2(b) Total cumulative effects on soil degradation.	Negative	LSA	Short- to long-term	Isolated to continuous	Short-term to permanent	Medium	High	High	Not significant
3. Combined Cumulative Effects on Soil and Soil Productivity									
3(a) Project contribution to cumulative effects on the soil and soil productivity indicators (1[a] and 2[a]).	Negative	LSA	Short-term	Periodic	Short to medium-term	Low	High	High	Not significant
3(b) Total cumulative effects on soil and soil productivity indicators (1[b] and 2[b]).	Negative	LSA	Short- to long-term	Isolated to continuous	Short-term to permanent	Medium	High	High	Not significant

Notes:
1 LSA = Soil LSA.
2 Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Water Quality and Quantity

Table 8.3-2 compares significance criteria ratings for total cumulative effects on water quality and quantity indicators and the Project contribution to these effects. Many criteria ratings for total cumulative effects on water quality and quantity indicators differ from those for Project-specific ratings. Duration is rated as immediate to long-term, frequency is rated as isolated to continuous and reversibility is rated as immediate to long-term for total cumulative effects because effects associated with some existing and reasonably foreseeable activities (*e.g.,* oil and gas development and forestry) are anticipated to be temporary, while others (*e.g.,* livestock grazing and run-of-river developments) could have continuous, long-term effects on water quality and surface flow (water quantity). Total cumulative effect magnitude is rated as medium (British Columbia) to high (Alberta) at the Aquatic Regional Study Area (RSA) scale based on the provincial and watershed-specific information provided for the riparian disturbance metric (refer to Tables 8.6-6 and 8.6-7 in Volume 5A (Filing ID A3S1R2). Riparian disturbance is an indicator of sediment yield and overall watershed health and the data suggest that cumulative effects risk is currently low in relatively intact watersheds such as the Upper Fraser River and Clearwater River and high in highly developed watersheds such as the Sturgeon River, Pembina River, North Saskatchewan River, Lower Nicola River and Thompson River. This risk is mainly associated with existing agriculture and forestry development. Existing cumulative effects on water quality and quantity indicators at the Aquatics RSA scale could be considered to range from not significant to significant based on assigned hazard levels, although established regulatory thresholds do not exist. It is anticipated that reasonably foreseeable developments will apply best management construction and operating practices to minimize their contribution to total cumulative effects at the Aquatics RSA scale. Based on existing cumulative effects risk, total cumulative effects could be considered to range from not significant to significant, and this is expected to persist with or without the Project. The Project contribution to total cumulative effects is rated as low to medium magnitude and not significant following application of proposed mitigation measures.

TABLE 8.3-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON WATER QUALITY AND QUANTITY

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Water Quality and Quantity Indicator – Surface Water Quality									
1(a) Project contribution to cumulative change in surface water quality.	Negative	RSA	Short-term	Isolated to occasional	Immediate to medium-term	Low to medium	High	High	Not significant
1(b) Total cumulative effects on surface water quality.	Negative	RSA	Immediate to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Not significant to significant
2. Water Quality and Quantity Indicator – Surface Water Quantity									
2(a) Project contribution to cumulative change in surface water quantity.	Negative	RSA	Short-term	Isolated to occasional	Short-term to permanent	Low to medium	High	High	Not significant
2(b) Total cumulative effects on surface water quantity.	Negative	RSA	Immediate to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Not significant to significant
3. Combined Cumulative Effects on Water Quality and Quantity									
3(a) Project contribution to combined cumulative effects on the water quality and quantity indicators (1[a] and 2[a]).	Negative	RSA	Short-term	Isolated to occasional	Short-term to permanent	Low to medium	High	High	Not significant
3(b) Total cumulative effects on water quality and quantity indicators (1[b] and 2[b]).	Negative	RSA	Immediate to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Not significant to significant

Notes:
1 RSA = Aquatics RSA.
2 Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Air Emissions

Table 8.4-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on air emissions indicators. Criteria ratings for total cumulative effects on air quality differ from Project-specific ratings because some continuous emission sources occur, and magnitude is rated as high for both air emissions indicators because air quality modelling of existing and reasonably foreseeable emissions predicted exceedances of air quality standards in one or more locations. This leads to the conclusion of a significant adverse effect for total cumulative emissions based on modelling specific to a number of Project facilities and airsheds. These significant adverse effects are associated with existing activities and will continue with or without the Project. It is expected that reasonably foreseeable developments will be required to comply with air quality standards, thus these regulated activities are unlikely to create additional exceedances.

Due to the existing cumulative effects risk for the criteria air contaminants (CACs), volatile organic compounds (VOCs), and secondary particulate matter emissions predicted by air quality modelling, Trans Mountain has committed to meet the applicable ambient air quality objectives and is completing air quality modeling as input into engineering design to ensure

that the Project will meet these objectives. Updated dispersion modelling has indicated that predicted maximum concentrations (*i.e.,* nitrogen dioxide [NO_2], particulate matter [$PM_{2.5}$] and PM_{10}) will no longer exceed the ambient air quality objectives, as originally reported in the 2013 Application to the NEB. With application of this mitigation philosophy, the Project contribution to total cumulative air emissions is rated as low to medium magnitude. This translates to a not significant adverse effect for the Project contribution to cumulative effects on air emissions indicators.

TABLE 8.4-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON AIR EMISSIONS

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Air Emissions Indicator – Primary Emissions of CACs and VOCs									
1(a) Project contribution to cumulative increase in CAC and VOC emissions during construction and operations activities.	Negative	RSA	Short-term	Isolated to periodic	Long-term	Low to medium	High	Moderate	Not significant
1(b) Project contribution to cumulative increase in fugitive VOC emissions from storage tanks and tanker loading.	Negative	RSA	Long-term	Continuous	Long-term	Low	High	Moderate	Not significant
1(c) Total cumulative effect of CAC and VOC emissions.	Negative	RSA	Long-term	Isolated to continuous	Long-term	Low to **high**	High	Moderate	Not significant to significant
2. Air Emissions Indicator – Formation of Secondary Particulate Matter and Ozone									
2(a) Project contribution to cumulative increases in secondary particulate matter and ozone.	Negative	LFV	Long-term	Continuous	Long-term	Low to medium	High	Moderate	Not significant
2(b) Total cumulative effect on secondary particulate matter and ozone.	Negative	LFV	Long-term	Isolated to continuous	Long-term	Low to **high**	High	Moderate	Not significant to significant
3. Combined Cumulative Effects on Air Emissions									
3(a) Project contribution to combined cumulative effects on the air emissions indicators (1[a], [b] and 2[a]).	Negative	RSA or LFV	Long-term	Continuous	Long-term	Low to medium	High	Moderate	Not significant
3(b) Total cumulative effects on air emissions indicators (1[c] and 2[b]).	Negative	RSA or LFV	Long-term	Continuous	Long-term	Low to **high**	High	Moderate	Not significant to significant

Notes:
1 RSA = Air Quality RSA; LFV = Lower Fraser Valley.
2 Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Acoustic Environment

Table 8.5-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on the acoustic environment indicators. Criteria ratings for total cumulative effects on the acoustic environment indicators are identical to Project-

specific ratings, except that magnitude is rated as medium for each acoustic indicator because while existing and reasonably foreseeable sound sources are not predicted to exceed acoustic standards, they are higher than those associated with the Project. Total cumulative effect on acoustic environment indicators is rated as not significant. The Project contribution to total cumulative effects is rated as low to medium magnitude and not significant following application of proposed mitigation measures.

TABLE 8.5-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON THE ACOUSTIC ENVIRONMENT

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Acoustic Environment Indicator – Sound Levels									
1(a) Project contribution to cumulative increase in sound levels during construction and operation.	Negative	RSA	Short to long-term	Isolated to continuous	Short to long-term	Low to medium	High	Moderate	Not significant
1(b) Total cumulative effects on sound levels.	Negative	RSA	Short to long-term	Isolated to continuous	Short to long-term	Medium	High	Moderate	Not significant
2. Acoustic Environment Indicator – Vibration Levels									
2(a) Project contribution to cumulative increase in vibration emissions.	Negative	RSA	Short-term	Isolated	Short-term	Low to medium	Low	High	Not significant
2(b) Total cumulative effects of vibration emissions.	Negative	RSA	Short to long-term	Isolated to continuous	Short to long-term	Medium	High	Moderate	Not significant
3. Combined Cumulative Effects on the Acoustic Environment									
3(a) Project contribution to combined cumulative effects on the acoustic environment indicators (1[a] and 2[a]).	Negative	RSA	Long-term	Continuous	Short to long-term	Low to medium	High	Moderate	Not significant
3(b) Total cumulative effects on acoustic environment indicators (1[b] and 2[b]).	Negative	RSA	Short to long-term	Isolated to continuous	Short to long-term	Medium	High	Moderate	Not significant

Notes:
1 RSA = Acoustic Environment RSA.
2 Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Fish and Fish Habitat

Table 8.6-5 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on fish and fish habitat. Many criteria ratings for total cumulative effects on fish and fish habitat differ from those for Project-specific ratings. Duration is rated as immediate to long-term, frequency is rated as isolated to continuous and reversibility is rated as immediate to long-term for total cumulative effects, because effects associated with some existing and reasonably foreseeable activities (*e.g.,* oil and gas development and forestry) are anticipated to be temporary, while others (*e.g.,* livestock grazing and run-of-river developments) could have continuous, long-term effects on fish habitat and indicator species.

As described above for water quality and quantity, magnitude of existing cumulative effects on habitat and mortality is rated as medium to high at the Aquatics RSA scale based on the provincial and watershed-specific metrics provided in Sections 8.6.3.1, 8.6.3.2, and 8.6.3.3 in Volume 5A (Filing ID A3S1R2). These data suggest that existing cumulative effects risk is currently low in relatively intact watersheds such as the Upper Fraser River and Clearwater River and high in highly developed watersheds such as the Sturgeon River, Pembina River, North Saskatchewan River, Lower Nicola River and Thompson River. This existing risk is mainly associated with existing agriculture, forestry, road, and cutline development and is expected to persist with or without the Project. Existing cumulative effects on fish and fish habitat at the Aquatics RSA scale could be considered to range from not significant to significant based on assigned hazard levels, although established regulatory thresholds do not exist. It is anticipated that best management practices and offsets to any serious harm of fisheries habitat will be applied by reasonably foreseeable developments to minimize their contribution to total cumulative effects at the Aquatics RSA scale. Based on existing cumulative effects risk, total cumulative effects could be considered to range from not significant to significant and this is expected to persist with or without the Project. The Project contribution to total cumulative effects is rated as low magnitude and not significant following application of proposed mitigation measures.

Criteria ratings (*i.e.*, duration, frequency, reversibility and magnitude) for total cumulative effects on the indicator species reflect the criteria for total cumulative effects most likely to affect each species, identified in Section 7.2.7.6 of Volume 5A (Filing ID A3S1R2). For example, Arctic grayling is most likely affected by instream and riparian habitat disturbance, thus total cumulative effects for this species is based on total cumulative effects of instream and riparian habitat disturbance. Existing cumulative effects risk to Arctic grayling, Athabasca rainbow and bull trout is considered to be significant based on current watershed condition and their status as species of provincial management concern. Existing cumulative effects risk to northern pike and walleye, bull trout/Dolly Varden, Chinook salmon, coho salmon, and cutthroat trout are considered to be not significant to significant based on current watershed condition and their status as species or populations of management concern. Existing cumulative effects risk to rainbow trout and steelhead is considered to be not significant based on their widespread distribution and management guidance. Existing cumulative effects risk to burbot is considered to be not significant based on their secure status. It is anticipated that best management practices and offsets to any serious harm of fisheries habitat will be applied by reasonably foreseeable developments to minimize their contribution to total cumulative effects at the Aquatics RSA scale. Based on existing cumulative effects risk, total cumulative effects to these fish indicators could be considered to range from not significant to significant and is expected to persist with or without the Project. The Project contribution to total cumulative effects is rated as low magnitude and not significant following application of proposed mitigation measures.

TABLE 8.6-5

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON FISH AND FISH HABITAT

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Fish and Fish Habitat Indicator – Riparian Habitat									
1(a) Project contribution to cumulative increase in riparian habitat disturbance.	Negative	RSA	Immediate to short-term	Isolated to occasional	Medium to long-term	Low	High	High	Not significant
1(b) Total cumulative effects of riparian habitat disturbance.	Negative	RSA	Immediate- to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Not significant to significant
2. Fish and Fish Habitat Indicator – Instream Habitat									
2(a) Project contribution to cumulative increase in instream habitat disturbance.	Negative	RSA	Immediate to short-term	Isolated to occasional	Medium to long-term	Low	High	High	Not significant
2(b) Total cumulative effects of instream habitat disturbance.	Negative	RSA	Immediate- to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Not significant to significant
3. Fish and Fish Habitat Indicator – Fish Mortality and Injury									
3(a) Project contribution to cumulative effects on fish mortality and injury.	Negative	RSA	Immediate to long-term	Occasional to periodic	Long-term	Low	High	High	Not significant
3(b) Project contribution to cumulative effects associated with blockage of fish movements.	Negative	RSA	Immediate to short-term	Isolated	Immediate to short-term	Low	Low	High	Not significant
3(c) Total cumulative effects on fish mortality and injury.	Negative	RSA	Immediate- to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Not significant to significant
4. Fish and Fish Habitat – Indicator Species									
4(a) Project contribution to cumulative effects on Arctic grayling.	Negative	RSA	Immediate to short-term	Isolated to occasional	Medium to long-term	Low	High	High	Not significant
4(b) Total cumulative effects on Arctic grayling.	Negative	RSA	Immediate- to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Significant
4(c) Project contribution to cumulative effects on Athabasca rainbow trout and bull trout.	Negative	RSA	Immediate to short-term	Isolated to occasional	Medium to long-term	Low	High	High	Not significant
4(d) Total cumulative effects on Athabasca rainbow trout and bull trout.	Negative	RSA	Immediate- to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Significant
4(e) Project contribution to cumulative effects on burbot.	Negative	RSA	Immediate to long-term	Isolated to periodic	Long-term	Low	High	High	Not significant
4(f) Total cumulative effects on burbot.	Negative	RSA	Immediate- to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Not significant
4(g) Project contribution to cumulative effects on northern pike and walleye.	Negative	RSA	Immediate to short-term	Isolated to occasional	Medium to long-term	Low	High	High	Not significant
4(h) Total cumulative effects on northern pike and walleye.	Negative	RSA	Immediate- to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Not significant to significant
4(i) Project contribution to cumulative effects on bull trout/Dolly Varden.	Negative	RSA	Immediate to short-term	Isolated to occasional	Medium to long-term	Low	High	High	Not significant

TABLE 8.6-5

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON FISH AND FISH HABITAT (continued)

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
4(j) Total cumulative effects on bull trout/Dolly Varden.	Negative	RSA	Immediate-to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Not significant to significant
4(k) Project contribution to cumulative effects on Chinook salmon, coho salmon and cutthroat trout.	Negative	RSA	Immediate to short-term	Isolated to occasional	Medium to long-term	Low	High	High	Not significant
4(l) Total cumulative effects on Chinook salmon, coho salmon and cutthroat trout.	Negative	RSA	Immediate-to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Not significant to significant
4(m) Project contribution to cumulative effects on rainbow trout/steelhead.	Negative	RSA	Immediate to long-term	Isolated to periodic	Long-term	Low	High	High	Not significant
4(n) Total cumulative effects on rainbow trout/steelhead.	Negative	RSA	Immediate-to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Not significant
5. Combined Cumulative Effects on Fish and Fish Habitat									
5(a) Project contribution to combined cumulative effects on the fish and fish habitat indictors (1[a], 2[a], 3[a], 3[b], 4[a], 4[c], 4[e], 4[g], 4[i], 4[k] and 4[m]).	Negative	RSA	Immediate to long-term	Isolated to periodic	Immediate to long-term	Low	High	High	Not significant
5(b) Total cumulative effects on fish and fish habitat indicators (1[b], 2[b], 3[c], 4[b], 4[d], 4[f], 4[h], 4[j], 4[l] and 4[n]).	Negative	RSA	Immediate-to long-term	Isolated to continuous	Immediate to long-term	Medium to high	High	High	Not significant to significant

Notes:
1 RSA = Aquatics RSA.
2 Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Wetlands

Table 8.7-4 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on the wetland indicator. Several criteria ratings for total cumulative effects on the wetland indicator differ from those for Project-specific ratings. Frequency is rated as isolated to continuous and reversibility is rated as medium-term to permanent for total cumulative effects, because effects associated with some existing activities (*e.g.,* oil and gas development and forestry) are anticipated to be temporary, while others (*e.g.,* agriculture, communities, and mines) could have continuous, permanent effects on the wetland indicator. Magnitude of existing cumulative effects is rated as low to high because analyses summarized in Section 8.7.3.1 of Volume 5A ([Filing ID A3S1R1]) indicate that existing disturbance within the Wetland RSA is comparatively small outside the City of Edmonton and Lower Mainland Developed Area (LMDA) where most wetlands have presumably been lost (*i.e.,* Reference xii in the preamble). Existing cumulative effects on the wetland indicator at the RSA scale could be considered to range

from not significant to significant, given the range of existing disturbance levels and the existence of federal (*e.g.,* Federal Policy on Wetland Conservation, [Environment Canada 1991] goal of "no net loss of wetland function]) and Alberta policy (*e.g.,* the new Alberta Wetland Policy [Alberta Government 2013] goal is to conserve, restore, protect and manage Alberta's wetlands) to minimize ongoing wetland loss. It is anticipated that best management practices for wetland conservation will be applied by reasonably foreseeable developments to minimize their contribution to total cumulative effects at the Wetland RSA scale. Based on existing cumulative effects risk, total cumulative effects could be considered to range from not significant to significant and is expected to persist with or without the Project.

Due to the existing cumulative effects risk for wetland loss or alteration and management guidance to avoid further loss of wetland function, Trans Mountain will implement mitigation measures to minimize effects on wetland function (refer to the response to NEB IR No. 2.050), and a wetland compensation plan to be implemented where warranted to achieve no net loss of wetland function (refer to the responses to NEB IR No. 2.051 and 2.052). With application of these mitigation and compensation measures, the Project contribution to total cumulative wetland function loss or alteration is rated as low to medium magnitude. This translates to a not significant adverse effect for the Project contribution to cumulative effects on wetland indicators.

TABLE 8.7-4

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON WETLAND LOSS OR ALTERATION

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Wetland Loss or Alteration Indicator – Wetland Function									
1(a) Project contribution to cumulative increase in wetland disturbance.	Negative	RSA	Short to long-term	Periodic	Medium to long-term	Low to medium	High	High	Not significant
1(b) Total cumulative effects of wetland disturbance.	Negative	RSA	Short to long-term	Isolated to continuous	Medium-term to permanent	Low to **high**	High	High	Not significant to significant

Notes:
1 RSA = Wetland RSA.
2 Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Vegetation

Table 8.8-4 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on vegetation indicators. Most criteria ratings for total cumulative effects on vegetation indicators differ from those for Project-specific ratings. Duration is rated as short to long-term, frequency is rated as isolated to continuous and reversibility is rated as medium-term to permanent for total cumulative effects, because effects associated with some existing activities (*e.g.,* oil and gas development and forestry)

are anticipated to be temporary, while others (*e.g.,* agriculture, communities, and roads and other paved areas) could have continuous, permanent effects on vegetation indicators. Magnitude of existing cumulative effects is rated as medium to high because analyses provided in Section 7.2.9.6 of Volume 5A (Filing ID A3S1Q9) and Section 8.8.1 of Volume 5A (Filing ID A3S1R1) indicate that existing disturbance within the Vegetation RSA is comparatively high in settled areas of western Alberta, smaller in the British Columbia portion of the RSA, and high in the City of Edmonton and LMDA where vegetation indicators have been substantially affected. Existing cumulative effects risk is primarily associated with communities, forestry, agriculture, roads, and pipelines and could be considered to range from not significant to significant, given the range of existing disturbance levels and the existence of federal and provincial guidance to minimize ongoing loss of rare or uncommon vegetation communities or species and minimize introduction of invasive species. It is anticipated that best management practices will be applied by reasonably foreseeable developments to minimize their contribution to total cumulative effects at the Vegetation RSA scale. Based on existing cumulative effects risk, total cumulative effects could be considered to range from not significant to significant and this is expected to persist with or without the Project.

Due to the existing cumulative effects risk for vegetation indicators and management guidance to avoid further loss of rare or uncommon vegetation communities or species and introduction of invasive species, Trans Mountain will implement mitigation measures to minimize effects on vegetation communities and species of concern (refer to the responses to NEB IR No. 2.047 and 2.049). With application of these mitigation measures, the Project contribution to total cumulative effects on vegetation indicators is rated as low to medium magnitude. This translates to a not significant adverse effect for the Project contribution to cumulative effects on vegetation indicators.

TABLE 8.8-4

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON VEGETATION

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Vegetation Indicator – Vegetation Communities of Concern									
1(a) Project contribution to incremental increase in alteration or disturbance of native vegetation.	Negative	RSA	Short-term	Isolated to periodic	Medium to long-term	Low to medium	High	High	Not significant
1(b) Project contribution to incremental increase in alteration or disturbance of rare ecological communities.	Negative	RSA	Short-term	Isolated	Medium to long-term	Medium	High	High	Not significant
1(c) Project contribution to incremental increase in alteration or disturbance of grassland communities in the BG BGC Zone.	Negative	RSA	Short-term	Isolated to periodic	Short to long-term	Medium	High	High	Not significant
1(d) Project contribution to combined incremental increase in alteration or disturbance of vegetation communities of concern.	Negative	RSA	Short-term	Isolated to periodic	Medium to long-term	Medium	High	High	Not significant
1(e) Total cumulative effects on vegetation communities of concern.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	High	Not significant to significant

TABLE 8.8-4

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON VEGETATION (continued)

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
2. Vegetation Indicator – Plant and Lichen Species of Concern									
2(a) Project contribution to incremental increase in alteration or disturbance of rare plant and rare lichen populations, if mitigation does not completely protect the site.	Negative	RSA	Short-term	Isolated to periodic	Medium to long-term	Medium	High	High	Not significant
2(b) Total cumulative effects on plant and lichen species of concern.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	High	Not significant to significant
3. Vegetation Indicator – Presence of Infestations of Provincial Weed Species and Other Invasive Non-Native Species Identified as a Concern									
3(a) Project contribution to weed introduction or spread.	Negative	RSA	Short-term	Isolated to periodic	Short to medium-term	Low to medium	High	High	Not significant
3(b) Total cumulative effects of weed introduction or spread.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	High	Not significant to significant
4. Combined Cumulative Effects on Vegetation									
4(a) Project contribution to cumulative effects on the vegetation indicators (1[a] to 1[d], 2[a] and 3[a]).	Negative	RSA	Short-term	Isolated to periodic	Short to long-term	Low to medium	High	High	Not significant
4(b) Total cumulative effects on the vegetation indicators (1[e], 2[b], and 3[b]).	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	High	Not significant to significant

Notes:
1 RSA = Vegetation RSA.
2 Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Wildlife - Mammals

Table 8.9-6 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on wildlife mammal indicators. Several criteria ratings for total cumulative effects on wildlife mammal indicators differ from those for Project-specific ratings. Duration is rated as short to long-term, frequency is rated as isolated to continuous and reversibility is rated as medium-term to permanent for total cumulative effects because effects associated with some existing activities (*e.g.,* oil and gas development and forestry) will be temporary, while others (*e.g.,* agriculture, communities, and roads and other paved areas) could have continuous, permanent effects on wildlife mammal indicators. Magnitude of existing cumulative effects is rated as medium to high for grizzly bear, forest furbearers, coastal riparian small mammals, and bats, groups that include habitat specialists and species of management concern. Analyses provided in Section 8.9 of Volume 5A (Filing ID A3S1R2) and the responses to NEB IR No. 1.44 and 1.47 (Filing ID A60392), indicate that existing disturbance within the Grizzly Bear RSA, Caribou RSA, and Wildlife RSA is comparatively high in settled areas of western Alberta, settled areas and managed forests in interior British Columbia, and the City of Edmonton and LMDA where habitat has been substantially affected. Magnitude of existing cumulative

effects is rated as medium for woodland caribou because total undisturbed habitat in both the Groundhog and Wells Gray ranges currently exceeds the minimum threshold identified in the Recovery Strategy for the Woodland Caribou, Southern Mountain population (*Rangifer tarandus caribou*) in Canada (Environment Canada 2014). Existing cumulative effects risk for grizzly bear, forest furbearers, coastal riparian small mammals, and bats is primarily associated with communities, agriculture, forest harvest, seismic lines and roads and could be considered to range from not significant to significant, given the range of existing disturbance levels and the existence of federal and provincial guidance to minimize ongoing loss of sensitive or candidate or designated critical habitat. Existing cumulative effects risk for moose is rated as low to medium because they are habitat generalists that utilize recently disturbed forest habitat. It is anticipated that best management practices will be applied by reasonably foreseeable developments to minimize their contribution to total cumulative effects at the Wildlife RSA scale. Based on existing cumulative effects risk, total cumulative effects on wildlife mammal indicators could be considered to range from not significant to significant and this is expected to persist with or without the Project. Additional information on grizzly bear total cumulative effects risk is provided in the response to NEB IR No. 2.034b.

Due to the existing cumulative effects risk for wildlife mammal indicators and management guidance to avoid further effects on sensitive and designated critical habitat, Trans Mountain will implement mitigation measures to minimize effects on mammal species of concern (refer to the responses to NEB IR No. 1.42, 1.44 and 1.47 [Filing ID A60392]). With application of these mitigation and compensation measures, the Project contribution to total cumulative effects on wildlife mammal indicators is rated as low to medium magnitude. This translates to a not significant adverse effect for the Project contribution to cumulative effects on wildlife mammal indicators.

TABLE 8.9-6

SUMMARY OF SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON MAMMAL INDICATORS

Potential Cumulative Effects	Impact Balance	Spatial Boundary	Temporal Context			Magnitude[2]	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
1. Wildlife Indicator – Grizzly Bear									
1(a) Project contribution to cumulative effects on grizzly bear.	Negative	Grizzly RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
1(b) Total cumulative effects on grizzly bear.	Negative	Grizzly RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to **high**	High	Moderate	Not significant to significant
2. Wildlife Indicator – Woodland Caribou									
2(a) Project contribution to cumulative effects on woodland caribou.	Negative	Caribou RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
2(b) Total cumulative effects on woodland caribou.	Negative	Caribou RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium	High	Moderate	Not significant
3. Wildlife Indicator – Moose									
3(a) Project contribution to cumulative effects on moose.	Negative	Wildlife RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
3(b) Total cumulative effects on moose.	Negative	Wildlife RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Low to medium	High	Moderate	Not significant
4. Wildlife Indicator – Forest Furbearers									
4(a) Project contribution to cumulative effects on forest furbearers.	Negative	Wildlife RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
4(b) Total cumulative effects on forest furbearers.	Negative	Wildlife RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to **high**	High	Moderate	Not significant to significant
5. Wildlife Indicator – Coastal Riparian Small Mammals									
5(a) Project contribution to cumulative effects on coastal riparian small mammals.	Negative	Wildlife RSA	Short-term	Periodic	Long-term	Medium	High	Low	Not significant
5(b) Total cumulative effects on coastal riparian small mammals.	Negative	Wildlife RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to **high**	High	Low	Not significant to significant
6. Wildlife Indicator – Bats									
6(a) Project contribution to cumulative effects on bats.	Negative	Wildlife RSA	Short-term	Periodic	Long-term	Low	High	Low	Not significant
6(b) Total cumulative effects on bats.	Negative	Wildlife RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to **high**	High	Low	Not significant to significant

Notes:
1. Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
2. Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Wildlife - Birds

Table 8.9-12 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on wildlife bird indicators. Several criteria ratings for total cumulative effects on wildlife bird indicators differ from those for Project-specific ratings. Duration is rated as short to long-term, frequency is rated as isolated to continuous and reversibility is rated as medium-term to permanent for total cumulative effects because effects associated with some existing activities (*e.g.,* oil and gas development and forestry) will be temporary, while others (*e.g.,* agriculture, communities, and roads and other paved areas) could have continuous, permanent effects on wildlife bird indicators. Magnitude of existing cumulative effects is rated as medium to high for: grassland/shrub steppe birds; mature forest birds; riparian and wetland birds; wood warblers; short-eared owl; Lewis' woodpecker; Williamson's sapsucker; Western screech owl; spotted owl; common nighthawk; Northern goshawk; and olive-sided flycatcher - all indicators that include particularly sensitive or threatened or endangered species. Analyses provided in Sections 8.9.1, 8.9.2, and 8.9.7 of Volume 5A (Filing ID A3S1R2) indicate that existing disturbance within the Wildlife RSA is comparatively high in settled areas of western Alberta, settled areas and managed forests in interior British Columbia, and the City of Edmonton and LMDA where habitat used by these indicators has been substantially affected. Existing cumulative effects risk is primarily associated with communities, agriculture, forest harvest, seismic lines and roads and could be considered to range from not significant to significant, given the range of existing disturbance levels and the existence of federal and provincial guidance to minimize ongoing loss of sensitive habitat or designated or proposed critical habitat. Existing cumulative effects risk is rated as low to medium for early seral forest birds, rusty blackbird, flammulated owl, great blue heron, and bald eagle because their current conservation status is thought to be more secure. It is anticipated that best management practices will be applied by reasonably foreseeable developments to minimize their contribution to total cumulative effects at the Wildlife RSA scale. Based on existing cumulative effects risk, total cumulative effects could be considered to range from not significant to significant and this is expected to persist with or without the Project.

Due to the existing cumulative effects risk for wildlife bird indicators and management guidance to avoid further effects on sensitive and designated or candidate critical habitat, Trans Mountain will implement mitigation measures to minimize effects on bird species at risk (refer to the responses to NEB IR No. 1.45 and 1.46 [Filing ID A60392]). With application of these mitigation and compensation measures, the Project contribution to total cumulative effects on wildlife bird indicators is rated as negligible to medium magnitude. This translates to a not significant adverse effect for the Project contribution to total cumulative effects on wildlife bird indicators.

TABLE 8.9-12

SUMMARY OF SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON BIRD INDICATORS

Cumulative Effect	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Wildlife Indicator – Grassland/Shrub-steppe Birds									
1(a) Project contribution to cumulative effects on grassland/shrub-steppe birds.	Negative	RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
1(b) Total cumulative effects on grassland/shrub-steppe birds.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	Moderate	Not significant to significant
2. Wildlife Indicator – Mature/Old Forest Birds									
2(a) Project contribution to cumulative effects on mature/old forest birds.	Negative	RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
2(b) Total cumulative effects on mature/old forest birds.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	Moderate	Not significant to significant
3. Wildlife Indicator – Early Seral Forest Birds									
3(a) Project contribution to cumulative effects on early seral forest birds.	Negative	RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
3(b) Total cumulative effects on early seral forest birds.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Low to medium	High	Moderate	Not significant
4. Wildlife Indicator – Riparian and Wetland Birds									
4(a) Project contribution to cumulative effects on riparian and wetland birds.	Negative	RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
4(b) Total cumulative effects on riparian and wetland birds.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	Moderate	Not significant to significant
5. Wildlife Indicator – Wood Warblers									
5(a) Project contribution to cumulative effects on wood warblers.	Negative	RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
5(b) Total cumulative effects on wood warblers.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	Moderate	Not significant to significant
6. Wildlife Indicator – Short-eared Owl									
6(a) Project contribution to cumulative effects on short-eared owl.	Negative	RSA	Short-term	Periodic	Long-term	Negligible	High	Moderate	Not significant
6(b) Total cumulative effects on short-eared owl.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	Moderate	Not significant to significant
7. Wildlife Indicator – Rusty Blackbird									
7(a) Project contribution to cumulative effects on rusty blackbird.	Negative	RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
7(b) Total cumulative effects on rusty blackbird.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Low to medium	High	Moderate	Not significant
8. Wildlife Indicator – Flammulated Owl									
8(a) Project contribution to cumulative effects on flammulated owl.	Negative	RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
8(b) Total cumulative effects on flammulated owl.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Low to medium	High	Moderate	Not significant

TABLE 8.9-12

SUMMARY OF SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON BIRD INDICATORS (continued)

Cumulative Effect	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
9. Wildlife Indicator – Lewis's Woodpecker									
9(a) Project contribution to cumulative effects on Lewis's woodpecker.	Negative	RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
9(b) Total cumulative effects on Lewis's woodpecker.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	Moderate	Not significant to significant
10. Wildlife Indicator – Williamson's Sapsucker									
10(a) Project contribution to cumulative effects on Williamson's sapsucker.	Negative	RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
10(b) Total cumulative effects on Williamson's sapsucker.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	Moderate	Not significant to significant
11. Wildlife Indicator – Western Screech-owl									
11(a) Project contribution to cumulative effects on western screech-owl.	Negative	RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
11(b) Total cumulative effects on western screech-owl.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	Moderate	Not significant to significant
12. Wildlife Indicator – Great Blue Heron									
12(a) Project contribution to cumulative effects on great blue heron.	Negative	RSA	Short-term	Periodic	Long-term	Negligible	High	Moderate	Not significant
12(b) Total cumulative effects on great blue heron.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Low to medium	High	Moderate	Not significant
13. Wildlife Indicator – Spotted Owl									
13(a) Project contribution to cumulative effects on spotted owl.	Negative	RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
13(b) Total cumulative effects on spotted owl.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	Moderate	Not significant to significant
14. Wildlife Indicator – Bald Eagle									
14(a) Project contribution to cumulative effects on bald eagle.	Negative	RSA	Short-term	Periodic	Long-term	Negligible	High	Moderate	Not significant
14(b) Total cumulative effects on bald eagle.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Low to medium	High	Moderate	Not significant
15. Wildlife Indicator – Common Nighthawk									
15(a) Project contribution to cumulative effects on common nighthawk.	Negative	RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
15(b) Total cumulative effects on common nighthawk.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	Moderate	Not significant to significant
16. Wildlife Indicator – Northern Goshawk									
16(a) Project contribution to cumulative effects on northern goshawk.	Negative	RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
16(b) Total cumulative effects on northern goshawk.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to high	High	Moderate	Not significant to significant

TABLE 8.9-12

SUMMARY OF SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON BIRD INDICATORS (continued)

Cumulative Effect	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
17. Wildlife Indicator – Olive-sided Flycatcher									
17(a) Project contribution to cumulative effects on olive-sided flycatcher.	Negative	RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
17(b) Total cumulative effects on olive-sided flycatcher.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to **high**	High	Moderate	Not significant to significant

Notes:
1 RSA = Wildlife RSA.
2 Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Wildlife – Amphibians and Reptiles

Table 8.6-5 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on wildlife amphibian and reptile indicators. Several criteria ratings for total cumulative effects on wildlife amphibian and reptile indicators differ from those for Project-specific ratings. Duration is rated as short to long-term, frequency is rated as isolated to continuous and reversibility is rated as medium-term to permanent for total cumulative effects because effects associated with some existing activities (*e.g.,* oil and gas development and forestry) will be temporary, while others (*e.g.,* agriculture, communities, and roads and other paved areas) could have continuous, permanent effects on wildlife amphibian and reptile indicators. Magnitude of existing cumulative effects is rated as medium to high for all amphibian and reptile indicators because they include threatened or endangered species. Analyses provided in Sections 8.9.1, 8.9.2, and 8.9.8 of Volume 5A (Filing ID A3S1R2) indicate that existing disturbance within the Wildlife RSA is comparatively high in settled areas of western Alberta, settled areas and managed forests in interior British Columbia, and the City of Edmonton and LMDA where habitat used by these indicators has been substantially affected. Existing cumulative effects risk is primarily associated with communities, agriculture, forest harvest, seismic lines and roads and could be considered to range from not significant to significant, given the range of existing disturbance levels and the existence of federal and provincial guidance to minimize ongoing loss of sensitive habitat or designated or proposed critical habitat. It is anticipated that best management practices will be applied by reasonably foreseeable developments to minimize their contribution to total cumulative effects at the Wildlife RSA scale. Based on existing cumulative effects risk, total cumulative effects could be considered to range from not significant to significant and this is expected to persist with or without the Project.

Due to the existing cumulative effects risk for wildlife amphibian and reptile indicators and management guidance to avoid further effects on sensitive and designated or candidate critical habitat, Trans Mountain will implement mitigation measures to minimize effects on

amphibian and reptile species at risk (refer to the response to NEB IR No. 1.44 [Filing ID A60392]). With application of these mitigation and compensation measures, the Project contribution to total cumulative effects on wildlife amphibian and reptile indicators is rated as low to medium magnitude. This translates to a not significant adverse effect for the Project contribution to total cumulative effects on wildlife amphibian and reptile indicators.

TABLE 8.9-14

SUMMARY OF SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON AMPHIBIAN AND REPTILE INDICATORS

Cumulative Effect	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Wildlife Indicator – Pond-dwelling Amphibians									
1(a) Project contribution to cumulative effects on pond-dwelling amphibians.	Negative	RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
1(b) Total cumulative effects on pond-dwelling amphibians.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to **high**	High	Moderate	Not significant to significant
2. Wildlife Indicator – Stream-dwelling Amphibians									
2(a) Project contribution to cumulative effects on stream-dwelling amphibians.	Negative	RSA	Short-term	Periodic	Long-term	Medium	High	Moderate	Not significant
2(b) Total cumulative effects on stream-dwelling amphibians.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to **high**	High	Moderate	Not significant to significant
3. Wildlife Indicator – Arid Habitat Snakes									
3(a) Project contribution to cumulative effects on arid habitat snakes.	Negative	RSA	Short-term	Periodic	Long-term	Low	High	Moderate	Not significant
3(b) Total cumulative effects on arid habitat snakes.	Negative	RSA	Short- to long-term	Isolated to continuous	Medium-term to permanent	Medium to **high**	High	Moderate	Not significant to significant

Notes:
1 RSA = Wildlife RSA.
2 Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Marine Sediment and Water Quality (Westridge Marine Terminal)

The discussion included in Section 8.11.3 of Volume 5A (Filing ID A3S1R2) concludes that Project effects associated with the Westridge Marine Terminal on marine sediment and water quality indicators are unlikely, so the Project is also unlikely to contribute to total cumulative effects on these indicators.

Table 8.11-3 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on marine sediment and water quality indicators. Most criteria ratings for total cumulative effects on marine sediment and water quality indicators differ from Project-specific ratings. Duration is rated as short to long-term, frequency is rated as isolated to continuous and reversibility is rated as short-term to permanent for total cumulative effects because water quality effects can be reversed in the short-term while

historical and current practices have contributed to permanent sediment contamination. Magnitude of existing cumulative effects is rated as medium to high for the marine sediment and water quality indicators because in some areas, contaminants are present at levels higher than applicable guidelines to protect marine life, but generally, sediment and water quality meet the guidelines. The probability that these effects will continue is high. Existing cumulative effects risk is associated with industrial, municipal, and residential activities and could be considered to range from not significant to significant, given the range of existing conditions and exceedance of applicable guidelines in some areas. It is anticipated that best management practices will be applied by reasonably foreseeable developments to minimize their contribution to total cumulative effects at the Marine RSA scale for the Westridge Marine Terminal. Based on existing cumulative effects risk, total cumulative effects on marine sediment and water quality could be considered to range from not significant to significant and are expected to persist with or without the Project.

Due to the existing cumulative effects risk for marine sediment and water quality indicators and management guidance to avoid further effects, Trans Mountain will implement mitigation measures to minimize effects on marine sediment and water quality and meet applicable guidelines. With application of these mitigation measures, the Project contribution to total cumulative effects on marine sediment and water quality indicators is rated as low magnitude. This translates to an unlikely not significant adverse effect for the Project contribution to total cumulative effects on marine sediment and water quality indicators.

TABLE 8.11-3

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON MARINE SEDIMENT AND WATER QUALITY

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Marine Sediment and Water Quality Indicator – Marine Sediment Quality									
1(a) Project contribution to cumulative change in marine sediment quality.	Negative	LSA	Short-term	Isolated	Short-term	Low	Low	High	Not significant
1(b) Total cumulative effects on marine sediment quality.	Negative	RSA	Short to long-term	Isolated to continuous	Long-term to permanent	Medium to high	High	High	Not significant to significant
2. Marine Sediment and Water Quality Indicator – Marine Water Quality									
2(a) Project contribution to cumulative change in marine water quality.	Negative	LSA	Long-term	Periodic	Short-term	Low	Low	High	Not significant
2(b) Total cumulative effects on marine water quality.	Negative	LSA	Long-term	Isolated to continuous	Short to long-term	Medium	High	High	Not significant
3. Combined Cumulative Effects on Marine Sediment and Water Quality									
3(a) Project contribution to cumulative increase in effects on marine sediment and water quality indicators (1[a] and 2[a]).	Negative	LSA	Long-term	Periodic	Short-term	Low	Low	High	Not significant

TABLE 8.11-3

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON MARINE SEDIMENT AND WATER QUALITY (continued)

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
3(b) Total cumulative effects on marine sediment and water quality indicators (1[b] and 2[b]).	Negative	RSA	Short to long-term	Isolated to continuous	Short-term to permanent	Medium to **high**	High	High	Not significant to significant

Notes:
1 LSA = Marine Sediment and Water Quality LSA; RSA = Westridge Marine Terminal Marine RSA.
2 Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Marine Fish and Fish Habitat (Westridge Marine Terminal)

Table 8.12-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on marine fish and fish habitat indicators. Most criteria ratings for total cumulative effects on marine fish and fish habitat indicators differ from Project-specific ratings. Duration is rated as short to long-term, frequency is rated as isolated to continuous and reversibility is rated as short-term to permanent for total cumulative effects on marine fish and fish habitat indicators because effects are associated with historical and ongoing activities and developments. Magnitude of existing cumulative effects is rated as medium to high because some extensive loss or modification of intertidal habitat important to Pacific salmon and other species has been documented, although specific environmental or regulatory standards for past habitat alteration or loss do not exist. Existing cumulative effects risk is associated with industrial, municipal, and residential activities and could be considered to range from not significant to significant, given the range of existing conditions and loss or modification of a large percentage of intertidal habitat in Burrard Inlet, and smaller effects on subtidal habitat. It is anticipated that best management practices will be applied by reasonably foreseeable developments to minimize their contribution to total cumulative effects at the Marine RSA scale at the Westridge Marine Terminal. Based on existing cumulative effects risk, total cumulative effects on marine fish and fish habitat indicators could be considered to range from not significant to significant and this is expected to persist with or without the Project.

Due to the existing cumulative effects risk for marine intertidal habitat, Trans Mountain has committed to implement mitigation measures to minimize effects on marine fish and fish habitat and develop a preliminary marine fish habitat offsetting plan as described in the response to NEB IR No. 1.51 (Filing ID A60392). With application of these mitigation and offsetting measures, the Project contribution to total cumulative effects on marine fish and fish habitat indicators is rated as low magnitude. This translates to a not significant adverse effect for the Project contribution to total cumulative effects on marine fish and fish habitat indicators.

TABLE 8.12-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON MARINE FISH AND FISH HABITAT

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Marine Fish and Fish Habitat Indicator – Intertidal Habitat									
1(a) Project contribution to cumulative loss of intertidal habitat.	Negative	RSA	Short-term	Isolated	Permanent	Low	High	High	Not significant
1(b) Total cumulative effects on intertidal habitat.	Negative	RSA	Short- to long-term	Isolated to continuous	Permanent	Medium to high	High	High	Not significant to significant
2. Marine Fish and Fish Habitat Indicator – Subtidal Habitat									
2(a) Project contribution to cumulative loss of subtidal habitat.	Negative	RSA	Short-term	Isolated	Permanent	Low	High	High	Not significant
2(b) Total cumulative effects on subtidal habitat.	Negative	RSA	Short- to long-term	Isolated to continuous	Permanent	Medium	High	High	Not significant
3. Marine Fish and Fish Habitat Indicator – Dungeness Crab									
3(a) Project contribution to cumulative decrease in productive capacity of suitable habitat for Dungeness crab.	Negative	RSA	Short-term	Isolated	Medium-term	Low	High	High	Not significant
3(b) Project contribution to cumulative injury or mortality of Dungeness crab.	Negative	RSA	Short-term	Isolated	Medium-term	Low	High	High	Not significant
3(c) Total cumulative effects on Dungeness crab.	Negative	RSA	Short- to long-term	Isolated to continuous	Short-term to permanent	Medium	High	High	Not significant
4. Marine Fish and Fish Habitat Indicator – Inshore Rockfish									
4(a) Project contribution to cumulative decrease in productive capacity of suitable habitat for inshore rockfish.	Negative	RSA	Short-term	Isolated	Medium-term	Low	High	High	Not significant
4(b) Total cumulative effects on productive capacity of suitable habitat for inshore rockfish.	Negative	RSA	Short- to long-term	Isolated to continuous	Short-term to permanent	Medium	High	High	Not significant
5. Marine Fish and Fish Habitat Indicator – Pacific Salmon									
5(a) Project contribution to cumulative decrease in productive capacity of suitable habitat for Pacific salmon.	Negative	RSA	Short-term	Isolated	Medium-term	Low	High	High	Not significant
5(b) Total cumulative effects on productive capacity of suitable habitat for Pacific salmon.	Negative	RSA	Short- to long-term	Isolated to continuous	Short-term to permanent	Medium to high	High	High	Not significant to significant
6. Combined Cumulative Effects on Marine Fish and Fish Habitat									
6(a) Project contribution to combined cumulative effects on the marine fish and fish habitat indicators (1[a], 2[a], 3[a], 4[a] and 5[a]).	Negative	RSA	Short-term	Isolated	Medium-term to permanent	Low	High	High	Not significant
6(a) Total combined cumulative effects on the marine fish and fish habitat indicators (1[b], 2[b], 3[b], 4[b] and 5[b]).	Negative	RSA	Short- to long-term	Isolated to continuous	Short-term to permanent	Medium to high	High	High	Not significant to significant

Notes:
1 RSA = Westridge Marine Terminal Marine RSA.
2 Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Marine Mammals (Westridge Marine Terminal)

The discussion included in Section 8.13 of Volume 5A (Filing ID A3S1R2) concludes that Project effects on marine mammal indicators are unlikely to overlap with reasonably foreseeable projects, so conclusions from the Project-specific assessment provided in Section 7.6.11 of Volume 5A (Filing ID A3S1R0) apply.

Marine Birds (Westridge Marine Terminal)

Table 8.14-3 compares significance criteria ratings for total cumulative effects and the Project contribution to disturbance-related effects on marine bird indicators. Most criteria ratings for total cumulative effects on marine bird indicators differ from Project-specific ratings. Duration is rated as short to long-term, frequency is rated as isolated to continuous and reversibility is rated as short- to long-term for total cumulative effects on marine bird indicators because effects are associated with a variety of existing and reasonably foreseeable activities and developments. Magnitude of existing cumulative effects is rated as medium because the level of existing and reasonably foreseeable activities that could disturb birds is much larger than those of the Project. Existing cumulative effects risk is associated with industrial, municipal, and residential activities and is considered not significant in the absence of established environmental or regulatory standards. It is anticipated that best management practices will be applied by reasonably foreseeable developments to minimize their contribution to total cumulative effects at the Marine RSA scale for the Westridge Marine Terminal. Based on existing cumulative effects risk, total cumulative effects on marine birds are considered to be not significant. With application of proposed mitigation measures, the Project contribution to total cumulative effects on marine bird indicators is rated as low magnitude. This translates to a not significant adverse effect for the Project contribution to total cumulative effects on marine bird indicators.

TABLE 8.14-3

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON MARINE BIRDS

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Marine Bird Indicator – Bald Eagle									
1(a) Project contribution to cumulative increase in stress, behavioural changes or avoidance of preferred or important habitats, which may adversely affect species fitness and population sustainability.	Negative	RSA	Long-term	Periodic	Short-term	Low	High	High	Not significant
1(b) Total cumulative effects of disturbance on bald eagle.	Negative	RSA	Short- to long-term	Isolated to continuous	Short to long-term	Medium	High	High	Not significant
2. Marine Bird Indicator – Great Blue Heron									
2(a) Project contribution to cumulative increase in stress, behavioural changes or avoidance of preferred or important habitats, which may adversely affect species fitness and population sustainability.	Negative	RSA	Long-term	Periodic	Short-term	Low	High	High	Not significant

TABLE 8.14-3

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON MARINE BIRDS (continued)

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
2(b) Total cumulative effects of disturbance on great blue heron.	Negative	RSA	Short- to long-term	Isolated to continuous	Short to long-term	Medium	High	High	Not significant
3. Marine Bird Indicator – Pelagic Cormorant									
3(a) Project contribution to cumulative increase in stress, behavioural changes or avoidance of preferred or important habitats, which may adversely affect species fitness and population sustainability.	Negative	RSA	Long-term	Periodic	Short-term	Low	High	Moderate	Not significant
3(b) Total cumulative effects of disturbance on pelagic cormorant.	Negative	RSA	Short- to long-term	Isolated to continuous	Short to long-term	Medium	High	High	Not significant
4. Marine Bird Indicator – Barrow's Goldeneye									
4(a) Project contribution to cumulative increase in stress, behavioural changes or avoidance of preferred or important habitats, which may adversely affect species fitness and population sustainability.	Negative	RSA	Long-term	Periodic	Short-term	Low	High	Moderate	Not significant
4(b) Total cumulative effects of disturbance on Barrow's goldeneye.	Negative	RSA	Short- to long-term	Isolated to continuous	Short to long-term	Medium	High	High	Not significant
5. Marine Bird Indicator – Glaucous-winged Gull									
5(a) Project contribution to cumulative increase in stress, behavioural changes or avoidance of preferred or important habitats, which may adversely affect species fitness and population sustainability.	Negative	RSA	Long-term	Occasional	Short-term	Low	High	High	Not significant
5(b) Total cumulative effects on glaucous-winged gull.	Negative	RSA	Short- to long-term	Isolated to continuous	Short -term	Medium	High	High	Not significant
6. Marine Bird Indicator – Spotted Sandpiper									
6(a) Project contribution to cumulative increase in stress, behavioural changes or avoidance of preferred or important habitats, which may adversely affect species fitness and population sustainability.	Negative	RSA	Long-term	Periodic	Short-term	Low	High	Moderate	Not significant
6(b) Total cumulative effects on spotted sandpiper.	Negative	RSA	Short- to long-term	Isolated to continuous	Short to long-term	Medium	High	High	Not significant
7. Combined Cumulative Effects on Marine Birds									
7(a) Project contribution to combined cumulative effects on the marine birds indicators (1[a], 2[a], 3[a], 4[a], 5[a] and 6[a]).	Negative	RSA	Long-term	Periodic	Short-term	Low	High	High	Not significant
7(b) Total cumulative effects on marine birds indicators (1[b], 2[b], 3[b], 4[b], 5[b] and 6[b]).	Negative	RSA	Short- to long-term	Isolated to continuous	Short to long-term	Medium	High	High	Not significant

Notes:
1 RSA = Marine RSA.
2 Significant Contribution to a Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Volume 5B ESA - Socio-economic

As previously noted in Section 8.3 of Volume 5B (Filing ID A3S1T0), socio-economic cumulative effects are highly complex, and are affected by multiple dynamic factors; no standard models are available for conducting socio-economic cumulative effects assessments - or predicting the additive and integrated experience of existing and reasonably foreseeable developments by communities.

Traditional Land and Resource Use

Table 8.2-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on traditional land and resource use (TLRU) and traditional marine resource use (TMRU) indicators. Criteria ratings for duration, frequency, and reversibility are different for total cumulative effects on TLRU and TMRU indicators than for the Project contribution to these indicators. Duration is rated as short to long-term, frequency is rated as isolated to continuous and reversibility is rated as medium-term to permanent for total cumulative effects because cumulative effects associated with some existing activities (*e.g.,* oil and gas development and forestry) are anticipated to be temporary, while others (*e.g.,* agriculture, communities, and paved areas) could have continuous, permanent effects on TLRU indicators. Based on the total cumulative effect significance ratings provided for each environmental resource relative to environmental and regulatory standards, potential effects on subsistence activities resulting from existing developments and activities are estimated to range from low magnitude (relatively intact areas) to high magnitude (highly developed areas such as the LMDA). Existing cumulative effects risk on environmental resources is primarily associated with agriculture, forest harvest, roads and other transportation infrastructure, communities, quarries and mines, and oil and gas development and could be considered to range from not significant to significant. It is anticipated that best management practices will be applied by reasonably foreseeable developments to minimize their contribution to total cumulative effects on TLRU and TMRU indicators at the RSA scale.

The strategy of paralleling and expanding existing facilities is the best approach to minimize the Project contribution to the existing cumulative effects risk on environmental resources used for traditional purposes. Trans Mountain acknowledges the importance of continuing to work with Aboriginal communities to identify measures that avoid or minimize effects on TLRU and TMRU. With application of these mitigation measures, the Project contribution to total cumulative effects on TLRU and TMRU is rated as medium magnitude and not significant.

TABLE 8.2-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON TRADITIONAL LAND AND RESOURCE USE

Potential Cumulative Effects	Impact Balance	Spatial Boundary	Temporal Context			Magnitude[2]	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
1. TLRU Indicator – Subsistence Activities and Sites									
1(a) Project contribution to cumulative effects on subsistence activities and sites.	Negative	TLRU RSA	Short-term	Isolated to periodic	Short to long-term	Medium	High	Moderate	Not significant
1(b) Total cumulative effects on subsistence activities and sites.	Negative	TLRU RSA	Short to long-term	Isolated to continuous	Medium-term to permanent	Low to high	High	Moderate	Not significant to significant
2. TLRU Indicator – Cultural Sites									
2(a) Project contribution to cumulative effects on cultural sites.	Negative	TLRU RSA	Short-term	Isolated to periodic	Short-term	Medium	High	Moderate	Not significant
2(b) Total cumulative effects on cultural sites.	Negative	TLRU RSA	Short to long-term	Isolated to continuous	Medium-term to permanent	Medium	High	Moderate	Not significant
3. TLRU Indicator – Traditional Marine Resource Use									
3(a) Project contribution to cumulative effects on TMRU.	Negative	Marine TLRU RSA	Long-term	Isolated to periodic	Medium-term to permanent	Medium	High	High	Not significant
3(b) Total cumulative effects on TMRU.	Negative	Marine TLRU RSA	Short to long-term	Isolated to continuous	Medium-term to permanent	Medium	High	Moderate	Not significant
4. Combined Cumulative Effects on TLRU									
4(a) Project contribution to combined cumulative effects on the TLRU indicators (1[a], 2[a], 3[a]).	Negative	TLRU RSA; Marine TLRU RSA	Short-term to long-term	Isolated to periodic	Short to long-term	Medium	High	Moderate	Not significant
4(b) Total cumulative effects on TLRU indicators (1[b], 2[b], 3[b]).	Negative	RSA	Short to long-term	Isolated to continuous	Medium-term to permanent	Low to high	High	Moderate	Not significant to significant

Notes:
1 Significant Cumulative Socio-Economic Effect: a cumulative socio-economic effect is considered significant if the effect is predicted to be:
- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

2 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Social and Cultural Well-being

The primary contribution of any Project-specific adverse effects on social and cultural well-being indicators (*i.e.,* community way-of-life) is expected to be related to temporary increased potential for in-migration of people from outside the Socio-Economic RSA to regional commercial centres. Temporary and permanent in-migration can affect community way-of-life due to capacity pressures on infrastructure, services and amenities, and also related to the presence of temporary workers and the potential for undesirable community/worker interactions. Table 8.3-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on the relevant social and

cultural well-being indicator, community way-of-life. Criteria ratings for total cumulative effects on community way-of-life differ from Project-specific ratings in the following ways.

Duration of the events causing the total cumulative effects are considered short to long-term. For a pipeline, such as the Trans Mountain Expansion Project, or other linear developments (*e.g.,* highways/road developments, transmission lines), the duration (presence of temporary workers) is short-term because the temporary nature of the construction workforce and a marginal incremental operations workforce. Duration could be long-term for other existing and reasonably foreseeable developments that continue to operate with larger workforce numbers during operations (*e.g.,* mines). Frequency is considered to extend to continuous due to the presence of operations phase workers associated with some existing and reasonably foreseeable developments over the assessment period. Reversibility is rated short to medium-term because operations of existing and reasonably foreseeable developments would likely contribute to increased population beyond construction phases. However, operations phase workforce would be considered permanent rather than temporary inhabitants. It is assumed that any population influx to meet operations labour demand will become settled in the region and integrated into community life within several years of operations, thus not presenting the potential issues associated with temporary workers over the long-term.

Magnitude of the total cumulative effect on community way-of-life is considered to be negligible to high. In a worst-case situation, severe modification of the socio-economic environment could occur in or near smaller communities in select areas that may host temporary workers associated with multiple projects (*e.g.,* Town of Hinton, District of Clearwater). In such places, a significant total cumulative effect is possible, as details of workforce size, timing/seasonality, accommodation, code of conduct policies and plans for socio-economic effects monitoring are not available for reasonably foreseeable developments. Significant total cumulative effects on social and cultural well-being could occur with or without the Project, and in recognition of this, Trans Mountain has identified mitigation and monitoring measures to minimize the Project contribution to total cumulative effects on community way-of-life. With implementation of these measures, the Project contribution is rated as negligible to medium magnitude and not significant.

TABLE 8.3-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON SOCIAL AND CULTURAL WELL-BEING

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Social and Cultural Well-Being Indicator – Community Way-of-Life									
1(a) Project contribution to cumulative effects on community way-of-life.	Negative to positive	RSA	Short-term	Isolated	Short-term	Negligible to medium	Low or high	Moderate	Not significant
1(b) Total cumulative effects on community way-of-life.	Negative to positive	RSA	Short to long-term	Isolated to continuous	Short to medium-term	Negligible to high	Low or high	Moderate	Not significant or significant

Notes:
1 RSA = Socio-Economic RSA.
2 Significant Contribution to a Cumulative Socio-Economic Effect: the Project contribution to a cumulative socio-economic effect is considered significant if the contribution to the cumulative effect is predicted to be:
- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Human Occupancy and Resource Use

Table 8.4-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on human occupancy and resource use (HORU) indicators. Criteria ratings for total cumulative effects on human occupancy and resource use indicators differ from Project-specific ratings in the following ways.

Duration of the events causing the total cumulative effects are considered short to long-term. For pipelines, such as the Trans Mountain Expansion Project, the duration is short-term because lands disturbed during construction are reclaimed and most land use activities can resume during operations. In contrast, the duration of other reasonably foreseeable developments could continue to occupy/disturb land with a previous use or restrict activities during operations. Frequency is considered to extend to continuous due to the above ground presence of many reasonable foreseeable developments, as well as additional marine vessel traffic that may be continually moving through the Marine HORU RSA. Reversibility of the total cumulative effects is considered short to long-term. Disturbance associated with many of the reasonably foreseeable developments are anticipated to continue after construction due to new permanent structures, infrastructure and/or land use restrictions in footprint areas resulting from the new development. This is not the case with pipelines, including the Trans Mountain Expansion Project, as previous uses can frequently continue along and near the pipeline right-of-way after the pipeline construction and reclamation phase. Total cumulative effects on marine commercial, recreational and tourism use may extend into the long-term due to continual presence of additional marine traffic in Burrard Inlet associated with anticipated future traffic growth.

With one exception, magnitude is rated as medium for the total cumulative effect on HORU indicators because existing and reasonably foreseeable effects are higher than those associated with the Project alone. It is assumed that all reasonably foreseeable developments that are approved and built will have been located to allow local and regional authorities to meet their long-term growth and land development objectives; as such high magnitude total cumulative effects are considered unlikely. Total cumulative effects on sensory or viewshed disturbance continue to be rated low because they are considered to be remain as inconvenience or nuisance value.

Confidence related to the total cumulative effects is reduced to moderate for some indicators, given lack of information regarding: the location of other developments in relation to valued viewsheds; human access and use patterns near other developments (terrestrial and marine); and stakeholder perspectives regarding sensory disturbance related to other developments.

With these criteria ratings, both total cumulative effects on HORU indicators and the Project contribution to these cumulative effects are not significant.

TABLE 8.4-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON HORU

	Potential Cumulative Effects	Impact Balance	Spatial Boundary	Temporal Context			Magnitude[2]	Probability	Confidence	Significance[1]
				Duration	Frequency	Reversibility				
1.	HORU Indicators – Parks and Protected Areas									
1(a)	Project contribution to cumulative physical disturbance to land and resource use areas.	Negative	Footprint	Short-term	Periodic	Short-term	Low to medium	High	Moderate	Not significant
1(b)	Total cumulative effects on physical disturbance to land and resource use areas.	Negative	Footprint	Short to long-term	Periodic to continuous	Short to long-term	Medium	High	Moderate	Not significant
1(c)	Project contribution to cumulative change to access and use patterns.	Negative to positive	HORU RSA	Short-term	Isolated to periodic	Short to long-term	Low to medium	High	Moderate	Not significant
1(d)	Total cumulative effects on change to access and use patterns.	Negative to positive	HORU RSA	Short to long-term	Isolated to continuous	Short to long-term	Medium	High	Moderate	Not significant
2.	HORU Indicator – Indian Reserves, Métis Settlements and Asserted Traditional Territories									
2(a)	Refer to Potential Cumulative Effects 1(a), 1(b), 1(c) and 1(d).	Refer to Potential Cumulative Effects 1(a), 1(b), 1(c) and 1(d).								
3.	HORU Indicator – Residential Use									
3(a)	Refer to Potential Cumulative Effects 1(a), 1(b), 1(c) and 1(d).	Refer to Potential Cumulative Effects 1(a), 1(b), 1(c) and 1(d).								
4.	HORU Indicator – Agricultural Use									
4(a)	Refer to Potential Cumulative Effects 1(a), 1(b), 1(c) and 1(d).	Refer to Potential Cumulative Effects 1(a), 1(b), 1(c) and 1(d).								
5.	HORU Indicator – Outdoor Recreation Use									
5(a)	Refer to Potential Cumulative Effects 1(a), 1(b), 1(c) and 1(d).	Refer to Potential Cumulative Effects 1(a), 1(b), 1(c) and 1(d).								

TABLE 8.4-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON HORU (continued)

Potential Cumulative Effects	Impact Balance	Spatial Boundary	Temporal Context			Magnitude[2]	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
6. HORU Indicator – Other Land and Resource Use									
6(a) Refer to Potential Cumulative Effects 1(a), 1(b), 1(c) and 1(d).	Refer to Potential Cumulative Effects 1(a), 1(b), 1(c) and 1(d).								
7. HORU Indicator – Water Supply and Use									
7(a) Refer to Potential Cumulative Effects 1(a), 1(b), 1(c) and 1(d).	Refer to Potential Cumulative Effects 1(a), 1(b), 1(c) and 1(d).								
8. HORU Indicator – Aesthetic Attributes									
8(a) Project contribution to cumulative sensory or viewshed disturbance.	Negative	HORU RSA; Marine HORU RSA	Short-term	Isolated to periodic	Short to long-term	Low	High	High	Not significant
8(b) Total cumulative effects of sensory or viewshed disturbance.	Negative	HORU RSA; Marine HORU RSA	Short to long-term	Isolated to continuous	Short-to long term	Low	High	Moderate	Not significant
9. HORU Indicator – MCRTU									
9(a) Project contribution to cumulative changes in marine access and use patterns.	Neutral to negative	Marine HORU RSA	Short-term	Isolated	Short-term	Low to medium	High	High	Not significant
9(b) Total cumulative effects on marine access and use patterns.	Neutral to negative	Marine HORU RSA	Short to long-term	Isolated to continuous	Short to long-term	Medium	High	Moderate	Not significant
10. Combined Cumulative Effects on HORU									
10(a) Project contribution to combined cumulative effects on the HORU indicators (1[a], 1[c], 8[a], 9[a]).	Negative to positive	HORU RSA; Marine HORU RSA	Short-term	Isolated to periodic	Short to long-term	Low to medium	High	Moderate	Not significant
10(b) Total cumulative effects on the HORU indicators (1[b], 1[d], 8[b], 9[b]).	Negative to positive	HORU RSA; Marine HORU RSA	Short to long-term	Isolated to continuous	Short to long-term	Medium	High	Moderate	Not significant

Notes:
1. Significant Contribution to a Cumulative Socio-Economic Effect: the Project contribution to a cumulative socio-economic effect is considered significant if the Project contribution to the effect is predicted to be:
   - high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
   - high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.
2. Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Infrastructure and Services

It is expected that a key cause of cumulative effects on infrastructure and services indicators is related to a temporary in-migration of people from outside the Socio-Economic RSA to regional commercial centres. Table 8.5-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on infrastructure and services indicators. Criteria ratings for total cumulative effects on infrastructure and services indicators differ from Project-specific ratings in the following ways.

Duration of the events causing total cumulative effects on infrastructure and services indicators is considered short to long-term. For a pipeline, such as the Trans Mountain

Expansion Project, the duration associated with construction activities is short-term, while duration can be long-term for other reasonably foreseeable developments that have notable workforce numbers during operations. Frequency is considered to extend to continuous due to the presence of operations phase workers associated with some reasonably foreseeable developments over the assessment period. Reversibility of total cumulative effects may extend into the long-term due to reasonably foreseeable developments that contribute to long-term population growth and demand for all infrastructure and services.

Magnitude of total cumulative effects is rated as medium for most infrastructure and services indicators because effects associated with existing and reasonably foreseeable developments are higher than those associated with the Project alone. A medium to high magnitude was noted for cumulative effects on demand for regional infrastructure and services. In a worst-case situation, severe modification of the socio-economic environment could occur in or near smaller communities in select areas that may host temporary workers associated with multiple projects (*e.g.,* Town of Hinton, District of Clearwater). In such places, a significant total cumulative effect is possible, as details of workforce size, timing/seasonality, accommodation, and code of conduct policies are not available for reasonably foreseeable developments. Significant total cumulative effects on infrastructure and services could occur with or without the Project, and in recognition of this, Trans Mountain has identified mitigation and monitoring measures to minimize the Project contribution to total cumulative effects. With implementation of these measures, the Project contribution is rated as negligible to medium magnitude and not significant.

TABLE 8.5-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON INFRASTRUCTURE AND SERVICES

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Infrastructure and Services Indicator – Transportation Infrastructure									
1(a) Project contribution to cumulative effects on transportation infrastructure.	Negative	RSA	Short-term	Isolated	Short-term	Low to medium	High	Moderate	Not significant
1(b) Total cumulative effects on transportation infrastructure.	Negative	RSA	Short to long-term	Isolated to continuous	Long-term	Medium	High	Moderate	Not significant
2. Infrastructure and Services Indicator – Linear Infrastructure and Power Supply									
2(a) Project contribution to cumulative decrease in land available for future linear infrastructure planning.	Negative	RSA	Long-term	Continuous	Long-term	Low to medium	High	Low	Not significant
2(b) Total cumulative effects on land available for future linear infrastructure planning.	Negative	RSA	Long-term	Continuous	Long-term	Medium	High	Low	Not significant

TABLE 8.5-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON INFRASTRUCTURE AND SERVICES (continued)

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
3. Infrastructure and Services Indicator – Waste and Water Infrastructure									
3(a) Project contribution to cumulative increased demand on regional infrastructure and services.	Negative and positive	RSA	Short-term	Isolated	Short-term	Negligible to medium	High	Moderate	Not significant
3(b) Total cumulative effects of demand for regional infrastructure and services.	Negative and positive	RSA	Short to long-term	Isolated to continuous	Long-term	Medium to high	High	Moderate	Not significant to significant
4. Infrastructure and Services Indicator – Housing									
4(a) Refer to Potential Cumulative Effect 3(a).	Refer to Potential Cumulative Effect 3(a).								
4(b) Refer to Potential Cumulative Effect 3(b).	Refer to Potential Cumulative Effect 3(b).								
5. Infrastructure and Services Indicator – Emergency Protective and Social Services									
5(a) Refer to Potential Cumulative Effect 3(a).	Refer to Potential Cumulative Effect 3(a).								
5(b) Refer to Potential Cumulative Effect 3(b).	Refer to Potential Cumulative Effect 3(b).								
6. Combined Cumulative Effects on Infrastructure and Services									
6(a) Project contribution to cumulative effects on the infrastructure and services indicators (1[a], 2[a] and 3[a]).	Negative and positive	RSA	Short to long-term	Isolated to continuous	Short to long-term	Negligible to medium	High	Moderate	Not significant
6(b) Total cumulative effects on the infrastructure and services indicators (1[b], 2[b], and 3[b]).	Negative and positive	RSA	Short to long-term	Isolated to continuous	Long-term	Medium to high	High	Moderate	Not significant to significant

Notes:
1 RSA = Socio-Economic RSA.
2 Significant Contribution to a Cumulative Socio-Economic Effect: the Project contribution to a cumulative socio-economic effect is considered significant if the contribution is predicted to be:
- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Community Health

Table 8.7-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on community health indicators. The primary cause of any Project-specific adverse cumulative effects on the socio-economic health effects and health care service provision indicators is related to the increased potential for influx of people into the Socio-Economic RSA in search of business or employment opportunities. Short-term growth associated with temporary workers can affect community health due to capacity pressures on health care services and also changes to the socio-economic environment including population demographics, employment and working conditions,

individual and community income, housing, land-use, social cohesion and social networks, or crime. Criteria ratings for total cumulative effects on community health differ indicators from Project-specific ratings in the following ways.

Duration of the events causing the total cumulative effects is considered short to long-term. For a pipeline, such as the Trans Mountain Expansion Project, or other linear developments (*e.g.,* highways/road developments, transmission lines) duration is short-term because the temporary nature of the construction workforce and a marginal incremental operations workforce. Duration can be long-term for other reasonably foreseeable developments that continue to operate with larger workforce numbers during operations (*e.g.,* mines). Frequency of total cumulative effects is considered to extend to continuous due to the presence of operations phase workers associated with some reasonably foreseeable developments over the assessment period. Reversibility of total cumulative effects is rated medium-term for socio-economic health effects because operations of all reasonably foreseeable developments would contribute to increased population beyond construction phases; however, it is assumed that any population influx to meet operations labour demand will become settled in the region and integrated into community life within several years of operations, thus not presenting the potential issues associated with temporary workers over the long-term. The long-term presence of operations phase workers associated with some reasonably foreseeable developments over the assessment period means demand for health care service provision will continue into the operations phase. However, it is also assumed that regional planning will take into consideration long-term population growth and adjust health care services to meet the population demand, thus overall reversibility for community health indicators is rated as medium-term.

Magnitude of the total cumulative effect on socio-economic health effects is considered to be negligible to high. In a worst-case situation, severe modification of the socio-economic environment could occur in or near smaller communities in select areas that may host temporary workers associated with multiple projects (*e.g.,* Town of Hinton, District of Clearwater). Magnitude for total cumulative effects on health care service provision was rated as medium to high magnitude, again where multiple Projects occurring in or near smaller communities could result in a significant deterioration of service capacity. In such places, a significant total cumulative effect is possible, as details of workforce size, timing/seasonality, accommodation, and code of conduct policies, transportation plans and heath care service provision plans are not available for reasonably foreseeable developments. Significant total cumulative effects on community health indicators could occur with or without the Project, and in recognition of this, Trans Mountain has identified mitigation and monitoring measures to minimize the Project contribution to total cumulative effects. With implementation of these measures, the Project contribution is rated as negligible to medium magnitude and not significant.

TABLE 8.7-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON COMMUNITY HEALTH

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Community Health Indicator – Socio-Economic Health Effects									
1(a) Project contribution to cumulative effects on socio-economic health effects.	Negative to positive	RSA	Short-term	Isolated	Short-term	Negligible to medium	High	Moderate	Not significant
1(b) Total cumulative effects on socio-economic health effects.	Negative to positive	RSA	Short to long-term	Isolated to continuous	Medium-term	Negligible to high	High	Moderate	Not significant or significant
2. Community Health Indicator – Health Care Service Provision									
2(a) Project contribution to cumulative effects on health care service provision.	Negative	RSA	Short-term	Isolated	Short-term	Negligible to medium	High	Moderate	Not significant
2(b) Total cumulative effects on health care service provision.	Negative	RSA	Short to long-term	Isolated to continuous	Medium-term	Medium to high	High	Moderate	Not significant or significant
3. Combined Cumulative Effects on Community Health									
3(a) Combined cumulative effects on the community health indicators (1[a] and 2[a]).	Negative to positive	RSA	Short-term	Isolated	Short-term	Negligible to medium	High	Moderate	Not significant
3(b) Total cumulative effects on the community health indicators (1[b] and 2[b]).	Negative to positive	RSA	Short to long-term	Isolated to continuous	Medium-term	Negligible to high	High	Moderate	Not significant or significant

Notes:
1 RSA = Socio-Economic RSA.
2 Significant Contribution to a Cumulative Socio-Economic Effect: the Project contribution to a cumulative socio-economic effect is considered significant if the contribution to the cumulative effect is predicted to be:
- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Volume 8A ESA - Marine Transportation

Marine Air Emissions

Table 4.4.2-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on marine air emissions indicators. Criteria ratings for total cumulative effects of marine vessel traffic on marine air emissions indicators are identical to Project-specific ratings included in the Application, except that magnitude is rated as medium for each air emissions indicator because while existing and reasonably foreseeable emissions are not predicted to exceed air quality standards, they are higher than those from increased marine vessel traffic associated with the Project. Both the total cumulative effect on marine air emissions indicators and the Project contribution to total cumulative effects are rated as not significant.

TABLE 4.4.2-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON MARINE AIR EMISSIONS

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1 Marine Air Emissions Indicator – Primary Emissions of CACs									
1(a) Project contribution to cumulative increase in CAC emissions.	Negative	RSA	Long-term	Periodic	Short-term	Low	High	Moderate	Not significant
1(b) Total cumulative CAC emissions.	Negative	RSA	Long-term	Periodic	Short-term	Medium	High	Moderate	Not significant
2 Marine Air Emissions Indicator – Primary Emissions of VOCs									
2(a) Project contribution to cumulative increase in VOC emissions.	Negative	RSA	Long-term	Periodic	Short-term	Low	High	Moderate	Not significant
2(b) Total cumulative VOC emissions.	Negative	RSA	Long-term	Periodic	Short-term	Medium	High	Moderate	Not significant
3 Marine Air Emissions Indicator – Formation of Secondary PM and Ozone									
3(a) Project contribution to cumulative increase in formation of secondary PM and ozone emissions.	Negative	LFV	Long-term	Periodic	Short-term	Low	High	Moderate	Not significant
3(b) Total cumulative formation of secondary PM and ozone emissions.	Negative	RSA	Long-term	Periodic	Short-term	Medium	High	Moderate	Not significant
4 Marine Air Emissions Indicator – Visibility									
4(a) Project contribution to cumulative increase in decreased visibility during operations.	Negative	LFV	Long-term	Periodic	Short-term	Low	High	Moderate	Not significant
4(b) Total cumulative decreased visibility.	Negative	LFV	Long-term	Periodic	Short-term	Medium	High	Moderate	Not significant
5 Combined Cumulative Effects on Marine Air Emissions									
5(a) Project contribution to combined cumulative effects on marine air emissions indicators (1[a], 2[a], 3[a] and 4[a]).	Negative	LFV	Long-term	Periodic	Short-term	Low	High	Moderate	Not significant
5(b) Total cumulative effects on marine air emissions indicators (1[b], 2[b], 3[b] and 4[b]).	Negative	LFV	Long-term	Periodic	Short-term	Medium	High	Moderate	Not significant

Notes:
1 RSA = Marine Air Quality RSA; LFV = Lower Fraser Valley
2 Significant Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Marine Acoustic Environment

Table 4.4.3-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on the marine acoustic environment. Criteria ratings for total cumulative effects of marine vessel traffic on the acoustic environment are identical to Project-specific ratings, except that magnitude is rated as medium for each acoustic indicator because while existing and reasonably foreseeable emissions are not predicted to exceed acoustic standards, they are higher than those from increased marine vessel traffic associated with the Project. Both the total cumulative effect on marine acoustic

environment indicators and the Project contribution to total cumulative effects are rated as not significant.

TABLE 4.4.3-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON MARINE ACOUSTIC ENVIRONMENT

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Marine Acoustic Environment Indicator – Atmospheric Sound Levels									
1(a) Project contribution to cumulative atmospheric sound levels.	Negative	RSA	Long-term	Periodic	Immediate	Low to medium	High	Moderate	Not significant
1(b) Total cumulative contribution to atmospheric sound levels.	Negative	RSA	Long-term	Periodic	Immediate	Medium	High	Moderate	Not significant
2. Combined Cumulative Effects on Marine Acoustic Environment									
2(a) Project contribution to combined cumulative effects on marine acoustic environment indicator (1[a]).	Negative	RSA	Long-term	Periodic	Immediate	Low to medium	High	Moderate	Not significant
2(b) Total cumulative contribution to atmospheric sound levels (1[b]).	Negative	RSA	Long-term	Periodic	Immediate	Medium	High	Moderate	Not significant

Notes:
1 RSA = Marine RSA.
2 Significant Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Marine Fish and Fish Habitat (Marine Transportation)

Table 4.4.4-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on the marine fish and fish habitat indicator. Criteria ratings for total cumulative effects of marine vessel traffic on the marine fish and fish habitat indicator are identical to Project-specific ratings, except that magnitude is rated as medium for the marine fish and fish habitat indicator because while no environmental or regulatory standards exist, any effects associated with existing and reasonably foreseeable vessel traffic would likely be larger than those from increased marine vessel traffic associated with the Project. Both the total cumulative effect on the marine fish and fish habitat indicator and the Project contribution to total cumulative effects are rated as not significant.

TABLE 4.4.4-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON MARINE FISH AND FISH HABITAT

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Marine Fish and Fish Habitat Indicator – Intertidal Habitat									
1(a) Project contribution to cumulative disturbance to intertidal habitat.	Negative	RSA	Long-term	Periodic	Immediate	Low	High	High	Not significant
1(b) Total cumulative disturbance to intertidal habitat.	Negative	RSA	Long-term	Periodic	Immediate	Medium	High	High	Not significant
2. Combined Cumulative Effects on Marine Fish and Fish Habitat									
2(a) Project contribution to combined cumulative effects on marine fish and fish habitat indicator (1[a]).	Negative	RSA	Long-term	Periodic	Immediate	Low	High	High	Not significant
2(b) Total cumulative disturbance effects on marine fish and fish habitat indicators (1[b]).	Negative	RSA	Long-term	Periodic	Immediate	Medium	High	High	Not significant

Notes:
1 RSA = Marine RSA
2 Significant Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Marine Mammals (Marine Transportation)

Table 4.4.5-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on marine mammal indicators. Criteria ratings for total cumulative effects of marine vessel traffic on marine mammal indicatorss are identical to Project-specific ratings, except that frequency is rated at periodic to continuous because the number of existing and reasonably foreseeable vessel passages is predicted to be much larger than those from increased marine vessel traffic associated with the Project; these would continue with or without the Project. For reasons described in Section 4.3.7 of Volume 8A (Filing ID A3S4Y3), both the total cumulative effect on humpback whale and Steller sea lion indicators, and the Project contribution to total cumulative effects on these marine mammal indicators are rated as not significant and existing total cumulative effects on the southern resident killer whale population are concluded to be significant.

TABLE 4.4.5-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON MARINE MAMMALS

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Marine Mammals Indicator – Southern Resident Killer Whale									
1(a) Project contribution to cumulative increase in sensory disturbance due to underwater noise.	Negative	RSA	Long-term	Periodic	Immediate	**High**	High	Low	Significant
1(b) Total cumulative increase in disturbance due to underwater noise.	Negative	RSA	Long-term	Periodic to continuous	Immediate	**High**	High	Low	Significant
2. Marine Mammals Indicator – Humpback Whale									
2(a) Project contribution to cumulative increase in sensory disturbance due to underwater noise.	Negative	RSA	Long-term	Periodic	Immediate	Medium	High	Low	Not Significant
2(b) Total cumulative increase in disturbance due to underwater noise.	Negative	RSA	Long-term	Periodic to continuous	Immediate	Medium	High	Low	Not Significant
3. Marine Mammals Indicator – Steller Sea Lion									
3(a) Project contribution to cumulative increase in sensory disturbance due to underwater noise.	Negative	RSA	Long-term	Periodic	Immediate	Low	High	High	Not Significant
3(b) Total cumulative increase in sensory disturbance due to underwater noise.	Negative	RSA	Long-term	Periodic to continuous	Immediate	Low	High	Low	Not Significant
4. Combined Cumulative Effects on Marine Mammals									
4(a) Project contribution to combined cumulative effects on marine mammals indicators (1[a], 2[a] and 3[a]).	Negative	RSA	Long-term	Periodic	Immediate	**High**	High	Low	Not significant to Significant
4(b) Total cumulative effects on marine mammal indicators (1[b], 2[b] and 3[b]).	Negative	RSA	Long-term	Periodic to continuous	Immediate	Low to **high**	High	Low	Not significant to significant

Notes:
1 RSA = Marine RSA.
2 Significant Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of regulatory sensory disturbance standard is predicted.

Marine Birds (Marine Transportation)

Table 4.4.6-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on marine bird indicators. Criteria ratings for total cumulative effects of marine vessel traffic on marine bird indicators are identical to Project-specific ratings, except that magnitude is rated as medium for each marine bird indicator because while no environmental or regulatory standards exist, any effects associated with existing and reasonably foreseeable vessel traffic would likely be larger than those from increased marine vessel traffic associated with the Project. Both the total cumulative effect on marine bird indicators, and the Project contribution to total cumulative effects on these indicators are rated as not significant.

TABLE 4.4.6-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON MARINE BIRDS

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Marine Birds Indicator – Fork-tailed Storm-Petrel									
1(a) Project contribution to the cumulative increase in behavioural alteration or sensory disturbance.	Negative	RSA	Long-term	Periodic	Short-term	Low	High	High	Not significant
1(b) Total cumulative increase in behavioural alteration or sensory disturbance.	Negative	RSA	Long-term	Periodic	Short-term	Medium	High	High	Not significant
2. Marine Birds Indicator – Cassin's auklet									
2(a) Project contribution to the cumulative increase in behavioural alteration or sensory disturbance.	Negative	RSA	Long-term	Periodic	Short-term	Medium	High	High	Not significant
2(b) Total cumulative increase in behavioural alteration or sensory disturbance.	Negative	RSA	Long-term	Periodic	Short-term	Medium	High	High	Not significant
3. Marine Birds Indicator – Surf Scoter									
3(a) Project contribution to the cumulative increase in behavioural alteration or sensory disturbance.	Negative	RSA	Long-term	Periodic	Short-term	Medium	High	High	Not significant
3(b) Total cumulative increase in behavioural alteration or sensory disturbance.	Negative	RSA	Long-term	Periodic	Short-term	Medium	High	High	Not significant
4. Marine Birds Indicator – Pelagic Cormorant									
4(a) Project contribution to the cumulative increase in behavioural alteration or sensory disturbance.	Negative	RSA	Long-term	Periodic	Short-term	Medium	High	High	Not significant
4(b) Total cumulative increase in behavioural alteration or sensory disturbance.	Negative	RSA	Long-term	Periodic	Short-term	Medium	High	High	Not significant
5. Marine Birds Indicator – Glaucous-winged Gull									
5(a) Project contribution to the cumulative increase in behavioural alteration or sensory disturbance.	Negative	RSA	Long-term	Periodic	Short-term	Low	High	High	Not significant
5(b) Total cumulative increase in behavioural alteration or sensory disturbance.	Negative	RSA	Long-term	Periodic	Short-term	Medium	High	High	Not significant
6. Combined Cumulative Effects on Marine Birds									
6(a) Project contribution to combined cumulative effects on marine birds indicators (1[a], 2[a], 3[a], 4[a] and 5[a]).	Negative	RSA	Long-term	Periodic	Short-term	Medium	High	High	Not significant
6(b) Total cumulative effects on marine bird indicators (1[b], 2[b], 3[b], 4[b] and 5[b]).	Negative	RSA	Long-term	Periodic	Short-term	Medium	High	High	Not significant

Notes:
1 RSA = Marine RSA
2 Significant Cumulative Environmental Effect: A high probability of occurrence of a permanent or long-term cumulative effect of high magnitude that cannot be technically or economically mitigated.
3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Traditional Marine Resource Use

Table 4.4.8-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on TMRU indicators. Criteria ratings for total cumulative effects of marine vessel traffic on TMRU indicators are identical to Project-specific ratings. As described in Section 4.4.8.2 of Volume 8A (Filing ID A3S4Y3), a significant adverse total cumulative effect is predicted for traditional use of southern resident killer whales due to existing marine shipping activities that will continue with or without the Project. Total cumulative effects on other traditional marine resources and indicators, and the Project contribution to those effects, are concluded to be not significant.

TABLE 4.4.8-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON TRADITIONAL MARINE RESOURCE USE

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Traditional Marine Resource Use Indicator – Subsistence Activities and Sites									
1(a) Project contribution to cumulative effects on subsistence activities and sites.	Negative	RSA	Long-term	Periodic	Short to long-term	Low to high	High	High	Significant
1(b) Total cumulative effects on subsistence activities and sites.	Negative	RSA	Long-term	Periodic	Short to long-term	Low to high	High	High	Significant
2. Traditional Marine Resource Use Indicator – Cultural Sites									
2(a) Project contribution to cumulative effects on cultural sites.	Negative	RSA	Long-term	Continuous	Long-term	Medium	High	High	Not significant
2(b) Total cumulative effects on cultural sites.	Negative	RSA	Long-term	Continuous	Long-term	Medium	High	High	Not significant
3. Combined Cumulative Effects on Traditional Marine Resource Use									
3(a) Combined Project contribution to cumulative effects on traditional marine resource use indicators (1[a] and 2[a]).	Negative	RSA	Long-term	Continuous	Long-term	High	High	High	Not significant
3(b) Total cumulative effects on traditional marine resource use indicators (1[b] and 2[b]).	Negative	RSA	Long-term	Continuous	Long-term	High	High	High	Not significant to significant

Notes:
1 RSA = Marine RSA
2 Significant Cumulative Socio-Economic Effect: A cumulative socio-economic effect is considered significant if the effect is predicted to be:
- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

Marine Commercial, Recreational, and Tourism Use

Table 4.4.9-2 compares significance criteria ratings for total cumulative effects and the Project contribution to these effects on marine commercial, recreational, and tourism use (MCRTU) indicators. Criteria ratings for total cumulative effects of marine vessel traffic on MCRTU indicators are identical to Project-specific ratings, except for the following.

The spatial boundaries of total cumulative effects on MCRTU indicators extend beyond the shipping lanes and are considered to be the Marine RSA. Magnitude is rated as medium for each MCRTU indicator because while existing and reasonably foreseeable effects on MCRTU are not predicted to result in severe modification to the socio-economic environment, they are higher than those from increased marine vessel traffic associated with the Project. With these criteria ratings, both total cumulative effects on MCRTU indicators and the Project contribution to these cumulative effects are not significant.

TABLE 4.4.9-2

SIGNIFICANCE EVALUATION OF CUMULATIVE EFFECTS ON MCRTU

Potential Cumulative Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude[3]	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. MCRTU Indicator – Commercial Fisheries and Aquaculture									
1(a) Project contribution to cumulative effects on commercial fishing.	Negative	LSA to RSA	Long-term	Periodic	Long-term	Low to medium	High	High	Not significant
1(b) Total cumulative effects on commercial fishing.	Negative	RSA	Long-term	Periodic	Long-term	Medium	High	High	Not significant
2. MCRTU Indicator – Marine Transportation									
2(a) Project contribution to cumulative effects on marine transportation.	Negative	LSA to RSA	Long-term	Periodic	Long-term	Low to medium	High	High	Not significant
2(b) Total cumulative effects on marine transportation.	Negative	RSA	Long-term	Periodic	Long-term	Medium	High	High	Not significant
3. MCRTU Indicator – Marine Recreational Use									
3(a) Project contribution to cumulative effects on marine recreational use.	Negative	LSA to RSA	Long-term	Periodic to Continuous	Long-term	Low to medium	High	High	Not significant
3(b) Total cumulative effects on marine recreational use.	Negative	RSA	Long-term	Periodic to Continuous	Long-term	Medium	High	High	Not significant
4. MCRTU Indicator – Marine Tourism Use									
4(a) Project contribution to cumulative effects on marine tourism use.	Negative	LSA to RSA	Long-term	Periodic	Long-term	Low to medium	High	High	Not significant
4(b) Total cumulative effects on marine tourism use.	Negative	RSA	Long-term	Periodic	Long-term	Medium	High	High	Not significant
5. Combined Cumulative Effects on MCRTU									
5(a) Combined Project contribution to cumulative effects on MCRTU indicators (1[a], 2[a], 3[a] and 4[a]).	Negative	LSA to RSA	Long-term	Periodic	Long-term	Low to medium	High	High	Not significant
5(b) Total cumulative effects on MCRTU indicators (1[b], 2[b], 3[b] and 4[b]).	Negative	RSA	Long-term	Periodic	Long-term	Medium	High	High	Not significant

Notes:
1 LSA = Marine LSA; RSA = Marine RSA.
2 Significant Cumulative Socio-Economic Effect: A cumulative socio-economic effect is considered significant if the effect is predicted to be:
- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

3 Bolded magnitude rating indicates that exceedance of environmental and/or regulatory standard is predicted.

References:

Alberta Government. 2013. Alberta Wetland Policy. Edmonton, AB. 24 pp.

Antoniuk, T. 2002. Cumulative effects assessment of pipeline projects. Pages 143-161 *in* A.J. Kennedy (ed.). Cumulative effects assessment in Canada: From concept to practice. Alberta Society of Professional Biologists, Calgary, AB.

Environment Canada. 1991. The Federal Policy on Wetland Conservation. Available from the Canadian Wildlife Service, Environment Canada. Ottawa, ON.

Environment Canada. 2014. Recovery Strategy for the Woodland Caribou, Southern Mountain population (*Rangifer tarandus caribou*) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment Canada. Ottawa, ON. 68 pp.

Finley, C. and R. Revel. 2002. Pipeline projects and cumulative effects assessment issues. Pages 219-231 *in* J.W. Goodrich-Mahoney, D.F. Mutrie and C.A. Guild (eds.). Environmental Concerns in Rights-of-Way Management: Seventh International Symposium. Elsevier Science Ltd.

Hegmann, G., C. Cocklin, R. Creasey, S. Dupuis, A. Kennedy, L. Kingsley, W. Ross, H. Spaling, and D. Stalker. 1999. Cumulative effects practitioners guide. Prepared by the Cumulative Effects Assessment Working Group and AXYS Environmental Consulting Ltd. for Canadian Environmental Assessment Agency.

Kennett, S. 2002. Lessons from Cheviot: Redefining government's role in cumulative effects assessment. Pages 17-29 *in* A.J. Kennedy (ed.). Cumulative effects assessment in Canada: From concept to practice. Alberta Society of Professional Biologists, Calgary, AB.

b.1) The cumulative effects assessment (CEA) methodology applied in the Environmental and Socio-Economic Assessment (ESA) is appropriate for a consistent evaluation of cumulative effects where one or more environmental or regulatory thresholds is already exceeded. As noted in the response to NEB IR No. 2.041a, the *Canadian Environmental Assessment Act, 2012* (*CEAA, 2012*) is project-focused, and thus its stated purpose is to "protect the components of the environment that are within the legislative authority of Parliament from significant adverse environmental effects <u>caused by a designated project</u>" (emphasis added). Justification of significant effects under the *CEAA, 2012,* is also considered to be focused on the Project's contribution, rather than the contribution of existing or reasonably foreseeable future effects. As noted in the preamble, where incremental residual effects would contribute to additional adverse effects where a threshold has been crossed, and best management practices are considered insufficient, special actions must be evaluated to preferably avoid, or fully mitigate or compensate for any residual Project contribution to cumulative effects. There are several instances where this approach has been adopted for the Project.

Two good examples of how the CEA methodology was applied are referenced in the preamble to this request – effects on terrestrial wildlife species at risk and effects on air

quality. Where potential effects on terrestrial wildlife critical habitat are predicted, Trans Mountain has assumed that these represent undesirable effects (*i.e.*, assumed to have exceeded a regulatory threshold by the fact that they have been listed under the *Species at Risk Act*) and has committed to work with appropriate regulatory authorities to identify special actions to avoid, or fully mitigate or compensate for any residual Project contribution to cumulative effects (responses to NEB IR No. 1.42, 1.44, 1.45, 1.46 and 1.47 [Filing IDs A3W9H8 and A3W9J7]). In the case of air emissions, where air quality standards are predicted to be exceeded by existing developments and activities, Trans Mountain has committed to adopt facility design and emission control measures that do not result in any additional exceedances. In both cases, the focus is on measures within the control of the Applicant, and these measures are proposed based on predicted existing and reasonably foreseeable cumulative effects risk, independent of any conclusions on the significance of total cumulative effects that would occur with or without the Project.

The assessment team concluded that in all but two cases, technically and economically feasible mitigation or compensation measures acceptable to regulatory authorities will be available to mitigate or compensate for Project-specific residual effects. This conclusion was based on the team's experience with past pipeline projects, including those involving air quality, woodland caribou, grizzly bear, and other fish, wildlife and vegetation species at risk. For example, the assessment team concluded that development and implementation of a Caribou Habitat Restoration Plan and Offset Measures Plan consistent with NEB Draft Conditions No. 10 and 55 (NEB 2014) (Filing ID A3V8Z8), would reduce potential magnitude from high without these measures to low to medium with these measures (and thereby from a significant adverse effect for total cumulative effects to a not significant adverse effect for Project contribution to cumulative effects [refer to Table 8.9-6 in the response to NEB IR No. 2.041a]). Assuming this rationale is accepted by the National Energy Board (NEB), justification of significant effects under the *CEAA, 2012* would not be required for Project-specific effects on species at risk.

The two exceptions noted in the Application are for effects of underwater noise from marine vessel traffic on the endangered southern resident killer whale population and associated traditional use of this population. In this instance, the Project team was not able to identify technically and economically feasible mitigation or compensation measures that would offset Project-specific residual effects for reasons described in the Application and Marine Mammal Protection Program (refer to the response to NEB IR No. 1.56 [Filing ID A3W9H8]). For these two residual effects, Project approval under the *CEAA, 2012* would require justification of significant adverse effects. Justification would need to reflect the situation that neither Trans Mountain nor the NEB have direct control over marine vessel activity within southern resident killer whale critical habitat, that this is an established shipping lane where marine vessel activity will continue with or without the Project, and that no clear solution has been identified. This is why Trans Mountain has identified integrated, multi-party solutions in its Marine Mammal Protection Program as the most appropriate approach to manage effects on southern resident killer whale critical habitat and any associated effects on traditional use of this population.

For these and any other significant adverse effects of the Project detailed by the NEB, Trans Mountain believes that the effects are justified, considering the overall balance of environmental, social, and economic impacts and benefits described in the Application.

b.2) The significance criteria adopted for the Project consider environmental and regulatory thresholds when rating the magnitude criterion. Instances where environmental and/or regulatory standards have been exceeded for total cumulative effects are indicated by bolded magnitude ratings in significance evaluation tables included in the response to NEB IR No. 2.041a.

Reference:

National Energy Board. 2014. Draft Conditions and Regulatory Oversight. Hearing Order OH-001-2014. Trans Mountain Pipeline ULC (Trans Mountain) Application for the Trans Mountain Expansion Project (Project). April 16, 2014 (Filing ID A3V8Z8).

c) Trans Mountain does not understand why separate regional significance evaluations would be required to allow the National Energy Board (NEB) to reach conclusions on whether or not the Project is in the public interest, and whether unjustified significant adverse effects would be likely to occur as a result of the Project. As noted in the responses to NEB IR No. 2.041a and 2.041b, the objective of a project-specific cumulative effects assessment (CEA) is to ensure that unjustified significant adverse effects do not occur as a result of the Project. This requires an understanding of existing and reasonably foreseeable cumulative effects risk, along with the contribution of the Project to that risk.

The methodology applied in the Environmental and Socio-Economic Assessment (ESA) is appropriate for considering the variability in total cumulative effects risk between regions/areas/segments and how these differences should inform design and selection of technically and economically feasible mitigation measures that avoid, mitigate, or compensate for any residual Project contribution to cumulative effects. This allows conclusions on significance and justification for any significant adverse effects to be made at the scale of the entire Project, while recognizing that local effects may be, or may be perceived to be, significant. The findings of the Joint Review Panel for the Mackenzie Gas Project addressed this matter (JRP 2009:103) when it said “there may well be impacts on individuals that, from an individual perspective, would be significant but which, again, the Panel might conclude would not be significant in the broader context”. Conclusions reached at the Project scale allow relevant (and frequently conflicting) local, municipal, provincial, and federal management guidance to be considered, as this guidance has, and will continue to, influence existing and future cumulative effects risk. Using the example referenced in the preamble, differences in existing native vegetation and wetland conditions and desired future conditions are to be expected between lands managed by government authorities and those controlled by private landowners. When evaluating potential trade-offs at Project or larger scales, common practice is to consider management guidance that explicitly acknowledges and considers trade-offs between social, economic, and environmental objectives (*e.g.,* land use plans).

The NEB Filing Manual (NEB 2014) notes that the level of effort and scale of a CEA should reflect not only the environmental and socio-economic setting and risks (the focus of a regional CEA), but also be appropriate to the project under assessment and its potential residual effects. Trans Mountain applied a number of complementary approaches to balance the influences of setting and project specifics when conducting the CEA:

1. Assessment indicators were selected to include resources, species or biological communities known or thought to be particularly sensitive to adverse effects, including cumulative effects.

2. The assessment team also considered differences in the environmental and socio-economic setting along the proposed pipeline corridor (see discussion in Section 8.1.3 in Volumes 5A and 5B [Filing IDs A3S1R1 and A3S1T0], and Section 4.4.1.3 in Volume 8A [Filing ID A3S4Y3]) as part of the CEA).

3. Where feasible, landscape- or watershed scale analysis were also conducted, including: quantification of stream crossing, riparian and instream habitat metrics for each watershed intersected by the proposed pipeline corridor (Section 8.6 in Volume 5A [Filing IDs A3S1R1 and A3S1R2]); quantification of disturbance by Ecosystem Unit, designated caribou range, and designated grizzly bear population unit (Section 8.9 in Volume 5A [Filing ID A3S1R2]); and estimates of reasonably foreseeable marine vessel activity for different segments along the shipping lanes (Section 4.4.1.4 in Volume 8A [Filing ID A3S4Y3]).

The cumulative effects significance ratings included in the response to NEB IR No. 2.041a incorporate these complementary setting, management guidance, and cumulative effects evaluations. An obvious example is where a range has been assigned to reversibility or magnitude ratings for an indicator based on expected regional/segment differences. Other instances where variability has been considered are identified in the response to NEB IR No. 2.041a as requested.

Reference:

National Energy Board. 2014. Filing Manual. Inclusive of Release 2014-01 (January 2014). Calgary, AB.

2.042 Mitigation and monitoring in the TMX Anchor Loop project

Reference:

A3S0Q7, Application Volume 1, Summary:

i) PDF page 43 of 113
ii) PDF page 89 of 113
iii) A3S0Q8, Application Volume 2, Project Overview, PDF page 31 of 45

A3S1Q9, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical:

iv) PDF page 143 of 403
v) PDF pages 202 and 203 of 403
vi) PDF page 212 of 403
vii) A2K6K3, 2011 TM Anchor Loop Post Construction Monitoring Report, PDF pages 25 and 26 of 64
viii) A3X5V7, Trans Mountain Response to ALIB IR 1.6.10a Attachment, Restoration of the TMX - Anchor Loop Project in Jasper National Park, D. Novak and G. Fryer, Pre-Publication Draft from Proceedings of the Ninth International Symposium on Environmental Concerns in Rights-of-Way Management held in Portland, Oregon, USA – September 27-30, 2009
ix) A3X5V6, Trans Mountain Response to ALIB IR 1.6.10a, PDF page 122 of 123

Preamble:

The Application refers to, and relies upon, numerous best practices, learnings, and monitoring results from the TMX Anchor Loop project, including:

- Reference i) notes that a number of unique and innovative (non- standard) restoration measures were implemented on the TMX Anchor Loop project at particularly sensitive areas with the objective of restoring ecological integrity of lands and watercourses and that “many” of the approaches, plans, and programs implemented have been adapted and enhanced for the present Project.

- Reference ii) states that follow-up wetland monitoring conducted for the TMX Anchor Loop project indicates that effects of the present Project on wetlands are expected to be reversible in the medium to long term, of low magnitude, and not significant.

- Reference iii) indicates that, should the Project be approved, Kinder Morgan Canada would aim to replicate the best practices and many successes of the TMX Anchor Loop project.

- Reference iv) states that riparian habitat revegetation plans for the TMX Anchor Loop Project included determining riparian plant species and numbers to be used at each site, based on detailed site assessments. By four years post-construction all outstanding issues relating to riparian loss and/or alteration were resolved.

- Reference v) lists a number of learnings from the TMX Anchor Loop project relevant to reclaiming most affected native vegetation communities, such as long-term wind protection structures and creating terrain undulations.
- Reference vi) notes the successful transplantation of a rare plant species off the right-of-way and temporary workspace prior to constructing the TMX Anchor Loop pipeline.

It is unclear if all mitigation and monitoring measures implemented in the TMX Anchor Loop project will be fully implemented for the current Project. For example, Reference vii) describes the Trans Mountain Legacy Fund set up for the TMX Anchor Loop project to be directed toward net ecological benefit projects with the parks that project was located in.

Reference viii) describes a range of specific restoration measures implemented in the TMX Anchor Loop project that go beyond standard reclamation. Reference ix) states that those measures will be carried forward at suitable locations along the Trans Mountain Expansion Project, but that not all of them are effective, practical, or economically feasible at all locations.

Request:

Please provide:

a) a list of all non-standard (in Trans Mountain's view) environmental mitigation and monitoring measures implemented during the TMX Anchor Loop project, including, but not limited to, all measures related to restoration, offsets, and legacy funds;

b) for each such non-standard measure, a brief description and indication of whether it will be fully implemented, partially implemented, or not implemented for the current Project;

c) a discussion of the potential for such non-standard mitigation measures and other potential off-right-of-way or legacy projects/funds to result in a net environmental benefit for one or more elements that will be affected by the Project;

d) a list of any standard environmental mitigation and monitoring measures that were implemented in the TMX Anchor Loop project that will not be fully implemented in the current Project; and

e) a justification for not fully implementing any mitigation or monitoring measure identified in b) or d) for the current Project, and criteria for deciding when and where partially implemented measures will be undertaken.

Response:

a) The development of non-standard environmental mitigation and monitoring for the TMX-Anchor Loop Project began with its unique Public Engagement process. One of the components of the engagement process included four environmental workshops held with non-government environmental organizations, Aboriginal groups, the general public and government officials to seek feedback regarding the environmental assessment. This approach was also adopted for the Trans Mountain Expansion Project (TMEP).

The TMX-Anchor Loop Project was situated in Jasper National Park (JNP) and Mount Robson Provincial Park (MRPP), a World UNESCO Heritage Site. This environmental context unequivocally placed the setting of this pipeline in a category like no other past pipeline project in Canada. As a result, the unique research and field work conducted in support of the environmental assessment for TMX-Anchor Loop included:

- an invertebrate survey;
- an amphibian survey;
- a wetland function survey;
- a Forest Health Assessment;
- a comprehensive non-vascular plant survey;
- grizzly and black bear assessment and mitigation ;
- a Viewshed Modelling Analysis;
- a Calcareous Soils Study; and
- a detailed Restoration Plan.

All of the studies listed above, with the exception of the Calcareous Soils Study and invertebrate study, which were unique to Jasper National Park, have been undertaken for the TMEP. At the time the environmental assessment (*i.e.,* from 2004 to 2008) was completed for TMX-Anchor Loop, these studies were not typical for most pipeline projects. Many of these studies have now become standard for complex, large scale pipeline projects. Furthermore, areas such as human health and ecological risk assessments, groundwater assessments and spill modelling have advanced well beyond what was required in 2004 and have been incorporated into the assessment for TMEP. Each of these reports generated a suite of mitigation measures, some of which that are now considered industry standard. Where applicable, these measures have been included in the Pipeline Environmental Protection Plan (EPP), unless they were site-specific mitigation measures. These include, but are not limited to the following measures.

<u>Forest Health</u>

- During the pipeline construction phase, any areas with previously unidentified forest health concerns were reported to Project managers and Parks officials. Inspection personnel completing the work were trained in the identification of such forest health concerns. A specialist was consulted where there was uncertainty in identification of specific forest health agents.

- Trans Mountain representatives were responsible for communicating identified forest health issues to JNP and MRPP managers. JNP and MRPP recognized that it was their responsibility to deal with forest health management issues.

- The movement of construction debris was carefully controlled and followed the specific requirements of provincial legislation and regulations. The Alberta regulations and legislation that apply are the *Forests Act* RSA 2000, c.F-22 and the Timber Management Regulation (164.1 (1)). These laws prohibit the import, into Alberta, of pine logs or products with bark attached between May 1st and September 30th. Outside of these

dates, written approval to transport logs with bark attached needed to be obtained from the Minister three months in advance. If logs were completely debarked, import authorization was not required at any time of year. Within BC, transport of logs with bark attached is restricted on a forest district by forest district basis. These restrictions are based on the beetle emergence period but specific dates vary. There were no restrictions on transporting debarked logs.

- Tree clearing was undertaken before beetle flight (May) or after beetle flight (September) but preferably not during the known flight period. The period of flight was carefully monitored and adjusted to reflect changes in the flight associated with winter/spring weather anomalies.

- If tree removal occurred between May 1st and September 30th when beetle flight is most likely to occur, and logs were to be imported into Alberta, all bark was removed from logs prior to transport from the site. This recommendation also applied to logs being transported within BC if there were procedural guidelines that applied within the relevant forest districts.

- From a forest health perspective, construction debris left on the right-of-way was minimized. Where applicable, JNP and MRPP required the maintenance of specific quantities of coarse woody debris to maintain habitat values. This was established in consultation with Park managers prior to the onset of construction.

- Damage to residual trees along the right-of-way corridor was minimized to limit the infection and spread of forest health pathogens. Prior to the onset of construction, Trans Mountain representatives consulted with JNP and MRPP to identify any potential conflicts between the timing of pipeline construction and planned prescribed burns. These conflicts were most likely to occur between April and June, and in August.

<u>Grizzly Bear</u>

- Plants less palatable to bears were used during re-vegetation. Palatable non-native invasive plants such as clover, dandelion and some grasses were controlled. Non-essential human accesses were restricted during all project phases, especially operations.

- The width of the pipeline right-of-way clearing was minimized as much as possible immediately adjacent to the highway. Where the pipeline right-of-way was close but not immediately adjacent to the highway, visual screening and security cover was maintained by trees or shrubs between the pipeline right-of-way and the highway right-of-way.

- The pipeline right-of-way was regenerated through promotion of natural succession. Human access was restricted on select access roads following construction. A winter construction schedule was maintained in this section to reduce the impact of increased human traffic on bears in designated areas.

Viewshed Analysis

- Site-specific restoration measures were implemented to minimize effects to the viewshed as outlined in the Restoration Plan.
- Painted structures and fencing were installed around above ground facilities to blend in with the natural environment.
- Clearing and maintenance of vegetation during operations was limited in certain areas of high wildlife use and or where there were access restrictions.

Wildlife and Wildlife Habitat

- Specific construction timing restrictions were imposed for mountain sheep, mountain goats, removal of beaver dams, harlequin duck nesting areas, mineral licks and raptor nests in Jasper National Park.

Restoration

During restoration of the TMX Anchor Loop Project, Trans Mountain implemented the following non-standard restoration measures.

- Detailed Environmental Alignment Sheets were created based on ecological land classification units developed for Jasper National Park.
- Native plants and seed were collected and propagated 2 years prior to construction.
- Plantations within riparian and other special upland restoration locations were irrigated.
- Non-vascular plant species were collected and replaced, and monitored post-construction.
- Wildlife trees were re-established at locations where wildlife trees were removed during construction.
- Wildlife visual barriers were created at strategic locations to reduce the visual line-of-sight of predators (wolves) and prey (elk and moose).
- Upland special restoration locations were re-vegetated to mitigate construction related visual scars located within the viewshed of Park visitors.
- A pre- and post-construction vegetation management program was implemented to monitor and manage weeds at riparian and general rights-of-way.
- Metal fencing was installed and maintained around select watercourses to allow for vegetation establishment and reduce wildlife browse.
- Culverts were replaced with single span bridges and non-functional culverts with bottomless culverts to re-establish fish connectivity throughout JNP and MRPP as part of the Fisheries and Oceans Canada Compensation Program.

- Existing gravel pits that were used for temporary workspace during construction and were originally constructed by Parks Canada were re-contoured, restored and seeded.

Post-Construction Monitoring

Trans Mountain was required to conduct a minimum 5 year post-construction monitoring program for the TMX-Anchor Loop Project. Prior to this project, pipelines regulated under the NEB typically required a 2 year post-construction monitoring program. Follow-up programs were conducted for Forest Health, Calcareous Soils, Aesthetics and Wetlands.

Please also refer to the response to Government of Canada, The Parks Canada Agency IR No. 1.2.7.

Knowledge Gains

The following provides a list of the knowledges gains associated with the TMX-Anchor Loop Project.

- Fish and fish habitat data and mapping for over 220 waterbodies and drainages along the Trans Mountain pipeline system.
- Classification of wetlands and surveys of wetland function in 105 wetlands.
- Invasive and non-native plant mapping.
- Wildlife habitat mapping.
- Baseline wildlife information on little known Park species such as amphibians (*e.g.,* boreal chorus frog, boreal (western) toad and long-toed salamander) and invertebrates (*e.g.,* Whitehouse's emerald dragonfly and Quebec emerald dragonfly).
- Information on presence of species at risk or special concern identified in the Terms Of Reference including bull trout, Haller's apple moss, boreal moonwort, Canada anemone, purple-leaved willow herb, meadow willow, western toad, mountain caribou, wolverine and grizzly bear.
- Forest Health Assessment that included an analysis of forest health issues and management strategies.
- Bear assessment and mitigation plan that summarized relevant information for grizzly and black bear, and identifies general and site-specific management actions.
- Heritage resource surveys documenting both previously known and new sites; identification of 21 new archaeological sites within JNP and 4 new archaeological and historic sites in MRPP.
- Traditional land and resource use study documenting the traditional use of Aboriginal groups.

- Jasper Highway Twinning Concept Planning Study identifying areas where Highway 16 road improvements and potential widening is likely to occur in JNP.
- Viewshed Modelling Analysis that provided viewshed modelling for 10 representative sites within JNP and MRPP.
- Palaeontological report that identified areas of palaeontological interest to Parks Canada and Geological Survey of Canada.
- Populated ALCES model that allows cost/benefit of resource and human management practices to be evaluated and related to ecological integrity indicators.
- All the supplemental research and studies in the Parks conducted over a four year period were submitted to Parks Canada and BC Parks. These studies now reside at the Parks Canada Library in Jasper and at the University of Alberta in Edmonton.
- Stabilization and revegetation of calcium-rich surface soils in JNP and MRPP. Information gained through reclamation trials and monitoring to develop specialized methods to stabilize and revegetate soils that are strongly to extremely calcareous at the surface will benefit resource managers and others working with these soils elsewhere in JNP and the Yellowhead corridor.

Net Gains

The following provides a list of net gains that were identified and realized during the construction of the TMX-Anchor Loop Project. At the time of the TMX-Anchor Loop Project, net gains were a new aspect of project planning and execution that stemmed from the project.

- Pipeline sized to accommodate all reasonably foreseeable system expansion opportunities to avoid future looping or new pump station locations within the Parks.
- Gathered enhanced digital database and 2005 air photos of the Local Study Area (LSA).
- Consistent, cross-referenced digital Ecological Land Classification (ELC) map for the LSA along the Yellowhead corridor developed by cross-referencing BC Biogeoclimatic Ecosystem Classification (BEC) units used in MRPP to the ELC system used in JNP.
- Rare vascular and non-vascular plant species and plant community mapping. Non-vascular work was the first study of its kind to be done in the Parks.
- Baseline information on a variety of wildlife species which helped Parks Canada in their preparation of status reports on species within JNP for consideration under federal species at risk legislation.
- Restoration of wetland function in Fiddle-Athabasca wetland complex in JNP. The old railway causeway has impeded surface water along the existing Trans Mountain right-of-way. During construction this area was remedied.

- Fish habitat compensation in JNP and MRPP. Compensation program emphasized riparian habitat and native fish at the watershed scale.
- Native species revegetation and control of invasive plants in JNP and MRPP on segments of the existing Trans Mountain right-of-way.
- Visual enhancement of Windy Point.
- Excavations of heritage sites in JNP. Several Stage I excavations were undertaken that extended well beyond the construction footprint to recover valuable cultural knowledge about the Park's past.
- Enhancement of bank and riparian areas and habitat in JNP and MRPP.
- Long-term monitoring of nonvascular plants.
- Use of shrub or tree visual screens in JNP and MRPP at road crossings where this would benefit wildlife movements or minimize visual impacts to travelers and not increase wildlife mortality.
- Reduction of wildlife mortality in JNP and MRPP. Less-palatable native plant species were planted in designated segments of the Anchor Loop right-of-way and along the existing Trans Mountain right-of-way to deter them away from known mortality sources (*i.e.,* highway and railway).

Legacy Fund

Another positive outcome of the Anchor Loop Project consultation process was Kinder Morgan Canada's commitment to complete a project that would result in a net ecological benefit for both JNP and MRPP. This program, formerly known as the Anchor Loop Net Benefit Program, went beyond the mitigation and special measures needed for regulatory approval, and has since become known as the Trans Mountain Legacy Fund (TMLF).

Initially, this program involved three separate components:

- a contribution to MRPP to support net benefit initiatives;
- a contribution to JNP to support net benefit initiatives; and
- a donation of $2.2 million for ecological improvement projects, identified through consensus.

Today, the TMLF supports projects that improve the ecological health of MRPP and JNP. As determined by the Fund Steering Committee, projects are providing positive action to improve the ecological conditions and knowledge of the corridor and adjacent lands.

The TMLF steering committee includes representatives from Kinder Morgan Canada, the Government of British Columbia, Parks Canada, the Canadian Parks and Wilderness Society (Southern Alberta Chapter) and the Fraser Headwaters Alliance.

b) Table 2.042B-1 provides information related to non-standard measures from the TMX Anchor Loop Project and their applicability to the TMEP along with a rationale for the inclusion or exclusion.

TABLE 2.042B-1

TMX ANCHOR LOOP PROJECT NON-STANDARD MEASURES AND APPLICABILITY TO TMEP

Non-Standard Measure from TMX Anchor Project	Applicability to TMEP	Rationale for Inclusion/Exclusion
Forest Health		
During the pipeline construction phase, any areas with previously unidentified forest health concerns were reported to Project managers and Parks officials. Inspection personnel completing the work were trained in the identification of such forest health concerns. A specialist was consulted where there was uncertainty in identification of specific forest health agents.	These measures will be implemented during the Project within Alberta and BC.	Forest health issues are known to occur in the study area. There is little evidence that shows linear disturbances create conditions conducive to the development and spread of forest health issues. Industry accepted tree clearing, salvage and movement practices will be implemented to minimize the spread of forest health issues.
Trans Mountain representatives were responsible for communicating identified forest health issues to JNP and MRPP managers. JNP and MRPP recognized that it was their responsibility to deal with forest health management issues.	These measures will be implemented during the Project within Alberta and BC.	Forest health issues are known to occur in the study area. As it is not expected that tree clearing activities will create conditions conducive to the development of forest health pathogens, monitoring targeted specifically at the identification of forest health issues will not be implemented.
The movement of construction debris was carefully controlled and followed the specific requirements of provincial legislation and regulations. The Alberta regulations and legislation that apply are the *Forests Act* RSA 2000, c.F-22 and the Timber Management Regulation (164.1 (1)). These laws prohibit the import, into Alberta, of pine logs or products with bark attached between May 1st and September 30th. Outside of these dates, written approval to transport logs with bark attached needed to be obtained from the Minister three months in advance. If logs were completely debarked, import authorization was not required at any time of year. Within BC, transport of logs with bark attached is restricted on a forest district by forest district basis. These restrictions are based on the beetle emergence period but specific dates vary. There were no restrictions on transporting debarked logs.	These measures will be implemented during the Project within Alberta and BC.	Movement of construction debris from within Alberta and BC and from one province to another, will follow current applicable legislation and regulations.

TABLE 2.042B-1

TMX ANCHOR LOOP PROJECT NON-STANDARD MEASURES AND APPLICABILITY TO TMEP (continued)

Non-Standard Measure from TMX Anchor Project	Applicability to TMEP	Rationale for Inclusion/Exclusion
Tree clearing was undertaken before beetle flight (May) or after beetle flight (September) but preferably not during the known flight period. The period of flight was carefully monitored and adjusted to reflect changes in the flight associated with winter/spring weather anomalies.	These measures will be implemented during the Project within Alberta and BC.	Local beetle flight data that reflects changes in the flight period associated with winter/spring weather anomalies, will be obtained to determine the appropriate tree clearing period.
If tree removal occurred between May 1st and September 30th when beetle flight is most likely to occur, and logs were to be imported into Alberta, all bark was removed from logs prior to transport from the site. This recommendation also applied to logs being transported within BC if there were procedural guidelines that applied within the relevant forest districts.	These measures will be implemented during the Project within Alberta and BC.	Where trees are cleared between May 1 and September 30th when beetle flight is most likely to occur, all bark will be removed prior to importing logs into Alberta or where logs are transported within BC if there were procedural guidelines that applied within the relevant forest districts.
From a forest health perspective, construction debris left on the right-of-way was minimized. Where applicable, JNP and MRPP may require the maintenance of specific quantities of coarse woody debris to maintain habitat values. This was established in consultation with Park managers prior to the onset of construction.	These measures will be implemented during the Project within Alberta and BC.	Coarse woody debris left on the right-of-way will be minimized on the Project. Where applicable, coarse woody debris for use as rollback and the creation of woody species habitat at riparian and dry, exposed upland areas will be used to reduce soil erosion and support vegetation reestablishment.
Damage to residual trees along the right-of-way corridor was minimized to limit the infection and spread of forest health pathogens. Prior to the onset of construction, Trans Mountain representatives consulted with JNP and MRPP to identify any potential conflicts between the timing of pipeline construction and planned prescribed burns. These conflicts were most likely to occur between April and June, and in August.	These measures will be implemented during the Project within Alberta and BC.	Damage to trees located at the forest edge along the right-of-way will be minimized. Trans Mountain will consult with Forest District, Municipalities and BC Provincial Parks Representatives to identify any potential conflicts between the timing of pipeline construction and burning of coarse woody debris.
Grizzly Bear		
Plants less palatable to bears were used during re-vegetation when the pipeline right-of-way was located adjacent to a transportation corridor (e.g., rail way or highway). Palatable non-native invasive plants such as clover, dandelion and some grasses were controlled. Non-essential human access were restricted during all project phases, especially operations.	These measures will be implemented during the Project within Alberta and BC.	Seed mixes developed using less-palatable species will be used when the Project right-of-way is located adjacent to a transportation corridor (e.g., rail way or highway). Non-essential human access will be restricted during all project phases, especially operations.

TABLE 2.042B-1

TMX ANCHOR LOOP PROJECT NON-STANDARD MEASURES AND APPLICABILITY TO TMEP (continued)

Non-Standard Measure from TMX Anchor Project	Applicability to TMEP	Rationale for Inclusion/Exclusion
The width of the pipeline right-of-way clearing was minimized as much as possible immediately adjacent to the highway. Where the pipeline right-of-way was close but not immediately adjacent to the highway, visual screening and security cover was maintained by trees or shrubs between the pipeline right-of-way and the highway right-of-way.	These measures will be implemented during the Project within Alberta and BC.	These measures will be implemented to the extent feasible to maintain visual screening and security cover for wildlife adjacent to the highway right-of-way.
The pipeline right-of-way was regenerated through promotion of natural succession. Human access was restricted on select access roads following construction.	These measures will be implemented during the Project within Alberta and BC.	Aided and natural succession will be promoted on the pipeline right-of-way (operational right-of-way and TWS areas). Temporary access roads will be deactivated following construction. A winter construction schedule will be maintained in select sections to reduce the impact of increased human traffic on bears in designated areas.
Viewshed Analysis		
Site-specific restoration measures were implemented to minimize effects to the viewshed as outlined in the Restoration Plan.	These measures will be implemented during the Project within BC Provincial Parks and municipal/regional parks.	Site-specific restoration measures will be implemented to minimize effects.
Painted structures and fencing were installed around above ground facilities to blend in with the natural environment.	These measures will be implemented during the Project within Alberta and BC.	Where applicable, painted structures and fencing will be installed around above ground facilities to blend in with the natural environment.
Clearing and maintenance of vegetation during operations was limited in certain areas of high wildlife use and or where there were access restrictions.	These measures will be implemented during the Project within Alberta and BC.	Where practical, clearing and maintenance of woody vegetation during operations will be limited in certain areas of high wildlife use, within TWS areas and where there are access restrictions
Wildlife and Wildlife Habitat		
Construction timing restrictions were imposed for mountain sheep, mountain goats, removal of beaver dams, harlequin duck nesting areas, mineral licks and raptor nests.	Various wildlife and fisheries timing constraints will apply along the entire pipeline corridor.	Where applicable, construction timing restrictions will be imposed for sensitive wildlife species and habitat features.
Restoration		
Detailed Environmental Alignment Sheets were created based on ecological land classification units developed for Jasper National Park.	This measure may be partially implemented.	Detailed Environmental Alignment Sheets will be created but will not be based on the Jasper National Park Ecological Land Classification.
Native plants and seed were collected and propagated 2 years prior to construction.	These measures will be implemented at select locations within Alberta and BC.	Native plants and seed will be collected.
Plantations within riparian and other special upland restoration locations were irrigated.	This measure may be implemented at very discrete locations within Alberta and BC.	Rather, the establishment of terrain undulations (mounds) should be installed during final clean-up and reclamation activities to create microsites to support the natural colonization and regrowth of vegetation.
Non-vascular plant species were collected and replaced, and monitored post-construction.	This measure may be implemented at very discrete locations within Alberta and BC.	Transplant of non-vascular plant salvage and replacement may be warranted if avoidance is not possible.

TABLE 2.042B-1

TMX ANCHOR LOOP PROJECT NON-STANDARD MEASURES AND APPLICABILITY TO TMEP (continued)

Non-Standard Measure from TMX Anchor Project	Applicability to TMEP	Rationale for Inclusion/Exclusion
Wildlife trees were re-established at locations where wildlife trees were removed during construction.	This measure may be implemented at very discrete locations within Alberta and BC.	Wildlife trees and visual barriers may be employed to increase forest biodiversity and reduce predator/prey interactions on the right-of-way.
Wildlife visual barriers were created at strategic locations to reduce the visual line-of-sight of predators (wolves) and prey (elk and moose).	This measure may be implemented at very discrete locations within Alberta and BC.	Wildlife trees and visual barriers may be employed to increase forest biodiversity and reduce predator/prey interactions on the right-of-way.
Upland special restoration locations were re-vegetated to mitigate construction related visual scars located within the viewshed of Park visitors.	This measure may be implemented at very discrete locations within Alberta and BC.	These measures may be implemented in BC provincial parks.
A pre- and post-construction vegetation management program was implemented to monitor and manage weeds at riparian and general rights-of-way.	Monitoring for weeds on the construction right-of-way and special restoration areas, and the development and implementation of a vegetation management program will be implemented on the Project. This measure was included in the Pipeline EPP (Volume 6B).	Monitoring for weeds on the construction right-of-way and special restoration areas, and the development and implementation of a vegetation management program will be implemented on the Project. Vegetation management will be implemented to a level that is consistent with the vegetation management that is currently being implemented directly adjacent to the construction right-of-way or to a level that was observed during the pre-construction weed survey.
Metal fencing was installed and maintained around select watercourses to allow for vegetation establishment and reduce wildlife browse.	This measure may be implemented at very discrete locations within Alberta and BC, where warranted.	This measure will not be implemented unless it is determined that plantation vegetation is at risk of establishment failure due to high localized vegetation browsing. Fencing of plantations may be justified where heavy wildlife browsing is observed directly adjacent to the plantation.
Culverts with single span bridges and non-functional culverts with bottomless culverts were replaced to re-establish fish connectivity throughout JNP and MRPP as part of the Fisheries and Oceans Canada Compensation Program.	DFO offsets have yet to be determined.	Fisheries offsets have yet to be determined. Offset for fisheries and other ecological components will be determined in consultation with the appropriate land managers and Trans Mountain representatives.
Existing gravel pits that were used for temporary workspace during construction and were originally constructed by Parks Canada were re-contoured, restored and seeded.	This measure may be implemented as part of compensation offsets.	Gravel pits that are to be used for temporary workspace during construction will be discussed with the appropriate authorities.

c) Major pipeline projects like the Trans Mountain Expansion Project (TMEP) allow the opportunity for the creation and development of non-standard mitigation measures. Input sought from the public consultation and Aboriginal engagement programs combined with industry initiatives also facilitate new approaches and provide input on mitigation strategies. While site-specific offsets have not been determined for TMEP, the net environmental benefits that are often realized during construction and operation of these types of projects include:

- enhancement of riparian vegetation at watercourse crossings where existing linear infrastructure currently traverses;
- discovery, clean-up and remediation of contaminated sites that may or may not be associated with the Project and would otherwise be undiscovered;
- discovery and recovery of archaeological sites that help inform our heritage resource knowledge and often support Aboriginal groups interests;
- compensation offsets under the federal *Fisheries Act* can often provide more fisheries habitat than what is credited for (*e.g.*, removal of barriers and culverts in watercourses that open up long reaches of available habitat for fishes that would not have otherwise been available);
- discovery of wildlife and vegetation species in the local and regional study areas of the project that are well beyond the construction footprint but adds to overall science (*i.e.,* this information is shared with agencies);
- technical reports and studies completed for the project will be available to researchers, resource managers, landowners and the public to better inform their decision making and add to the overall knowledge base;
- experience and development of environmental specialists, in particular Aboriginal peoples whom which the land the pipeline project traverses, leading to the creation of Aboriginal environmental businesses;
- drainage or grade concerns that may have been created from previous linear construction projects can be rectified during the construction of a new linear project (*e.g.,* re-contouring and enhancement of drainage patterns);
- weed management programs for programs often go beyond the construction footprint and require collaboration with invasive plants councils. Funding often precipitates into other programs not specifically focussed on the project;
- compensation programs for wetlands, species at risk, etc. often result in net environmental benefits;
- funding and support to researchers (*e.g.,* universities, interest groups) to assist with studies along the pipeline;
- projects can provide a forum for discussion on environmental issues beyond the scope of the project (*e.g.,* GHG, marine birds, underwater noise, etc.). Often this facilitates more cooperation and collaboration amongst industry, government and stakeholders to resolve issues that would not otherwise be addressed.

Trans Mountain is committed to a conservation offset program for the entire Project that results in a net benefit to communities and biodiversity.

A TMEP goal is that the Project produces no net loss of native biodiversity and the integrity of ecosystems in the regions of the four BC provincial parks and one recreation area through which the Trans Mountain pipeline corridor passes. Further, where practical, the Project shall strive to produce a net benefit to native biodiversity and ecological integrity in those regions. This goal demonstrates TMEPs commitment to exceed minimum standards in areas with acknowledged biodiversity values.

The Project has pursued its goal by employing a three step strategy, conventionally known as “the mitigation hierarchy”:

Avoidance

Through route selection and Project design, TMEP has consulted with potentially affected individuals and groups and selected a corridor that avoids environmental and socio-economic effects, including unnecessary disturbance and negative impacts to ecosystems and recreational areas through which the proposed corridor passes.

Mitigation

Industry-leading mitigation techniques, including on-site reclamation and restoration, have been proposed for those disturbances and negative impacts which cannot be avoided in the BC provincial parks and recreation area.

Offsetting

Disturbances and adverse effects that can neither be avoided nor mitigated were identified in the Environmental and Socio-economic Assessment. TMEP proposes to adopt similar methods developed by the Business and Biodiversity Offsets Programme (BBOP) to identify and undertake an offset project, or suite of projects, in order to produce a measurable ecological benefit of a comparable nature and extent, so as to result in no net loss of native biodiversity and ecological integrity on a regional basis. TMEP will work with land managers, stakeholders, and Aboriginal groups, with the advice of internationally-recognized experts to identify and select the most appropriate project(s). Where possible the offset project will be designed to result in a net benefit to native biodiversity and ecological integrity.

The third step of the mitigation hierarchy provides independent recommendations for an approach that TMEP could apply to achieve no net loss of native biodiversity and ecological integrity in BC provincial parks and recreation area. This biodiversity offset program assumes that irreplaceable habitat has been avoided.

BBOP Offset Design Process

The BBOP process for designing biodiversity offsets includes the following steps.

1. Review Project scope and activities.

2. Review the legal framework and /or policy context for a biodiversity offset.

3. Initiate a stakeholder participation process.

4. Determine the need for an offset based on residual adverse effects.
5. Choose methods to calculate loss/gain and quantify residual losses.
6. Review potential offset locations and activities and assess the biodiversity gains which could be achieved at each.
7. Calculate offset gains and select appropriate offset locations and activities.
8. Record the offset design and enter the offset implementation process.

d) It is expected that all standard environmental mitigation and monitoring that were implemented during the TMX Anchor Loop project will be implemented in part, or in full, at select locations along the current Project. With the exception of the following:

- In certain areas, the mitigation measures (*e.g.*, construction timing windows for wildlife) will be different from species to species and from location to location along the proposed pipeline corridor.
- Collection and propagation of native seed and shrubs would likely be conducted in parks and protected areas only, as this would not be practical or necessary for all areas of the proposed pipeline corridor.
- The purchase and installation of temporary greenhouses for housing plants would not likely occur on the Trans Mountain Expansion Project (TMEP) as other existing venues could be sourced, if needed.
- The establishment of fencing around watercourses in Jasper National Park was at the request of Parks Canada. Jasper National Park is a well-controlled area with several Parks officials that monitor the Park. It would not be practical to establish fencing at all watercourses along TMEP to control for browse as these fences would need ongoing maintenance and monitoring and could become a safety concern to people and wildlife if they are not visited on a regular basis.
- Follow-up programs for wetland function, aesthetics, forest health and calcareous soils. These programs have been completed for the TMX-Anchor Loop and the applicable results and recommendations have already been considered in the design and approach of the field study programs for TMEP.

e) Please refer to the response to NEB IR No. 2.042b.

The criteria for deciding when and where partially implemented mitigation measures be considered, includes the following (but not limited to):

- meet regulatory requirements and any permits required by law;
- results of discussions with the appropriate regulatory authorities, Aboriginal communities, landowners, public members and other stakeholders;

- commitments made during the NEB Public hearing process;
- geographic location and site accessibility;
- compatibility with other users, landowners, tenure holders, etc. and land use requirements;
- economic feasibility;
- proven outcomes;
- technical feasibility; and
- safety.

2.043 Post-construction environmental monitoring (PCEM) program

Reference:

i) A3S2S1, Application Volume 6A, Environmental Compliance, PDF page 32 of 42

A3S1Q9, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical:

ii) PDF page 38 of 403
iii) PDF page 178 of 403
iv) A3S2S1, Application Volume 6A, Environmental Compliance, PDF pages 37 and 38 of 42

A3S1Q9, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical:

v) PDF page 262 of 403
vi) PDF page 5 of 403
vii) A3S2S1, Application Volume 6A, Environmental Compliance, PDF page 39 of 42

Preamble:

Reference i) states that Trans Mountain will conduct the PCEM program during a period up to the first five complete growing seasons following Project commissioning or as per certificate conditions.

The Board notes that the reversibility period for some reversible residual effects identified in the Environmental and Socio-Economic Assessment is considerably longer and it is unclear if five years is a sufficient period for monitoring. For example:

- Reference ii) states that the reversibility of mixing problem lower subsoils with upper subsoils could extend beyond 10 years.
- Reference iii) states that the reversibility of residual effects on wetland function may take longer than one year with the possibility of being greater than 10 years. Reference iv) acknowledges that wetland reclamation (or compensation) may be necessary after the fifth year of monitoring.
- Reference v) states that the reversibility for all mammal indicators is long-term, which is defined at Reference vi) as greater than 10 years to reverse residual effects. Reference vii) reiterates that post- construction monitoring for wildlife and wildlife habitat will be conducted over a five-year period, and discusses the potential for further monitoring and remedial measures, but does not provide specific justification of for a five-year monitoring period.

Request:

Please provide:

a) a list of all reversible residual effects identified in the Environmental and Socio-Economic Assessment that have a reversibility that might extend beyond five years; and

b) for each element, indicator, or measurement endpoint with such residual effects:
   b.1) explain how a PCEM program of five years provides adequate monitoring to identify potential residual effects, mitigation effectiveness, and the need for corrective actions; or
   b.2) propose and justify a new PCEM program duration, either of fixed duration or continuing until a specified goal is reached.

Response:

a) The likely potential residual effects identified in the Environmental and Socio-economic Assessment (ESA) that have a reversibility that might extend beyond 5 years are discussed below, according to element. There are no likely residual effects that are anticipated to extend beyond five years for the physical and meteorological environment and water quality and quantity elements.

Soil and Soil Productivity

Based on results of post-construction environmental monitoring reports from past projects in similar environmental settings (*e.g.,* TMX Anchor Loop Project and large pipeline projects on agricultural lands in western Canada), most of the likely residual effects on soil indicators have been shown to be resolved within 5 years post-construction. However, depending on the soil types encountered and success of soil handling, it may take longer than 5 years to alleviate some effects, including:

- mixing of topsoil/root zone material and subsoil;
- undesirable lower subsoils may be unexpectedly encountered and admixed with upper subsoil horizons;
- reduction in soil productivity on agricultural areas from changes in evaporation and transpiration rates; and
- pulverization resulting in fugitive dust and loss of soil structure can be expected during dry conditions.

Where topsoil/root zone material is stored in berms at pump stations and terminals, issues related to topsoil/root zone material and subsoil mixing would not be resolved until the topsoil/root zone material is replaced during decommissioning or abandonment and, consequently, this residual effect would last more than 10 years.

Air Emissions

The likely potential residual effects on air emissions indicators that may extend beyond 5 years are applicable only to operational activities at the Edmonton, Sumas, Burnaby and Westridge terminals. These effects include: increases in ambient ground-level concentrations of volatile organic compounds (VOCs), ozone concentrations, hydrogen sulphide (H_2S), mercaptans, criteria air contaminants (CACs), secondary ozone and

particulate matter; and reduced visibility. The effects will extend over the operational life of the terminals and will cease when the facilities are decommissioned.

Greenhouse Gas Emissions

The potential residual effects of greenhouse gas emissions associated with the Project were determined to be not reversible.

Acoustic Environment

Operation of the pump stations, storage tank facilities and Westridge Marine Terminal will result in an increase in continuous sound levels. The effect of an increase in sound will extend over the life of the facilities and will cease when the facilities are decommissioned.

Fish and Fish Habitat

Alleviation of the likely potential residual effects on the riparian habitat indicator depends on the pre-existing vegetation community (*e.g.,* shrubs regenerate within several years, however, tree regrowth is expected to extend over 10 years). The results of the post-construction environmental monitoring reports for the TMX Anchor Loop Project and other large pipeline projects in western Canada have indicated that the residual effects on riparian and instream habitat were resolved within 5 years. The effects of fish mortality or injury could extend beyond 5 years, as the loss of one or more individuals could affect population scale for several years, or until those individuals can be replaced.

Wetland Loss or Alteration

The likely potential residual effect on wetland loss or alteration is the alteration of wetland habitat, hydrological and biogeochemical functions during and following construction and maintenance activities until vegetation is re-established, grade and natural flow patterns are restored and sedimentation is controlled. The length of time to reverse the residual effects on wetland habitat will depend on the pre-construction vegetative cover (*e.g.,* shrubs regenerate within several years, however, tree regrowth is expected to extend over 10 years). Post-construction environmental monitoring of wetland hydrological function at wetlands along the TMX Anchor Loop Project have shown that mitigation measures implemented during construction can be successful in returning surface water to pre-construction levels. However, seedbank moisture regime recovery has proven to occur more slowly. Depending on the growth time of wetland species found along the proposed pipeline corridor, the time required to reclaim pre-construction elevation and contours, and the time for biogeochemical processes to be reclaimed, the reversibility of the residual effect may extend beyond 5 years.

Vegetation

Depending on the associated land use and the growth time required for species in each affected area (*e.g.,* forb versus tree), the loss or alteration of vegetation may extend beyond 5 years. The effects of the proposed Project on forb species is expected to be reversible within a few years, whereas the effects on native grasslands are expected to take longer

than 5 years and greater than 10 years to reverse for tree species since the right-of-way will be maintained free of higher growing vegetation until abandonment. Although areas disturbed during construction and periodic maintenance activities will revegetate to a stable state with the appropriate native species, species composition in the disturbed Footprint will be altered from pre-construction conditions. Clearing of the right-of-way and temporary workspace and maintenance of the right-of-way during operations will result in the perpetuation of early seral vegetation. Vegetation management will preclude further succession until abandonment of the pipeline. In the grasslands, establishing a cover of native grassland species or a cover crop species will occur over a period greater than 1 year; however, greater species diversity, including the establishment of some grassland species (*i.e.*, fescue), may occur more slowly over a period of time greater than 10 years.

The likely potential residual effect of weed introduction and spread may take less than 1 year or up to 10 years to reverse, depending on the weed species, size and location of the weed occurrence and the associated land use. The final post-construction environmental monitoring report for the TMX Anchor Loop Project indicated that after 5 years, the post-construction vegetation management program had effectively controlled or suppressed non-native invasive broadleaf species of concern along the right-of-way.

Wildlife and Wildlife Habitat

The likely potential residual effects on wildlife and wildlife habitat indicators are the combined Project effects on mammal, bird, amphibian and reptile indicators resulting from habitat loss or alteration, changes in movement and increased mortality risk. The combined effects on wildlife indicators will reverse following the decommissioning and abandonment of the Project, once native vegetation regenerates over the Project Footprint. Re-establishment of herbaceous and shrub vegetation on the disturbed Footprint is expected to occur within a few years following reclamation. Similarly, changes in aquatic habitats from watercourse crossings or sediment introduction are expected to be alleviated within a few years with the application of appropriate mitigation and reclamation measures. However, residual effects on treed terrestrial and wetland habitats, as well as sagebrush habitats (*i.e.,* for the reptile indicator) are expected to take longer than 10 years to regenerate.

Socio-economic Elements

The likely potential residual socio-economic effects that may extend beyond 5 years are discussed in Section 7.0 of Volume 5B (Filing ID A3S1S7). Socio-economic effects are not included in the post-construction environmental monitoring program for the Project. However, certain socio-economic issues will be monitored during Project construction as discussed in the Socio-economic Management Plan in Appendix C of Volume 6B (Filing ID A3S2S3). Post-construction monitoring measures for agriculture (including organic and specialty crops) are provided in the Agricultural Management Plan in Appendix C of Volume 6B (Filing ID A3S2S3). The post-construction environmental monitoring program will assess and recommend corrective measures for weed infestations, soil erosion and vegetation establishment. It is expected that likely residual effects associated with agricultural use will be resolved within 5 years. Trans Mountain will continue to monitor any remaining unresolved issues, if needed, beyond 5 years.

b.1) Trans Mountain has proposed to conduct the Post-Construction Environmental Monitoring (PCEM) Program for a period up to the first five complete growing seasons (or during years one, three and five) following commissioning of the Project. As stated in the NEB *Filing Manual* (NEB 2014), the time period for required reporting can vary, but typically ranges from one to five years following the commencement of project operations.

The results of PCEM reports for a recent pipeline project in forested and mountainous areas (*i.e.,* TMX Anchor Loop Project) and for other large pipeline projects in forested and agricultural lands in western Canada have demonstrated that most residual effects associated with pipeline construction can be resolved within 5 years following construction with the implementation of appropriate mitigation measures (see Section 7.2 of Volume 5A [Filing ID A3S1Q9] for documented examples for applicable indicators or elements).

The PCEM Program will document any locations with unresolved environmental issues and the remedial measures planned by Trans Mountain to resolve these issues. Trans Mountain will continue to monitor any unresolved environmental issues remaining after 5 years (*e.g.,* wetland function) until they are resolved.

Upon completion of the PCEM Program, monitoring by Trans Mountain personnel will occur regularly throughout the life of the Project. Monitoring during operations and maintenance activities will be composed of regular aerial patrols with ground reconnaissance to assess any issues raised during the aerial patrols, issues raised by Aboriginal communities, landowners and leaseholders or regulatory authorities. Operational and environment personnel will ensure that any mitigation measures that are warranted are implemented on a timely basis.

For some aspects of the environment (*e.g.,* woody vegetation along the pipeline easement), it will not be possible to return to pre-construction conditions until the decommissioning and abandonment phase of the Project. For example, vegetation management along the pipeline easement in closed coniferous or deciduous forested areas will result in the perpetuation of early seral vegetation and will preclude the further succession of woody vegetation until abandonment of the pipeline. However, a 5 year PCEM Program is a sufficient period of time to determine whether disturbed portions of the right-of-way have stabilized and have established an early successional trajectory of a suitable native vegetation community. As discussed in Section 7.2.9.6 of Volume 5A (Filing ID A3S1Q9), up to 5 years of post-construction environmental monitoring in the grasslands on other major projects have been able to confirm the establishment of desirable species of vegetation as well as a positive successional trend towards grassland plant communities present prior to construction and early seral graminoid and forb vegetation plant communities where forest vegetation occurred prior to construction.

The objective of the wildlife and wildlife habitat monitoring component of the PCEM Program is to collect sufficient information to determine the effectiveness of mitigation, identify the need for adaptive measures and detect changes in wildlife and wildlife habitat resulting from the Project. A 5 year PCEM Program for wildlife and wildlife habitat is considered sufficient to meet the objectives of monitoring discussed in Section 9.9 of Volume 6A (Filing ID A3S2S1). Similar to vegetation, 5 years is expected to be a sufficient

time period to determine whether disturbed habitat has stabilized and established an early successional trajectory of a suitable wildlife habitat. Follow-up programs will be developed for select wildlife indicator species and could extend beyond 5 years. Refer to the response to NEB IR No. 2.032 for additional information on the selection of wildlife species for follow-up programs.

If any watercourses are identified where serious harm to fish and fish habitat is deemed likely to occur as a result of the Project, Trans Mountain will be required to provide an offset plan which includes monitoring. The monitoring component of the offset plan would identify whether any monitoring past the 5 year PCEM Program would be necessary.

Air emissions and noise will be monitored as part of the PCEM Program at select facilities within 1 year of the commencement of operation of the Project, or as per NEB certificate conditions, to ensure the facilities are operating within air and noise objectives. No additional monitoring would be warranted so long as engineering specifications and operational parameters remain constant. If the results of the PCEM Program show exceedances, Trans Mountain will undertake corrective actions and additional monitoring to ensure the facilities are operating within air and noise objectives.

A Preliminary Abandonment Plan was provided in Section 12.0 of Volume 4C (Trans Mountain, December 2013, Filing ID A3S1L1), which discusses general reclamation objectives and principles that would be applied during abandonment to return the right-of-way and facility sites to a state comparable with the surrounding environment.

b.2) Please refer to the response to NEB IR No. 2.043b.1.

Reference:

National Energy Board. 2014. Filing Manual. Inclusive of Release 2014-01 (January 2014). Calgary, AB.

2.044 Alternative means of carrying out the Project – alternative marine terminal locations

Reference:

i) A3W9H8, Trans Mountain Response to Board IR No. 1, IR 1.39, PDF pages 234 and 235 of 421
ii) NEB Filing Manual, Section 4.2.2, Guidance – Alternatives, PDF page 48 of 258

Preamble:

In Reference i), Trans Mountain states that, early in its Project planning, it tested the basic premise that expanding existing facilities is the most responsible approach to the development. Trans Mountain states that it considered potential alternative marine terminal locations based on the feasibility of coincident marine and pipeline access, and screened them based on technical, economic, and environmental considerations. It states that these alternative locations in British Columbia included Kitimat, and Roberts Bank in Delta. It also indicates that it ultimately concluded that constructing and operating a new marine terminal and supporting infrastructure would result in significantly greater cost, a larger footprint, and additional environmental effects, as compared to expanding existing facilities. Trans Mountain states that it, therefore, did not continue with a further assessment of alterative termini for the Project.

The NEB Filing Manual (Reference ii)) describes Board guidance related to filing requirements on alternatives, and states that different project, routing, and design alternatives must be summarized and compared using criteria that justify and demonstrate how the proposed option was selected and why it is the preferred option. It requires that the criteria to be elaborated upon include engineering design, economic feasibility or life span costs, effects on reliability and security of the existing system, demonstrated public concern, and environmental and socio-economic constraints or potential effects. The Filing Manual also notes that the level of detail provided may reflect the more conceptual nature of the options.

Request:

a) For each alternative marine terminal location and associated pipeline concept considered, including the Kitimat and Roberts Bank locations noted in Reference i), please elaborate on each of the criteria listed in Reference ii) for comparing Project routing, design, or construction options, as well as the marine terminal's location in relation to the open sea. This must include the potential differences in marine tanker passage through certain waters and consequences for risk assessments.

b) Please elaborate on Trans Mountain's rationale for the Westridge Marine Terminal as the preferred alternative, including details to justify Trans Mountain's statement in Reference i) that constructing and operating a new marine terminal and supporting infrastructure would result in significantly greater cost, a larger footprint, and additional environmental effects, as compared to expanding existing facilities.

Response:

a) **Northern *vs.* Southern Route Alternatives**

Concepts for the expansion of the existing Trans Mountain Pipeline System (TMPL) have evolved since its inception with the first 160m km looping expansion occurring in 1957 four years after the pipeline came into service. More recently the configuration proposed for the Trans Mountain Expansion Project (TMEP) has evolved from a concept developed ten years ago that envisioned a phased expansion of the existing system in four parts. In addition to requisite pumping power and terminal expansion the main elements were the pipeline additions which could be constructed in the following order:

- TMX-1 – partial looping between Edson AB and Valemount BC and the addition of pumping power along the pipeline.
- TMX-2 – further looping in AB between Edmonton and Edson AB and between Valemount and Kamloops BC along with additional pumping capacity.
- TMX-3 – completion of the looping between Kamloops and Sumas and Burnaby to provide a fully twinned pipeline system.
- TMX-Northern Leg – construction of a new lateral north and west from Valemount BC to a new marine terminal at either Prince Rupert or Kitimat BC.

In 2005 Trans Mountain received approval for construction of the TMX-1 Anchor Loop project which subsequently came into service in 2008. In 2006 Trans Mountain held an open-season for TMX-2 but did not receive sufficient market support to justify further development of the program. It was through the work leading up to the 2006 open season that Trans Mountain most recently considered expansion to Northern versus Southern terminals.

While each alternative has advantages and disadvantages, the results of Trans Mountain's assessment favoured expansion of the existing system south over a new northern lateral and terminal. Relative to the southern expansion the TMX-Northern Leg concept involved:

- A 250 kilometre longer pipeline and 10% to 20% higher project capital cost
- Greater technical challenges including routing through high alpine areas of the Coast Mountains or extensive tunneling to avoid these areas. While no issues were determined to be insurmountable these technical challenges resulted in greater uncertainty for cost and schedule.
- Fewer opportunities to benefit from existing operations, infrastructure, and relationships. These efficiencies involve both the use of existing Trans Mountain right-of-way, facilities, programs, and personnel as well as synergies with other existing infrastructure such as, road access, power, and marine infrastructure all which would increase the footprint and potential impact.

- Early in its assessment of the Northern Leg Trans Mountain considered marine terminal locations at Kitimat and Prince Rupert and based on a high level review determined that Kitimat was the most viable alternative. While Prince Rupert was expected to provide superior access for deep draft tankers and to have the most developed port and maritime infrastructure these advantages were negated by technical challenges and uncertainties related to pipeline access. While no insurmountable issues were identified on balance Kitimat was determined to offer the most feasible location for oil pipeline service to a northern marine loading facility.

Due to higher costs and greater uncertainty of cost and schedule Trans Mountain determined expansion along the existing TMPL route to be more favourable and the Project was developed on that basis.

Southern Terminal Alternatives Considered

Although good planning and best practices favour utilizing existing facilities Trans Mountain nonetheless considered, at a high level, potential alternative marine terminal alternatives to Westridge for TMEP. Considerations included feasibility of requisite pipeline access and the location of storage facilities as well as marine access by tanker. The following six general areas were considered and all but Roberts Bank were eliminated from further assessment for the reasons listed below:

- **Howe Sound** – no feasible pipeline access west of Hope, requires a new lateral from Kamloops area, extreme terrain and limited land available in close proximity for storage.
- **Vancouver Harbour** – no locations with coincident feasible pipeline access and land for storage
- **Sturgeon Bank** – no feasible land available in close proximity for the storage facilities
- **Washington State** – longer pipeline depending on terminus, complex regulatory issues including additional permits required by Washington State and the USA federal government
- **Boundary Bay** – insufficient water depth
- **Roberts Bank**

Roberts Bank Assessment

To further understand the Roberts Bank alternative a screening level assessment was conducted based on desktop studies of technical, economic and environmental considerations for marine access, storage facilities, and pipeline routing for a terminal at that location.

One of the many challenges in assessing options for a marine loading facility for oil is the large number of competing environmental, social, technical, economic and Aboriginal issues and concerns. The potential sites, in the Lower Mainland and estuary of the Fraser River

delta, represent complex environmental values, multiple stakeholders, regulatory regimes, and Aboriginal interests. Notwithstanding these complex interests, the approach to the assessment was one of a high-level review of current conditions. Since it was intended to be a screening level assessment to identify potential issues, no consultation was undertaken with regulatory authorities, Aboriginal groups, or stakeholders, other than preliminary discussions with PMV staff.

As stated in Reference i), and based on the findings of the assessment which are provided below, Trans Mountain concluded that a new marine terminal and pipeline to Roberts Bank would result in significantly greater cost, larger footprint and additional environmental effects, as compared to expanding existing facilities. Accordingly, Trans Mountain did not continue with further development of alternatives to Westridge.

The following information describes the setting, conditions and assumptions for the Roberts Bank alternative used in comparison with expansion of the existing system to the Westridge Marine Terminal. Details of the later are provided in the application albeit in a more comprehensive form than was available at the time of the assessment. The level of detail for the Roberts Bank alternative reflects the preliminary nature of the assessment relative to the Project Application and the decision not to pursue it further given the advantages of Westridge.

A summary of the findings of the assessment for each alternative marine terminal location and associated pipeline concept considered, including the Kitimat and Roberts Bank locations in terms of the criteria listed in Reference ii) is provided in Table 2.044a-1 (NEB IR No. 2.044a – Attachment 1).

Assumed Roberts Bank Configuration

The assessment was conducted based on the following hypothetical technical configuration for the Roberts Bank dock, storage, and pipeline, in relation to the existing system:

- Given the greater draft available for vessels calling in the Robert's Bank area a conventional dock with two berth faces capable of loading Aframax, Suezmax or VLCC sized vessels was considered. Given that redevelopment of PMV's existing Roberts Bank terminal is underway, the design and outcome of which is uncertain, the assessment assumed a dedicated standalone dock structure. The assumed dock location would be just north of the PMV's Robert's Bank facility and to achieve sufficient draft it would be served by a 7 km long trestle supporting pipelines and a single lane roadway. Despite the higher cost this conventional configuration was chosen for the assessment over constructing an island terminal or mooring-buoy options which were eliminated due to their larger environmental footprint and the complexity of constructing an underwater pipeline in the deltaic foreshore soils. As well, to ensure sufficient depth and maneuvering room the mooring-buoy options were found to need to be located so far from shore as to encroach on the established shipping lane adjacent to Roberts Bank.

- Storage facilities were assumed to comprise of a land area of approximately 100 acres for 20 storage tanks as well as ancillary equipment and buildings. While no specific location for the storage terminal was identified it was assumed to be located within a few kilometres of the trestle at the shore line.
- A mapping study was conducted to identify potential routes from the existing Trans Mountain right-of-way to the Robert's Bank area based on distance and potential to follow existing linear infrastructure. For the assessment a 47 km route departing the existing system near Fort Langley and following adjacent to existing rail and road infrastructure was assumed to be viable.
- The assessment also assumed that the existing pipeline to Burnaby and Westridge Terminals would continue to operate serving the refinery, and refined products terminal, crude barges, small tankers, and the jet fuel system through the existing Burnaby and Westridge terminals.

Roberts Bank Engineering and Geotechnical Considerations

Roberts Bank is part of the Fraser River delta and is comprised mainly of alluvial sand and silts to depths well in excess of 100 m. The sand and silt deposits comprising parts of the delta are known to be relatively loose and subject to liquefaction during an earthquake. The delta front itself is thought to be unstable in some places, as are many such delta fronts in river systems worldwide.

Based on past experience with berth structures at Roberts Bank Terminals and the nearby Tsawwassen Ferry Terminal, the soils in the area are known to be generally suitable for marine terminal construction. However due to the relatively soft nature of the in-situ soils extensive ground improvement programs have been required in some cases to support the overlying structures and provide seismic stability.

It was assumed that a conventional loading dock would be constructed using driven piles supporting a concrete deck. Given the construction methods used at the existing terminals in the area it was assumed that the soils would have adequate capacity to develop practical piling configurations for both the breasting and mooring dolphin structures as well as the access trestle.

Soil conditions in foreshore represent a significant source of uncertainty for the assessment. The extent and of ground improvements necessary to address potential ground instability due to seismic-induced liquefaction is unknown and contributes to uncertainty of the cost, potential environmental impact, and mitigation. As such, the potential for seismically-induced soil liquefaction is an important issue that would have to be considered. If the soil proves to be susceptible to liquefaction under design conditions, it may be necessary to carry out a program of ground improvement (e.g., vibro densification) under the footprint of the terminal and pipeline prior to construction. This process is technically feasible but would add cost not accounted for in the assessment. It would also likely increase the affected area, possibly requiring additional offsetting habitat compensation.

The storage facility was assumed to be located on flat delta lands characterized by high water tables and weak sub-soils with the expectation that some form of ground improvement would be required to provide necessary bearing capacity for the tanks. Design of the facility is assumed to address expected seismic effects such as soil liquefaction or tsunamis although these issues were not studied in detail and also remain a source of uncertainty.

Relative to Westridge the pipeline route would avoid the Fraser River crossing and have fewer sections of difficult construction through congested areas, however it would be longer by 14 km and due to the low lying nature of the land pipeline construction would require extensive well pointing and buoyancy control for the pipeline. The construction procedures required for the pipeline would closely resemble those used in other parts of the pipeline and no special or unique measures required. However, poor ground conditions and high water tables will cause progress to be slow relative to the more benign parts of the route.

Overall no unsurmountable engineering or geotechnical issues were identified however, the assessment showed that relative to Westridge the Roberts Bank alternative required a significantly larger dock structure, a large new footprint for the storage terminal, a longer right of way, and a greater diversion from the existing corridor. The extent and cost of ground improvement necessary for the dock and storage terminal also presented a significant source of uncertainty.

Environmental Considerations

Roberts Bank supports numerous fish species (including salmon) and ecologically important eelgrass beds (important fish habitat); contain mudflats that sustain communities of birds on the Pacific Flyway; and are within an internationally recognized flight-path for migrating birds. The area also has important social, economic, and recreation ecosystem service value, including fishing, agriculture, First Nation use, direct employment to local and regional residents and the transportation of goods and people.

Fisheries and Oceans Canada (DFO) has identified 14 important areas in proximity to Roberts Bank including areas for Alaska Skate, big skate, Dungeness crab, eulachon, harbour seal, herring, longnose skate, marine birds, ocean features, pollock, resident killer whale, salmon, sandpaper skate and shrimp.

Although Roberts Bank area has a limited amount of ideal estuarine habitat required to support juvenile salmonids, it has been identified as having ideal habitat conditions for Dungeness crab and herring. Furthermore, the Fraser River estuary, in close proximity to Roberts Bank, is considered the most important salmon spawning river in the world and more than five million migratory birds use the Fraser River estuary and delta. As a result of existing development in the area, previous environmental studies have identified key environmental impact areas which include marsh areas along the shoreline, crab habitat north of the causeway (mating and migration habitat) and the eelgrass beds between the causeways. Many of these habitats are limited within the estuary and as a result, past developments have been restricted or declined to ensure minimal disturbance within the area.

The Roberts Bank Terminal is in proximity to a number of protected areas including:

- 4,400 m south of Alaksen National Wildlife Area;
- 5,500 m south George C. Reifel Migratory Bird Sanctuary;
- 3,800 m south of South Arm Marshes Wildlife Management Area; and
- 5,980 m west of Boundary Bay - Centennial Beach Regional Park (Metro Vancouver).

With the exception of the existing Roberts Bank terminal and the Tsawwassen Ferry terminal most of the foreshore in the area falls within the Provincially designated Roberts Bank Wildlife Management Area. Trans Mountain understands that the planned used for the area does not contemplate activities associated with the construction and operation of a marine terminal.

A conventional terminal on a piled structure with a trestle-supported pipe from shore would likely depend entirely on steel piles for support. This option was assumed for the assessment as it appeared to have the least impact to fish habitat as the trestle would be elevated over the intertidal and subtidal seabed resulting in a comparatively small footprint. Shading by the structure would be considered an issue but this could be mitigated to some extent by height off the seabed and minimizing solid decking. Depending on the number and size of the piles, the pile footprint may require some measure of compensation.

Piling for structures will require contractors to mitigate for sound impacts. Usually these types of projects require large piles and while they are usually vibrated in they do require seating at the end of the driving. Seating requires a hammer to drop on the pile, which generates significant sound waves that can harm fish and impact mammals. This would generally be mitigated by monitoring for mammals, monitoring the noise levels with hydrophones and using air or bubble curtains to dampen the noise generation as required.

Water quality concerns in Boundary Bay relate to pollution from urban and industrial developments along the Fraser River, and the potential for ballast water pollution arising from shipping in the Georgia Strait, Roberts Bank and the Fraser River.

While both Westridge and Roberts Bank have unique and important environmental values, based on the setting the environmental considerations at Roberts Bank appeared to be more substantial and uncertain than at Westridge Terminal, particularly given the larger footprint required for the dock and storage terminal. Without effective mitigation accidents or malfunctions at Roberts Bank could result in greater and more immediate consequences for the natural environmental.

First Nations Considerations

The marine terminal location considered in the assessment is in the territory of the Tsawwassen First Nation (TFN) where they have treaty rights. The TFN primary community is located in close proximity to Roberts Bank. Based on the location of their community, the Roberts Bank Terminal is in the heart of the TFN territory.

Other First Nations also have mapped territorial interests at Roberts Bank area including:

- Semiahmoo First Nation;
- Musqueam Indian Band;
- Hul'quimin'um Treaty Group (HTG) (Cowichan Tribes, Stzuminus, Penelakut, Lyackson, Halalt, Lake Cowichan and Hwlitsum First Nations); and
- Sto:lo

For the purpose of the screening assessment First Nation concerns and interests were assumed to be similar to those for Westridge and likely to include concerns for impacts on traditional rights, environmental protection, and potential interest in economic opportunities.

Land Use Considerations

The assumed construction has the potential to impact surrounding communities and farmlands, including environmental concerns related to the marine ecology, potential noise and air emissions, disruption of farming operations and potential losses of economic and community benefits through declines in long-term employment of local community. Local communities in proximity to the area would be expected to voice concern regarding the storage and transport of bulk liquids at Roberts Bank.

Roberts Bank is situated within the Corporation of Delta on the south side of the Fraser River estuary and is approximately 35 km from downtown Vancouver. Delta has a population of approximately 97,200 residents. In 2006, there were approximately 180 farms located within Delta under administration of the BC Agricultural Land Commission. Available industrial lands in the Delta area are scarce and with no parcels greater than 5 acres are available at the time of the assessment. Most lands in the Delta area are within the ALR and a large number of acreages are classified as “Heritage Lands”.

The location of the dock structure was assumed to be just north of PMV’s existing Roberts Bank facility and outside their proprietary jurisdiction. Seabed areas are assumed to be owned by the BC crown, for which a crown foreshore lease must be obtained pursuant to the BC Provincial Crown Land Tenure application process. The crown foreshore would include all submerged areas and intertidal areas up to the normal high tide line.

Land acquisition for portions of the project above the high tide line were assumed to be subject to the usual uplands acquisition processes.

Trans Mountain notes that the storage and transhipment of oil has been an issue of concern at PMV’s Roberts Bank terminal dating back to the initial proposal to expand the Roberts Bank Superport facilities in the 1970’s. In 1975 the National Harbours Board proposed an expansion of original coal terminal and the Province of BC subsequently passed Order in Council 908 requiring a comprehensive environmental assessment be conducted for any developments in the Roberts Bank management area with potential to impact the environment. The subsequent regulatory review of the coal expansion resulted in a condition that storage, transfer or handling of bulk liquid not be allowed for protection of the environment on the basis that these activities presented undue risk. While the degree to which this premise was tested or potential mitigation measures were considered is unclear, this condition has been adopted in regulatory reviews and permitting for subsequent

developments of the terminal dating back to the 1970s and 1980s. As such, Port Metro Vancouver does not allow the transfer, loading or storage of “bulk liquids”, including the bunkering of ships at berth at its Roberts Bank facility.

Trans Mountain understands that PMV’s current land use planning considers the area east of Second Narrows as the most appropriate for petroleum handling facilities.

Relative to Westridge the Roberts Bank alternative would result in a greater change in land use both for the storage terminal and the dock structure. As surrounding development is less than that for Westridge accidents or malfunctions at this location would be expected to affect fewer people.

Estimated Cost Difference

As part of the assessment the capital cost difference of the Roberts Bank alternative was estimated relative to that for Westridge. The estimate showed the capital cost of the Roberts Bank alternative to be $1.2 billion dollars higher.

Operating costs were not quantified for comparison in the assessment, however given the additional dock and storage terminal required these costs would be higher for the Roberts Bank alternative.

Marine Access Considerations

Roberts Bank is an extensive alluvial fan formed by sediments deposited from the Fraser River. Most of the bank is relatively shallow, with extensive drying banks extending more than 6 km offshore. The location is not constrained by the depth or width of the navigational approaches, and can therefore accommodate larger vessels, up to VLCC, and comparable in size to the largest vessels calling at the existing terminal.

Located on the southern portion of Georgia Straight the area is subject to migratory low and high pressure systems that move through the area, producing day-to-day changes in weather and wind patterns. Low pressure systems can develop off-shore, more frequently during the winter, either originating from the Gulf of Alaska or as rapidly forming coastal low pressure systems, with relatively brief but high intensity winds. Ahead of these systems, strong south-easterly winds and rain are produced. Often, as the cold front passes, a second band of winds occur, originating from the west or northwest. These northwesterly winds can be particularly strong in spring and occasionally in summer as high pressure systems predominate and winds are funnelled down the Strait of Georgia. Often, there are few indicators of the onset of these winds.

Tidal currents in the section near Roberts Bank typically attain a speed of 0.5 to 1.0 m/s.

Approximately 38% of significant wave heights and 62% of maximum possible wave heights are above 0.33 m, and 4% of significant wave heights and 10% of maximum wave heights are above 1 m.

Overall Roberts Bank is exposed to higher wind and wave conditions than what is prevalent at Westridge where these conditions are relatively benign. Such conditions should not pose

hazards to a well-founded modern vessel at berth as has been proven by the proximity of large dry bulk carriers berthed at the Westshore Terminal. However, given the potential for more severe environmental conditions at Roberts Bank tanker loading might be expected to require more frequent loading stoppages and potentially the need to vacate the berth than at Westridge.

It was assumed that the berth face for the new berths would be placed in a water depth of approximately 30 m at low tide. The berth alignment would be placed generally parallel to the existing seabed contours, which coincidently is also generally parallel to prevailing winds and currents. Having the vessel berth aligned with the prevailing winds and currents is good practice as it simplifies navigation approaches and reduces the load on the mooring lines. Due to the greater exposure to winds and waves, it was not considered always suitable for barges, which would therefore continue to be accommodated at Westridge.

Navigating from Roberts Bank to sea would entail a passage of approximately 115 nautical miles through the Strait of Georgia, Boundary Pass, Haro Straits, past Discovery Island, Victoria and Race Rocks and thereafter through the Juan de Fuca Strait to Buoy J and beyond to enter the Pacific Ocean. Situating the terminal at Roberts Bank would reduce the overall distance travelled by tankers within the marine network and avoid the Burrard Inlet, about 30 nautical miles each way. Except for that, the passage is comparable to the passage from Westridge to Buoy J, as described in Volume 8C, Termpol 3.5/3.12 (see section 2.0 of Filing ID A3S4T9) including the route hazards described in that document for route segments 4 to 7. Locating the terminal at Roberts Bank reduces the overall complexity of navigating a tanker between the terminal and sea,

The Roberts Bank area is already exposed to ship movements. In addition to vessel traffic calling at the existing PMV terminal (Westshore Terminal and Delta Port), there is regularly scheduled ferry traffic between Tsawwassen and Duke Point and Tsawwassen and Swartz Bay. Adding tanker traffic at Roberts Bank might add up-to two vessel movements per day on average. Vessels arriving and leaving the oil terminal would have to cross the paths of other vessels transiting within the traffic separation scheme in a perpendicular. There would also be a commensurate increase in the number of other vessels, such as tugs required to escort or berth/unberth the tanker. The overall effect on the marine traffic pattern was not determined.

A reduction in the overall number of vessels would generally be expected to lead to an overall reduction to the underwater noise generated by project tankers. However it has to be considered that larger vessels are fitted with larger engines and bigger propellers; as well, it is possible that a VLCC would require additional tugs to escort it through the shipping lanes. Add to it any underwater noise generated from vessels at berth or waiting for berth, and it is possible that the impact of underwater noise could remain similar to that possible under the project as proposed in the application. The overall effect on underwater noise has not been determined.

The ability to service larger tankers is a key benefit of locating a tanker terminal at Roberts Bank. For Example a VLCC could in theory take almost three times the load of a partially laden Aframax tanker which in turn would result in the number of tankers within the marine

network. Such a reduction would reduce the probability of tanker related accidents during transit and increase the expected return period for oil spills resulting from tanker operations. Larger tankers would however lead to a commensurate increase in the potential size of a oil spill in the region. Work to establish the credible worst case size spill and suitable oil spill response capacity has not been undertaken. The overall effect on risk has not been determined.

While Roberts Bank offers a shorter and relatively less complex marine transit there is an existing well established marine safety system for vessels calling at Westridge. Although Roberts Bank would allow service to larger vessels which would result in potentially lower transport costs for shippers and lower probability of oil spill accidents larger cargos result in potentially larger spill volumes. While the overall effect on marine spill risk was not determined it is expected that larger cargos would require a greater investment in spill response.

Conclusions from the Assessment

The assessment involved consideration of many environmental, social, technical, economic concerns. Both the Westridge and Roberts Bank terminal alternatives have positive and negative attributes especially when viewed from any one perspective. Overall Trans Mountain's rationale for the Westridge Marine Terminal as the preferred alternative was based on the expectation that Roberts Bank would result in:

- significantly greater cost – the estimated $1.2b higher capital cost and assumed higher operating costs for the Roberts Bank alternative
- a larger footprint and additional environmental effects – Roberts Bank would result in an additional storage terminal with an estimated 100 acres of land required, a larger dock structure with a 7 km trestle, and a 14km longer pipeline that diverges further from the existing pipeline corridor.

b) Please refer to the response to NEB IR No. 2.044a.

2.045 Soil handling procedures and landowner requests

Reference:

i) A3S1Q9, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF page 24 of 403
ii) A3S1S7, Application Volume 5B, Environmental and Socio- Economic Assessment – Socio-Economic, PDF page 72 of 245
iii) A3W9H8, Trans Mountain Response to Board IR No. 1, IR 1.14, PDF pages 115 to 117 of 421
iv) A3S1L5, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF page 31 of 74
v) A3S1Q9, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF pages 28 and 29, and 41 of 403
vi) A3S2S1, Application Volume 6A, Environmental Compliance, PDF pages 35 and 36 of 42

Preamble:

References i) and ii) list mitigation measures related to soils and soil productivity and to disturbance of field crop areas, which include "[a]ccommodate landowner/Crown land authority topsoil/root zone material salvage requests, if feasible."

Reference iii) explains Trans Mountain's process for gathering and tracking additional information from each landowner and lessee, including requests related to restoration and soil handling methods, and for communicating and monitoring any Trans Mountain commitments agreed to in response.

Reference iv) describes known occurrences of clubroot disease and potato cyst nematodes. Reference v) discusses related mitigation measures.

Reference vi) states that Trans Mountain will initiate a post-construction dialogue with landowners and leaseholders along the pipeline right-of-way after final clean-up to address and/or resolve any relevant issues. For cultivated lands, landowners and farm operators will be engaged to solicit information on crop production.

Request:

a) Please provide a list of the special procedures relating to soil handling, health, and productivity that landowners and/or lessees have already requested.

b) For each type of request in a), please indicate whether or not Trans Mountain would likely be able to accommodate the request (including any likely potential limitations), and provide rationales in each case. If not already included in the list in a), please also address the following potential requests in your answer: additional soil sampling, different topsoil stripping depths and widths, additional areas to use (or areas to not use) alternative soil handling techniques (such as three-lift), shutdown due to wet soils, compaction testing and decompaction techniques, pre- and post-construction testing for soil diseases, and specific involvement in monitoring.

c) Please confirm that all relevant programs, plans, and procedures (e.g., the Pipeline Environmental Protection Plan, PCEM program, and Land Program Execution Plan mentioned in Reference iii)) will be updated to accord with the responses to a) and b) above. Please also confirm that any relevant property-specific information and commitments resulting from a) through b) will be appropriately tracked and communicated via the individual property files, Project landowner database, Line List, and construction contracts mentioned in Reference iii).

Response:

a) The development of special procedures for soil handling, plant and animal health, and agricultural productivity are based on input from a wide variety of stakeholders including private land owners, government agencies and farm associations. This information has been gathered through an agricultural workshop held in Abbotsford BC and meetings and individual interviews with stakeholders. A summary of consultation with agricultural stakeholders is provided in Section 2.0 of the Agricultural Assessment Technical Report 5D-6 in Volume 5D, ESA Technical Reports (McTavish Resource & Management Consultants Ltd. 2013) (Filing ID A3S2K9).

   Information gathered from stakeholders is incorporated into Section 2.0 Agricultural Management Plan Appendix C, Volume 6B, EPP (Filing ID A3S2S3), in Table 7.2.2-2 Potential Effects, Mitigation Measures and Residual Effects of Pipeline Construction and Operations on Soil and Soil Productivity in Volume 5A, ESA (Filing ID A3S1Q9) and into the Agricultural Assessment Technical Report 5D-6 in Volume 5D, ESA Technical Reports (McTavish Resource & Management Consultants Ltd. 2013) (Filing ID A3S2K9), and is reflected in the Environmental Alignment Sheets (Volume 6E).

   Since the filing of the Application with the National Energy Board in December 2013, there have been no requests from landowners and/or lessees for special procedures related to soil handling, health, or productivity. These requests are normally made at the time of negotiations for the acquisition of right-of-way which are commencing in July 2014. If special requests are made by landowners or lessees, these requests will be documented within the landowner database, and become part of the construction line list.

b) Since the filing of the Application with the National Energy Board in December 2013, there have been no requests from landowners and/or lessees for special procedures related to soil handling, health, or productivity. These requests are usually made at the time of negotiations for the acquisition of right-of-way, commencing in July 2014. As well, requests can be made during construction based on landowner and lessee observations and concerns and during the monitoring phase when landowners and lessees may notice the effects on soil and crop production. This response outlines how Trans Mountain will manage potential landowner and lessee requests in the areas mentioned above.

   An Agricultural Monitor who is familiar with soils, drainage and agricultural production will be in place for the Lower Mainland of BC. This Agricultural Monitor will report to the Lead Environmental Inspector who will be responsible for supervising the pipeline construction contractors while they prepare the construction right-of-way, install the pipeline and reclaim

the construction right-of-way. Refer to the response to CGLAP IR No. 1.8g (Filing ID A3X6A7).

Environmental Inspectors will be in place in all geographic areas. Environmental Inspector(s) work with the contractor and other Project inspection personnel to ensure environmental, soil and agricultural procedures are followed and that landowner and/or lessee concerns are communicated.

Detailed soil sampling has taken place for the TMEP based on the regulatory guidance provided in the NEB Filing Manual (2014) and BC and Alberta Provincial standards as described in the Soil Technical Report 5C-2 in Volume 5C, ESA Biophysical Technical Reports, (Mentiga Pedology Consultants Ltd. December 2013) (Filing ID A3S1T4). Results of the soil sampling program are provided in the Environmental Alignment Sheets (Volume 6E). Additional soil sampling will be considered on a case by case basis and will be based on landowner and/or lessee requests received prior to construction. These requests will be reviewed by a Professional Agrologist to determine if the existing sampling meets the needs of the landowner/lessee or if additional soil sampling is required. When requests are received during construction, the Professional Agrologist may attend the construction site for consultation.

Topsoil stripping depths are based on the detailed soil survey provided in the Soil Technical Report 5C-2 in Volume 5C (Filing ID A3S1T4) and information gained in the preparation of the Agricultural Assessment Technical Report 5D-6 in Volume 5D, ESA Technical Reports (McTavish Resource & Management Consultants Ltd. 2013) (Filing ID A3S2K9). Information regarding soil stripping depths from these reports has been incorporated into the Environmental Alignment Sheets (Volume 6E) and will be reflected in the contract documents. If landowners and/or Lessees communicate information to Trans Mountain prior to the commencement of construction that indicates that they have concerns with respect to recommended topsoil stripping depths on their land, this information will be reviewed by a Professional Agrologist and changes may be made to the stripping depth. These changes will be incorporated into updated Environmental Alignment Sheets, noted in the line list and contract documents if received prior to finalization of the Environmental Alignment Sheets and issuance of contract documents. Site specific concerns communicated during the construction phase will be evaluated by the Agricultural Monitor and/or Environmental Monitor.

Soil stripping widths will be based on multiple factors such as land use, ground conditions, soil texture, presence of weeds, construction and staging needs, which will be incorporated into the issued for construction version of the Environmental Alignment Sheets. If landowners and/or lessees indicate, prior to the commencement of construction that they have specific concerns regarding stripping widths on their property, Trans Mountain will capture these by way of landowner and/or lessee communication with Land Agents. These concerns will be reviewed with the landowners and/or lessees to determine if site-specific accommodations can be made. If changes are made they will be incorporated into the updated line list, Environmental Alignment Sheets and contract documents if received prior to finalization of the issued for construction version of the Environmental Alignment Sheets.

Site-specific concerns communicated during the construction phase will be evaluated by the Agricultural Monitor and/or Environmental Inspector.

Alternative soil handling techniques have been identified for specific soils and are incorporated into the Environmental Alignment Sheets (Volume 6E). If landowners and/or lessees request alternative soil handling techniques on their property prior to the commencement of construction, a Professional Agrologist will discuss the request with the landowner and/or lessee and may carry out further soil testing and on site observations, as needed, to verify their request and make recommendations to Trans Mountain. If changes to soil handling techniques are made, they will be incorporated into the updated line list, Environmental Alignment Sheets and contract documents, if received prior to finalization of the issued for construction version of the Environmental Alignment Sheets. When requests are received during construction, the Professional Agrologist, if needed, will attend the construction site for consultation.

Construction shut down due to wet soils may take place if soils are excessively wet and construction activities, if allowed to continue, would damage soil structure (refer to the Wet/Thawed Soils Contingency Plan provided in Section 13.0 of Appendix B of Volume 6B (Filing ID A3S2S3). In the Lower Mainland of BC, Trans Mountain has committed to having an Agricultural Monitor on site. The Agricultural Monitor will communicate with landowners and/or lessees and with the Lead Environmental Inspector to implement shut down procedures on excessively wet soil. In other geographic areas, the Environmental Inspectors will assume this role.

If landowners and/or lessees communicate to Trans Mountain that they believe there are soil compaction issues then soil compaction testing by a qualified professional will take place. If the area in question is found to have soil compaction at levels greater than undisturbed areas adjacent to the construction right-of-way, then decompaction processes will be initiated.

Areas with soil diseases have been identified and procedures and protocols to mitigate the risk of contamination and disease transmission have been developed. Table C2.1-1 in Appendix C of Volume 6B (Filing ID A3S2S3) summarizes known occurrences of clubroot in Alberta and BC. Through landowner consultation, Trans Mountain has identified one cultivated field near the City of Spruce Grove, Alberta that may be potentially contaminated with potato cyst nematode, see Section 5.2.1.4 Soil Diseases in Volume 5A (Filing ID A3S1L5). Procedures for mitigating the risk of soil borne disease transmittal are described in Table 7.2.1 of the Agricultural Assessment Technical Report 5D-6 in Volume 5D, ESA Technical Reports (McTavish Resource & Management Consultants Ltd. 2013) (Filing ID A3S2K9) and in Section 2.1 of Appendix C of Volume 6B (Filing ID A3S2S3). Since areas containing soil borne diseases have been delineated and mitigation measures developed that will implemented and monitored during construction, Trans Mountain does not believe that pre or post construction testing is required.

Trans Mountain does not anticipate that individual landowners and/or Lessees will have direct involvement in monitoring other than observing crop behaviour on their land. Procedures are in place to carry out environmental and agricultural/soil monitoring and to

ensure communication with landowners regarding effects of construction activities on their crops. These channels include communication of issues directly with the Agriculture monitors and/or Environmental Inspectors and with Land Agents. The role of these Project personnel is to ensure that monitoring issues are transmitted to the Lead Environmental Inspector and to appropriate construction management staff and Trans Mountain staff dealing with mitigation. Landowner communication regarding post construction effects on crops and soils are only expected during the post construction phase of the project.

c) All relevant programs, plans, and procedures will be updated to accord with the responses to parts a) and b), above. Relevant property-specific information and commitments resulting from the responses to NEB IR No. 2.045a, and 2.045b, will be appropriately tracked and communicated via the individual property files, line list and the Environmental Alignment Sheets. Relevant property specific information will be included in construction contracts if Trans Mountain is made aware of this information by landowners and/or lessees prior to the awarding of contracts and finalization of the issued for construction version of the Environmental Alignment Sheets. During construction, there are processes in place to relay property specific information to appropriate construction managers as described in the response to part b) above.

2.046 Vegetation communities, and plant and lichen species of concern – pre-construction surveys

Reference:

i) A3S2S3, Application Volume 6B, Pipeline Environmental Protection Plan, Appendix C – Rare Ecological Community and Rare Plant Population Management Plan, PDF pages 231 to 234 of 461
ii) A3S1Q9, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF page 217 of 403

Preamble:

Reference i) states that supplemental surveys for rare ecological communities and rare plants will be undertaken "where a need is identified."

For rare plant species, Reference i) notes that complete avoidance is preferred for rare species ranked S1 or S1S2 or species that are protected under provincial or federal legislation/ regulations. It provides a list of potential mitigation measures where complete avoidance is not feasible or for rare species of other rankings. It also states that one or more of the listed mitigation measures "may" be used at a site and that PCEM "may" be recommended to monitor the effectiveness of mitigation efforts.

Reference ii) states that rare plant surveys were completed during the 2013 growing season for over 25 per cent of the proposed pipeline corridor length. It indicates that supplemental rare plant surveys are planned prior to construction on new lands totaling less than 7 per cent of the proposed pipeline corridor, as well as in areas where land access was not available in 2013, or where rare plant species were identified that need verification.

Request:

Please provide:

a) details on when and where supplemental rare ecological community and rare plant surveys will be undertaken; and

b) justification as to the sufficiency of the final level of surveying, including Trans Mountain's level of confidence that all occurrences where complete avoidance is the preferred mitigation measure will be detected.

Response:

a) Supplemental rare ecological community and rare plant surveys scheduled to be conducted during 2014 address:

- areas where access was not available during 2013;
- revised and alternative pipeline corridors;
- select areas of concern as indicated by Intervener information requests; and

- areas with potential *Species at Risk Act* (*SARA)* listed species (including locations where identification made during 2013 vegetation surveys required confirmation and areas where Environment Canada has identified candidate/draft critical habitat within the proposed pipeline corridor).

The dates and locations for these surveys are presented in Table 2.046A-1. Survey results provided in the ESA (Volume 5A) are intended to inform the assessment process, while supplemental surveys conducted during 2014 were needed to verify the assessment conclusions and increase confidence. Both surveys conducted during 2012/2013 and supplement surveys conducted during 2014 were conducted within the proposed pipeline corridor rather than a specific Project footprint (*i.e.*, construction right-of-way). The vegetation surveys within the corridor are targeted based on desktop review (*e.g.*, areas of high rare plant/lichen and rare ecological community potential) and are based on guidelines described in the Alberta Native Plant Council (ANPC) *Guidelines for Rare Plant Surveys in Alberta* (ANPC 2012) and the BC Conservation Data Centre and E-Flora Protocols for Rare Plant Surveys (Penny and Klinkenberg 2012). For a detailed explanation of the rare plant/lichen and rare ecological community survey methodology, please see Section 3.6.1 of Technical Report 5C-9 in Volume 5C, Vegetation Technical Report (TERA Environmental Consultants December 2013; Filing ID A3S217).

Once the Project footprint has been determined, supplemental rare plant surveys will be conducted to provide further delineation or verification of rare ecological communities and rare plants, where necessary, and to inform site-specific mitigation for occurrences within the Project footprint. For further details regarding supplemental vegetation surveys, see Sections 6.1.1, 6.2.1, 6.3.1 and 6.4.1 of Technical Report 5C-9, Appendix 5C (Filing ID A3S217).

TABLE 2.046A-1

DATES AND LOCATIONS FOR 2014 SUPPLEMENTAL RARE ECOLOGICAL COMMUNITY AND RARE PLANT SURVEYS

Survey Dates	Segment
April 25 to April 28, 2014	Hope to Westridge
May 17 to May 24, 2014	Black Pines to Hope
June 10 to June 13, 2014	Edmonton to Hinton
June 13 to June 27, 2014[1]	Black Pines to Hope
July 2 to July 6, 2014	Black Pines to Hope
July 3 to July 8, 2014[2]	Hargreaves to Darfield
July 28 to July 31, 2014[2]	Edmonton to Hinton
August 5 to August 19, 2014[2,3]	Black Pines to Westridge
August 18 to August 24, 2014[2,3]	Hargreaves to Darfield

Notes:

1. Includes approximately two days of terrestrial ecosystem mapping (TEM) surveys.
2. Survey dates are approximate and may change.
3. Includes approximately one day of TEM surveys.

References:

Alberta Native Plant Council. 2012. ANPC *Guidelines for Rare Vascular Plant Surveys in Alberta* – 2012 Update. April 2012. Alberta Native Plant Council. Edmonton, AB. 25 pp.

Penny, J. and R. Klinkenberg. 2012. Protocols for Rare Plant Surveys (Red- and Blue-listed Species). In: Klinkenberg, Brian (Editor) 2013. E-Flora BC: Electronic Atlas of the Plants of British Columbia. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver, BC.

b) The objective of the vegetation surveys conducted were to inform the assessment of potential effects on vegetation within the proposed pipeline corridor. Rare plant survey guidelines (Alberta Native Plant Council [ANPC] 2012, ANPC 2010, Penny and Klinkenberg 2012) provide general guidance on the level of survey intensity but are intended for surveys detecting all rare elements which is more in alignment with the supplemental surveys, as described in the response to part a) above. The guidelines note that, where possible, that the entire project or study area should be surveyed. The ANPC guidelines provide more detail on survey intensity and note that if it is not possible to survey the entire area, that there are several considerations that should direct the sampling effort and the number of sites surveyed. All of the criteria noted in the ANPC guidelines (ANPC 2012) were considered in selecting sites for the vegetation surveys conducted to date and will also be considered during site selection for the supplemental surveys. Following supplemental surveys and with the implementation of the Rare Ecological Community and Rare Plant Population Management Plan (Sections 6.2.1 and 6.2.3 of Appendix C of Volume 6B [Filing ID A3S2S3]), there is a high degree of confidence in the detection of rare ecological communities and rare plant populations; particularly for species ranked S1, S1S2 or species that are protected under provincial or federal legislation/regulation (*i.e.,* occurrences where complete avoidance is the preferred mitigation).

References:

Alberta Native Plant Council. 2012. ANPC Guidelines for Rare Vascular Plant Surveys in Alberta – 2012 Update. April 2012. Alberta Native Plant Council. Edmonton, AB. 25 pp. Website: http://www.anpc.ab.ca/content/newsfiles/Guidelines%20For%20Rare%20Plant%20Surveys%20in%20AB_2012%20Update.pdf. Accessed: July 2014.

Alberta Native Plant Council. 2010. ANPC Recommendations for Botanical Surveys in Areas of Proposed Development. May 2010. Alberta Native Plant Council. Edmonton, AB. 2 pp. Website: http://www.anpc.ab.ca/assets/ANPC_Recommended_Documents_for_Botanical_Surveys.pdf. Accessed: July 2014.

Penny, J. and R. Klinkenberg. 2012. Protocols for Rare Plant Surveys (Red- and Blue-listed Species). In E-Flora BC: Electronic Atlas of the Plants of British Columbia. Lab for Advanced Spatial Analysis, Klinkenberg, Brian. (Editor) 2013. Department of Geography, University of British Columbia, Vancouver, BC. Website: http://www.geog.ubc.ca/biodiversity/eflora/ProtocolsforRarePlantSurveys.html. Accessed: July 2014.

2.047 Vegetation communities, and plant and lichen species of concern – mitigation

Reference:

A3S2S3, Application Volume 6B, Pipeline Environmental Protection Plan, Appendix C – Rare Ecological Community and Rare Plant Population Management Plan:

i) PDF pages 231 and 232 of 461
ii) PDF pages 232 to 234 of 461
iii) PDF page 239 of 461

A3S1Q9, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical:

iv) PDF page 212 of 403
v) PDF page 217 of 403
vi) A3S2S3, Application Volume 6B, Pipeline Environmental Protection Plan, Appendix J, Table J-1 – Resource-Specific Mitigation Measures for Rare Plant Communities Encountered within the Pipeline Corridor, PDF pages 396 to 401 of 461
vii) A3S1Q9, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF pages 207 and 212 of 403
viii) A3S1R2, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF page 43 of 148
ix) A3S1Q9, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF page 166 of 403
x) A3S0U6, Application Volume 3B, Aboriginal Engagement, Appendix A: Engagement Logs

Preamble:

For rare ecological communities, Reference i) provides a list of potential mitigation measures, such as avoidance; reducing disturbance; consideration of salvage, propagation and transplant techniques; and consideration of delaying clearing to allow seed set and to limit drying of the soils.

For rare plant species, Reference ii) notes that complete avoidance is preferred for rare species ranked S1 or S1S2 or species that are protected under provincial or federal legislation/regulations. It provides a list of potential mitigation measures where complete avoidance is not feasible or for rare species of other rankings, such as avoidance, reducing disturbance, and relocating substrates or portions of the plants population.

References i) and ii) both state that:

- one or more of the listed mitigation measures “may” be used at a site; and
- PCEM “may” be recommended to monitor the effectiveness of mitigation efforts.

Reference iii) includes additional mitigation measures for rare plants (e.g., using a span bridge or ramping). References iv) and v) provide examples of successful mitigation for rare plants used in other projects, including ramping and extended horizontal direction drilling (HDD). Not all of these measures are noted in References i) and ii).

Reference vi) states only "See Appendix – C Rare Ecological Community and Rare Plant Population Management Plan" for every listed species and community.

Reference vii) states that the mitigation measures proposed for rare ecological communities and those for rare plants have been used previously on other major pipeline construction projects with good success. However, Reference viii), in explaining why maintenance activities completed more than one year after construction will not further disturb or alter rare ecological communities, states that, once native vegetation (which provides potential habitat for rare ecological communities) is cleared, there is a low probability of rare ecological communities revegetating the area.

Reference ix) states that wetlands of special concern are evaluated within the vegetation communities of concern indicator.

The Aboriginal Engagement Logs (Reference x)) note unresolved questions related to whether certain species will be transplanted (wild carrot, flowering grass (including a request for consultation regarding this species), and moonwort), whether willow stands will be avoided and planted along the right-of-way as part of reclamation, and whether sage and diamond willow fungus will be avoided.

Request:

Please provide:

a) a comprehensive description of all potential mitigation measures for rare ecological communities, including wetlands of special concern, and rare plants and lichens (including transplantation, bridging, ramping, and HDD);

b) a description of what additional resource-specific mitigation measures for specific communities and species will be added to Reference vi);

c) detailed criteria explaining under what circumstances each potential mitigation measure will be employed, including for what communities and species each measure is appropriate, the expected level of success for each measure based on previous experience, and measurable goals for each measure to determine success;

d) the monitoring that Trans Mountain will undertake to determine mitigation success, including survey methods, potential corrective measures, and the circumstances under which such measures will be applied; and

e) an explanation of how the issues already raised in the Aboriginal Engagement Logs, and that are noted in the preamble, will be addressed.

Response:

a) As outlined in the Rare Ecological Community and Rare Plant Population Management Plan (Section 6.0 of Appendix C of Volume 6B; Filing ID A3S2S3), potential mitigation measures generally fall into categories of avoidance, disturbance reduction and alternative reclamation techniques. There are several ways in which these mitigation strategies can be achieved.

For example, avoidance techniques include adjusting workspace locations, realigning the right-of-way, narrowing down the area of disturbance and fencing/flagging and extension of planned horizontal directional drilling. Table 2.047A-1 (NEB IR No. 2.047a – Attachment 1) summarizes potential mitigation measures for rare ecological communities, rare plants and rare lichens.

b) Mitigation measures for rare plant species and rare communities generally fall into categories of avoidance, (*e.g.*, realignment, change of work side, narrowing), reducing disturbance (*e.g.*, narrowing, adjusting workspaces, ramping/matting over) and alternative construction/reclamation techniques (*e.g.*, salvaging seed or sod, plant propagation, transplanting, separate topsoil/root zone material salvage, delay clearing, access management). All these mitigation measures will be considered in developing recommended community and species-specific mitigation for each observation which occurs on the Project footprint. The mitigation categories and mitigation options presented in Reference vi) will be utilized. However, site-specific measures will be described in more detail as to how each technique will be applied for a particular species or location (refer to the response to part a) above and Table 2.047A-1 [NEB IR No. 2.047a – Attachment 1]). Mitigation measures for whitebark pine candidate critical habitat, if encountered by the Project footprint, will be determined in consultation with Environment Canada.

c) Additional information regarding the potential mitigation measures provided within the references cited above, including a comprehensive description of all described potential mitigation measures, circumstances under which each measure might be employed, a general description of which communities and species for which each measure is appropriate, the expected level of success for each measure based on previous experience, and specific measureable goals to determine successful mitigation are provided in Table 2.047A-1 (NEB IR No. 2.047a – Attachment 1).

d) Post-construction environmental monitoring (PCEM) for rare plants and rare ecological communities is discussed in Section 9.6 of Volume 6A (Filing ID A3S2S1) and Section 6.1.4 of the Vegetation Technical Report (Filing ID A3S2I7) in Volume 5C.

For rare plant occurrences and rare ecological communities where PCEM is recommended (as part of the site specific mitigation measures developed after the Project footprint has been defined), vegetation specialists will revisit the locations documented during pre-construction surveys at intervals over a 5 year period (*e.g.*, years 1, 3 and 5 following completion of reclamation, until the issue has been considered to be resolved), and during biologically appropriate times. For rare plant occurrences, abundance, distribution, plant health and phenology will be documented. For rare ecological community occurrences, distribution will be documented as well as the plant species present and associated percent cover for each layer. For both rare plants and rare ecological communities, site conditions will also be documented (*e.g.,* hydrology, weeds, contours etc.), as well as photos and waypoints recorded.

The primary objective of PCEM for rare plants and rare ecological communities is to determine the effectiveness of mitigation measures. However, following PCEM, corrective measures may be recommended in the event that a visible and resolvable threat to an

enduring rare plant or rare ecological community is observed. For example, changes to site hydrology and/or contours may be recommended in the event that ponding of water is decreasing the viability of a population.

e) Many moonwort species (*Botrychium* spp.) are rare in Alberta and BC and, therefore, will be mitigated as warranted as per the measures provided in the Rare Ecological Community and Rare Plant Population Management Plan (see Section 6.0 of Appendix C of Volume 6B; Filing ID A3S2S3). Refer to the response to part a) above and Table 2.047A-1 (NEB IR No. 2.047a – Attachment 1) for a detailed discussion of rare plant mitigation, including the circumstances under which transplants will be recommended.

   Transplants and reclamation of other native species will also occur as part of the Reclamation Management Plan (Section 7.0 of Appendix C of Volume 6B; Filing ID A3S2S3), but are not targeted specifically to those species listed in the Aboriginal Engagement logs. The Reclamation Management Plan includes the salvage, storage and installation of native plant material and plants, tree/shrub transplants and native seed procurement to promote the return to pre-construction vegetation conditions (Section 7.3.10 of Appendix C of Volume 6B; Filing ID A3S2S3).

   Site-specific avoidance and plant harvesting are planned for areas of traditional land and resource use at locations listed in Appendix Q of Volume 6B (Filing ID A3S2S3).

   Trans Mountain will continue to engage Aboriginal communities through all phases of the Project. Any additional site-specific mitigation measures resulting from these studies will be provided in the updated Environmental Protection Plans to be filed with the NEB a minimum of 90 days prior to the commencement of construction as per NEB Draft Conditions No. 29 to 31 of the NEB's Letter – Draft Conditions and Regulatory Oversight (NEB 2014) (Filing ID A3V8Z9).

Reference:

National Energy Board (2014). Hearing Order OH-001-2014, Trans Mountain Pipeline ULC (Trans Mountain), Application for the Trans Mountain Expansion Project (Project), Draft conditions and regulatory oversight, Application Board File OF-Fac-Oil_T260-2013-03-02. April 16, 2014 (Filing ID A3V8Z9).

2.048 Vegetation communities, and plant and lichen species of concern – non-avoidable effects

Reference:

i) A3S2S3, Application Volume 6B, Pipeline Environmental Protection Plan, Appendix C – Rare Ecological Community and Rare Plant
ii) Population Management Plan, PDF pages 231 to 234 of 461 A3S1R2, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical, PDF page 43 of 148
iii) NEB Filing Manual, Table A-2 – Filing Requirements for Biophysical Elements, Species at Risk or Species of Special Status – Guidance, PDF pages 100 and 101 of 258

Preamble:

For rare plant species, Reference i) notes that complete avoidance is preferred for rare species ranked S1 or S1S2 or species that are protected under provincial or federal legislation/ regulations. It provides a list of potential mitigation measures where complete avoidance is not feasible or for rare species of other rankings. It also states that:

- one or more of the listed mitigation measures "may" be used at a site; and
- PCEM "may" be recommended to monitor the effectiveness of mitigation efforts.

Reference ii) states that, once native vegetation (which provides potential habitat for rare ecological communities) is cleared, there is a low probability of rare ecological communities revegetating the area.

The NEB Filing Manual (Reference iii)) states that "[m]any rare species (e.g., endangered or threatened species under the SARA) are at risk in large part as a result of the past cumulative effects on their population or habitat. Their inclusion on official lists reflects their status as having crossed a threshold requiring special actions for their protection and recovery. Any additional residual effects have the potential to further contribute to this existing situation. Consequently, proposed projects must preferably avoid, or fully mitigate or compensate for any residual project contribution to cumulative effects… When relying on compensation plans, describe the details of consultation with relevant experts, the options available, and criteria for selecting the options relied on, and for assessing the adequacy (sufficiency and validity) of any compensation measures or offsets."

Request:

Please provide:

a) a description of the circumstances under which effects on species and communities will be considered non-avoidable, taking into account the specific ranking or listing status of species and communities and the identification of candidate or final critical habitat;

b) a rationale and description of circumstances as to if and when offsets will be implemented for non-avoidable effects, including:

b.1) when no net loss will be the goal, taking into account the specific ranking or listing status of species and communities;
b.2) how non-avoidable effects will be quantified, including a description of any additional necessary pre-construction surveying and post-construction monitoring;
b.3) the types of offsets that will be provided; and
b.4) an overview of the monitoring, corrective actions, and reporting that Trans Mountain will undertake to ensure offsets are successful.

Response:

a) Circumstances under which effects on species and communities will be considered unavoidable are when there are potential concerns relating to the site which may jeopardize construction and workers' safety.

Trans Mountain is committed to install the Line 2 pipeline on or adjacent to the existing TMPL right-of-way to the extent feasible, to minimise environmental and socio-economic effects and facilitate efficient pipeline operations. As outlined in Section 2.1 of Volume 2 (Filing ID A55987), 73% of the proposed pipeline corridor follows the existing TMPL right-of-way, approximately 17% follows other existing rights-of-way and 10% will be within a new corridor.

In the event that rare species or communities are observed within the final Project footprint, complete avoidance will be adopted, where practical, as the preferred mitigation method for rare species ranked S1 or S1S2 or species that are provincially or federally protected (refer to the response to NEB IR No. 2.047a and Table 2.047A-1 [NEB IR No. 2.047a – Attachment 1]). However, factors such as construction and workers' safety will be taken into consideration prior to implementing site-specific mitigation measures. Mitigation will be developed which balances the efforts needed to apply the mitigation with the benefit to the resource being mitigated. Sites that are unavoidable will be mitigated as completely as practical using the mitigation hierarchy and considering the likelihood of mitigation success for the species and the site.

In the event that the Project footprint encounters a candidate critical habitat or a critical habitat, site-specific mitigation measures for the protected habitat area encountered by the final footprint will be determined in consultation with Environment Canada.

b) Offsets will not be implemented specifically for rare plant and rare ecological community occurrences as other technical mitigation options are available which will sufficiently mitigate potential impacts. However, other offsets planned for the Project may limit the reduction in habitat for certain rare plants and rare ecological communities. In particular, refer to the responses to NEB IR No. 2.052a to 2.052d and NEB IR No. 2.052a – Attachment 1 for details on wetland compensation. In addition, in BC Parks, Trans Mountain proposes to adopt similar methods developed by the Business and Biodiversity Offsets Programme [BBOP] (BBOP 2012) to identify and undertake an offset Project, or suite of Projects, in order to produce a measurable ecological benefit of a comparable nature and extent, so as to result in no net loss of native biodiversity and ecological integrity on a regional basis. Trans Mountain will work with land managers, stakeholders, and Aboriginal groups, with the

advice of internationally-recognized experts to identify and select the most appropriate Project(s). Where possible, the offset Project will be designed to result in a net benefit to native biodiversity and ecological integrity.

Reference:

Business and Biodiversity Offsets Programme. 2012. BBOP Standard on Biodiversity Offsets. Referenced in Resource Paper: No Net Loss and Loss-Gain Calculations in Biodiversity Offsets. Washington, DC.

2.049 Rare Ecological Communities or Rare Plant Species Discovery Contingency Plan

Reference:

A3S2S3, Application Volume 6B, Pipeline Environmental Protection Plan:

i) PDF page 179 of 461
ii) PDF pages 50 and 55 of 461

Preamble:

Reference i) describes the sequence of measures to be followed in the event that potential ecological communities or rare plants are discovered on or within 30 metres of the construction right-of-way or associated components. Such measures include:

- If feasible, avoid further disturbance to the location or within 10 m of the location until a qualified Vegetation Resource Specialist has been consulted.
- A qualified Vegetation Resource Specialist may deem it necessary to visit the site and will, regardless of whether a site visit is warranted, determine if site-specific mitigation is required, then develop an appropriate site-specific mitigation plan in consultation with Trans Mountain following the Rare Ecological Community and Rare Plant Population Management Plan.

Reference ii) requires activities to be suspended if previously unidentified rare plants or rare ecological communities are encountered on or within 10 metres of the construction right-of-way during construction where harmful effects to the plants and/or communities are anticipated. It refers to the Rare Ecological Community and Rare Plant Population Management Plan, rather than the Rare Ecological Communities or Rare Plant Species Discovery Contingency Plan.

Request:

Please provide:

a) measures to be taken to provide confidence that rare ecological communities and rare plants/lichens will be discovered prior to disturbance;

b) a description of the circumstances in which avoiding further disturbance prior to consulting a qualified Vegetation Resource Specialist would be considered not feasible;

c) criteria for when the Vegetation Resource Specialist will visit the site and for when a site-specific mitigation plan will be developed; and

d) confirmation that the Environmental Protection Plan will refer to the correct plans and be consistent with them.

Response:

a) Please refer to the response to NEB IR No. 2.046a.

b) While every effort will be made to avoid disturbance to identified rare ecological communities, rare plants or rare lichens prior to consultation with a qualified Vegetation Resource Specialist, this may not always be feasible. For example, if unsafe conditions may compromise the well-being of the Project personnel or where delay in the implementation of mitigation could precipitate a larger cascade of environmental effects (*e.g.,* if the rare community or population is located on an eroding bank that may threaten riparian and aquatic habitat if mitigation is delayed until consultation with a Vegetation Resource Specialist has taken place).

c) The PDF pages referred to in the above reference provide a general overview of the process that will be followed. Additional detail and clarification of this process are provided below.

The protocol that is to be followed in the event that potentially rare ecological communities, rare plants or rare lichens are discovered on or within 30 m of the construction right-of-way or associated components is highly dependent on particular site-specific conditions and species sensitivity criteria. In general, a Vegetation Resource Specialist will visit any newly-discovered potentially rare ecological communities, rare plant or rare lichen occurrences unless:

- the observation of the potentially rare community or species is an expansion of an already-documented population; and/or
- the potentially rare community or species is easily identified, the Environmental Inspector is familiar with the community or species and the extent of the community/population can be accurately delineated in the absence of a Vegetation Resource Specialist.

If the observation is an expansion of an already-documented community or population, the Vegetation Resource Specialist will work with the Environmental Inspector to adapt existing mitigation strategies to the newly observed extent.

Site-specific mitigation recommendations will be developed for all newly-discovered rare ecological communities or rare species occurrences. In the event that a new occurrence has been observed and a Vegetation Resource Specialist does not visit the site, the Environmental Inspector and Vegetation Resource Specialist will work together to develop site-specific mitigation recommendations. The resulting mitigation recommendations will be documented by both parties and implemented by the Environmental Inspector on site.

d) Reference i), The Rare Ecological Communities or Rare Plant Species Discovery Contingency Plan, refers to the correct plans. Reference ii) was meant to summarize the information provided in Reference i), however it should read “If potential rare plants or rare ecological communities are encountered within 30 m of the construction right-of-way or associated components, follow the measures outlined in the Rare Ecological Communities or Rare Plant Species Discovery Plan (see Section 7.0)” on both PDF page 50 and 55.

This inconsistency will be corrected in the final submission of the Pipeline Environmental Protection Plan prior to the commencement of construction.

Summary of New Commitments:

- Provide correct and consistent plans for rare ecological community and rare plant discovery in the final submission of the Pipeline Environmental Protection Plan prior to the commencement of construction.

2.050 Wetlands – mitigation

Reference:

i) A3S2H5, Application Volume 5C, Environmental and Socio- Economic Assessment – Biophysical Technical Reports, TR 5C-8 – Wetland Evaluation Technical Report, PDF pages 126 to 132 of 157

A3S2S3, Application Volume 6B, Pipeline Environmental Protection Plan:

ii) PDF pages 126 and 127 of 461
iii) PDF page 225 of 461
iv) PDF page 114 of 461
v) A3S1Q9, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF pages 176 and 178 of 403
vi) A3S2S3, Application Volume 6B, Pipeline Environmental Protection Plan, PDF pages 403 to 431 of 461

Preamble:

Reference i) lists wetlands encountered by the proposed pipeline corridor that are of special concern (i.e., associated with rare plants and/or rare ecological communities, including wetlands of special concern listed provincially).

Reference ii) includes Trenched Crossing, including isolation, as a potential mitigation measure, and Trenchless Wetland Crossing as potential activities/concerns. Reference iii) states that HDD technology may be used for watercourse/wetland/lake crossings. Reference iv) refers to a Wetland Crossing Plan to be developed by the Contractor.

Reference v) overviews the importance of microtopography features and explains that restoring microtopography features and microclimate variation following construction accelerates plant community development and re-establishment. However, it only mentions narrowing the construction right-of-way and allowing for natural recovery as related mitigation.

The resource-specific mitigation measures in Reference vi) refer generally to Section 6.0 (general wetland mitigation recommendations) of the Wetland Evaluation Technical Report for every wetland listed. Added to some entries is ‘Potential Shrub Staking’, or a general aquatics reference such as ‘Aquatics for fish mitigation’ or ‘Aquatics for watercourse mitigation’.

Request:

Please provide:

a) the information requirements and detailed criteria, with rationales, to decide upon the appropriate crossing method for each wetland, taking into account wetlands of special concern;

b) an overview of potential restoration measures to recreate microtopography features and an explanation of the appropriate application of such measures to the Project; and

c) a description of what additional site-specific mitigation will be added to the Resource-Specific Mitigation Measures for Wetlands in Reference vi).

Response:

a) Based on experience gained during past pipeline projects in similar terrain (*e.g.,* Kinder Morgan Canada Inc. TMX – Anchor Loop Project), most of the wetlands will be crossed using a trenched method during pipeline construction. The approach taken to determine the crossing method (*e.g.,* open cut trenching, isolation) for each wetland, including wetlands of special concern, will be on a site-specific, case by case basis since water management constraints are an important factor. Section 1.2.2 of Volume 6B (Filing ID A3S2S3) provides an outline of the decision making process. Construction crossing methods will be determined at completion of detailed engineering and design and construction planning. As wetland crossing methods are site-specific and will be determined on a case by case basis, general required information, criteria and rational is available at this time.

The site (*i.e.*, wetland) specific information required along with the criteria required to decide upon the appropriate crossing method for each wetland, including wetlands of special concern, is included below.

- Permit or approval conditions:
  - criteria includes the direction outlined in the permit or approval, the rational for using the approval conditions is to ensure compliance with the appropriate regulatory authorities.
- Site conditions at the time of construction:
  - criteria includes slope gradient and aspect, soil texture, frozen or non-frozen soil conditions, water permanency and depth, the rational being that crossing methods will depend soil conditions to ensure a reduced disturbance to the wetland and maintenance of safe work practices (*e.g.*, unstable steep slopes could be a potential safety concern).
- Weather conditions at the time of construction:
  - criteria includes wind, precipitation forecast and air temperature, the rational being that weather will have an effect on construction practices and potentially wetland crossing methods (*e.g.*, high water levels).
- Options available as identified in the Pipeline Environmental Protection Plan (Volume 6B) (Filing IDs A3S2S3 and A3S2S4):
  - criteria includes the Environmental Inspectors (EI) knowledge of the Pipeline Environmental Protection Plan and their responsibility to ensure due diligence to ensure the Pipeline Environmental Protection Plan is followed during construction through wetlands, regardless of crossing method.

- Equipment and/or materials availability at the time of construction:
  - criteria includes types of material on site and professional judgement of the EIs once the wetland in question is evaluated to determine the most appropriate crossing method, the rational being that the EIs are responsible to provide guidance on construction practices (*i.e.*, wetland crossings) that are the most environmentally sound and take into consideration all environmental factors (*e.g.*, rare plants).
- Consultation with geotechnical and civil engineers, drainage specialists and soils specialists:
  - criteria will be dependent on the professional judgement of the above-listed professionals and specialists and will be on a case by case basis, the rational being that they will implement the most appropriate crossing method based on their knowledge.
- Contractor experience with conducting specific construction techniques:
  - criteria will be up to the professional judgement of the contractor, the rational being that they will have the information and experience to implement the most appropriate crossing method based on their knowledge, with the input and guidance from the EIs.
- Environmental Inspection staff experience with implementing applicable protection measures and/or procedures:
  - criteria will be up to the professional judgement of the EIs, the rational being that they will have the information and experience to implement the most appropriate crossing method based on their knowledge.
- Applicable Environmental Health and Safety management systems:
  - criteria includes what is outlined in the approved Environmental Health and Safety guidance documents, the rational for this is to ensure safe work is carried out based on the chosen crossing method being implemented in the safest way possible.

In addition to the above-list, recommended mitigation from other biophysical disciplines will also be considered when selecting the crossing method for wetlands that have demonstrated special features such as Red or Blue-listed wetlands in BC, rare plants or ecological communities, wildlife species of concern or sensitive aquatic habitat (*e.g.*, a trenchless crossing may be considered at a wetland associated with sensitive fish habitat). The resource specific appendix for wetlands (Appendix K of the Pipeline Environmental Protection Plan in Volume 6B [Filing ID A3S2S3]) will be updated to identify wetland crossing techniques along the final pipeline construction right-of-way and will be submitted to the NEB 90 days prior to construction.

In addition, the resource specific appendix for wetlands will also be updated to include any site-specific mitigation from other biophysical disciplines for special features relating to rare plants or ecological communities, wildlife species of concern or sensitive aquatic habitat.

b) Mitigation measures related specifically to the maintenance or recreation of microtopography in wetlands is provided in Sections 8.6 and 8.7.4 of Volume 6B, Pipeline Environmental Protection Plan (EPP) of the Application (Filing ID A3S2S3). These mitigation measures are implemented in such a way as to not impede hydrology across the construction right-of-way in wetlands. Examples of mitigation measures which take into consideration the maintenance or recreation of microtopography include:

- install mounds on contours in riparian areas, to reduce erosion and to enhance woody vegetation establishment, where it is desired; and
- replace any remaining salvaged upper soil (root zone) material over the trench area, reclaim the wetland to as close as feasible to its pre-construction profile and ensure no permanent trench crown is left following trench crown subsidence.

These mitigation measures will be applied to all wetlands encountered by the final construction right-of-way as warranted.

c) Re-establishment of wetland vegetation will occur through natural regeneration of plant propagules located within the salvaged wetland substrate for all wetlands as per Volume 6B (Filing ID A3S2S3). However, site-specific mitigation is being recommended for select wetlands where a dominant woody riparian fringe exists or the wetland is dominated by woody vegetation throughout. Shrub staking, along with natural regeneration of other wetland vegetation, has been determined to be of benefit to overall wetland function in disturbed wetlands. The following criteria will be used to determine wetlands where shrub staking will occur.

- Wetlands where shrubs (*e.g.*, willow *sp.*, red-osier dogwood, mountain alder) are documented either within the woody riparian fringe or throughout the wetland during the pre-construction wetland field survey.
- Wetlands where shrubs are documented to be of sufficient height (*i.e.*, greater than 1 m) that removing cuttings of at least 1 m in length is feasible.
- Wetlands where the population and distribution of shrubs present is anticipated to be large enough after disturbance that removing cuttings would not cause extensive damage or affect the potential donor shrubs (*i.e.*, enough individuals of a large enough size that cuttings will not be taken from just one plant but many plants to reduce the stress placed upon the donor shrubs).

Once the proposed pipeline route is finalized, wetlands encountered that meet the above criteria will be identified in the Wetlands Resource Specific Mitigation table in Appendix K of the Pipeline EPP (Volume 6B) (Filing ID A3S2S3). Additional site-specific mitigation measures associated with wetlands will be implemented in order to ensure “no net loss” of wetland function and to reduce any temporary disturbance to wetlands. Reference to site-

specific mitigation measures with respect to rare plants and rare ecological communities, wildlife, watercourses and fish associated with wetlands is provided in the response to part a) above.

2.051 Wetlands – functional condition category and no net loss

Reference:

i) A3S2H5, Application Volume 5C, Environmental and Socio- Economic Assessment – Biophysical Technical Reports, TR 5C-8, Wetland Evaluation Technical Report, PDF pages 49 and 50 of 157
ii) A3S1R0, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF page 166 of 260

Preamble:

Reference i) provides examples of some of the criteria used to evaluate the functional condition category of each wetland (high, high-moderate, low- moderate, or low), the score range for each (75-100 per cent, 50-74 per cent, 25-49 per cent, and 0-24 per cent, respectively), and explains that the aim is to return each wetland to the same functional condition category as documented pre-construction.

The Board notes that the full method to calculate each score is not provided. It also appears that returning each wetland to the same functional condition category would, in many cases, allow a reduction in score. For example, a wetland with a pre-construction score of 74 per cent (high-moderate) would be considered successfully reclaimed once it reached a score of 50 per cent post-construction, given that is also considered high-moderate. This would never require an increase in score, and therefore could allow an overall decrease in wetland function.

Reference ii), in justifying the conclusion that the magnitude of combined effects of the Project on wetlands will be low states that "with meeting the goals and objectives of applicable management plans and with the potential implementation of compensation, if required, there will be 'no net loss' of wetlands (for all effects)."

Request:

a) Please provide the full method used to determine functional condition category, including all criteria and their potential values, and details on how the score (per cent) is calculated. Provide some examples demonstrating the calculation and category determination, with reference to one or more of the site cards provided in Appendix B to Reference i).

b) Please indicate if Trans Mountain commits to reclaim each wetland to at least its pre-construction score. If not, provide an explanation as to how the use of functional condition categories will not allow for an overall decrease in wetland function scores, and how using such categories is at least as good a measure for determining no net loss as using the scores directly.

Response:

a) As provided in Section 3.6.4 of Technical Report 5C-8 of Volume 5C, Wetland Evaluation Technical Report (TERA Environmental Consultants December 2013) (Filing ID A3S2H5) and Section 7.2.8.1 of Volume 5A (Filing ID A3S1Q9) four wetland functional categories (*i.e.,* High, High-Moderate, Low-Moderate and Low Functional Condition) were developed.

The definitions of these functional condition categories are provided in Section 7.2.8.1 of Volume 5A (Filing ID A3S1Q9) and Section 3.6.4 of Technical Report 5C-8 of Volume 5C (Filing ID A3S2H5). A breakdown of the categories, including a summary of the criteria used to assess wetland function per category is provided in Table 3.6-7 of Technical Report 5C-8 of Volume 5C (Filing ID A3S2H5).

The wetland landscape functional assessment is intended to address several key selected functional components that inform a wetlands' overall functional condition. Although individual wetlands may vary in the types of functions they provide, the selected components apply to most wetlands encountered. This assessment is meant as a generalized tool for assessing some key biophysical (*i.e.*, not socio-economic) functions.

TERA, a CH2M Hill Company has developed this wetland landscape functional assessment for use on this Project and has tailored it for use along linear disturbances (*i.e.*, pipeline rights-of-way) as existing literature and available tools did not meet the requirements of assessing wetlands disturbed by pipeline construction during pre-construction surveys and post-construction monitoring. Wetland landscape function was evaluated using a tiered approach. The first tier of landscape functions consists of functions that have been identified as being the most important to the surrounding landscape (*e.g.,* water quality and biodiversity) based on a review of existing wetland function assessment literature (Adamus 2011, Ambrose *et al*. 2009, Fitch *et al*. 2001, Gilbert *et al.* 2006, Hanson *et al.* 2008, Ontario Ministry of Natural Resources 1993). As a result, criteria identified in this first tier have a heavier weighting (each have a total score generally out of 16 points) within the assessment (approximately 54% of the total assessment). Descriptions of the functions identified in the first tier are provided below in Table 2.051A-1.

TABLE 2.051A-1

TIER 1 WETLAND LANDSCAPE FUNCTIONS

Wetland Function	Description
Water Quality – Sediment and Nutrient Retention	The effectiveness of a wetland's riparian area to slow down overland flow from the surrounding landscape and lands uses, and retain any suspended sediment and nutrients therefore preventing a flush of contaminates, which could otherwise impact water quality within a wetland and watershed. Assessment of this function depends on the characteristics of the wetland riparian area (*e.g.,* disturbance to riparian area and vegetation characteristics) and the type of surrounding land use (*e.g.,* level of disturbance to surround area).
Water Quality – Water Purification	The ability of a wetland to treat incoming water of sediments, nutrients and other contaminants before it is released downstream or into the groundwater. This function can be quantified by considering the occurrence of water entering a wetland (water flow), the length of the flow path through the wetland (wetland surface connectivity) as well as the composition and cover of vegetation (vegetation cover/density).
Biodiversity and Habitat Availability	Wetlands provide a range of habitat for many wildlife and plant species. Due to their unique biogeochemistry, some wetlands are also habitat for rare plants. Additionally, because wetlands often occur as transitions from terrestrial to aquatic environments, they have higher biodiversity than either terrestrial or aquatic environments. Not all wetland types provide the same kind of habitat potential (*e.g.,* marsh versus a bog). As a result, a scoring option for marsh/herbaceous type and woody type wetlands is provided. If the wetland contains herbaceous and woody components, assessments for both types are conducted. An adjustment is then made to the total outcome of the landscape functional assessment to account for both wetland types being assessed.

The wetland functions that make up the second tier of landscape functions are those that have been identified through a review of the literature as being of moderate importance to the surrounding landscape (*e.g.*, erosion control and flood attenuation). The second tier landscape functions comprise approximately 27% of the assessment and have a weighting of 12 points each. Descriptions of the functions identified in the second tier are provided below in Table 2.051A-2.

TABLE 2.051A-2

TIER 2 WETLAND LANDSCAPE FUNCTIONS

Wetland Function	Description
Substrate Protection	The ability of a wetland to provide substrate protection during high wind or storm events (*e.g.*, increase water inputs). The type of vegetation found within a wetland can influence the ability of the wetland to prevent substrate erosion. A wetland with a diverse plant community (*i.e.,* presence of woody and herbaceous vegetation) with little bare soil (*i.e.,* less than 1% of the wetland) will provide a larger substrate protection function and score higher than a wetland that has greater than 15% bare soil present.
Flood/Spring Melt Control	The ability and effectiveness of a wetland to retain surface water from heavy storm events as well as spring snow melt. This parameter consists of two components: the presence of artificial impedances or altered wetland contour disturbances; and the wetlands' water storage capacity.

The third tier of wetland functions are important to the surrounding landscape (*e.g.,* groundwater recharge and climate change) but to a lesser extent, based on review of the literature. Each component of this section of the assessment has a weighting of 8 points each and comprise approximately 18% of the overall assessment. Table 2.051A-3 provides a description of these functions.

TABLE 2.051A-3

TIER 3 WETLAND LANDSCAPE FUNCTIONS

Wetland Function	Description
Groundwater Recharge	The effectiveness of a wetland to supply the groundwater table with additional water. This function consists of two components: hydrological connectivity (*i.e.,* surface and subsurface connections); and hydraulic conductivity (*i.e.,* substrate porosity).
Climate Change	The effectiveness of a wetland to store carbon (*i.e.*, a sink). Carbon sequestration in wetlands occurs with peat development and depends on vegetation quality (*i.e.*, ease of decomposition), temperature, water table position, and litter input rates. It should be noted that a wetland that does not accumulate peat can still sequester carbon through high rates of plant productivity but only for very short periods of time.

There are two different outcomes of the assessment with respect to the total wetland function score. Each outcome is dependent on the class characteristics of the wetland being assessed. If the wetland is found to only be dominated by herbaceous plant species (*e.g.*, marsh or non-woody fen) or the wetland is found to only be dominated by woody plant species (*e.g.,* shrubby swamp or treed fen) then the total wetland function score is out of 88. Should the wetland being assessed be determined to be a mixed class complex (*i.e.,*

presence of both herbaceous plant species dominated [*e.g.,* marsh] and woody plant species dominated [*e.g.,* shrubby swamp]) then the total wetland function score is out of 97.

Information on the purpose of assigning a range of scores and corresponding percentages is outlined in the response to NEB IR No. 2.051b. The methodology and criteria used in the wetland landscape functional assessment is not static, the tool is evolving and modified as more assessments are being conducted for the Project and post-construction work is being planned. However, the tiered foundation based on the key biophysical functions is well established and will remain the basis of future wetland functional assessment revisions.

For an example of how the wetland landscape functional assessment has been used, please refer to the site card for WT-158 in Appendix B of Technical Report 5C-8 of Volume 5C (Filing ID A3S2I5, PDF page 23). This Flat Swamp (broad-leaf treed swamp) is located at a-18-L/82-M-11 at approximately RK 672.86 along the proposed pipeline corridor.

The functional assessment conducted at this wetland determined that it was of High-Moderate Functional Condition with a score of 65%. Table 2.051A-4 provides a breakdown of the functional assessment for this particular wetland.

TABLE 2.051A-4

WETLAND LANDSCAPE FUNCTIONAL ASSESSMENT

Wetland Function	Description	Score
Water Quality – Sediment and Nutrient Retention	Riparian area has been narrowed due to existing disturbances (*e.g.,* existing pipeline and transmission line rights-of-way). Wetland has been bisected by the existing pipeline right-of-way.	6 / 16
Water Quality – Water Purification	Wetland was observed to not have any surface hydrologic flow. Wetland is isolated. Wetland is heavily vegetated with little open water or bare soil.	14 / 16
Biodiversity and Habitat Availability	Wetland provides habitat for amphibians, ungulates and songbirds. No tame pasture species (*e.g.,* clover species) or provincially-listed weed species (*e.g.,* scentless chamomile) were observed.	15 / 16
Substrate Protection	Wetland is heavily vegetated with a mix of woody and herbaceous plant species and less than 1% bare soil.	12 /12
Flood/Spring Melt Control	Wetland has experienced artificial impedance resulting in ponding along the existing right-of-way. The wetland is small in area with no peat accumulation.	0 / 12
Groundwater Recharge	Wetland is isolated and permeable substrate.	8 / 8
Climate Change	Wetland does not accumulate peat.	2 / 8
	TOTAL SCORE	57 / 88 65%

References:

Adamus, P. 2011. Manual for the Wetland Ecosystem Services Protocol for the United States (WESPUS).

Ambrose, N., G. Ehlert and K. Spicer-Rawe. 2009. Riparian Health Assessment for Lakes, Sloughs and Wetlands – Field Workbook. Second Edition. Modified from Fitch, L., B. W. Adams and G. Hale. 2001. Riparian Health Assessment for Streams and Small Rivers – Field Wordbook. Lethbridge, AB: Cows and Fish Program. 96 p.

Fitch, L., B.W. Adams and G. Hale. 2001. Riparian Health Assessment for Streams and Small Rivers – Field Wordbook. Lethbridge, AB: Cows and Fish Program. 90 p.

Gilbert, M.C., P.M. Whited, E.J. Clairain and R.D. Smith. 2006. A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Prairie Potholes. Final Report. Prepared for U.S. Army Corps of Engineers. Washington, DC.

Hanson, A., L. Swanson, D. Ewing, G. Grabas, S. Meyer, L. Ross, M. Watmough and J. Kirkby. 2008. Wetland Ecological Functions Assessment: An Overview of Approaches. Canadian Wildlife Service Technical Report Series No. 497. Atlantic Region. 59 p.

Ontario Ministry of Natural Resources. 1993. Ontario Wetland Evaluation System Southern Manual. 3rd Edition. Toronto, ON. 127 p.

b) Each wetland is anticipated to reach pre-construction functional condition category (*i.e.,* not necessarily the exact score within the category) through the implementation of mitigation measures during construction (see Sections 6.0, 7.0, 8.1, 8.2, 8.4, 8.6.3, 8.7.1, 8.7.4 and 9.0 of Volume 6B (Filing ID A3S2S3).

The four functional condition categories are assigned a range of scores and percentages as outlined in the response to NEB IR No. 2.051a. The purpose of assigning a range of scores and corresponding percentages to the functional condition categories is to try and accommodate the seasonal and annual variation and dynamic nature of wetlands found in Alberta and British Columbia. As well, having a range allows for some subjectivity inherent in these types of assessments. The intent is for the overall functional condition outcomes to be reproducible by different wetland ecologists. For example, wetland ecologists have strengths in hydrology, soils, vegetation, wildlife and ecosystem interactions but may not be an expert in all categories and the assessment is designed to not have this skew the results (*i.e.*, broader functional condition categories and tiered approach). As well, the functional assessment considers a landscape review of the wetland ecosystem, and the actual assessment location of a given wetland may vary depending on accessibility from pre- to post-construction surveys (*e.g.*, high water levels may prevent access to the original assessment location).

The functional condition categories are designed so that a difference in score is not likely to change the overall functional category outcome. However, the utilization of a score range dampens any variation in hydrology (*e.g.,* surface water and moisture levels*)* between years, variability between crew members' aptitudes, and variability in the exact assessment location within the wetland ecosystem. Wetland ecologists conducting the assessments will be trained in the use of the wetland landscape functional assessment and outcomes will be reviewed by senior wetland scientists to ensure that outcomes will be consistent and accurate pre- and post-construction.

During the Wetland Function Post-Construction Monitoring Program, it is up to the discretion and professional judgement of the field crew and senior wetland scientists through data collected during post-construction monitoring to determine if additional remedial measures will be recommended in order to assist the wetland in returning to full pre-construction functional condition (*i.e.*, pipeline construction related issues will be noted, reported on and discussed between Trans Mountain and Environment Canada following Wetland Function Post-construction Monitoring). For instance, if a wetland is determined to be within the same functional condition category but received a lower score post-construction relative to the pre-construction score, this difference will be considered by the assessment team and additional remedial measures may be recommended to improve the inhibited parameters (*e.g.*, habitat function being inhibited by increased weeds within wetland and weed control is recommended or hydrological function being inhibited by areas of compaction or rutting and resurfacing is recommended) to ensure the wetland reaches its full potential recovery within the functional condition category. Refer to the response to NEB IR No. 2.052a and the Preliminary Wetland Compensation Plan (NEB IR No. 2.052a – Attachment 1) for more information related to functional condition reclamation following post-construction monitoring.

It should be noted that external factors may play a role in whether a wetland is able to be reclaimed to the same functional condition category and score and that these external factors may be outside of the control of Trans Mountain (*e.g.,* land use practices, such as cultivation). The dynamic nature of wetlands also contributes to whether a wetland is able to be reclaimed to the same functional condition category and score documented during pre-construction wetland surveys. Annually changing climatic conditions (*e.g.,* droughts, fires, flooding) can also contribute to variation in wetland characteristics and changes in the functions a wetland may provide.

Based on subjectivity, variability of natural conditions and provisions of the landscape functional assessment described above, “no net loss” of wetland function is still being achieved by using functional condition categories rather than exact pre-construction scores within the categories. If a wetland is determined to not be on the trajectory to returning to pre-construction functional condition at the end of the Wetland Function Post-construction Monitoring Program (*i.e.*, post-construction functional condition category is less than the pre-construction category), Trans Mountain will discuss the next steps with Environment Canada to achieve the goal of “no net loss” of wetland function.

2.052 Wetlands – compensation

Reference:

i) A3S1Q9, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical, PDF page 166 of 403
ii) A3S1R2, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical, PDF page 30 of 148

A3S1Q9, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical:

iii) PDF page 366 of 403
iv) PDF page 362 of 403
v) PDF page 176 of 403
vi) PDF page 203 of 403
vii) PDF pages 178 and 179 of 403
viii) PDF page 367 of 403
ix) A3S1R0, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF page 166 of 260
x) A3S2S1, Application Volume 6A, Environmental Compliance, PDF page 38 of 42

Preamble:

Generally, the Application acknowledges that some wetland area and/or function may be altered or lost due to pipeline construction.

For example, Reference i) states that for low-moderate functioning wetlands, the potential for a land use change (e.g., cultivation) following construction may alter the wetland's ability to recover its wetland function qualities. Low-functioning wetlands have unlikely potential to recover to their wetland type and class or may not recover as functional wetlands. However, Reference ii) states that permanent loss of wetland function is not anticipated to result from either the construction or operations phases of the proposed pipeline in trenched wetlands or at the pump stations.

With regard to the Kingsvale power line, References ii) and iii) state that the in-wetland structure placement will permanently reduce wetland area and this may result in the overall loss of wetland function, depending on existing anthropogenic disturbance, the size of the wetland, and the type of lost habitat. However, Reference iv) states that the proposed construction works at the Blackpool Pump Station will not affect the wetland located within the pump station boundary, "and nor the 23 potential wetlands which may be crossed by the proposed Kingsvale power line."

The Application also acknowledges the potential for medium- to long- term changes in wetland type.

For example, Reference v) states that wetlands previously dominated by woody vegetation initially recover as sedge-dominated marshes due to an increased moisture regime. Reference

vi) explains that treed wetlands cleared for construction often have long-term regeneration periods due to hydrologic alteration, especially in cases where trees will be kept mowed on the right-of-way for the life of the operating pipeline.

Reference vii) states that, if permanent loss or alteration of wetland habitat function is identified upon completing the Wetland Function PCEM Program, Trans Mountain will consult with Environment Canada regarding potential remedial or compensatory measures to offset functional loss. Reference viii), in discussing the Kingsvale power line, discusses the potential implementation of a wetland compensation plan to be carried out through either reclamation, restoration, or financial contribution.

Reference ix), in justifying the conclusion that the magnitude of combined effects of the Project on wetlands will be low states that, "with meeting the goals and objectives of applicable management plans and with the potential implementation of compensation, if required, there will be 'no net loss' of wetlands (for all effects)."

Reference x) states that, if at the end of the PCEM monitoring (i.e., year five after construction) there appears to be some loss of wetland function, then compensation would be considered, but only where additional mitigation to reclaim wetland function was determined not to be an appropriate course of action and following consultation with Environment Canada and other regulatory authorities regarding the appropriate next steps.

Request:

Please provide a preliminary wetland compensation plan that includes:

a) confirmation that the goal of no net loss will apply to all wetlands disturbed by the Project, or an explanation for which wetlands it will apply to and a rationale for the limitation;

b) a description of the circumstances under which compensation will be carried out, including the area, type, and duration of alteration, loss, or contamination that would trigger compensation, and the timing for when such determinations will be made;

c) the types of compensation that will be provided and the approach for choosing between them; and

d) any offset ratio(s) that would be applied.

Response:

a) No net loss of function applies to all wetlands disturbed by the Project. A Preliminary Wetland Compensation Plan (refer to NEB IR No. 2.052a – Attachment 1) has been developed in response to NEB IR No. 2.052a as well as to GoC EC IR No. 1.040 [Filing ID A3Y2K9, PDF pages 88 and 89]. Please refer to Section 2.2 of the Preliminary Wetland Compensation Plan for information in response to NEB IR No. 2.052a.

b) A description of circumstance under which compensation will be carried out is included in Section 3.2 of the Preliminary Wetland Compensation Plan (NEB IR No. 2.052a – Attachment 1).

c) Compensation approaches will be discussed with the NEB and Environment Canada as warranted, this is outlined in Section 3.3 of the Preliminary Wetland Compensation Plan (NEB IR No. 2.052a – Attachment 1).

d) A discussion of potential offset ratios is included in Section 3.4 of the Preliminary Wetland Compensation Plan (NEB IR No. 2.052a – Attachment 1).

2.053 Old growth management areas (OGMAs) and other old growth forest

Reference:

i) A3S2J9, Application Volume 5D, Environmental and Socio- Economic Assessment – Socio-Economic Technical Reports, TR 5D-4 – Managed Forest Areas and Forest Health Technical Report, PDF pages 11 and 37 of 49
ii) A3S1S7, Application Volume 5B, Environmental and Socio-Economic Assessment – Socio-Economic, PDF page 109 of 245

A3S2J9, Application Volume 5D, Environmental and Socio-Economic Assessment – Socio-Economic Technical Reports TR 5D-4 – Managed Forest Areas and Forest Health Technical Report:

iii) PDF pages 11 and 22 to 24 of 49
iv) PDF pages 28, and 31 and 32 of 49
v) PDF pages 40 and 41 of 49
vi) PDF pages 36 and 37 of 49
vii) A3S2S1, Application Volume 6A, Environmental Compliance, PDF page 37 of 42

Preamble:

Reference i) states that OGMAs originated as a key element of biodiversity planning and that a key goal of OGMAs is ensuring relatively undisturbed ecosystems are represented on the landscape.

Reference ii) anticipates that there will be a loss of forestry resources along the pipeline for the duration of the Project and at temporary roads and workspace for the one to two years while they are in use. In each case, recovery will take at least one harvest regeneration cycle (60 to 100 years, depending on location and forest type).

Reference ii) states that, upon finalization of the construction right-of- way, final OGMA disturbance will be calculated. Trans Mountain will work with the British Columbia Ministry of Environment (BC MOE), the British Columbia Ministry of Forests, Lands and Natural Resources Operations (BC MFLNRO), and forest tenure holders to determine associated permitting requirements and appropriate mitigation measures related to OGMAs, which will include identifying replacement areas, as required, prior to construction.

Reference iii) states that OGMAs are currently not legally required to be considered outside of Forest Stewardship Plans and there is currently no standardized approach to addressing projects that traverse or encounter OGMAs outside of the forest sector. It notes that there have been discussions to suggest BC MFLNRO may issue an order designating OGMAs under the British Columbia Oil and Gas Activity Act in the future. It also notes that, for the Upper Lillooet Hydro Project, compensation was required and replacement areas would be calculated according to criteria for permissible effects, direct effects, edge effects, and isolation effects.

Reference iv) provides summary tables that estimate the areas that would be affected by fragmentation, edge effects, and removal (corridor overlap) if the entire pipeline corridor was cleared, and states that mitigation of effects "may" be required.

Reference v) appears to indicate that, for some OGMAs, much of the total OGMA area will be affected by fragmentation, edge effects, or 'area affected' (e.g., KAM_TKA_226). For some of the smaller OGMAs, all of it will be affected (e.g., KAM_TKA_7375, KAM_TME_560).

References vi) and vii) describe a post-construction review of OGMAs to identify where actual effects on OGMAs deviate from anticipated effects and to recommend appropriate mitigation measures and monitoring to document changes to newly created edges in OGMAs. The review will also identify where further mitigation measures are required should windthrow levels exceed natural levels.

Request:

a) Please provide an update on consultation with BC MOE, BC MFLNRO, and forest tenure holders regarding permitting and mitigation requirements in OGMAs that would apply to the Project, including an explanation of the implications of the statement in the preamble that OGMAs are not required to be considered outside of Forest Stewardship Plans.

b) Please clarify whether or not compensation/replacement will be undertaken where the pipeline and/or the Kingsvale power line affects OGMAs by direct disturbance, fragmentation, or edge effects.
   - b.1) If not, provide a rationale, taking into account the purposes of OGMAs.
   - b.2) If so, explain whether such compensation/replacement would cover all areas in OGMAs disturbed by the Project, including temporary workspace and indirect effects (e.g., edge effects, fragmentation). Please also provide an initial estimate of the area that would be compensated/replaced, and describe the type of compensation/ replacement that would be provided and how it would mitigate Project disturbance, taking into account the purposes of OGMAs.

c) Please explain the implications for those OGMAs where much or all of their total area will be affected.

d) Please provide an overview of the types of additional mitigation that could be undertaken following the post-construction review of OGMAs and from the monitoring of newly created edges and windthrow levels described in References vi) and vii).

e) Please provide an estimate of the old growth forest area that will be disturbed directly or indirectly by the Project outside of OGMAs in each of Alberta and British Columbia. Please also describe any surveys, quantification, avoidance, mitigation, compensation, and/or monitoring that will be undertaken in relation to such areas.

Response:

a) Trans Mountain held a conference call with BC Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) on May 8, 2014, of which one of the topics was Old

Growth Management Areas (OGMAs) and forest health related matters. The BC MFLNRO submitted preliminary review questions to Trans Mountain which were addressed and discussed in the conference call. The assessment of impacts to OGMAs in the December 2013 Application was based on a 150 m wide proposed pipeline corridor. A final assessment of impact will be developed in conjunction with detailed engineering design and construction planning, with impacts based on the final pipeline right-of-way and construction footprint. Once the construction right-of-way is finalized, the OGMA analysis will be updated and any planned clearing within OGMAs will include discussions with BC Ministry of Environment (MOE) and BC MFLNRO, and licensees where required. To date, no specific consultation with BC MOE and forest tenure holders regarding permitting and mitigation requirements in OGMAs for the Project have been initiated.

"Orders established under the *Land Act*, or those made under the *Forest Practices Code of British Columbia Act* (the code) and continued under the *Land Act*, are enforceable only through a forest stewardship plan (FSP)" (Forest Practices Board 2012; page 9). Considering the number and type of conditions varies among orders, the thresholds for harvesting or road construction are typically set at 10 hectares or 10% of the OGMA, whichever is less. Generally, if a licensee intends to exceed this amount they must seek an amendment under the *Land Act* and/or their FSP (Forest Practices Board 2012; page 17). The *Oil and Gas Commission* recommends that applicants should minimize impacts to OGMAs and the Forest Practices Board highlights that although oil and gas development may result in a greater number of OGMAs being impacted, as part of project mitigation proponents are encouraged but not necessarily required to avoid or mitigate disturbances to these areas (Forest Practices Board 2012; page 29).

Reference:

Forest Practices Board. 2012. Conserving Old Growth Forests in BC – Implementation of old-growth retention objectives under FRPA. Special Investigation. FPB/SIR/36.

b) Avoidance is the key mitigation measure with respect to Old Growth Management Areas (OGMAs) along the pipeline and the Kingsvale power line followed by minimization of impact to OGMAs and use of existing linear disturbances to the extent practical.

Trans Mountain is committed to looking at compensation/replacement as an option for OGMAs. Compensation/replacement of OGMA incursions or impacts associated with the construction of the pipeline and the Kingsvale power line will be discussed with BC Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO) and BC Ministry of Environment (BC MOE) once the construction right-of-way is finalized. A precise estimate of the area of OGMAs that may be compensated/replaced is not available at this time and as detailed design progresses and the study corridor is narrowed to a construction footprint, the information will become available through the first half of 2015. Trans Mountain plans to meet with BC MFLNRO and BC MOE in Q3/Q4 of 2014 to explore compensation/ replacement opportunities prior to refinement of the construction footprint.

c) Avoidance of Old Growth Management Areas (OGMAs) is the top priority where possible and routing has been adjusted where possible to mitigate impacts to OGMAs and will

continue to be considered as the construction right-of-way is finalized. Once the construction right-of-way is finalized the actual implications to OGMAs will be defined. Implications where much or all of their total area is affected cannot be identified until replacement or mitigation measures are determined. This will be determined through consultation with BC Ministry of Environment and BC Ministry of Forests, Lands and Natural Resource Operations.

d) The types of mitigation measures that can be employed following post-construction environmental monitoring once an issue has been identified, may include, but is not limited to: invasive weed species whereby the Weed and Vegetation Management Plan set out in Appendix C of the Pipeline Environmental Protection Plan can be implemented or if windthrow is identified, then treatment and removal of the trees would be warranted to mitigate the spread of forest health pests. Similar programs were employed successfully on the Anchor Loop project as part of the forest health program.

   Replacement and/or mitigation of OGMA incursions or impacts will be discussed with BC MFLNRO and BC MOE once the construction right-of-way is finalized. This detailed information is not available at this time and can be provided in Q4 2014.

e) To date no specific surveys, quantification, avoidance, mitigation, compensation, and/or monitoring specifically of old growth areas has been recommended outside of OGMAs. Post-construction environmental monitoring has been recommended for OGMAs and along the construction right-of-way for forest health which may include old growth forest area; however, it has not been specifically identified.

   An estimation of old growth areas intersecting the proposed pipeline corridor can be provided in the first half of 2015 once the construction right-of-way and footprint is further delineated. Estimates of old growth will be based on the Vegetation Resource Inventory data.

Summary of New Commitments:

- Any planned clearing within OGMAs will include discussions with licensees, where required.
- An estimate of the area of OGMAs that may be compensated/replaced is not available at this time and will be provided in the first half of 2015 once the construction right-of-way and footprint is further delineated and discussions with BC MFLNRO and BC MOE have been conducted.
- An estimation of old growth areas impacted by the Project will be provided in the first half of 2015 once the construction right-of-way and footprint is further delineated.

2.054 Potential effects on aquatic species at risk from Westridge Marine Terminal construction and operations

Reference:

i) A3S1Q8, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical, Table 6.2-1 – Summary of the Environmental Elements and Considerations for the Westridge Marine Terminal, PDF page 32 of 48
ii) A3S1R0, Application Volume 5A, Environmental and Socio-economic Assessment – Biophysical, PDF page 99 of 260

Preamble:

Reference i) provides a brief summary of the environmental elements and considerations for the Westridge Marine Terminal, including marine species at risk.

Reference ii) states that indicators used to represent marine fish and fish habitat and marine mammals were carefully selected to ensure that the full range of potential Project effects on species at risk was addressed. Mitigation measures to reduce these effects apply to all species at risk, not just the indicators.

The Board requests species-specific information on aquatic species at risk in order to assess potential effects from Westridge Marine Terminal construction and operations.

Request:

a) Please provide a catalog of all aquatic species listed on Schedule I of the SARA that could be found in each of the Westridge Marine Terminal's spatial boundaries.

b) Please discuss the potential effects resulting from Westridge Marine Terminal construction and operations on all species identified in a), excluding species that were assessed as indicator species or in response to previous information requests (in which case, please identify which information requests and the species assessed). For each individual species, this discussion must include, but not be limited to:
   b.1) the frequency of occurrence within the applicable spatial boundaries (e.g. rare, seasonal, etc.);
   b.2) potential habitat usage;
   b.3) potential Project-related mortality (including fish eggs and larvae);
   b.4) potential behavioral impacts;
   b.5) potential effects on population levels;
   b.6) any species-specific mitigation to be undertaken;
   b.7) identification of any critical habitat; and
   b.8) records of engagement with relevant government agencies, stakeholders, and Aboriginal groups.

Response:

The assessment of potential effects of construction and operation of the Westridge Marine Terminal on marine species (*i.e.,* marine fish, marine mammals and marine birds) used an

indicator-based approach, which is a commonly-employed method in environmental assessment. For example, several recent Section 52 and Section 58 Applications to the National Energy Board (NEB) have used an indicator-based approach, including the recently-approved Enbridge Inc. Edmonton to Hardisty Pipeline Project, the NOVA Gas Transmission Ltd. Northwest Mainline Natural Gas Pipeline Expansion Project, and the NOVA Gas Transmission Ltd. Sunday Creek South Lateral Loop No. 3 Pipeline Project. As discussed in Section 7.6.13 of Volume 5A (Filing ID A3S1R0) of the Application, indicator species were carefully selected to ensure the full range of potential Project effects on species listed on Schedule 1 of the *Species at Risk Act* (*SARA*) were addressed. Mitigation measures to reduce potential Project effects on marine species apply to all species at risk, not just indicators.

In April 2013 the assessment team met with Environment Canada to review work plans and discuss the environmental assessment approach. Environment Canada endorsed the use of indicator species to describe potential effects of the Project on marine species, and was largely in agreement with the species proposed. Environment Canada did not, at that time, suggest that an individual assessment of every species at risk potentially affected by the Project was warranted or necessary. In the preamble to GoC EC IR No. 1.029 (Filing ID A3Y2K9), Environment Canada states: 'In an April 2013 meeting with TERA [lead environmental consultant], EC emphasized that species of special conservation status must not be over-stated in the selection of Wildlife Indicators, and that general species more representative on the landscape must not be ignored'. Based on this guidance, marine indicators for the assessment of potential effects of construction and operation of the Westridge Marine Terminal were selected to ensure that the final suite of species was representative of both broader species groups (*e.g.,* foraging guilds of marine birds) and species listed on Schedule 1 of *SARA*.

Trans Mountain is confident that the marine indicators presented in Volume 5A of the Application are appropriate for assessing potential effects of construction and operation of the Westridge Marine Terminal on both species at risk and species not at risk. Having followed the guidance provided by Environment Canada, Trans Mountain does not believe that further assessment of additional marine species listed on Schedule 1 of *SARA* is warranted at this time.

2.055 Potential effects on aquatic species at risk from marine transportation

Reference:

i) A3S4Y0, Application Volume 8A, Marine Transportation, Table 4.2.9.1 – Marine Species at Risk in the Marine RSA, PDF pages 14 to 16 of 34
ii) A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 126 of 294

Preamble:

Reference i) lists all the species at risk that may occur in the Marine Transportation RSA.

Reference ii) states that not all marine species at risk are discussed explicitly under each indicator, and that potential Project effects were assessed in consideration of all species at risk. This reference further states that the indicators used to represent marine fish and fish habitat and marine mammals were carefully selected to ensure that the full range of potential Project effects on species at risk was addressed. Mitigation measures to reduce these effects apply to all species at risk, not just the indicators.

The Board requests species-specific information on aquatic species at risk in order to assess potential effects from marine transportation.

Request:

Please discuss the potential effects resulting from marine transportation on all aquatic species listed on Schedule I of the SARA, excluding species that were assessed as indicator species or in response to previous information requests (in which case, please identify which information requests and the species assessed). For each individual species, this discussion must include, but not be limited to:

a) the frequency of occurrence within the applicable spatial boundaries (e.g. rare, seasonal, etc);

b) potential habitat usage;

c) potential Project-related mortality (including eggs and larvae);

d) potential behavioural impacts;

e) potential effects on population levels;

f) any species-specific mitigation to be undertaken at these locations;

g) identification of any critical habitat; and

h) records of engagement with relevant government agencies, stakeholders, and Aboriginal groups.

Response:

The assessment of potential effects of Project-related marine transportation activities on marine species (*i.e.,* marine fish, marine mammals and marine birds) used an indicator-based approach, which is a commonly-employed method in environmental assessment. For example, several recent Section 52 and Section 58 Applications to the National Energy Board (NEB) have used an indicator-based approach, including the recently-approved Enbridge Inc. Edmonton to Hardisty Pipeline Project, the NOVA Gas Transmission Ltd. Northwest Mainline Natural Gas Pipeline Expansion Project, and the NOVA Gas Transmission Ltd. Sunday Creek South Lateral Loop No. 3 Pipeline Project. As discussed in Section 4.3.9 of Volume 8A (Filing ID A3S4Y3) of the Application, indicator species were carefully selected to ensure the full range of potential Project effects on species listed on Schedule 1 of the *Species at Risk Act* (*SARA*) were addressed. Mitigation measures to reduce potential Project effects on marine species apply to all species at risk, not just indicators.

In April 2013 the assessment team met with Environment Canada to review work plans and discuss the environmental assessment approach. Environment Canada endorsed the use of indicator species to describe potential effects of the Project on marine species, and was largely in agreement with the species proposed. Environment Canada did not, at that time, suggest that an individual assessment of every species at risk potentially affected by the Project was warranted or necessary. In the preamble to GoC EC IR No. 1.029 (Filing ID A3Y2K9), Environment Canada states: 'In an April 2013 meeting with TERA [lead environmental consultant], EC emphasized that species of special conservation status must not be over-stated in the selection of Wildlife Indicators, and that general species more representative on the landscape must not be ignored'. Based on this guidance, marine indicators for the assessment of potential effects of Project-related marine transportation were selected to ensure that the final suite of species was representative of both broader species groups (*e.g.,* foraging guilds of marine birds) and species listed on Schedule 1 of *SARA*.

Trans Mountain is confident that the marine indicators presented in Volume 8A of the Application are appropriate for assessing potential effects of Project-related marine transportation on both species at risk and species not at risk. Having followed the guidance provided by Environment Canada, Trans Mountain does not believe that further assessment of additional marine species listed on Schedule 1 of *SARA* is warranted at this time.

2.056 Potential effects on provincial species of concern from Westridge Marine Terminal construction and operations

Reference:

A3S1Q8, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical, Table 6.2-1 – Summary of the Environmental Elements and Considerations for the Westridge Marine Terminal, PDF page 32 of 48

Preamble:

The reference provides a brief summary of environmental elements and considerations for the Westridge Marine Terminal, including provincial marine species of concern.

The Board requests species-specific information on provincially-listed aquatic species of concern in order to assess potential effects from the construction and operation of Westridge Marine Terminal.

Request:

a) Please provide a catalog of British Columbia's provincially-listed aquatic red and blue species of concern that could be found in each of the Westridge Marine Terminal's spatial boundaries.

b) Please discuss the potential effects resulting from Westridge Marine Terminal construction and operations on all species identified in a), excluding species that were assessed as indicator species or in response to previous information requests (in which case, please identify which information requests and the species assessed). For each individual species, this discussion must include, but not be limited to:
   - b.1) the frequency of occurrence within the applicable spatial boundaries (e.g. rare, seasonal, etc);
   - b.2) potential habitat usage;
   - b.3) potential Project-related mortality (including eggs and larvae);
   - b.4) potential behavioral impacts;
   - b.5) potential effects on population levels;
   - b.6) any species-specific mitigation to be undertaken; and
   - b.7) records of engagement with relevant government agencies, stakeholders, and Aboriginal groups.

Response:

Please refer to the response to NEB IR No. 2.055. The assessment of potential effects of construction and operation of the Westridge Marine Terminal on marine species (*i.e.,* marine fish, marine mammals and marine birds) used an indicator-based approach, which is a commonly-employed method in environmental assessment. As discussed in Section 7.6.13 of Volume 5A (Filing ID A3S1R0) of the Application, indicator species were carefully selected to ensure the full range of potential Project effects on marine species at risk (including those on

British Columbia's Red and Blue lists) were addressed. Mitigation measures to reduce potential Project effects on marine species apply to all species at risk, not just indicators.

Trans Mountain is confident that the marine indicators presented in Volume 5A of the Application are appropriate for assessing potential effects of construction and operation of the Westridge Marine Terminal on both species at risk and species not at risk. Having followed the guidance provided by Environment Canada, Trans Mountain does not believe that further assessment of additional provincially-listed marine species is warranted at this time.

2.057 Potential effects on provincial species of concern from marine transportation

Reference:

i) A3S4Y0, Application Volume 8A, Marine Transportation, Table 4.2.9.1 – Marine Species at Risk in the Marine RSA, PDF pages 14 to 16 of 34
ii) A3S4Y3, Application Volume 8A, Marine Transportation, PDF pages 125 and 126 of 294

Preamble:

Reference i) lists all species at risk that may occur in the Marine Transportation RSA.

Reference ii) states that, for the purpose of this assessment, marine species at risk are considered to include all federally and provincially listed marine species of conservation concern. It also states that, although not all marine species at risk are discussed explicitly under each indicator, potential Project effects were assessed in consideration of all species at risk. The indicators used to represent marine fish and fish habitat and marine mammals were carefully selected to ensure that the full range of potential Project effects on species at risk was addressed. Mitigation to reduce these effects apply to all species at risk, not just the indicators.

The Board requests species-specific information on provincially-listed aquatic species of concern in order to assess potential effects from marine transportation.

Request:

Please discuss the potential effects resulting from marine transportation on British Columbia's provincially-listed aquatic red and blue species of concern, excluding species that were assessed as indicator species or in response to previous information requests (in which case, please identify which information requests and the species assessed). For each individual species, this discussion must include, but not be limited to:

a) the frequency of occurrence within the applicable spatial boundaries (e.g. rare, seasonal, etc);

b) potential habitat usage;

c) potential Project-related mortality (including eggs and larvae);

d) potential behavioral impacts;

e) potential effects on population levels;

f) any species-specific mitigation to be undertaken; and

g) records of engagement with relevant government agencies, stakeholders, and Aboriginal groups..

Response:

Please refer to the responses to NEB IR No. 2.055 and NEB IR No. 2.056.

2.058 Significance evaluation for aquatic indicators for the combined potential residual effects assessment at the Westridge Marine Terminal

Reference:

A3S1R0, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical:

i) Table 7.6.9-3 – Significance Evaluation of Potential Residual Effects of Construction and Operations at the Westridge Marine Terminal on Marine Fish and Fish Habitat, PDF pages 43 and 44 of 260
ii) PDF page 50 of 260
iii) PDF pages 50 to 54 of 260

Preamble:

Reference i) lists the potential residual effects on each marine fish and fish habitat indicator and the resulting significance determination from Westridge Marine Terminal construction and operations.

Reference ii) discusses the significance evaluation for the combined potential residual effects on Dungeness crab from Westridge Marine Terminal construction and operations.

Reference iii) discusses the significance evaluation for the potential residual effects on inshore rockfish from Westridge Marine Terminal construction and operations.

The Board notes the absence of significance evaluations for the combined potential residual effects for some of the aquatic indicators.

Request:

Please submit a significance evaluation for the combined potential residual effects from Westridge Marine Terminal construction and operations for the each of the following indicators, or provide a rationale for why each was omitted from the Application in each case:

a) harbour seal;

b) inshore rockfish; and

c) pacific salmon.

Response:

a) As described in the assessment methodology, Section 7.1.7 of Volume 5A (Filing ID A3S1Q9), for the Project effects assessment, an evaluation of combined adverse residual effects is conducted for those indicators where more than one identified potential adverse residual effect may occur. The evaluation of the combined effects considers only those residual effects that are likely to occur (*i.e.,* of high probability). For harbour seals, only one residual effect of high probability was identified (*i.e.,* sensory disturbance of harbour seals or other marine mammals due to underwater noise produced during pile driving or dredging;

see Table 7.6.11-4 of Volume 5A [Filing ID A3S1R0]). Therefore, the combined potential residual effects from Westridge Marine Terminal construction and operations on harbour seals are the same as the individual effect of sensory disturbance and are determined to be not significant.

b) As described in the assessment methodology, Section 7.1.7 of Volume 5A (Filing ID A3S1Q9), for the Project effects assessment, an evaluation of combined adverse residual effects is conducted for those indicators where more than one identified potential adverse residual effect may occur. The evaluation of the combined effects considers only those residual effects that are likely to occur (*i.e.,* of high probability). For inshore rockfish, only one residual effect of high probability was identified (*i.e.,* decrease in productive capacity of suitable habitat for inshore rockfish due to construction activities; see Table 7.6.9-3 of Volume 5A [Filing ID A3S1R0]). Therefore, the combined potential residual effects from Westridge Marine Terminal construction and operations on inshore rockfish are the same as the individual effect of decreased productive capacity of suitable habitat and are determined to be not significant.

c) As described in the assessment methodology, Section 7.1.7 of Volume 5A (Filing ID A3S1Q9), for the Project effects assessment, an evaluation of combined adverse residual effects is conducted for those indicators where more than one identified potential adverse residual effect may occur. The evaluation of the combined effects considers only those residual effects that are likely to occur (*i.e.,* of high probability). For Pacific salmon, only one residual effect of high probability was identified (*i.e.,* decrease in productive capacity of suitable habitat for Pacific salmon due to construction activities; see Table 7.6.9-3 of Volume 5A [Filing ID A3S1R0]). Therefore, the combined potential residual effects from Westridge Marine Terminal construction and operations on Pacific salmon are the same as the individual effect of decreased productive capacity of suitable habitat and are determined to be not significant.

2.059 Significance evaluation for fish and fish habitat indicators for the combined potential residual effects assessment from Project construction and operations

Reference:

A3S1Q9, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical:

i) Table 7.2.7-3 – Significance Evaluation of Potential Residual Effects of Project Construction and Operations on Fish and Fish Habitat, PDF pages 140 to 143 of 403
ii) PDF page 147 of 403
iii) PDF pages 147 to 151 of 403

Preamble:

Reference i) lists the potential residual effects on each fish and fish habitat indicator and the resulting significance determination from Project construction and operations.

Reference ii) discusses the significance evaluation for the combined potential residual effects on riparian habitat from Project construction and operations.

Reference iii) discusses the significance evaluation for the potential residual effects on instream habitat from Project construction and operations.

The Board notes the absence of a significance evaluation for the combined potential residual effects for instream habitat.

Request:

Please submit a significance evaluation for the combined potential residual effects from Project construction and operations on instream habitat, or provide a rationale for why it was omitted from the Application.

Response:

Trans Mountain evaluated the combined effects on indicators if two or more potential residual effects associated with pipeline construction and operations for that indicator were considered likely to occur (*i.e.,* high probability). The riparian habitat and fish mortality or injury indicators each have multiple high probability potential residual effects which could result in a combined effect for that indicator. However, the instream habitat indicator only has one potential residual effect with a high probability (*i.e.,* alteration of instream habitat within the Zone of Influence), therefore no combined effects assessment was necessary.

2.060 Westridge Marine Terminal - noise from construction activities

Reference:

A3S1R0, Application Volume 5A, Environmental and Socio-Economic Assessment – Biophysical:

i) PDF page 64 of 260
ii) PDF page 65 of 260
iii) PDF page 68 of 260
iv) PDF page 54 of 260
v) PDF page 63 of 260

Preamble:

Reference i) states that cetaceans (including species at risk) may be exposed to sound levels capable of causing permanent auditory damage if they are present in the Marine Mammal LSA during construction. It also indicates that a marine mammal monitoring program will be implemented as an additional mitigation measure so that cetaceans or species at risk that enter the Marine Mammal LSA will not be permanently injured by loud underwater noise.

Reference ii) states that, while mitigation measures are expected to be effective at reducing the occurrence of temporary threshold shifts (TTS), a small number of marine mammals in the vicinity of pile-driving may experience TTS.

Reference iii) states that, while noise levels are likely to exceed the National Oceanic and Atmospheric Administration threshold for behavioural disruption within the Marine Mammal LSA and potentially small portions of the Marine RSA, the literature suggests that pinnipeds may habituate to these sounds.

Reference iv) states that, though unlikely, it is possible a small number of rockfish could be harmed or killed due to underwater noise produced during pile-driving. Therefore, the residual effect is considered to have a negative impact balance.

Reference v) states that a hydrophone will be used to monitor pressure levels during pile-driving, so as to reduce potential fish injury or mortality. It further states that the hydrophone will be monitored at the onset of pile-driving to confirm assumptions concerning source levels, potential exceedances of marine mammal auditory injury levels, and mitigation measure effectiveness.

The Board requests more information on the potential effects of underwater noise, specifically regarding distances that auditory injury or sensory disturbances can be expected for different species.

Request:

a) Please provide underwater noise contour plots for Sound Exposure Levels and Sound Pressure Levels from pile-driving in the Westridge Marine Terminal RSA, including, but not be limited to:

a.1) different proposed pile-driving techniques, with and without bubble curtains, and dredging methods;
a.2) maximum distances for permanent auditory injury, temporary auditory injury, and sensory disturbances for marine fish and marine mammals; and
a.3) cetacean exclusion zones, Rockfish Conservation Areas, Fisheries and Oceans Canada (DFO) Important Area for Dungeness Crab, haulout sites for pinnipeds, and any other sensitive areas for marine fish or marine mammals in the Westridge Marine Terminal RSA.

b) Please discuss, using the predicted sound levels in a), the potential effects of underwater noise caused by construction activities at the Westridge Marine Terminal on marine fish and marine mammals. This discussion must address, at a minimum:
b.1) potential effects on species in any sensitive areas referenced in a);
b.2) potential effects on cetaceans outside the exclusion zone;
b.3) additional mitigation measures to avoid permanent threshold shift, TTS, and sensory disturbance for marine mammals and marine fish (e.g., pile-driving multiple piles at once to reduce duration of impacts); and
b.4) references to threshold levels used in the Application.

Response:

a.1) Underwater noise modelling for construction activities at Westridge Marine Terminal (WMT) has not been conducted, but the following information is provided in response to specific issues raised in the request.

During pile driving, a cetacean exclusion zone will be implemented, and if cetaceans or species at risk are detected within the exclusion zone, the underwater construction activity will be immediately stopped until the marine mammal has been observed to exit the exclusion zone, or has not been re-sighted for 30 minutes. The area of the exclusion zone (generally set at 500 m from the sound source) will be confirmed through discussion with Fisheries and Oceans Canada (DFO), and may involve acoustic modelling if deemed necessary during the permitting phase. With the implementation of this mitigation measure, no cetaceans or species at risk are expected to be exposed to sound levels capable of causing permanent auditory injury. At the onset of pile-driving, a hydrophone will be deployed and monitored to confirm the assumptions concerning source levels, potential exceedance of marine mammal auditory injury levels, and effectiveness of mitigation measures (e.g., bubble curtains).

As discussed in Section 7.6.9.6, Volume 5A of the Facilities Application (Filing ID A3S1R0), underwater noise levels produced during dredging and vibratory pile installation will not exceed the injury threshold for fish. If an impact hammer is required, bubble curtains will be deployed over the full length of the wetted pile to assist in attenuating underwater noise. With this mitigation measure, noise levels are not expected to exceed the injury threshold for fish, except possibly within the immediate vicinity (i.e., several metres) of the pile. Any fish within this range are expected to relocate in response to the preparatory activities such as pile placement and/or installation of bubble curtains. As committed to in Section 7.6.9.6, Volume 5A (Filing ID A3S1R0), a hydrophone will be used to monitor pressure levels from

pile driving. Should the sound pressure exceed 30 kPa, the work will stop immediately and the methods will be reviewed and corrected to ensure acceptable conditions. These mitigation measures are in accordance with the Best Management Practices for Pile Driving and Related Operations, developed by the BC Marine and Pile Driving Contractors Association.

a.2) Refer to the response to NEB IR No. 2.060a.1.

a.3) A Rockfish Conservation Area and DFO Important Area for Dungeness crab overlap the Marine Fish and Fish Habitat LSA (see Figures 4.3 and 4.5, Volume 5C, Biophysical Technical Report 5C13, Marine Resources – Westridge Marine Terminal Technical Report [Stantec Consulting Ltd. December 2013], Filing ID A3S2R7). Burrard Inlet has also been identified as a DFO Important Area for Pacific Salmon. No DFO Important Areas or critical habitat for marine mammal species at risk have been identified or designated in the Marine RSA (WMT). There are no rookeries or major haul-outs for Steller sea lions in the Marine RSA. Terrestrial haul-out sites for harbour seals, used for resting, mating, and pupping, include isolated rocks or islets, sandbars, log booms, and recreational floats and may be found throughout the coastal waters of BC (including within the Marine RSA).

b) As noted in the response to NEB IR No. 2.060a, underwater noise modelling for activities associated with construction of the Westridge Marine Terminal has not been conducted. Potential effects on marine mammals in and outside the exclusion zone are discussed in Section 7.6.11 of Volume 5A, B5-21 (Filing ID A3S1R0) alongside mitigation measures and thresholds used in the assessment. Potential effects of underwater noise on marine fish are assessed in Section 7.6.9 of Volume 5A (Filing ID A3S1R0) alongside mitigation measures and thresholds used in the assessment. An additional discussion of the effects of underwater noise on the behaviour of migratory marine fish is provided in the response to NEB IR No. 2.064. The assessment was based on sound levels measured during other construction projects, reasonable assumptions concerning engineering details, and commonly applied threshold levels.

2.061 Potential effects on pinnipeds from atmospheric noise

Reference:

i) A3S4Y3, Application Volume 8A, Marine Transportation, PDF pages 74 and 75 of 294
ii) A3S1R0, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, PDF page 67 of 260

Preamble:

Regarding atmospheric noise, Reference i) states that repeated disturbance of rookeries or haulouts by construction, aircraft, boats, or fishing activities may result in temporary, or even permanent, abandonment of these areas. The reference highlights the Fisheries and Oceans Canada Management Plan for the Steller sea lion, which states that this species "often habituate to chronic disturbances" and notes that there are currently haulout sites in "high traffic areas close to major urban centres such as Vancouver and Victoria." It also states that this is not predicted to change as a result of the increase in Project-related atmospheric vessel noise. As such, the potential effect of atmospheric noise on marine mammals is not discussed further.

Reference ii) states that the extent of sensory disturbance to pinnipeds depends on numerous factors, including the source level, frequency, and attenuation rate of the underwater sound, as well as the species, proximity, activity state, and individual marine mammal in question.

The Board requests a further potential effects assessment of atmospheric noise impacts on all pinniped species.

Request:

Please provide:

a) the locations of pinniped haulouts or rookeries in the Marine Transportation RSA;

b) a discussion on the potential effects of sensory disturbance caused by atmospheric noise, including, but not limited to:

- the areas referenced in a); and
- how an increase in the number of vessels, both Project-specific and cumulatively, may impact pinnipeds at haulouts or rookeries; and

c) a discussion on the potential effects on pinnipeds of atmospheric noise created from Westridge Marine Terminal construction activities.

Response:

a) There are no Steller sea lion rookeries within or in close proximity to the Marine Regional Study Area (RSA); however, Carmanah Point, located on the western shore of Vancouver Island, has been consistently used as a year-round pinnipeds haulout site. The Marine Protected Area at Race Rocks protects an important winter haulout site for California and Steller sea lions. Elephant seals also haul out at Race Rocks and in recent years a few pups

have been born there. Unlike Steller sea lions, which congregate to breed, birth, and rear their pups on a very limited number of rookeries in British Columbia (BC), harbour seals are ubiquitous in BC's coastal waters, and use over a thousand haulout sites to rest, moult, mate, and give birth to their pups, which enter the water only a few hours after birth (Fisheries and Oceans Canada 2010). These haulout sites often include reefs, rocks, islets, sandbars, floats, wharves and log booms, and these occur throughout the Marine RSA as well as throughout the rest of BC's coastal waters.

Important marine mammal areas, including Carmanah Point, Race Rocks Ecological Reserve and other important haulouts, are described and mapped based on readily available information in Technical Report 8B-1, Volume 8B, Marine Resources Technical Report (Stantec Consulting Ltd. December 2013), B19-2 (Filing ID AS34J5). See in particular Section 4.3.4 and Figure 4.5 in the aforementioned report.

Reference:

Fisheries and Oceans Canada. 2010. Population Assessment Pacific Harbour Seal (*Phoca vitulina richardsi*). Fisheries and Oceans Canada Canadian Science Advisory Secretariat Science Advisory Report. 2009/011.

b) Southall *et al.* (2007) have proposed a precautionary value of 109 dB re: 20µPa (peak, unweighted), as a threshold for behavioural responses of pinnipeds to single pulses of atmospheric noise. Quantitative values for multiple pulses and non-pulse noises (such as from shipping) were not provided (Southall *et al.* 2007). The National Oceanic and Atmospheric Association (NOAA) used an in-air value of 90 dB re: 20µPa (root mean square [RMS], unweighted) for the onset of behavioural disruption of harbour seals, and 100 dB_{RMS} re: 20µPa for non-harbour seal pinnipeds (NOAA 2013).

Atmospheric noise attenuates quickly with distance. At Race Rocks Ecological Reserve (an important pinniped haulout and one of the closest points of approach in the Marine RSA), the distance to the outbound shipping lane is approximately 4.7 km. Atmospheric noise from Project-related shipping activities was not explicitly modelled or analyzed with respect to potential effects on pinnipeds. However, review of the atmospheric sound modelling completed for the Application suggests that pass-by of an Aframax or Panamax ship (engines at 40% load) and tug (at 80% load) would result in an L_{max} at Race Rocks of 44 dB re: 20µPa. The dominant sound level is created by the tug accompanying the tanker. Based on the sound source data used for the attenuation curves shown in Figures 4-2 and 4-3 in Technical Report 8B-4 of Volume 8B, Marine Atmospheric Noise Report, B19-9 (Filing ID A3S4K2) the distance from the tankers and tugs where the 90 dB re: 20µPa guidance may be exceeded is estimated at 25 meters, a distance at which only swimming pinnipeds may be exposed.

Exceedance of 90 dB re: 20µPa is therefore not predicted at Race Rocks or any other haulout in the Marine RSA and no behavioural disruption of pinnipeds is expected as a result of atmospheric noise from vessels (either Project-related or cumulatively).

References:

National Oceanic and Atmospheric Administration Fisheries. 2013. Interim Sound Threshold Guidance.Website: http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html Accessed: July 2014.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas and P.L. Tyack. 2007. Special Issue: Marine mammal noise exposure criteria. Aquatic Mammals 33(4):411-509.

c) Atmospheric noise from Westridge Marine Terminal construction activities was not explicitly modelled or analyzed with respect to potential effects on pinnipeds. In assessing potential effects of atmospheric noise on humans, either an A- or C-weighted curve is applied to correct the sound level measurement for the frequency-dependent hearing function of humans. The measurement endpoint used in the Application's Acoustic Environment valued component (VC) for the atmospheric sound level indicator was the energy equivalent (L_{eq}) sound level measured in A-weighted decibels (dBA). The overall $L_{eq(1hour)}$ dBA sound levels differ from the peak or spectral sound levels that are required to obtain a more accurate dBZ (i.e., linear or unweighted) prediction (i.e., the sound levels required for a comparison to the unweighted sound pressure levels (SPLs) predicted to affect pinnipeds). Based on a comparison of spectral data for similar types and sizes of heavy machinery as proposed for Project construction, there is on average a 6-8 dB increase in overall sound level going from dBA to dBZ. There is also an increase in sound level when going between the $L_{eq(1hour)}$ and instantaneous peak value.

Atmospheric construction noise from the Westridge Marine Terminal will include both continuous and impulsive elements. With respect to continuous atmospheric noise levels, the National Oceanic and Atmospheric Association (NOAA) uses an in-air value of 90 dB re: 20µPa (root mean square [RMS], unweighted) for the onset of behavioural disruption of harbour seals, and 100 dB_{RMS} re: 20µPa for non-harbour seal pinnipeds (NOAA 2013).

Based on the sound source data used for the attenuation curves shown in Figure 5-1 in Technical Report 5C-3 of Volume 5C, Terrestrial Noise and Vibration Technical Report, B6-6 (Filing ID A3S1T7) the loudest activity outside of "site clearing" (i.e., tree cutting) is "pipe placement" which is general activity involving multiple cranes and auxiliary vehicles. The distance from this general onshore construction activity where the 90 dB re: 20µPa guidance may be exceeded is estimated at 90 meters, a distance at which pinnipeds presence is considered unlikely given the large amount of activity on-site at this time.

The largest potential source of concern for atmospheric noise effects on pinnipeds will be the pile driving operations that are anticipated to occur onshore and offshore for the new berths and related activities. Southall *et al.* 2007 suggest that permanent threshold shifts (PTS; *i.e.,* auditory injury) are predicted for pinnipeds exposed to in-air SPLs of 149 dB re: 20µPa (peak, unweighted), and onset of temporary threshold shifts (TTS; *i.e.,* auditory fatigue) are predicted at 143 dB re: 20µPa (peak, unweighted).

Due to the impulsive nature of pile driving, the instantaneous peak level would be higher than the hourly averaged values presented in the Application. The instantaneous peak level and the conversion factor between dBA and dBZ are both dependent on the type of pile driver being used, which has not been finalized at this time. However, based on conservative assumptions used in Table 5-13 in Technical Report 5C-3 of Volume 5C, Terrestrial Noise and Vibration Technical Report, B6-6 (Filing ID A3S1T7) unweighted atmospheric SPLs are not predicted to exceed the PTS or TTS thresholds at 1 m from pile driving activities, and are not predicted to even approach these values at distances of 5 m or greater. Given that pinnipeds are unlikely to approach within a few metres of active pile installation operations, PTS and TTS are not anticipated as a result of atmospheric noise emissions during construction activities.

As discussed in the response to part b) above, Southall *et al.* 2007 have proposed a precautionary value of 109 dB_{peak} re: 20µPa as a threshold for behavioural responses of pinnipeds to single pulses of atmospheric noise (quantitative values for multiple pulses and non-pulse noise are not provided). Atmospheric noise levels will attenuate quickly with distance (geometric divergence) from the sound source and while there may be some behavioural disturbance in close proximity to the pile installation operations, geometric divergence is expected to further prevent the possibility of TTS or PTS. Mitigation measures in place to reduce the degree of sensory disturbance from underwater noise will also be effective at reducing any sensory disturbance from atmospheric noise during loud marine construction activities. Potential effects on pinnipeds of atmospheric noise created from Westridge Marine Terminal construction activities are therefore considered to be not significant.

References:

National Oceanic and Atmospheric Administration Fisheries. 2013. Interim Sound Threshold Guidance.Website: http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html Accessed: July 2014.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas and P.L. Tyack. 2007. Special Issue: Marine mammal noise exposure criteria. Aquatic Mammals 33(4):411-509.

2.062 Aquatic species at risk permits

Reference:

A3S4Y3, Application Volume 8A, Marine Transportation:

i) PDF page 93 of 294
ii) PDF page 244 of 294
iii) Species at Risk Act, PDF page 37 of 104
iv) A3S2C1, Application Volume 5C, Environmental and Socio- Economic Assessment – Biophysical Technical Reports, TR 5C-7 – Fisheries (British Columbia) Technical Report, PDF pages 95 to 101 of 106

Preamble:

Reference i) states that the potential effects of increased Project-related marine vessel traffic are determined to be significant for southern resident killer whales.

Reference ii) states that, even though the Project contribution to overall underwater noise represents only one component of current and future marine transportation sources for underwater noise, the Project's contribution to potential cumulative effects of sensory disturbance is determined to be significant for southern resident killer whales.

Reference iii) outlines the terms to obtain a SARA agreement or permit. Reference iv) includes descriptions of federally-listed fish species at risk (Schedule 1 of the SARA), including their distribution throughout the RSA and LSA, and provides the watercourse crossings where they could potentially be located.

Request:

For each aquatic Schedule I SARA species, please:

a) identify any activities related to the construction and operation of the Project and the Westridge Marine Terminal, including marine transportation, that may require a SARA permit;

b) describe, for each activity that may require a SARA permit, how the survival of the species will not be jeopardized, as well as the mitigation that will be undertaken to minimize the impact on the species or its critical habitat;

c) indicate when the SARA permit will be applied for; and

d) provide a summary of Trans Mountain's consultation with relevant government agencies, stakeholders, and Aboriginal groups in relation to a), b), and c).

Response:

a) Trans Mountain does not intend to apply for any SARA permits for marine aquatic Schedule I SARA species for activities related to the construction and operation of the Project and the Westridge Marine Terminal, including marine transportation.

While Trans Mountain can actively enforce restrictions on tankers docked at the Westridge Marine Terminal to comply with Trans Mountain operating practices and standards, once the tanker departs from the terminal, Trans Mountain has little direct control over the operating practices of the tankers or tugs as Project-related marine vessels are owned and operated by a third party. Marine transportation in Canadian waters is authorized and regulated through the *Canada Shipping Act, 2001* and related legislation, and regulations are administered by Transport Canada and the CCG.

Trans Mountain is not aware of any requirement for current vessel operators in the Marine Regional Study Area (Marine RSA) to obtain a SARA permit for routine shipping operations or other vessel activities. With respect to the reference to southern resident killer whales included in the preamble, the determination of significance for southern resident killer whales was in relation to the potential effects of increased Project-related marine vessel traffic in the Marine RSA. The Marine RSA encompasses a busy marine intersection of a wide range of vessel traffic travelling to and from the urban ports of Vancouver, Victoria, and Seattle, as well as locally around each of these centres and the Gulf and San Juan islands. While current ambient underwater noise conditions may already exceed levels predicted to cause sensory disturbance, not all of this noise is associated with commercial shipping activities (*i.e.,* tankers, tugs, cargo containers, and bulk carriers). This area also contains high levels of vessel traffic associated with passenger lines (*i.e.,* ferries and cruise ships), commercial and recreational fishing vessels, and both commercial tourism (*e.g.,* whale watching) and general recreational vessels. Should SARA permits become a future requirement for commercial, passenger, commercial fishing, recreational fishing, and commercial tourism marine vessel activities, they would need to be obtained for all Project-related marine vessels.

b) Please refer to the response to part a) above.

c) Please refer to the response to part a) above.

d) Please refer to the response to part a) above. Trans Mountain has not discussed the need for acquiring SARA permits for marine species with any outside parties.

2.063 Effects of wave action on sensitive habitat

Reference:

i) A3S4X8, Application Volume 8A, Marine Transportation, Table 4.2.6.2 – Length and Relative Abundance of Shore Types in the Canadian Portion of the Marine LSA and Marine RSA, PDF page 18 of 23
ii) A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 55 of 294

Preamble:

Reference i) identifies the intertidal substrate types that are located within the Marine LSA and RSA.

Reference ii) states that potential effects associated with vessel wakes include: 1) the physical disturbance of fish habitat due to increased erosion of sediments or dislodging of structure-forming organisms along the shoreline (e.g., algae, sessile invertebrates); and 2) injury or mortality of marine fish due to the dislodging of fish eggs (roe) from shoreline substrates and/or the stranding of fish migrating or foraging along the shoreline.

The Board does not consider the use of substrate type as an effective indicator for potential biological effects from vessel wakes.

Request:

a) Please identify the biological sensitive areas (e.g., eelgrass beds) within the intertidal zone of the Marine Transportation LSA.

b) Please discuss the predictive effects of wave action (e.g., wave height, sediment suspension, etc.) on the biologically sensitive areas identified in a).

Response:

a) The distribution of eelgrass beds and eelgrass biobands within the Marine Fish and Fish Habitat local study area (LSA) and the Marine regional study area (RSA) is shown in Figures 2.063-1 through 2.063-5 (NEB IR No. 2.063a - Attachments 1, 2, 3, 4 and 5). No other marine fish habitats potentially sensitive to vessel wake generated by Project-related vessels have been identified within the Marine Fish and Fish Habitat LSA. Data for eelgrass beds were obtained from two sources: the Coastal Resource Information Management System (CRIMS 2004); and the British Columbia Marine Conservation Analysis (BCMCA 2009). Data for eelgrass biobands were obtained from the British Columbia Marine Conservation Analysis (BCMCA 2008).

   The eelgrass polygons shown in Figures 2.063-1 through 2.063-5 (NEB IR No. 2.063a – Attachments 1 through 5) represent mapped eelgrass beds. The eelgrass biobands are derived from provincial shorezone mapping data, and represent shorezone units within which eelgrass has been observed. Because not all eelgrass beds on the British Columbia coast have been mapped, the eelgrass polygons likely underestimate the true distribution of eelgrass. However, the eelgrass biobands are assumed to encompass all existing eelgrass

beds, including those that have not been physically delineated. According to the metatada provided for the eelgrass biobands, 'areas not depicting eelgrass biobands can be assumed to be an eelgrass absence' (BCMCA 2008).

References:

British Columbia Marine Conservation Analysis. 2008. Eelgrass Bioband Data: BCMCA_ECO_VascPlants_Eelgrass_Bioband_Data (digital file).

British Columbia Marine Conservation Analysis. 2009. Eelgrass Polygons Data: BCMCA_ECO_VascPlants_Eelgrass_Polygons_Data (digital file).

Coastal Resource Information Management System. 2004. Eelgrasses (digital file). British Columbia Ministry of Forests, Lands and Natural Resource Operations.

b) As shown in Figures 2.063-1 through 2.063-5 (NEB IR No. 2.063a - Attachments 1, 2, 3, 4 and 5), most mapped eelgrass beds and eelgrass biobands are found within the protected waters of the Gulf Islands, outside of the Marine Fish and Fish Habitat local study area (LSA). Large eelgrass beds also occur on Roberts Bank and in Boundary Bay. Based on the available data, there are no mapped eelgrass beds within the Canadian portion of the Marine Fish and Fish Habitat LSA. The total length of eelgrass biobands within the Canadian portion of the Marine Fish and Fish Habitat LSA is 1.2 km, which represents 0.9% of the total shoreline length (108.9 km). By comparison, the total area of mapped eelgrass beds within the Canadian portion of the Marine regional study area (RSA) is 74,484,411 m^2. The total length of eelgrass biobands within the Canadian portion of the Marine RSA is 311,741 km, which represents 13.5% of the total shoreline length (2,315 km).

The dominant factors influencing eelgrass distribution within the Marine Fish and Fish Habitat LSA are likely substrate type and exposure. A lack of soft sediment habitat combined with natural exposure to currents and wind-generated waves appear to limit the distribution of eelgrass along shoreline habitats adjacent to the shipping lanes. Eelgrass is typically found in sheltered habitats with low to moderate currents and low wave action. Most shoreline habitats along the shipping lanes have relatively high fetch, which results in larger wave heights compared to more sheltered habitats (*e.g.,* the inner Gulf Islands). In addition, the dominance of rock, gravel and anthropogenic shoreline types within the Marine Fish and Fish Habitat LSA means that suitable habitat for eelgrass (*i.e.,* soft sediment) is relatively rare in this area (for a detailed discussion of shoreline types within the Marine Fish and Fish Habitat LSA, see Section 4.3.6.6 in Volume 8A, Filing ID A3S4Y3).

As discussed in Section 4.3.6.6.1 of Volume 8A (Filing ID A3S4Y3), wake waves generated by Project-related tankers and tugs transiting the shipping lanes are predicted to be < 0.1 m in height at the shoreline, which is well within the range of natural wave conditions. In addition to wind-generated waves, which can be substantial in height especially during the winter months, the shipping lanes are heavily utilized by vessel traffic. For example, in 2012 a total of 8,896 vessels were recorded transiting through Haro Strait (see Table 4.4.1.2 in Volume 8A, Filing ID A3S4Y3). This included 391 tankers, 4,506 cargo carriers, and 975 tugs. Wake waves from these vessels would be similar in height to those generated by

Project-related vessels. Although there are no mapped eelgrass beds within the Canadian portion of the Marine Fish and Fish Habitat LSA, any eelgrass beds that are present (*i.e.,* within the eelgrass biobands) would be acclimated to existing levels of exposure (both natural wave conditions and wake waves from existing vessel traffic). It is therefore considered unlikely that any eelgrass beds located within the Marine Fish and Fish Habitat LSA will be adversely affected by the Project.

2.064 Potential effects on migrating fish species from Westridge Marine Terminal construction

Reference:

A3S2R7, Application Volume 5C, Environmental and Socio-Economic Assessment – Biophysical Technical Reports, TR 5C-13 – Marine Resources Westridge Marine Terminal Technical Report,

i) PDF page 38 of 109
ii) Appendix A – Figures, Figure 4.4 – Salmon-bearing Rivers and Streams Entering the Marine RSA and DFO Important Areas for Pacific Salmon, PDF page 89 of 109
iii) A3S1Q8, Application Volume 5A, Environmental and Socio- Economic Assessment – Biophysical, Table 6.2-1 – Summary of the Environmental Elements and Considerations for the Westridge Marine Terminal, PDF page 29 of 48
iv) A3S4Y0, Application Volume 8A, Marine Transportation, Table 4.2.9.1 – Marine Species at Risk in the Marine RSA, PDF pages 14 to 16 of 34.

Preamble:

Reference i) states that Fisheries and Oceans Canada has identified 12 salmon-bearing rivers and streams that drain into the Westridge Marine Terminal Marine RSA. Reference i) further states that Burrard Inlet has been recognized by Fisheries and Oceans Canada as an Important Area for Pacific salmon.

Reference ii) identifies the locations of Pacific salmon Important Areas and salmon-bearing streams that drain into the Westridge Marine Terminal RSA.

Reference iii) states that marine riparian, intertidal, and subtidal habitat is used by marine fish and invertebrates for spawning, rearing, migration, and foraging in the Westridge Marine Terminal RSA.

Reference iv) indicates the presence of marine fish species that migrate into freshwater areas to spawn, such as the eulachon, in the Marine Transportation RSA.

The Board notes that various fish species use the Westridge Marine Terminal RSA for migration into adjacent watercourses. The Board requires additional information on the potential behavioral impacts on migratory fish species from noise produced from the construction of Westridge Marine Terminal.

Request:

Please discuss the potential effects of underwater noise produced from Westridge Marine Terminal construction for various species of migrating fish. This discussion must address, at a minimum, the alteration or prevention of fish migration, and population effects.

Response:

Migratory fish species found in the Marine regional study area (RSA) for the Westridge Marine Terminal include all five species of Pacific salmon (pink [*Oncorhynchus gorbuscha*], chum [*O. keta*], coho [*O. kisutch*], Chinook [*O. tshawytcha*]) and sockeye [*Oncorhynchus nerka*]), steelhead [*O. Mykiss]*, and Pacific herring [*Clupea pallasii*]). Eulachon (*Thaleichthys pacificus*) are not likely to occur in the Marine RSA, as there are no eulachon spawning rivers in Burrard Inlet. Juvenile salmon are expected to migrate through the Marine Fish and Fish Habitat local study area (LSA) for the Westridge Marine Terminal during their outbound migration from creeks and rivers in Port Moody Arm and Indian Arm. Adults are also expected to pass through the Marine Fish and Fish Habitat LSA during their return migration to spawning habitats. Juvenile and adult Pacific herring may occur within the Marine Fish and Fish Habitat LSA; however, their abundance is expected to be low as there are no known herring spawning areas in the vicinity of the Westridge Marine Terminal or along adjacent shoreline habitats.

During construction of the Westridge Marine Terminal, most underwater noise will be generated by pile installation. As discussed in Section 7.6.9.6 of Volume 5A (Filing ID A3S1R0), a vibratory method of pile installation will be used wherever technically feasible in order to reduce underwater noise. In general, a vibratory driver produces sound pressure levels (SPLs) that are roughly 25 dB lower, on average, than those produced by an impact hammer in a comparable setting (Illingworth and Rodkin Inc. 2007, McCauley and Salgado Kent 2008). In cases where an impact hammer is required (*e.g.,* to seat a pile into bedrock or drive a pile through compact substrate), bubble curtains will be deployed over the full length of the wetted pile to assist in attenuating sound levels. Underwater noise will also be generated by dredging equipment, although source levels are typically lower than those produced during pile installation. Dredging activities are expected to take approximately 2 months to complete, and will be scheduled to occur within the Fisheries and Oceans Canada (DFO) least-risk window for Burrard Inlet, which is from August 16 to February 28, unless otherwise authorized by DFO. This timing will avoid the bulk out-migration of juvenile salmon from Burrard Inlet.

As discussed in Section 7.6.9.6 of Volume 5A (Filing ID A3S1R0), underwater noise produced during in-water construction activities (*e.g.,* dredging and pile installation) may cause some fish species to temporarily avoid habitats within the Marine Fish and Fish Habitat LSA. Although no explicit behavioural thresholds exist for fish, studies have shown that some species of fish, including salmonids, exhibit startle and avoidance responses to underwater sound (McCauley *et al.* 2000, Nedwell *et al.* 2006, Wardle *et al.* 2001). Because salmon are hearing generalists and, therefore, assumed to be relatively insensitive to underwater noise, behavioural responses are expected to be limited in spatial extent and short-lived (Nedwell *et al.* 2006). Indeed, studies that have investigated the behavioural responses of caged salmonids to noise generated during pile installation have found little or no response, even at very close distances (Nedwell *et al.* 2006, Ruggerone *et al.* 2008).

Few field studies have investigated the behavioural responses of marine fish to noise generated during pile installation, likely due to the inherent difficulty of observing fish in their natural environment. In a Master's study conducted near Everett, Washington, Feist (1991) assessed the effects of impact pile driving on the behaviour and distribution of schools of juvenile pink and

chum salmon. The study found that the number of schools located in proximity of two pile driving rigs was lower on days with active pile driving compared to days without pile driving. However, the distribution of schools relative to the shoreline was apparently unaffected by pile driving; most fish were observed within 2 m of shore on both pile driving and non-pile driving days. In addition, pile driving activities did not appear to affect the foraging ability of juvenile salmon, as stomach content analysis indicated that most fish were actively feeding. Unfortunately, underwater noise levels were not measured in this study, making it difficult to interpret the results in relation to other pile installation projects.

While the lack of scientific investigation into the effects of pile driving on salmon behaviour makes it difficult to accurately predict the spatial extent of potential startle and avoidance responses, there is no evidence in the scientific literature to suggest that localized marine construction activities alter or prevent salmon migration. While juvenile salmon likely use habitats in the vicinity of the Westridge Marine Terminal to some extent for rearing and foraging, the area does not possess the habitat attributes that would make it a high value nursery habitat (*e.g.,* kelp, eelgrass, saltmarsh vegetation, complex shoreline). In addition, there are no salmon-bearing creeks or streams in the vicinity of the Westridge Marine Terminal. Therefore, temporary, localized avoidance of nearshore habitats within the Marine Fish and Fish Habitat LSA during periods of in-water construction is not expected to affect the viability of any local salmon populations.

References:

Feist, B.E. 1991. Potential impacts of pile driving on juvenile pink (*Oncorhynchus gorbuscha*) and chum (*O. keta*) salmon behaviour and distribution. M.Sc. Thesis, University of Washington. 66 pp.

Illingworth and Rodkin Inc. 2007. Compendium of Pile Driving Sound Data. Prepared for the California Department of Transportation. Petaluma, CA. 129 pp.

McCauley, R.D. and C.P. Salgado Kent. 2008. Pile Driving Underwater Noise Assessment, Proposed Bell Bay Pulp Mill Wharf Development. Prepared for Gunns Limited. Centre for Marine Science and Technology Report 2008-27. Curtin University, Perth, Australia.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M.N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch and K. McCabe. 2000. Marine seismic surveys: analysis and propagation of air-gun signals and effects of air-gun exposure on humpback whales, sea turtles, fishes and squid. No. R99-15. Prepared for Australian Petroleum Production and Exploration Association, Centre for Marine Science and Technology, Curtin University. Perth, Australia. 198 pp.

Nedwell, J.R, A.W.H. Turnpenny, J.M. Lovell and B. Edwards. 2006. An investigation into the effects of underwater piling noise on salmonids. Journal of the Acoustical Society of America 120(5): 2550-2554.

Ruggerone, G.T., S. Goodman and R. Miner. Behavioural Response and Survival of Juvenile Coho Salmon Exposed to Pile Driving Sounds. Prepared for Port of Seattle. 42 pp.

Wardle, C.S., T.J. Carter, G.G. Urquhart, A.D.F. Johnstone, A.M. Ziolkowski, G. Hampson and D. Mackie. 2001. Effects of seismic air guns on marine fish. Continental Shelf Research 21(8-10): 1005-1027.

2.065 Marine Mammal Protection Program

Reference:

i) A3W9H8, Trans Mountain Response to Board IR No.1, IR 1.56, PDF page 330 of 421
ii) A3S4Y3, Application Volume 8A, Marine Transportation, PDF page 209 of 294

Preamble:

Reference i) states that ship design guidelines for designers, shipbuilders, and ship operators have recently been released by an International Maritime Organization Design and Equipment Sub-Committee (IMO n.d.). It further states that expert workshops have been occurring to develop guidelines for mitigating underwater noise effects so that, going forward, other parties (such as industry) and government can apply standardized management. In addition, Trans Mountain engagement efforts to date have identified a number of other initiatives directly and indirectly related to the study of marine mammals in the Salish Sea.

Reference ii) states that ship strikes leading to marine mammal fatalities can and do occur, but such occurrences are infrequent relative to the number of vessels (of all sizes and classes) on the water. It also indicates that a vessel strike resulting in minor injuries may be low magnitude; however, mortality of a SARA-listed species would be considered high magnitude..

Request:

Please discuss:

a) how Trans Mountain will incorporate any future guidelines or standards for reducing underwater noise from commercial vessels into its Tanker Acceptance Standards;

b) how Trans Mountain plans to include any of the results from the research initiatives discussed in the response to Board IR 1.56 into their Marine Mammal Protection Program; and

c) the potential effects on cetacean populations from vessel strikes, including discussion on:
   - c.1) increased mortality to a species that has low reproductive rates and low population numbers (e.g., the southern resident killer whale);
   - c.2) increased risk of vessel strikes, both from traffic associated with this Project and cumulatively;
   - c.3) potential mitigation measures; and
   - c.4) how Trans Mountain will promote the implementation of applicable aspects of the Marine Mammal Protection Program to vessels docking at the Westridge Marine Terminal

Response:

a) The Tanker Acceptance Standards require all accepted vessels to meet all applicable international and local rules and regulations. Should future guidelines or standards for reducing underwater noise from commercial vessels come into force as international and local rules and regulation, the vessel would meet those. Trans Mountain is not aware of any

vessels in the current global tanker fleet that are specifically designed to mitigate underwater noise effects and, therefore, supports any regional initiative by industry promoting operational best practices that assist in reducing underwater noise from commercial vessels. Trans Mountain shall ensure that such initiatives, once developed, are included as requirements to the Tanker Acceptance Standards and will actively promote their use by tankers nominated to load at Westridge Marine Terminal, within the broader framework of the overall acceptance criteria, *e.g.,* vessel age criteria. As part of change management, Trans Mountain will also raise awareness of such initiatives with its shippers and carriers and also seek its implementation during their vessel selection process. Trans Mountain remains committed to working cooperatively with governments and industry on this matter.

b) Information from the research initiatives will form part of an adaptive approach to manage and monitor Project effects. Results are also expected to be of value to other organizations and proponents, and where applicable, will be used to support the recovery strategies and action plans for species of conservation concern. The Marine Mammal Protection Program will be a living document and, therefore, may go through multiple iterations over the life of the Project as the various programs develop over time; all updates will be filed with the National Energy Board.

c) Please see Trans Mountain's response to Tsawwassen FN IR No. 1.16 (Filing ID A3Y3U7).

The only known potential mitigation measures relevant to the Salish Sea to reduce the risk of marine mammal vessel strikes are: (1) to alter the shipping lanes to avoid sensitive habitat (*i.e.,* whale aggregation areas), and (2) to set speed restrictions. Shipping lanes are set by Transport Canada and within the Marine RSA there are no alternative routings that would avoid killer whale critical habitat. Speed restrictions could also be set at the discretion of Transport Canada, but to be most effective would need to apply to all vessels (*i.e.,* commercial shipping activities [tankers, tugs, cargo containers, and bulk carriers], passenger lines [ferries and cruise ships], commercial and recreational fishing vessels, and both commercial tourism [*e.g.,* whale watching] and general recreational vessels) as all sizes and types of vessels can strike and injure marine mammals. All vessels calling at the Westridge Marine Terminal must operate according to rules established by the International Maritime Organization (IMO), Transport Canada, the Pacific Pilotage Authority, and Port Metro Vancouver (PMV). Trans Mountain is responsible for ensuring the safety of the terminal operations but does not own or operate the vessels calling at the Westridge Marine Terminal. If the Project proceeds, vessels calling at the Westridge Marine Terminal will continue to represent a comparatively small proportion of total marine transportation activity in the Salish Sea. For these reasons, Trans Mountain is not proposing specific measures to mitigate the effects of increased marine vessel traffic.

2.066 Marine environmental effects monitoring

Reference:

A3W9H8, Trans Mountain Response to Board IR No. 1, IR 1.57, PDF page 333 of 421

Preamble:

Reference i) states that the environmental effects of shipping activities are most effectively monitored and managed at the regional scale by regulatory authorities, resource managers, or multi-stakeholder groups.

Reference i) further states that Trans Mountain has participated, and will continue to participate, in regional shipping industry environmental initiatives designed to minimize effects on marine resources.

Request:

Please discuss the monitoring initiatives currently being undertaken by various regional authorities, resource managers, or multi-stakeholder groups, including:

a) names of the authorities or groups participating in such initiatives;

b) details of monitoring, including monitoring goals and objectives, information on what environmental elements are being monitored, and the frequency of monitoring;

c) Trans Mountain's level of collaboration and/or participation in these initiatives; and

d) how Trans Mountain intends to use the outcomes of these initiatives to minimize the potential effects of increased Project-related marine vessel traffic.

Response:

Trans Mountain is supportive of a number of regional marine initiatives that are aimed at minimizing environmental and socio-economic effects of marine terminal and marine vessel transportation activities. Key initiatives are identified in Table 2.066-1 (NEB IR No. 2.066 – Attachment 1).

2.067 Post-construction environmental monitoring plan for the Westridge Marine Terminal

Reference:

A3S2S9, Application Volume 6D, Westridge Marine Terminal Environmental Protection Plan:

i) PDF page 35 of 165
ii) PDF page 92 of 165
iii) PDF page 120 of 165

A3S2S1, Application Volume 6A, Environmental Compliance:

iv) PDF page 39 of 42
v) PDF page 40 of 42
vi) PDF page 41 of 42

Preamble:

Reference i) states that monitoring at the Westridge Marine Terminal may be necessary prior to, during, and following construction or a specific construction activity in the vicinity of water wells or springs. It further states that monitoring will be necessary at some locations to assess the effects on specific environmental features (e.g., marine mammals, archaeological sites, nesting birds, etc.).

Reference ii) states that locations where spot spills occur are to be recorded at the Westridge Marine Terminal to ensure that post- construction environmental monitoring can be conducted, if warranted.

Reference iii) states that the weed and vegetation management plan includes measures to be implemented in the short term (during pre- construction, construction, and post-construction environmental monitoring phases) and in the long term (during the operation and maintenance phase).

Reference iv) states that, at the Westridge Marine Terminal, the noise monitoring program will be implemented at a time when tankers will be involved in operations.

Reference v) states that post-construction monitoring of well water quality will take place if requested by landowners.

Reference vi) states that monitoring will be conducted at facilities pursuant to permitting conditions (e.g., storm water monitoring will be conducted at the Westridge Marine Terminal).

It is unclear to the Board whether Trans Mountain intends to monitor all environmental elements or only certain elements following construction at the Westridge Marine Terminal.

Request:

Please provide details on the post-construction monitoring plan for the Westridge Marine Terminal, including:

a) what environmental elements Trans Mountain proposes to monitor and Trans Mountain's rationale for selecting those elements;

b) parameters to be monitored for each element;

c) a description of the methods to be used, and frequency of monitoring;

d) measurable goals for each element to be assessed, against which the monitoring results would be compared, and an overview of corrective actions that will be implemented if goals are not met; and

e) a schedule for filing the monitoring results with the Board.

Response:

a) Trans Mountain is proposing to monitor elements at the Westridge Marine Terminal, based on the need to evaluate the effectiveness of mitigation measures for construction and ongoing operations, and the potential need for any remedial measures that are warranted to address any outstanding or new environmental issues.

For the marine environment, Trans Mountain is proposing to monitor marine fish and fish habitat and marine sediment and water quality. For marine fish and fish habitat, Trans Mountain expects that offsetting measures will be required for the unavoidable loss of marine fish habitat resulting from construction of the Westridge Marine Terminal. Following the implementation of offsetting measures, Trans Mountain will carry out a habitat effectiveness monitoring program to evaluate the success of the offsetting habitat(s). For marine sediment and water quality, Trans Mountain will monitor the quality of surface water discharged to the marine environment to ensure compliance with the conditions the BC Ministry of Environment discharge permit.

For terrestrial elements, Trans Mountain is proposing to monitor air emissions and the acoustic environment. For acoustic environment, sound emissions from the Westridge Marine Terminal will be recorded. Continuous sound levels and short term sound events at sensitive noise receptors identified in Section 4.2.13 of Technical Report 5C-3 in Volume 5C, Terrestrial Noise and Vibration Report (RWDI December 2013; Filing IDs A3S1T7, A3S1T8, A3S1T9) will be verified.

For air emissions, the post-construction monitoring plan will adhere to the National Energy Board (NEB) Draft Condition No. 21 of the NEB's Letter – Draft Conditions and Regulatory Oversight (NEB 2014; Filing ID A3V8Z9), which describes post-construction monitoring at the Westridge Marine Terminal.

For potential effects from construction spot spills, weed and vegetation management and storm water run-off, potential effects will be monitored during normal operation of the Westridge Marine Terminal.

- Station personnel complete an inspection program for potential erosion and vegetation management daily, monthly and annually. Westridge Marine Terminal is included in

Kinder Morgan Canada's Vegetation Management Program, which is a BC-specific integrated vegetation management plan registered with the BC Ministry of Environment. This program includes early growing season inspections from which decisions are made on method of noxious weed control and/or re-seeding where appropriate. Post control or reclamation inspections are completed to assess the process/success of the activity.

- Both the reclamation and vegetation management programs have annual performance measures as required in Kinder Morgan Canada's environmental management system (Environmental Protection Program).

- Kinder Morgan Canada's groundwater monitoring program includes the Westridge Marine Terminal where monitoring wells are sampled semi-annually for a suite of hydrocarbon analysis. The location and number of wells will be assessed prior to operation of the potentially expanded facility and changes made will be as required to ensure satisfactory monitoring of groundwater quality in conjunction with applicable regulatory criteria.

If potential environmental effects are ongoing after construction, operational personnel will apply mitigation or remediation measures based on the Westridge Marine Terminal Environmental Protection Plan (Volume 6D, Filing ID A3S2S9).

Reference:

National Energy Board. 2014. Draft Conditions and Regulatory Oversight. Hearing Order OH-001-2014. Trans Mountain Pipeline ULC (Trans Mountain) Application for the Trans Mountain Expansion Project (Project). April 16, 2014 (Filing ID A3V8Z9).

b) For marine fish and fish habitat, parameters to be monitored as part of the habitat effectiveness monitoring program will depend on the type(s) of offsetting measures that are implemented. These parameters will be determined in consultation with Fisheries and Oceans Canada (DFO) during the permitting phase, and will be detailed in the application for a *Fisheries Act* authorization for the Project. An overall framework for the habitat effectiveness monitoring program will be provided in the Preliminary Marine Fish Habitat Offsetting Plan, which will be submitted to the NEB in August 2014 (refer to the response to NEB IR No. 1.51, Filing ID A60392).

For marine sediment and water quality, parameters to be monitored for surface water discharged to the marine environment will be as stipulated in the BC Ministry of Environment discharge permit for the expanded Westridge Marine Terminal. Current permit conditions require that total extractable hydrocarbons be sampled and analyzed monthly from four locations, with a maximum allowable level of 5 mg/L (see City Burnaby IR No. 1.18.17d – Attachment 1, Filing ID A3Y2F7). In addition, a 96-hour single-concentration toxicity test for rainbow trout (maximum of 50% mortality) is conducted annually using water samples collected from two locations. It is assumed that the existing permit will be amended in association with final approvals for the expanded Westridge Marine Terminal.

For the acoustic environment, the following parameters will be monitored at noise sensitive receptors:

- daytime and nighttime Leq, dBA (equivalent sound level in A-weighted decibels);
- daytime and nighttime Leq, dBC (equivalent sound level in C-weighted decibels);
- recorded sounds when criteria are being exceeded; and
- logs of 1 minute Leq, dB (unweighted decibels) of 1/3 octave data.

With respect to verification of sound emissions at the Westridge Marine Terminal, parameters to be measured at each piece of sound emitting equipment include the following:

- 5-15 minutes of 1-minute Leq, dBA of overall sound levels;
- 5-15 minutes of 1-minute Leq, dB of 1/3 octave data; and
- peak, maximum or impulsive indicators would be added should relevant sources be identified.

c) For marine fish and fish habitat, methods and frequency of monitoring for the habitat effectiveness monitoring program will depend on the type(s) of offsetting measures that are implemented. Specific methods and frequency of monitoring will be determined in consultation with Fisheries and Oceans Canada (DFO) during the permitting phase, and will be detailed in the application for a *Fisheries Act* authorization for the Project.

For marine sediment and water quality, methods and frequency of monitoring for surface water water discharged to the marine environment will be stipulated in the BC Ministry of Environment discharge permit for the expanded Westridge Marine Terminal.

For acoustic environment, monitoring at noise sensitive receptors will generally follow standard methods including ISO 1996-2, Acoustics – Description, Measurement and Assessment of Environmental Noise – Part 2: Determination of environmental noise levels (ISO 2007) or ASTM E1503-14: Standard Test Method for Conducting Outdoor Sound Measurements Using a Digital Statistical Sound Analysis System (ASTM 2014). Should site conditions require a deviation from the standard methods, any changes would be documented and justified. The monitoring would occur over a period of several days during each of summer and winter conditions to account for variation in natural ambient conditions in the first year. Should sound levels be compliant, no further monitoring would be proposed, except in the event of a complaint. Should compliance issues be identified, the monitoring would be repeated after appropriate controls had been put in place on the site.

Measurement of sound emission sources will also generally follow standard methods issued by the ISO (International Standards Organization) or ASTM International (Formerly the American Society for Testing and Materials). These methods vary depending on the type of equipment to be measured, but all will provide the measurement and calculation methods to convert the measured data to sound power, which is required to compare the results to the Environmental and Socio-economic Assessment. This program would be conducted once, and also include tankers at the berths. Should a need for additional noise controls be

identified for any equipment, the measurement would be redone for that equipment once the controls are in place.

References:

ASTM International. 2014. Standard Test Method for Conducting Outdoor Sound Measurements Using a Digital Statistical Sound Analysis System. West Conshohocken, PA, USA.

International Organization for Standardization. 2007. International Standard ISO 1996-2, Acoustics – Description, Measurement and Assessment of Environmental Noise – Part 2: Determination of environmental noise levels. Geneva, Switzerland.

d) For marine fish and fish habitat, measurable goals for the habitat effectiveness monitoring program will depend on the type(s) of offsetting measures that are implemented. Success criteria for the offsetting habitat(s) will be determined in consultation with Fisheries and Oceans Canada (DFO) during the permitting phase, and will be detailed in the application for a *Fisheries Act* authorization for the Project. If success criteria are not met by the end of the monitoring period, corrective actions will be conducted to modify or enhance the offsetting habitat(s). These measures will be discussed in the application for a *Fisheries Act* authorization for the Project.

For marine sediment and water quality, measurable goals for the monitoring of surface water discharged to the marine environment will be stipulated in the BC Ministry of Environment discharge permit for the expanded Westridge Marine Terminal. If these criteria are not met, corrective actions would be determined in consultation with the BC Ministry of Environment.

For acoustic environment, measurement results from the noise sensitive receptors will be directly compared with the BC Oil and Gas Commission Criteria for that location, as identified in Section 4.2.13 of Technical Report 5C-3 in Volume 5C, Terrestrial Noise and Vibration Report (RWDI December 2013; Filing ID A3S1T7).

Measurement results of equipment sound emissions will be analyzed and converted to sound power levels per the methods cited in the response to NEB IR No. 2.067c. The resulting sound power levels will be compared to the values used in the modeling as reported in Table 6-53 of Technical Report 5C-3 in Volume 5C (Filing ID A3S1T7).

The results of the sound emissions monitoring will be used to confirm whether Westridge Marine Terminal sources are a major contributor of sound at sensitive noise receptors, and help identify the equipment to be controlled should an exceedance due to Westridge Marine Terminal operations be identified. Should controls be required, the equipment identified through the measurements as the major contributor(s) would be addressed. Engineering controls such as enclosures, silencers or acoustic vents would be pursued first, with secondary controls such as berms or walls being examined second. Performance of any controls will be verified through measurement once implemented.

e) For the marine fish and fish habitat, results of the habitat effectiveness monitoring program will be submitted to Fisheries and Oceans Canada (DFO) as required by the *Fisheries Act* authorization for the Project. These results will be available to the National Energy Board

(NEB) upon request. Likewise, for marine sediment and water quality, monitoring results will be submitted to the BC Ministry of Environment as required by the discharge permit. These results will also be available to the NEB upon request.

For acoustic environment, the monitoring results will be filed with the NEB within 6 months of conducting the initial measurements. Measurement programs will be scheduled within the first 6 months of normal operations, but will be weather and activity dependent.

Summary of New Commitments:

- For acoustic environment, the monitoring results will be filed with the NEB within 6 months of conducting the initial measurements. Measurement programs will be scheduled within the first 6 months of normal operations, but will be weather and activity dependent.

2.068 Deactivation and demolition of the existing berth at the Westridge Marine Terminal

Reference:

i) A3S1L3, Application Volume 5A, Environmental and Socio- economic Assessment – Biophysical, PDF page 4 of 150
ii) A3S1R0, Application Volume 5A, Environmental and Socio- economic Assessment – Biophysical, PDF pages 1 to 99 of 260

Preamble:

Reference i) states that the scope of the Project would involve constructing a new dock complex, with a total of three Aframax-capable berths, as well as a utility dock (for tugs, boom deployment vessels, and emergency response vessels and equipment) at the Westridge Marine Terminal, followed by the deactivation and demolition of the existing berth.

Reference ii) provides the environmental effects assessment of various elements that interact with the proposed construction and operation of the Westridge Marine Terminal.

The Board notes that Trans Mountain has noted provided an assessment of the potential environmental and socio-economic effects associated with the deactivation and demolition of the existing berth.

Request:

Please provide an assessment of the potential environmental and socio- economic effects resulting from the deactivation and demolition of the Westridge Marine Terminal's existing berth, or the rationale for why one was not provided.

Response:

Potential environmental and socio-economic effects resulting from deactivation and demolition of the Westridge Marine Terminal's existing berth are discussed below, with reference to potential effects and mitigation discussed in the Environmental and Socio-economic Effects Assessment (Volumes 5A and 5B) (Filing IDs A3S1Q9, A3S1R0, A3S1S7, A3S1S8, A3S1S9) as warranted. This assessment follows the methodology described in Section 7.1 of Volumes 5A and 5B at a high level (Filing IDs A3S1Q9, A3S1S7).

Deactivation and Demolition Activities

The existing dock will be evaluated during the detailed engineering and design phase and during detailed construction planning, likely with the assistance of a specialized marine structures demolition contractor. The extent of the demolition, particularly underwater, will be determined with consideration of mitigation of potential environmental and socio-economic effects.

The existing berth foundation structures are comprised of a variety of materials including steel piles, reinforced concrete, and fill materials such as sand, gravel and stone. The equipment on

top of the berth structures includes steel piping and other structural shapes, reinforced concrete, plastics, rubber, electric pumps and motors, electrical wiring, etc.

The pipelines connecting the berth to the shore facilities will be drained and disconnected, and other utilities such as water and power disconnected and removed. Prior to demolition the existing facilities will be inspected and any equipment to be salvaged for reuse, resale or recycling will be identified. The facilities will then be demolished using marine and/or land based equipment. Demolition methods may include saw cutting, flame cutting, and pneumatic/hydraulic jackhammers. The structures will be disassembled in pieces and taken away by barge for recycling or disposal on land in accordance with applicable regulations. Piles will be removed completely from the water if possible, or if they cannot be removed they will be cut off at or below the seabed level. The final treatment of the shoreline has not been determined but once the structures are removed the shoreline will most likely be re-graded to form a stable slope and protected with rip rap. Demolition and deactivation activities will be carried out during the construction phase of the Project.

Environmental and socio-economic elements potentially interacting with deactivation and demolition of the Westridge Marine Terminal's existing berth include air emissions, greenhouse gas (GHG) emissions, acoustic environment, marine sediment and water quality, marine fish and fish habitat, marine mammals, marine birds, traditional marine resource use, marine commercial, recreational and tourism use, infrastructure and services, and navigation and navigation safety.

Assessment of Deactivation and Demolition of the Existing Berth at Westridge Marine Terminal

The activities to be conducted are expected to produce effects generally similar to dock construction activities in nature and magnitude. For air emissions, GHG emissions, acoustic environment, marine birds, traditional marine resource use, marine commercial, recreational and tourism use, navigation and navigation safety, and infrastructure and services, potential effects exist whether a partial or complete removal of the berth is conducted. For marine sediment and water quality, marine mammals and marine fish and fish habitat, potential effects exist if Trans Mountain pursues underwater removal and demolition of the berth.

Mitigation will be applied from sections referenced for each element below and the Westridge Marine Terminal Environmental Protection Plan (Volume 6D, Filing ID A3S2S9) as warranted to reduce, eliminate or offset potential effects, including implementation of the Waste Management Standard in Appendix C. A site-specific waste management plan will be developed by the contractor, prior to demolition. Key mitigation for each element is discussed under the element subheading. All mitigation measures are considered prior to the determination of significance as per Sections 7.1 of Volumes 5A and 5B (Filing IDs A3S1Q9, A3S1S7).

<u>Air Quality and GHG Emissions</u>

Deactivation and demolition would result in potential effects to air emissions similar to construction of the Westridge Marine Terminal for emissions of criteria air contaminants (CACs) (see Section 7.6.4 of Volume 5A, Filing ID A3S1R0). While there are also volatile organic

compound (VOC) emissions associated with the operation of construction equipment, these are considered *de minimus* in comparison with other anthropogenic and biogenic VOC sources. Likewise, the contribution of deactivation and demolition emissions to the formation of secondary ozone is negligible. No emissions of hydrogen sulphide (H_2S) or mercaptans are expected from these activities.

Deactivation and potential demolition would also result in GHG emissions similar to construction at the Westridge Marine Terminal. As explained in Section 7.6.5 of Volume 5A, Filing ID A3S1R0, the assessment of effects on GHG emissions was conducted considering all the Project components in an integrated manner, since GHG emissions associated with the construction and operation of each Project component were aggregated for the Project as a whole and then compared to provincial and federal GHG inventory totals. The significance evaluation of residual effects was provided in Section 7.2.5.6. GHG emissions associated with the deactivation and demolition at Westridge Marine Terminal are expected to be a small contributor to overall Project-related GHG emissions. Prior to deactivation, a plan will be completed as part of detailed engineering design and construction planning, which will include expected uses of heavy equipment, duration of deactivation, and other details. This information can be used to assist with quantifying GHG and CAC emissions from any demolition activities as well as refining the proposed mitigation measures:

Table 2.068-1 provides a summary of the significance evaluation of the potential residual environmental effects of demolition and deactivation activities at the Westridge Marine Terminal on the applicable air emissions and GHG emissions indicators.

TABLE 2.068-1

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF DEMOLITION AND DEACTIVATION ACTIVITIES AT THE WESTRIDGE MARINE TERMINAL ON AIR EMISSIONS AND GHG EMISSIONS

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Air Emissions Indicator – Primary Emissions of Criteria Air Contaminants									
1(a) Increase in ambient concentrations of CACs.	Negative	RSA	Short -term	Isolated	Short-term	Medium	High	Moderate	Not significant
2. GHG Emissions Indicator – Emissions of CO_2, CH_4, and N_2O and Effect on Overall Climate Change									
2(a) Increase in CO_2e emissions.	Negative	International	Short -term	Isolated	Permanent	Low	High	Moderate	Not significant
3. GHG Emissions Indicator –Effect on Overall Climate Change									
3(a) Changes in environmental parameters (*e.g.,* increase in global average temperature).	Negative	International	Short -term	Isolated	Permanent	Negligible	High	High	Not significant

Notes:

1 RSA = Air Quality RSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

The increase in ambient ground-level concentrations of CACs is considered to have a negative impact balance. As shown in Table 2.068-1 point 1(a), the increase in ambient ground-level concentrations of CACs is confined to the Air Quality RSA. Air emissions are expected to change ambient concentrations of CACs during the demolition of the Westridge Marine Terminal. Mitigation measures for both the reduction of potential effects to air emissions and GHG emissions include restricting the duration that vehicles and equipment are allowed to sit and idle to less than one hour unless air temperatures are less than 0°C; ensuring equipment is well-maintained during construction to minimize air emissions; using multi-passenger vehicles for the transportation of crews to and from the job sites, where feasible; and watering down construction sites and access roads, when warranted, as directed by Trans Mountain, to reduce or avoid the potential for dust emissions. Although not quantified, while the increase in CAC concentrations during the demolition and deactivation activities is anticipated to be measurable, it is not anticipated to exceed air quality objectives given the nature of the activities. Therefore, the magnitude of the increase in CACs is conservatively considered to be of medium magnitude. The probability of this occurring is high, because the equipment used during the demolition activities will emit CACs. A summary of the rationale for all of the significance criteria for the increase in ambient concentrations of CACs (Table 2.068-1, point 1[a]) is provided below.

- Spatial Boundary: Air Quality RSA – changes to ambient ground-level concentrations of CACs from demolition and deactivation activities are expected to occur within the Air Quality RSA.
- Duration: short-term – the event resulting in emissions of CACs is the demolition and deactivation activities of the existing berth.
- Frequency: isolated – the event resulting in emissions of CACs is confined to a specified phase of the assessment period.
- Reversibility: short-term – emissions of CACs will reverse once demolition and deactivation activities are complete.
- Magnitude: medium – the increase in CAC concentrations during the demolition and deactivation activities is anticipated to be measurable; however, it is not anticipated to exceed air quality objectives given the nature of the activities.
- Probability: high – demolition and deactivation activities will result in emissions of CACs.
- Confidence: moderate – residual effects assessment is based on a good understanding of cause-effect relationships between demolition and deactivation activities and air emissions; however, details on expected uses of heavy equipment are not yet available.

During demolition and deactivation of the existing berth at the Westridge Marine Terminal, marine vessels as well as the operation of vehicles and equipment will result in GHG emissions. Although emissions from these activities at the Westridge Marine Terminal were not estimated, all demolition and deactivation emissions will be intermittent and limited in duration and are not anticipated to exceed those associated with the construction and operation of the terminal (see

Section 7.6.5 of Volume 5A, Filing ID A3S1R0). A summary of the rationale for all of the significance criteria for an increase in CO_2e emissions and associated changes in environmental parameters (Table 2.068-1, points 2[a] and 3[a] respectively) is provided below.

- Spatial Boundary: international – Project emissions of GHG disperse globally.
- Duration: short-term – the event causing emissions of GHG is the demolition and deactivation of the existing berth.
- Frequency: isolated – the event causing emissions of GHG is the demolition and deactivation of the existing berth which is confined to a specified phase of the assessment period.
- Reversibility: permanent – emissions will result in a permanent addition to global GHG. Emissions of GHG cease immediately when Project activities end.
- Magnitude: negligible to low – emissions of GHG associated with demolition and deactivation activities will be detectable and are not expected to exceed those associated with the construction and operation of the terminal. In the absence of environmental or regulatory emission limits for GHG emissions for these activities, the magnitude is rated as low for the increase of CO_2e emissions (2[a]). Changes in environmental parameters (*e.g.*, increase in global average temperature, point 3[a]) resulting from demolition and deactivation activities would not be detectable from existing (baseline) climate variability; therefore, the magnitude of changes in environmental parameters is negligible.
- Probability: high – Project-related activities will result in emissions of GHG.
- Confidence: moderate to high – residual effects assessment is based on a good understanding of cause-effect relationships between the Project and GHG emissions. Since details on expected uses of heavy equipment are not yet available, the confidence for the significance evaluation of increases in CO_2e emissions is moderate (2[a]). With respect to changes in environmental parameters (3[a]), additional observational and numerical modelling data support the significance determination, and the confidence was rated high.

Acoustic Environment

Deactivation and demolition would result in potential effects to acoustic environment similar to the construction of the Westridge Marine Terminal (se Sections 7.6.6 and of Volume 5A, Filing ID A3S1R0). Table 2.068-2 provides a summary of the significance evaluation of the potential residual environmental effects of demolition and deactivation activities at the Westridge Marine Terminal on the applicable acoustic environment indicators.

TABLE 2.068-2

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF DEMOLITION AND DEACTIVATION ACTIVITIES AT THE WESTRIDGE MARINE TERMINAL ON THE ACOUSTIC ENVIRONMENT

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Acoustic Environment Indicator – Sound Level									
1(a) Increase in sound levels during demolition and deactivation activities.	Negative	LSA	Short-term	Isolated	Short-term	Medium	High	Moderate	Not Significant

Notes:

1 LSA = Acoustic Environment LSA.

2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

The potential for the increase in sound levels for human receptors associated with demolition and deactivation activities at the Westridge Marine Terminal is considered to have a negative impact balance. The sound levels at the homes will vary throughout the day, and can be controlled through detailed planning and use of sound reduced equipment in densely populated areas. The detailed demolition and deactivation planning required to fully assess urban sound levels is not available at this stage of project planning. A detailed noise management plan that is used during the planning for construction in urban environments can reduce the potential sound levels associated with demolition and deactivation. Mitigation, including mitigation from the Westridge Marine Terminal Environmental Protection Plan (Volume 6D, Filing ID A3S2S9), that would be considered in a detailed noise management plan for demolition and deactivation activities includes adhering to all federal, provincial and municipal guidelines and regulations for noise management; ensuring that Westridge Marine Terminal construction activities adhere to the City of Burnaby Noise and Sound Abatement Bylaw 1979 (Number 7332), including approved hours of work, if feasible; scheduling construction activities during the period from 07:00 to 20:00, during weekdays, and 09:00 to 20:00, during weekends, if feasible; and considering the placement and orientation of equipment to be used at the Westridge Marine Terminal prior to the activity in order to reduce the noise disturbance of residents and sensitive wildlife in the vicinity of the Westridge Marine Terminal.

The residual effect of an increase in sound levels during demolition and deactivation activities is reversible in the short-term as sound level changes due to demolition and deactivation activities at the Westridge Marine Terminal will cease as soon as the activities stop. The magnitude of the residual effect will change depending on the distance between the demolition and deactivation activities and the surrounding receptors and similar to construction activities at the Westridge Marine Terminal is considered to be of medium magnitude in consideration of the above mitigation. A summary of the rationale for all of the significance criteria is provided below (Table 2.068-2, point 1[a]).

- Spatial Boundary: Acoustic Environment LSA – compliance with the BC OGC *Noise Control Best Practices Guideline* are achieved within the Acoustic Environment LSA.

- Duration: short-term – the events causing changes in sound levels will occur only during the demolition and deactivation of the existing berth.
- Frequency: isolated – the events causing changes in sound levels will occur at residential dwellings during the demolition and deactivation of the existing berth.
- Reversibility: short-term – the period over which the change in sound levels extends is the demolition and deactivation of the existing berth. However, sound level changes will cease when demolition and deactivation of the existing berth has finished.
- Magnitude: medium – the magnitude is medium or lower with the implementation of a detailed noise management plan for demolition and deactivation activities.
- Probability: high – based on the proximity of residences to the terminals.
- Confidence: moderate – based on the nature of data inputs.

Marine Sediment and Water Quality, Marine Fish and Fish Habitat, Marine Mammals

If underwater work is conducted, deactivation and demolition would result in potential effects to marine sediment and water quality, marine fish and fish habitat and marine mammals similar to the construction of the Westridge Marine Terminal (see Sections 7.6.8, 7.6.9 and 7.6.11 of Volume 5A, Filing ID A3S1R0). Under Fisheries and Oceans Canada's (DFO's) Fisheries Protection Policy, where impacts cannot be avoided or completely mitigated, offset measures (*i.e.,* compensation measures) are required (DFO 2013). Trans Mountain will work with regulatory agencies, including Port Metro Vancouver and DFO, to provide habitat compensation or offset as required if serious harm to marine fish and fish habitat cannot be avoided or mitigated.

Table 2.068-3 provides a summary of the significance evaluation of the potential residual environmental effects of demolition and deactivation activities at the Westridge Marine Terminal on marine sediment and water quality, marine fish and fish habitat and marine mammals indicators.

TABLE 2.068-3

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF DEMOLITION AND DEACTIVATION ACTIVITIES AT THE WESTRIDGE MARINE TERMINAL ON MARINE SEDIMENT AND WATER QUALITY, MARINE FISH AND FISH HABITAT AND MARINE MAMMALS

Potential Residual Effects	Impact Balance	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
1. Marine Sediment and Water Quality Indicators - Marine Sediment Quality and Water Quality									
1(a) Release of TSS and other contaminants from demolition and deactivation activities.	Negative	Marine Sediment and Water Quality LSA	Short-term	Isolated	Short-term	Low	High	High	Not significant
2. Marine Fish and Fish Habitat Indicators - Subtidal Habitat, Dungeness Crab, Inshore Rockfish and Pacific Salmon									
2(a) Temporary habitat disturbance from demolition and deactivation activities.	Negative	Marine Fish and Fish Habitat LSA	Short-term	Isolated	Short-term	Low	High	High	Not significant
3. Marine Mammal Indicator – Harbour seal									
3(a) Sensory disturbance of harbour seals or other marine mammals due to underwater noise produced during demolition and deactivation.	Negative	Marine Mammal LSA	Short-term	Isolated	Short-term	Low	High	High	Not significant

Note:

1 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

Marine Sediment and Water Quality Indicators

There is potential for demolition and deactivation work in the water column to release total suspended solids (TSS) and other contaminants such as hydrocarbons (PAH) or metals. There is little potential for the release of polychlorinated biphenyls (PCBs) based on the work to be conducted and historical records in the vicinity of the Westridge Marine Terminal. Contaminant levels in the vicinity of the Westridge Marine Terminal are discussed in Section 7.6.8 of Volume 5A (Filing ID A3S1R0). Whether there is potential for the release of hydrocarbons or metals depends on the work to be conducted during deactivation and demolition, which will be developed during detailed planning for construction. If the potential exists, mitigation will be followed from the Westridge Marine Terminal Environmental Protection Plan (Volume 6D, Filing ID A3S2S9) to reduce or eliminate potential effects. For the release of TSS, mitigation measures and the potential to affect fish is discussed under marine fish and fish habitat. A summary of the rationale for the significance criteria related to marine sediment and water quality indicators is provided below (Table 2.068-3, point 1[a]).

- Spatial Boundary: Marine Sediment and Water Quality LSA – sediment and potential contaminant disturbance and dispersal will be limited to the demolition area and a small area of the Marine Sediment and Water Quality LSA where sediment may be dispersed.

- Duration: short-term – release of TSS and other contaminants is expected to be confined to the period of demolition and deactivation, which is within the construction phase.

- Frequency: isolated – release of TSS and other contaminants is expected to be intermittent during the demolition and deactivation activities.
- Reversibility: short-term - residual effects will occur during the demolition and deactivation activities of the construction phase and are expected to be reversible within a few hours to a few days after the end of construction.
- Magnitude: low - residual effects are not expected to be detectable from existing (baseline) conditions.
- Probability: high – release of TSS and other contaminants are likely from work associated with demolition and deactivation.
- Confidence: high - there is a good understanding of the cause-effect relationships between sediment contaminant conditions and potential for adverse effects on marine life (with the caveat that there is considerable conservatism in the sediment quality guidelines used to assess potential toxicity), effectiveness of the mitigation measures, and site-specific data upon which to base the assessment.

Marine Fish and Fish Habitat Indicators

The marine fish and fish habitat discussion relates to the marine fish and fish habitat indicators discussed in Section 7.6.9 of Volume 5A (Filing ID A3S1R0), which include subtidal habitat, Dungeness crab, inshore rockfish and Pacific salmon. Removal of the existing loading berth will increase the availability of seafloor habitat for marine fish and invertebrates. This is expected to increase the productivity of marine fish habitats within the Marine Fish and Fish Habitat LSA, particularly for those species that inhabit soft substrates (*e.g.,* flatfish, Dungeness crab). Demolition and removal of the existing berth at Westridge Marine Terminal may result in a minimal amount of disturbance to subtidal substrates, potentially leading to elevated total suspended solid (TSS) levels in the immediate vicinity of the work area. Temporary avoidance of the work area by some marine fish is possible due to elevated TSS as well as some sensory disturbance due to underwater noise. Mitigation measures to reduce or eliminate potential adverse effects to marine fish and fish habitat will be determined in consultation with DFO, and may include the installation of turbidity curtains to minimize the spatial extent of elevated TSS. A summary of the rationale for the significance criteria related to marine fish and fish habitat indicators such as subtidal habitat, Dungeness crab, inshore rockfish and Pacific salmon is provided below (Table 2.068-3, point 2[a]).

- Spatial Boundary: Marine Fish and Fish Habitat LSA –temporary disturbance of subtidal habitat will be confined to the immediate work area and underwater noise associated with the in-water activities is expected to dissipate within a relatively short distance from the source. Therefore, potential effects are expected to be confined to the Marine Fish and Fish Habitat LSA.
- Duration: short-term – temporary habitat disturbance is expected to be confined to the period of demolition and deactivation, which is within the construction phase.

- Frequency: isolated – temporary habitat disturbance is expected to be intermittent during the demolition and deactivation activities.
- Reversibility: short-term - residual effects will occur during the construction phase and are expected to be reversible within a few hours to a few days after the end of construction.
- Magnitude: low - since mitigation measures will be applied to reduce the potential effect, and it is expected to be limited in nature given the scope of the demolition activities, the magnitude is expected to be low.
- Probability: high – demolition activities are expected to result in the temporary disturbance of habitats immediately surrounding the existing in-water infrastructure.
- Confidence: high - determination of confidence is based on the engineering assumptions made, the species of fish and invertebrates that inhabit the Marine Fish and Fish Habitat LSA and their sensitivity to disturbance, and the presumed use of appropriate mitigation measures.

Marine Mammals Indicators

A comprehensive mitigation program has been developed to reduce or eliminate potential harm to marine mammals during construction of the Westridge Marine Terminal and the same measures will be applied, as warranted, during demolition and deactivation activities (see Section 7.6.11 of Volume 5A, Filing ID A3S1R0). While mitigation measures are expected to be effective at reducing the potential effect of sensory disturbance, a small number of marine mammals in the vicinity of demolition activities may still be exposed to sound levels capable of causing behavioural effects. Sound levels capable of causing permanent or temporary auditory injury of harbour seals or other marine mammals are not expected as a result of demolition and deactivation activities. The area in the vicinity of the Westridge Marine Terminal is not considered high quality marine mammal habitat, and while harbour seals are expected to be regularly observed in the area, they are also expected to temporarily move away from areas where demolition and deactivation activities are occurring. A summary of the rationale for the significance criteria related to the marine mammal indicator is provided below (Table 2.068-3, point 3[a]).

- Spatial Boundary: Marine Mammal LSA – underwater noise levels are expected to dissipate within a relatively short distance from the source. Therefore, potential effects are expected to be confined to the Marine Mammals LSA.
- Duration: short-term – sensory disturbance is expected to be confined to the period of demolition and deactivation, which is within the construction phase.
- Frequency: isolated – sensory disturbance is expected to be intermittent during the demolition and deactivation activities.
- Reversibility: short-term – residual effects will be limited to the construction phase and are likely to be reversible in the short-term (*i.e.,* within a few hours to a few days after the underwater demolition and deactivation activity ceases).

- Magnitude: low – since mitigation measures will be applied to reduce the potential effect, and it is expected to be limited in nature given the scope of the demolition activities, the magnitude is expected to be low.
- Probability: high - it is considered likely that marine mammals in the vicinity of demolition and deactivation activities at the Westridge Marine Terminal will experience some degree of sensory disturbance.
- Confidence: high - determination of confidence is based on the engineering assumptions made, the limited number and diversity of marine mammals in the Marine Mammal LSA, and the presumed use of appropriate mitigation measures.

Marine Birds

While marine birds may use habitat in the vicinity of the existing berth at the Westridge Marine Terminal for foraging, nesting, and roosting, demolition and deactivation activities are not expected to result in changes to habitat availability, except for the temporary influence of sensory disturbance. Any habitat removed by demolition (*i.e.*, availability for roosting on the existing berth) would be offset by the addition of newly constructed berths as available habitat.

Table 2.068-4 provides a summary of the significance evaluation of the potential residual environmental effects of demolition and deactivation activities at the Westridge Marine Terminal on the applicable marine bird indicators.

TABLE 2.068-4

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF DEMOLITION AND DEACTIVATION ACTIVITIES AT THE WESTRIDGE MARINE TERMINAL ON MARINE BIRDS

	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
				Duration	Frequency	Reversibility				
1.	Marine Bird Indicators - Bald Eagle, Great Blue Heron, Pelagic Cormorant, Barrow's Goldeneye, Glaucous-Winged Gull and Spotted Sandpiper									
1(a)	Sensory disturbances causing stress, behavioural changes or avoidance of preferred or important habitats, which may adversely affect individual fitness and local population sustainability.	Negative	LSA	Short-term	Isolated	Short-term	Low to medium	High	High	Not significant

Notes:
1 LSA = Marine Birds LSA.
2 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

The following discussion applies to the marine bird indicators discussed in Section 7.6.12 of Volume 5A (Filing ID A3S1R0), including bald eagle, great blue heron, pelagic cormorant, Barrow's goldeneye, glaucous-winged gull, and spotted sandpiper.

Temporary sediment releases in marine waters surrounding the in-water demolition site could alter prey abundance or impede prey visibility for species that forage in marine habitats. In addition, increased in-air noise and activity at the Westridge Marine Terminal may result in stress to individuals present, and may alter normal movement patterns through avoidance of foreshore and shoreline areas. Substantial noise levels during demolition activities are expected to have some detectable effect on marine bird species with territories that overlap the Marine Birds LSA. A comprehensive mitigation program has been developed to reduce or eliminate potential harm to marine birds during construction of the Westridge Marine Terminal and the same measures will be applied, as warranted, during demolition and deactivation activities (see Section 7.6.12 of Volume 5A, Filing ID A3S1R0). Mitigation presented under the Acoustic Environment section of this response will reduce sensory disturbance to marine birds as well as human receptors. A summary of the rationale for the significance criteria related to marine bird indicators of bald eagle, great blue heron, pelagic cormorant, Barrow's goldeneye, glaucous-winged gull, and spotted sandpiper is provided below (Table 2.068-4, point 1[a]).

- Spatial Boundary: Marine Birds LSA – sensory disturbance is expected to be confined to the area in the vicinity of the Westridge Marine Terminal and, therefore, the Marine Birds LSA.
- Duration: short-term – sensory disturbance is expected to be confined to the period of demolition and deactivation, which is within the construction phase.
- Frequency: isolated – sensory disturbance is expected to be intermittent during the demolition and deactivation activities.
- Reversibility: short-term – marine birds are expected to recover from the effects of temporary sensory disturbance within the short-term.
- Magnitude: low to medium – mitigation measures will be applied to reduce the potential effect. The magnitude is expected to be low for bald eagle and glaucous-winged gull based on their use of the habitat. For great blue heron, pelagic cormorant, Barrow's goldeneye and spotted sandpiper, the effect is expected to be medium.
- Probability: high - it is considered likely that marine birds in the vicinity of demolition and deactivation activities at the Westridge Marine Terminal will experience some degree of sensory disturbance.
- Confidence: high - determination of confidence is based on the engineering assumptions made, the number and diversity of marine birds in the Marine Birds LSA, and the presumed use of appropriate mitigation measures.

Traditional Marine Resource Use

Deactivation and demolition would result in potential effects to traditional marine resource use (TMRU) similar to the construction of the Westridge Marine Terminal (see Sections 7.6.2 of Volume 5B, Filing ID A3S1S9). Table 2.068-5 provides a summary of the significance evaluation of the potential residual socio-economic effects of demolition and deactivation activities at the Westridge Marine Terminal on the applicable TMRU indicators.

TABLE 2.068-5

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF DEMOLITION AND DEACTIVATION ACTIVITIES OF THE WESTRIDGE MARINE TERMINAL ON TRADITIONAL MARINE RESOURCE USE

Potential Residual Effects	Impact Balance	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
1. TLRU Indicators – Traditional Marine Resource Use									
1(a) Disruption to marine access and use patterns during demolition and deactivation activities.	Neutral to negative	Marine TLRU RSA	Short-term	Isolated	Short-term	Low to medium	High	High	Not significant
1(b) Sensory disturbance (from noise, air emissions, visual) during demolition and deactivation activities.	Negative	Marine TLRU RSA	Short-term	Isolated	Short-term	Low	High	High	Not significant
1(c) Alteration of subsistence resources.	Negative	Footprint to Marine TLRU RSA	Short-term	Isolated	Short-term	Low to medium	High	High	Not significant
1(d) Combined effects on the traditional marine resource use indicator (1[a] to 1[c]).	Negative	Marine TLRU RSA	Short-term	Isolated	Short-term	Low to medium	High	High	Not significant

Note:

1 Significant Residual Socio-economic Effect: A residual socio-economic effect is considered significant if the effect is predicted to be:

- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

The effects of demolition and deactivation activities on the TMRU indicator consider changes in marine access and use patterns, sensory disturbances and alteration of subsistence resources as well as combined effects. Based on the results of effects assessments for marine mammals, marine birds and marine fish and fish habitat, alteration of subsistence resources is a potential residual effect of interactions between traditional marine resources and demolition and deactivation activities at the Westridge Marine Terminal due to temporary habitat disturbance and sensory disturbances to indicator species.

The residual effects related to changes in marine access and use patterns, sensory disturbances of Aboriginal marine users and combined residual effects on TMRU are anticipated to be related to the increase marine vessel activity, marine demolition activity (*e.g.*, marine barges, potential for in-water activity) and sensory disturbance associated with these activities in the marine waters of Burrard Inlet. Mitigation measures, including those related to working with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members, reducing noise and air emissions from equipment, and placing warning signs (*e.g.,* Warning – Construction in the Vicinity) offshore and onshore, are provided in Table 7.6.2-3 of Volume 5B (Filing ID A3S1S9) as well as the Westridge Environmental Protection Plan (Filing ID A3S2S9).

Based on the preliminary interests identified to date, ongoing Project engagement and the desktop analysis, subsistence marine resources harvested are found throughout the marine TLRU RSA, and include marine fish, shellfish and marine vegetation. Harvesting of these marine resources can occur year round throughout the Marine TLRU RSA. Key issues and concerns relevant to the Westridge Marine Terminal and the alteration of subsistence resources

include potential change in the resources harvested. Changes to the distribution and abundance of resources could in turn result in loss or alteration of harvesting areas, which could result in indirect effects such as harvesters having to spend more time and money to travel further for subsistence activities. Mitigation measures are in place in the event any unidentified subsistence activities and uses are discovered (see the Westridge Marine Terminal Environmental Protection Plan (Volume 6D; Filing ID A3S2S9). The results of effects assessments for marine mammals, marine birds and marine fish and fish habitat indicate that although there may be residual effects due to demolition and deactivation of the existing berth at the Westridge Marine Terminal, the effects are considered to be not significant.

The impact balance of the residual effects on TMRU is considered neutral to negative. The spatial boundary ranges from temporary disturbance of marine fish habitat within the Footprint to sensory disturbances that extend into the Marine TLRU RSA. The duration of the event causing the effects on TMRU is limited to demolition and deactivation activities of the construction phase. The reversibility of the residual effects are considered to be short-term as disruption to marine access and use patterns, sensory disturbance, alteration of subsistence resources and the combined effect on TMRU are associated with demolition activities which form part of the construction phase of the Project. A summary of the rationale for all of the significance criteria on the TMRU indicator is provided below (Table 2.068-5, points 1[a] to 1[d]).

- Spatial Boundary: Footprint to Marine TLRU RSA – effects could extend to outside the direct area of disturbance from construction and operational facilities associated with the Terminal expansion.

- Duration: short-term – the events causing effects on marine resources are demolition and deactivation activities which are part of the construction phase.

- Frequency: isolated – the event causing the residual effects on marine resources and use will be demolition activities conducted during the construction phase of the Project.

- Reversibility: short-term – the residual effects will be reversible in the short-term as disruption to marine access and use patterns, sensory disturbance, alteration of subsistence resources and the combined effect are associated with demolition activities which form part of the construction phase of the Project.

- Magnitude: low to medium– marine passage by the terminal will not be disrupted and in most cases effects on marine users will be that of an inconvenience or nuisance (low); in some cases changes in use patterns may have implications for business or livelihood practices for certain users (commercial, tourism, traditional marine users) and the combined residual effect could be more than a nuisance or inconvenience (medium). In addition, the effects assessment results for marine fish and fish habitat, marine mammals and marine birds indicates that effects to traditionally harvested marine resources may be detectable and is dependent on each target species' sensitivities. Therefore, combined effects on marine resources also range from low to medium.

- Probability: high – the effects of demolition and deactivation activities on marine resources will also affect traditional marine resource users.

- Confidence: high – based on Project information and the professional experience of the assessment team.

Marine Commercial, Recreation and Tourism Use and Navigation and Navigation Safety

Deactivation and demolition of the existing berth were considered in the effects assessment for construction of the Westridge Marine Terminal on human occupancy and resource use (HORU), and navigation and navigation safety (see Sections 7.6.4 and 7.6.6 of Volume 5B, Filing ID A3S1S9). The marine commercial, recreational and tourism use (MCRTU) indicator within the human occupancy and resource use (HORU) element is considered reflective of potential HORU effects with regards to deactivation and demolition activities at Westridge Marine Terminal.

Table 2.068-6 provides a summary of the significance evaluation of the potential residual socio-economic effects of demolition and deactivation activities at the Westridge Marine Terminal on the applicable MCTRU and navigation and navigation safety indicators.

TABLE 2.068-6

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF DEMOLITION AND DEACTIVATION ACTIVITIES AT THE WESTRIDGE MARINE TERMINAL ON MCRTU AND NAVIGATION AND NAVIGATION SAFETY

Potential Residual Effects	Impact Balance	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance[1]
			Duration	Frequency	Reversibility				
1. HORU Indicator – Marine Commercial, Recreational and Tourism Use									
1(a) Disruption to marine access and use patterns during demolition and deactivation activities.	Neutral to negative	Marine HORU RSA	Short-term	Isolated	Short-term	Low to medium	High	High	Not significant
1(b) Sensory disturbance (from noise, air emissions, visual) during construction.	Negative	Marine HORU RSA	Short-term	Isolated	Short-term	Low	High	High	Not significant
1(c) Decrease in quality of the experience of Aboriginal and non-Aboriginal marine commercial, recreation and tourism users during demolition and deactivation activities.	Negative	Marine HORU RSA	Short-term	Isolated	Short to medium-term	Low to medium	High	High	Not significant
1(d) Combined effects on the MCRTU indicator (1[a] to 1[c]).	Negative	Marine HORU RSA	Short-term	Isolated	Short to medium-term	Low to medium	High	High	Not significant
2. Navigable Watercourses Indicator– Navigable Watercourses									
2(a) Disruption to a navigable water (Burrard Inlet) during demolition and deactivation activities.	Neutral to negative	Marine HORU RSA	Short-term	Isolated	Short-term	Low to medium	High	High	Not significant
2(b) Concern for safety of marine users due to changing movement patterns.	Negative	Marine HORU RSA	Immediate	Accidental	Short-term	Low to high	Low	Moderate	Not significant

Note:

1 Significant Residual Socio-economic Effect: A **residual** socio-economic effect is considered significant if the effect is predicted to be:

- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- High magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

Marine Commercial, Recreation and Tourism Use Indicator

The effects of demolition and deactivation activities on MCRTU consider changes in marine access and use patterns, sensory disturbance to marine users, and changes in the overall quality of the experience of Aboriginal and non-Aboriginal marine users. These residual effects and combined residual effects are anticipated to be primarily related to the increase marine vessel activity, marine demolition activity (*e.g.*, marine barges, in-water activity) and sensory disturbance associated with these activities in the marine waters of Burrard Inlet. Mitigation measures, including those related to contacting and notifying stakeholders, appropriate regulatory authorities and licensees, and marine and local fishing industry organizations, Aboriginal groups, marine recreation organizations prior to construction activities, reducing noise and air emissions from equipment, and placing warning signs (*e.g.,* Warning – Construction in the Vicinity) offshore and onshore, are provided in Table 7.6.4-2 of Volume 5B (Filing ID A3S1S9) as well as in the Westridge Environmental Protection Plan (Filing ID A3S2S9).

The duration of the residual effects is considered short-term and the frequency is considered isolated, as these residual effects are caused by demolition-related activity. The residual effects are considered reversible in the short to medium-term; primary effects will cease with the end of demolition activities (short-term); however, the restoration of disturbed fish habitat should pilings be removed may take several years into operations (medium-term) (Table 2.068-6, points 1[a] to [d]). A summary of the rationale for all of the significance criteria of residual effects on MCRTU from demolition and deactivation of the existing berth is provided below. Further details on the significance evaluation for each of the residual effects are provided in Section 7.6.4 of Volume 5B (Filing ID A3S1S9).

- Spatial Boundary: Marine HORU RSA – marine commercial, recreational, and tourism users travelling to and from different parts of the Marine HORU RSA may be affected.
- Duration: short-term – the residual effects will be caused by demolition activities conducted during the construction phase.
- Frequency: isolated – the event causing the residual effects will be demolition activities conducted during the construction phase of the Project.
- Reversibility: short to medium-term – the residual effects will primarily be reversible in the short-term as disruption to marine access and use patterns, sensory disturbance, decrease in quality of the experience of Aboriginal and non-Aboriginal marine commercial, recreation and tourism users and the combined effect are associated with demolition activities which form part of the construction phase of the Project (1[a], 1[b], 1[c] and 1[d]); however, since may take several years for disturbed fish habitat to be re-established through the marine fish habitat compensation program (should pilings be removed), a decrease in quality of the experience of Aboriginal and non-Aboriginal marine commercial, recreation and tourism users and the combined effect may extend into the medium-term (1[c] and 1[d]).
- Magnitude: low to medium – marine passage by the terminal will not be disrupted and in most cases effects on marine users will be that of an inconvenience or nuisance (low) (1[a],

1[b], 1[c] and 1[d]); in some cases changes in use patterns may have implications for business or livelihood practices for certain users (commercial, tourism, traditional marine users) and the combined residual effect could be more than a nuisance or inconvenience (medium) (1[a], 1[c] and 1[d]).

- Probability: high – given Project activity is occurring in Burrard Inlet where there are multiple marine commercial, recreational and tourism users.
- Confidence: high – based on information about the Project, information on marine use patterns, and the professional experience of the assessment team.

Navigable Watercourses Indicator

The residual effects of demolition and deactivation of the existing berth at Westridge Marine Terminal on navigable watercourses includes the potential for disruption to marine navigation in Burrard Inlet. During demolition and deactivation activities, the facilities will be demolished using marine and/or land based equipment. It is not anticipated that demolition-related vessels and marine equipment will obstruct passage of other vessels in Burrard Inlet, given the size of the inlet passage at the terminal site. In the unlikely event that there is any potential short-term obstruction of the waterway during demolition and deactivation activities that could affect safe navigation of other vessels, this would be coordinated in advance through the PMV Harbour Master and Coast Guard as described in Section 7.6.6 of Volume 5B (Filing ID A3S1S9). Waterway users are notified of such activities through the Canadian Coast Guard's weekly Notice to Mariners. Trans Mountain will also communicate with marine and local fishing industry organizations, Aboriginal communities, marine recreation organizations and other affected stakeholders to provide Project information related to Project activities affecting marine use areas. Additional mitigation measures, including ensuring barges used for heavy equipment access are placed (anchored or spudded down) in appropriate areas with minimal impacts and ensuring compliance with all established legislation, including the Navigation Safety Regulations under the *Canada Shipping Act*, *Fisheries Act* and Port Metro Vancouver's Marine Restricted Area (MRA) legislation, including *Clear Narrows Regulations*, are provided in Table 7.6.6-1 of Volume 5B (Filing ID A3S1S9) as well as the Westridge Environmental Protection Plan (Filing ID A3S2S9).

The impact balance of the residual effect on navigable watercourses related to the potential for disruption to marine navigation in Burrard Inlet is considered neutral to negative as demolition-related barges and an increased construction zone around the terminal will reduce the marine channel around the Westridge Marine Terminal, but the Project will not constrict marine passage. Waterway users will be notified of all activity in the area. There may, however, be a negative implication for recreational or traditional marine users that change their use patterns to avoid the terminal area during construction. The duration of the potential residual effect is considered short-term, and the frequency is considered isolated, as the effect is caused by demolition activities which are part of the construction phase. The magnitude of the effect is considered low to medium; it is considered to be primarily that of an inconvenience or nuisance as marine passage will not be constricted during these activities though use patterns for smaller vessels that navigate closer to shore may be altered (low), but it may have implications for livelihood practices for some traditional or tourism marine users (medium) (Table 2.068-6, point

2[a]). A summary of the rationale for all of the significance criteria related to disruption to a navigable water (Burrard Inlet) is provided below.

- Spatial Boundary: Marine HORU RSA – navigation in Burrard Inlet by marine vessels transiting to and from different parts of the Marine HORU RSA may be affected.
- Duration: short-term – the residual effect is caused by demolition activities which are part of the construction phase.
- Frequency: isolated – the event causing the potential effect is demolition activities which are part of the construction phase.
- Reversibility: short-term – the potential for disruption to marine navigation in Burrard Inlet is limited to demolition activities of the construction phase.
- Magnitude: low to medium – marine passage by the terminal will not be disrupted, but there may be some nuisance or inconvenience for smaller vessels that navigate close the shore in the areas around the terminal (low); there is the possibility for implications for livelihood practices for some marine users (medium).
- Probability: high – given Project activity is occurring in Burrard Inlet where there are multiple marine commercial, recreational, tourism and traditional navigation uses.
- Confidence: high – based on information about the Project, information on marine use patterns and areas, and the professional experience of the assessment team.

The residual effects of demolition and deactivation of the existing berth at Westridge Marine Terminal on navigable watercourses includes concern for safety of marine users due to changing movement patterns. The increase in marine vessel traffic around Westridge Marine Terminal associated with demolition and deactivation tugs and barges may reduce the available marine area for passage of other marine users, leading to an increased possibility of marine collisions, vessel damages or injury. Marine users may also inadvertently enter the construction zone. This may have implications for the safety of commercial, recreational, tourism and Aboriginal users of Burrard Inlet who typically travel in the vicinity of the Westridge Marine Terminal. Mitigation measures, including notifying marine commercial and recreational operators of the hazards associated with construction (including demolition) and placing warning signs (*e.g.,* Warning – Construction in the Vicinity) offshore and onshore, are provided in Table 7.6.6-1 of Volume 5B (Filing ID A3S1S9) as well as the Westridge Environmental Protection Plan (Filing ID A3S2S9).

Reduced safety is a negative potential residual effect that could occur in the areas around the Westridge Marine Terminal during demolition activities. The reversibility of the effect is considered short-term, as it is related primarily to presence of construction phase demolition vessels and reduced passage due to construction zone limits. The probability of the effect is low, as it is unlikely that a collision would occur which would result in harm to a marine user. In addition, if underwater infrastructure is left in place after demolition and deactivation, Trans Mountain will complete a safety and security plan to ensure there are no navigational hazards or effects to marine users. The location of the potential underwater infrastructure between Trans

Mountain's proposed dock complex and the onshore facilities at the Westridge Marine Terminal indicate that potential effects on marine users are of low probability if underwater infrastructure is left in place after demolition and deactivation. The magnitude of the effect is considered low to high, depending on the severity of an accident (Table 2.068-6, point 2[b]). It is understood that vessel damage or loss, and personal injury or loss of life, though unlikely, would have serious ramifications for the marine user. Vessel damage or loss can result in lost economic and long-term financial effects while the owner waits for repairs or replacement. In the case of injury, the effects equate to possible permanent loss in economic opportunity. Compensation for vessel damages and injury are regulated by the *Canada Marine Liability Act*. Marine vessels carry insurance and liability is determined through the court process. Further discussion of this potential residual effect is provided in Section 7.6.6 of Volume 5B (Filing ID A3S1S9).

A summary of the rationale for all of the significance criteria is provided below.

- Spatial Boundary: Marine HORU RSA – marine vessels associated with demolition and deactivation activities at the Westridge Marine Terminal will be located in the Marine HORU RSA.
- Duration: immediate – the event causing concern for safety of marine users is an accident, the duration of which would be less than or equal to two days.
- Frequency: accidental – an accident resulting in harm or safety concern for marine users is rare.
- Reversibility: short-term - the increase in marine vessels and activity around the existing berth, leading in turn to the increased possibility of collisions, is limited to demolition and deactivation activities of construction phase.
- Magnitude: low to high – depending on the severity of an accident involving a marine user.
- Probability: low – it is unlikely that an accident would occur which would result in harm to a marine user. In addition, if underwater infrastructure is left in place after demolition and deactivation, Trans Mountain will complete a safety and security plan to ensure there are no navigational hazards or effects to marine users.
- Confidence: moderate – based on available information on marine user patterns in the vicinity of the Westridge Marine Terminal.

Infrastructure and Services

Deactivation and demolition would result in potential effects to infrastructure and services similar to the construction of the Westridge Marine Terminal for the increased need for waste management (see Section 7.2.5 of Volume 5B, Filing ID A3S1S7). Table 2.068-7 provides a summary of the significance evaluation of the potential residual socio-economic effects of demolition and deactivation activities at the Westridge Marine Terminal on the applicable infrastructure and services indicator.

TABLE 2.068-7

SIGNIFICANCE EVALUATION OF POTENTIAL RESIDUAL EFFECTS OF DEMOLITION AND DEACTIVATION ACTIVITIES AT THE WESTRIDGE MARINE TERMINAL ON INFRASTRUCTURE AND SERVICES

Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
			Duration	Frequency	Reversibility				
1. Infrastructure and Services Indicator – Waste and Water Infrastructure									
1(a) Temporary increase in waste to regional landfills and transfer station sites during demolition and deactivation.	Negative	RSA	Short-term	Isolated	Short-term	Low	High	Moderate	Not significant

Notes:

1 RSA = Socio-economic RSA.

2 Significant Residual Socio-economic Effect: A residual socio-economic effect is considered significant if the effect is predicted to be:

- high magnitude, high probability, short to medium-term reversibility and regional, provincial or national in extent that cannot be technically or economically mitigated; or
- high magnitude, high probability, long-term or permanent reversibility and any spatial boundary that cannot be technically or economically mitigated.

The demolition and removal of the existing berth will cause a temporary increase in solid waste flow. Prior to demolition, the existing facilities will be inspected and any equipment to be salvaged for reuse, resale or recycling will be identified. The structures will be disassembled in pieces and taken away by barge for recycling or disposal on land in accordance with applicable regulations. In addition to the Waste Management Standard provided in the Westridge Marine Terminal Environmental Protection Plan (Volume 6D, Filing ID A3S2S9), a site-specific waste management plan related to demolition and deactivation activities will be developed by the Contractor.

The duration of the residual effect on waste infrastructure is short-term as it is related directly to the demolition and deactivation of the existing berth which is part of the construction phase of the Project. The effect is reversible in the short-term as it is related to construction phase activities of the Project. The magnitude is considered to be low, as Trans Mountain will develop mutually acceptable waste management agreements with service providers. The probability of increased waste is high. Confidence in this evaluation is moderate, as specific landfills/hazardous waste operators will be identified closer to construction (Table 2.068-7, point 1[a]). A summary of the rationale for all of the significance criteria related to increased waste flow is provided below.

- Spatial Boundary: Socio-economic RSA – waste infrastructure from the Socio-economic RSA could be utilized or indirectly affected by the Project.
- Duration: short-term – the event causing the effect is the demolition and deactivation needs which occur during the construction phase of the Project.
- Frequency: isolated – the event causing the incremental waste demands are associated with the demolition and deactivation activities which are confined the construction phase.

- Reversibility: short-term – the effect will occur during the construction phase.
- Magnitude: low – mutually acceptable waste management agreements will be developed with service providers.
- Probability: high – demolition and deactivation activities will require waste services.
- Confidence: moderate – specific landfills/hazardous waste operators will be identified closer to construction.

Summary

Given Trans Mountain's ability to mitigate potential effects, and the similarity of potential effects to construction and in-water activities at the Westridge Marine Terminal, it is concluded that the potential residual environmental and socio-economic effects of deactivation and demolition activities at the Westridge Marine Terminal will be not significant.

Reference:

Fisheries and Oceans Canada. 2013. Fisheries Protection Policy Statement. Ottawa, ON. 24 pp.

Emergency management (marine)

2.069 Spatial boundaries of the marine ecological risk assessment

Reference:

i) A3W9H8, Trans Mountain response to Board IR No. 1, IR 1.67, PDF pages 377 and 378 of 421

A3S4K7, Application Volume 8B, Marine Environmental and Socio- Economic Technical Reports, TR 8B-7 – Ecological Risk Assessment of Marine Transportation Spills Technical Report:

ii) PDF pages 62, 74, and 85 of 116
iii) PDF pages 26 and 27 of 116

Preamble:

In Reference i), Trans Mountain explains why the boundaries of the Regional Study Area for the ecological risk assessment did not match the predicted extent of surface oiling for stochastic modelling at Buoy J.

The Board notes that Trans Mountain did not provide a rationale for not matching the boundaries of the ecological risk assessment with the predicted extent of surface oiling for stochastic modeling completed at the following locations: Strait of Georgia, Arachne Reef, and Race Rocks. Depending on the scenario modelled, stochastic modeling predicted that there is a high or very high probability for surface oiling to extend beyond the boundaries of the Regional Study Area at these three locations, as noted in Reference ii).

The Board notes that this appears to be in contrast to Reference iii), which states that the "spatial boundaries for evaluating the environmental effects of spills originating from marine transportation accidents include the geographic domain where potential environmental effects of spilled crude oil are expected to be measurable i.e., the modelling domain for the stochastic oil spill model."

Request:

Please explain why the spatial boundaries of the ecological risk assessment did not match the predicted extent of surface oiling for stochastic modeling completed at the following locations: Strait of Georgia, Arachne Reef, and Race Rocks.

Response:

Trans Mountain apologizes for any misunderstanding that has arisen from an inaccurate statement regarding spatial boundaries for the stochastic ecological risk assessment studies for spills during marine transportation (Filing ID A3S4K7); specifically as referenced in this Information Request as follows: "spatial boundaries for evaluating the environmental effects of spills originating from marine transportation accidents include the geographic domain where potential environmental effects of spilled crude oil are expected to be measurable *i.e.,* the

modelling domain for the stochastic oil spill model". Trans Mountain appreciates this opportunity to provide clarification.

As mentioned in the response to NEB IR No. 1.67 (Filing ID A3W9H8), the spatial boundaries of the Marine Regional Study Area (RSA) were established, in part, based on direction from the NEB, and in advance of the final selection of marine transportation spill scenarios. However, it was expected that the majority of potential environmental effects associated with accidents and malfunctions (specifically accidental oil spills) would occur within these established boundaries. The geographic domain for the ecological risk assessment studies (both the stochastic scenarios evaluated in Technical Report 8B-7 in Volume 8B, Ecological Risk Assessment of Marine Transportation Spills (Stantec Consulting Ltd. December 2013; Filing ID A3S4K7) and the Detailed Quantitative Ecological Risk Assessment for Loading Accidents and Marine Spills (Stantec Consulting Ltd. May 2014; Filing IDs A3W9K1 to A3W9K9) was in fact the Regional Study Area (RSA) Boundary as illustrated in Figure 4.2 of Technical Report 8B-7 (Filing ID A3S4K7, PDF page 28), and not the geographic domain for the stochastic oil spill modeling, which occupied a larger area.

It must be recognized that where oil can potentially float for extended periods of time and travel great distances, some amount of oil could potentially cross any established RSA boundary. The ecological risk assessment has considered the the potential environmental effects resulting from these hypothetical spills, and the potential effects occurring outside of the RSA boundary would be very small in comparison to the effects described within the RSA, and would not change the overall conclusions of the ecological risk assessment.

While it is acknowledged that for some spill scenarios, surface oiling was predicted to extend beyond the RSA boundaries as noted, it should be understood that the probability of oil presence outside of the RSA is not an indicator of the quantity of oil that might be present outside of the RSA boundary. This is the case as the oil spill fate modelling tracks 50,000 individual "spillets" of oil from the moment of release, until the end of the simulation. Over time, the mass of oil remaining in each individual spillet decreases as a result of evaporation, dissolution, stranding on shorelines and other processes. The lower limit of mass in a spillet for modeling purposes was 1E-08 m^3, or 0.01 mL (a very small droplet). As a rule of thumb, 90% of the volume of an oil spill is found within approximately 10% of the surface area of the slick (Goodman undated). Therefore, although the model simulations identified a finite probability of crude oil being present beyond the RSA boundary, this statistic has no bearing on the quantity of oil outside of that boundary, which could be very small.

To reiterate, each seasonal set of calculations considered over 360 individual stochastic simulations. The oiling probability bands as presented in the stochastic oil spill model output are based on grid squares which contained crude oil on the water surface within the duration of the model run for ≥10%, ≥50% and ≥90% of the individual simulations. However, the cut off for deeming oil to be present was based on as little as 0.01 mL of oil within a surface grid of 500 m x 500 m considered in the modelling domain. For comparison, a thin sheen on the surface of the water (of 1 µm thickness) would require a volume of 250 L of oil evenly distributed over a grid square of this size.

The following discussion is intended to provide additional context which considers the total amount of oil involved where the probability of oiling is predicted to extend beyond the RSA Boundary.

The attached tables and drawings present summaries of the results for credible worst case spills of 16,500 m^3 of Cold Lake Winter Blend (CLWB) occurring at Strait of Georgia, Arachne Reef and Race Rocks (NEB IR No. 2.069 - Attachments 1 through 3, respectively). For these scenarios, the average quantity of spilled CLWB present on the surface of the water outside the RSA boundaries at the end of the simulations (expressed as % of total spilled volume), ranged from 0.07% for spills at Arachne Reef, to 0.84% for spills at Race Rocks. In other words, taken as a whole (across all simulations and for all three spill locations), more than 99% of the spilled oil remained within the RSA boundaries at the end of the simulations.

At the Strait of Georgia hypothetical spill location (Table 1 of NEB IR No. 2.069 - Attachment 1) the average quantity of oil on the water surface outside of the RSA boundary at the end of the four seasonal sets of simulations was 0.65% of the spilled volume of 16,500 m^3, ranging from 0.21% in summer to 0.99% in winter. Based on evaluation of individual simulations, the maximum amount of oil outside the RSA boundary was almost 14% in both winter and spring, with these scenarios involving weather and current conditions that tended to drive floating oil to the north. However, as can be seen from Figure 1 of NEB IR No. 2.069 - Attachment 1, these conditions were rare, so that in general, fewer than 5% of the modeled scenarios resulted in more than 5% of the floating oil being driven beyond the RSA boundary (this occurred 20 times in 364 “winter” simulations, and 16 times in 364 “spring” simulations), whereas in the majority of cases, very little if any oil was present outside of the RSA boundary at the end of the model simulation. Taken as a whole, less than 5% of the spilled oil was floating on the water surface outside the RSA boundary at the end of the simulations in 96.9% of simulations at the Strait of Georgia release location.

At the Arachne Reef hypothetical spill location (Table 1 of NEB IR No. 2.069 - Attachment 2) the average quantity of oil on the water surface outside of the RSA boundary at the end of the four seasonal sets of simulations was 0.07% of the spilled volume of 16,500 m^3, ranging from <0.01% in winter and spring, to 0.18% in summer. Based on evaluation of individual simulations, the maximum amount of oil outside the RSA boundary was almost 5.52% in summer, and 2.58% in fall, but much less than 1% in winter and spring. As can be seen from Figure 1 of NEB IR No. 2.069 - Attachment 2, only 2 scenarios during the summer season resulted in more than 5% of the spilled oil moving beyond the RSA boundary, with none of the oil going beyond the RSA boundary for the winter, spring or fall scenarios. Taken as a whole, less than 5% of the spilled oil was floating on the water surface outside the RSA boundary at the end of the simulations in 99.9% of simulations at the Arachne Reef release location.

At the Race Rocks hypothetical spill location (Table 1 of NEB IR No. 2.069 - Attachment 3) the average quantity of oil on the water surface outside of the RSA boundary at the end of the four seasonal sets of simulations was 0.84% of the spilled volume of 16,500 m^3, ranging from >0.01% in winter to 1.67% in summer. Based on evaluation of individual simulations, the maximum amount of oil outside the RSA boundary was about 25% in both summer and fall, these scenarios involving weather and current conditions that tended to drive floating oil to the

west. However, as can be seen from Figure 1 of NEB IR No. 2.069 - Attachment 3, these conditions were rare. About 10% of the modeled scenarios in summer and fall resulted in more than 5% of the spilled oil on the water surface outside the RSA boundary, however, none of the simulations in winter or spring resulted in more than 5% of the oil on the water surface outside of the RSA. Taken as a whole, less than 5% of the spilled oil was floating on the water surface outside the RSA boundary at the end of the simulations in 94.7% of simulations at the Race Rocks release location.

As indicated above, specific weather and current conditions can result on spilled crude oil travelling long distances on the surface of the water, so that almost any arbitrary boundary line could be crossed under some circumstances. However, as shown by this analysis, such conditions are infrequent (as indicated by the relatively infrequent occurrence of substantial quantities of CLWB beyond the RSA boundaries) and have little effect on the overall assessment of effect magnitude and spatial extent as described in the ecological risk assessment reports. In addition, because potential environmental effects of oil spills are described in terms of the percentage of the available habitat affected within the RSA, as well as the absolute area affected, extension of the RSA boundaries to ensure that all predicted oiling occurred within such extended RSA limits would effectively “dilute” the apparent environmental effects by increasing the overall quantity of available habitat (water surface area, and shoreline length) to include areas which are rarely affected by oil. Furthermore, it should also be noted that the spill modelling completed in support of the various ERA studies assumes no spill response or mitigation, which adds an additional measure of conservatism to the potential extent and probability of oiling in areas outside the RSA.

On this basis, Trans Mountain submits that the RSA boundaries as implemented and considered in the ERA reports reasonably capture the potential environmental effects of hypothetical crude oil spills at locations in the Strait of Georgia, at Arachne Reef, and at Race Rocks.

References:

Goodman, R. undated. Oil On Water Sheens. Innovative Ventures (ivl) Ltd. Cochrane, AB.

Stantec Consulting Ltd. 2013. Technical Report 8B-7 of Volume 8B, Ecological Risk Assessment of Marine Transportation Spills Technical Report. December 2013. Prepared for the Trans Mountain Pipeline ULC. Fredericton, NB.

Stantec Consulting Ltd. 2014. Detailed Quantitative Ecological Risk Assessment for Loading Accidents and Marine Spills. May 2014. Prepared for the Trans Mountain Pipeline ULC. Fredericton, NB.

Engineering and safety

2.070 Reliability study on pump stations

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 58 of 110

Preamble:

The reference states that four existing pump stations (at Albreda, Stump Lake, Hope, and Wahleach) are not hydraulically required and will be idle under normal operating scenarios. The reference further states that the pump stations may be deactivated if a reliability study indicates that these stations will not improve the reliability of the system.

Request:

Please provide:

a) a description of the "normal operating scenarios" under which the above four pump stations will be idle;

b) a description of the scenarios that could require the use of the existing pump stations at Albreda, Stump Lake, Hope, and Wahleach;

c) confirmation that the above four pump stations, which are in "idle" state, will still be covered under the Trans Mountain Facility Integrity Management Program;

d) an indication of when the reliability study will be completed; and

e) a brief explanation on how the reliability study will be used to decide whether the pump stations would be deactivated.

Response:

a) Normal operating scenarios are those which require the pipeline (Line 1) to operate at or near full design capacity while all pump stations and pump units intended for regular service (i.e. not including Albreda, Stump, Hope, and Wahleach) are available for use.

b) Scenarios which could require the use of the existing pump stations at Albreda, Stump, Hope, and Wahleach are those which require the pipeline (Line 1) to operate at or close to full design capacity while one or more pump units (or pump stations) intended for regular service are not available for use.

c) Pump stations that will be "idle" will be covered under the Trans Mountain Facility Integrity Management Program.

d) The reliability study to determine the potential benefit of Albreda, Stump, Hope, and Wahleach will be conducted as part of the reliability, availability, and maintainability (RAM)

analysis referred to in the response to NEB IR No. 1.93f (Filing ID A3W9H9). It is expected that the RAM analysis will be completed by the end of Q1, 2015.

e) Refer to the response to NEB IR No. 1.93f (Filing ID A3W9H9). In brief, hydraulic runs will determine the reduction in Line 1 capacity while pump units (and pump stations) intended for regular service are not available. The likelihood of the pump units (pump stations) not being available and the durations of the outages will be established from operating experience. The capacity reductions, frequencies, and durations will be used to determination the overall pipeline system availability factor. Additional hydraulic cases will be used to establish the improvement to the availability factor that will result from the operation of one or more of Albreda, Stump, Hope, and Wahleach while the pump units (pump stations) intended for regular service are not available. The benefit of the improvement will be weighed against the additional cost and practicality of maintaining the idle pump stations in a state of readiness for operations.

2.071 Decommissioning of facilities at Wolf and Blue River Pump Stations

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 57 of 110
ii) National Energy Board Onshore Pipeline Regulations, sections 1 and 45.1

Preamble:

Reference i) states that the scope of the pump station work includes 11 new Line 2 pump stations, including one at a new site at Black Pines, British Columbia, and 2 stations (Wolf and Blue River) that will replace the existing pump stations, utilizing the existing electrical infrastructure.

Reference ii) defines "decommission" as permanently ceasing operation such that the cessation does not result in the discontinuance of service. It also establishes the requirements to decommission a pipeline or part of one.

Request:

For the Wolf and Blue River Pump Stations, please provide:

a) a list of activities that will be carried out during replacement, as indicated in Reference i);

b) schematics of the two stations clearly indicating what components will be removed and what will be added;

c) a hazard assessment for the replacement work;

d) an assessment of any potential environmental and socio-economic effects of the replacement work; and

e) a discussion of whether the proposed activities at these pump stations are considered decommissioning activities as defined in Reference ii).

Response:

a) For the proposed Wolf and Blue River pump stations, Trans Mountain intends to add new pump units suitable for Line 2 pipeline service and to deactivate the pump units serving the existing pipeline. The new pumps cannot be installed in the existing pump buildings and the existing station piping is undersized for Line 2 service. The existing electrical service building (ESB), operator building, and electrical substation are suitable for Line 2 service and will be re-utilized. Activities at each site will include:

- Grade site for the proposed Line 2 pump station addition.
- Extend fence around the new pump station (Wolf only).
- Re-utilize (modify as necessary) existing pump station containment area.
- Construct pump building and pump foundations and install sump tank.
- Install pumps, motors, valves, and associated station piping.

- Install pump building.
- Install electrical equipment and instrumentation.
- Install power and control wiring and connect wiring to existing ESB and operator buildings.
- Tie-in pump station piping to Line 2.
- Commission new pump station.
- Deactivate the existing pump building, pumps, motors, associated station piping and sump tank.

b) See NEB IR No. 2.071b – Attachment 1 for a simple schematic showing the components that will be added and deactivated at Wolf pump station. The schematic is also representative of the proposed changes at Blue River. In principle, the existing pump buildings, pumps, piping, and sump tanks, will be deactivated and replaced with similar components, suitable for Line 2 service, adjacent to the existing pump buildings. The electrical substations, electrical service buildings (ESBs), and operator buildings will be re-utilized for Line 2 service. Process flow diagrams (PFDs), piping and instrumentation drawings (P&IDs), and plot plans identifying existing and new elements will be developed during the detailed engineering and design phase.

c) Hazard assessments, specifically for the proposed replacement work at Wolf and Blue River, have not been completed. The proposed replacement pump stations will be very similar to the existing stations, which were constructed in 2006, and very similar to the other new stations proposed as part of the Project. A preliminary pump station risk assessment has been provided in the response to NEB IR No. 1.98a - Attachment 10 (Filing ID A3W9T3). Safety hazard assessments for construction and deactivation activities will be developed as part of detailed construction planning in late 2015 or early 2016.

d) Potential environmental and socio-economic effects resulting from the new pump installation and deactivation (*i.e.*, replacement) activities at Wolf and Blue River pump stations were considered in the assessment of pump stations in Section 7.4 of Volumes 5A and 5B (Filing ID A3S1Q9 and A3S1S7). Table 7.4-1 in each volume describes the activities to be conducted at pump station facilities and includes new pump installation and deactivation activities at Wolf and Blue River pump stations. Nonetheless, Trans Mountain is providing the following summary of the effects assessment of replacement activities at Wolf and Blue River pump stations for clarity with reference to potential effects and mitigation discussed in the Environmental and Socio-economic Effects Assessment (Volumes 5A and 5B) (Filing IDs A3S1Q9, A3S1R0, A3S1S7, A3S1S8, and A3S1S9) as warranted.

The infrastructure to be deactivated will remain on site should there be the need to reactivate it at some point in the future. The deactivated piping will be drained, purged with nitrogen, and disconnected from the existing pipeline (which will form part of Line 1).

No new clearing is anticipated but the existing fence line at the Wolf pump station will be extended around Trans Mountain owned industrial land. Activities associated with the replacement work are described in the response to NEB IR No. 2.071a.

Based on an understanding of the environmental and socio-economic settings and the anticipated Project-related activities, potential environmental and socio-economic interactions include soil and soil productivity, water quality and quantity, air emissions, greenhouse gas (GHG) emissions, acoustic environment, infrastructure and services.

The activities to be conducted are expected to produce potential effects similar to construction and operation activities at other pump stations and include decrease in soil productivity, alteration of natural surface drainage patterns, increased air emissions, GHG emissions and noise during replacement activities, and increase in waste flow to regional landfills.

Soil handling may result in decreased topsoil/root zone material productivity during topsoil/root zone material salvaging or increased wind and water erosion, however, mitigation measures in the Facilities Environmental Protection Plan (EPP) of Volume 6C (Filing ID A3S2S6) are expected to reduce the potential for admixing and soil erosion. Mitigation measures include maintaining separate storage windrows/berms for grade subsoil and topsoil/root zone material and installing erosion and sediment control structures and materials and implementing, as warranted, erosion control measures outlined in the Soil Erosion and Sediment Control Contingency Plan. If any contaminated soil is encountered during replacement activities, measures from the Contamination Discovery Contingency Plan (Section 1.0 of Appendix B) and the Waste Management Standard (Section 8.0 of Appendix C) of the Facilities EPP will be implemented. Additional information related to potential effects, mitigation measures and residual effects resulting from pump station replacement activities on soil and soil productivity is provided in Section 7.4.2 of Volume 5A (Filing ID A3S1Q9).

Replacement activities may result in localized alteration of natural surface drainage patterns where grading is required, however, the extent of grading is expected to be minor since the pump stations are located on relatively level terrain, and drainage/erosion control measures will be implemented where warranted, as described in the Facilities EPP. Furthermore, areas disturbed during facility construction outside of the development zone will be recontoured to pre-construction contours, where feasible. Additional information related to potential effects, mitigation measures and residual effects resulting from pump station replacement activities on water quality and quantity is provided in Section 7.4.3 of Volume 5A (Filing ID A3S1Q9).

Increased air and GHG emissions will result from the use of equipment and vehicles during replacement activities and dust has the potential to occur from exposed soils under dry and windy conditions. GHG emissions and air emissions will be limited through implementation of mitigation measures provided in the Facilities EPP, such as restricting idling, ensuring equipment is well-maintained, and using multi-passenger vehicles. Additional information related to potential effects, mitigation measures and residual effects resulting from pump station replacement activities on air emissions is provided in Section 7.4.4 of Volume 5A (Filing ID A3S1Q9).

Pump station replacement activities may result in increased noise during construction. Operational noise is not expected to increase beyond existing noise levels (see Table 7.4.6-

5 of Volume 5A, Filing ID A3S1Q9). Noise related disturbance during replacement activities will be reduced through implementation of mitigation measures provided in the Facilities EPP, which includes scheduling construction activities within 300 m of residences, cabins, occupied campgrounds, or parks in accordance with applicable municipal noise bylaws or approval conditions. Additional information related to potential effects, mitigation measures and residual effects resulting from pump station replacement activities on the acoustic environment is provided in Section 7.4.6 of Volume 5A (Filing ID A3S1Q9).

The assessment of effects on infrastructure and services relating to waste was conducted considering all the Project components in an integrated manner (e.g., pipeline, pump stations, terminals, and other ancillary facilities) (see Section 7.2.5 of Volume 5B, Filing ID A3S1S7). Overall, socio-economic effects related to increased waste flow to regional landfills are expected to be minor given the limited scope of activities associated with the pump station replacements. Potential effects, mitigation measures and residual effects resulting from Project activities, including pump station replacement activities, on infrastructure and services is provided in Section 7.2.5 of Volume 5B (Filing ID A3S1S7).

Potential accidents and malfunctions arising from pump station replacement activities include small spills and transportation accidents. However, accidents and malfunctions are unlikely to occur with the implementation of the recommended mitigation measures provided in Section 7.9.3 of Volume 5A (Filing ID A3S1R0).

Mitigation will be applied from the sections referenced for each element and the Facilities EPP, as warranted, to reduce or eliminate potential effects. Given Trans Mountain's ability to mitigate potential effects, and the similarity of potential effects to the construction of the other pump stations associated with the Project, it is concluded that the residual environmental and socio-economic effects of the replacement activities at Wolf and Blue River will be not significant.

e) Trans Mountain does not consider the proposed activities at Wolf and Blue River pump stations to be decommissioning, as defined in the NEB Onshore Pipeline Regulations. Trans Mountain intends to deactivate the existing pumps, motors, associated station piping and sump tank (i.e. remove the pumps from service) at each location.

2.072 Miscellaneous pump station changes

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 73 of 110

Preamble:

The reference provides a description of the proposed replacement and reconfiguration work at the Hinton, Jasper, Rearguard, and Darfield Pump Stations. The reference further states that additional Variable Frequency Drives (VFDs) may be required at the existing stations in the North Thompson region.

Request:

Please provide:

a) a list of the pump stations that are considered to be in the North Thompson region; and

b) a set of schematics that includes the Hinton, Jasper, Rearguard, and Darfield Pump Stations, clearly indicating the components that will be removed and those that will be added.

Response:

a) The existing and proposed new pump stations that are located in the North Thompson region are:

- Rearguard
- Albreda
- Chappel
- Blue River
- Finn
- McMurphy
- Blackpool
- Darfield
- Black Pines

b) Schematics showing the components that will be added or removed at the Hinton, Jasper, Rearguard and Darfield pump stations are not available at this time. Process flow diagrams (PFDs), piping and instrumentation drawings (P&IDs), and plot plans identifying existing and new elements will be developed during the detailed engineering and design phase.

2.073 Pump stations on Line 1

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering:

i) PDF page 57 of 110
ii) PDF page 60 of 110
iii) A3S0Q7, Application Volume 1, Summary, PDF page 27 of 113

Preamble:

Reference i) states that, after completing the Project, Line 1 will have 19 active pump stations. The reference also indicates that the scope of the pump station work for the Project includes adding a unit to the Sumas Pump Station to support increased volumes to the Puget Sound system.

In Reference ii), Table 3.3.4 provides a summary of pumps and motors for Line 1 and Line 2 after the Project. According to the table, there will be 20 pumps stations for Line 1. The additional pump station shown in the table is "Sumas Puget Sound." According to Note 5, increased flow to the US Puget Sound line will require additional horse power at Sumas.

Reference iii) states the existing Trans Mountain Pipeline System transports crude oil and a range of refined products to multiple locations in British Columbia, which also includes deliveries to Sumas on the Trans Mountain Pipeline (Puget Sound) LLC pipeline to different points in Washington State.

Request:

Please provide:

a) a reconciliation between Reference i) and ii) regarding the number of pump stations on Line 1 after the Project is completed;

b) a map of the Board-regulated portion of the Trans Mountain Pipeline (Puget Sound) LLC pipeline, including associated facilities;

c) an explanation of the relationship between the Project and the Trans Mountain Pipeline (Puget Sound) LLC pipeline;

d) the Trans Mountain Pipeline (Puget Sound) LLC pipeline technical specifications, including current maximum operating pressure (MOP); and

e) a description of the proposed modifications to the Trans Mountain Pipeline (Puget Sound) LLC pipeline, including any potential changes to capacity and MOP.

Response:

a) There will be 19 pump stations on the proposed Line 1. Sumas Puget Sound Pump Station as identified in Table 3.3.4, Section 3.3.1, Volume 4A of the Facilities Application (Filing

ID A3S0Y8) is not physically separate from Sumas Pump Station. The pump units which serve the Puget Sound Pipeline are immediately adjacent to the pumps that serve the Trans Mountain mainline and all of the pump units share the common infrastructure at the site.

b) The Board does not regulate any part of the Trans Mountain Pipeline (Puget Sound) LLC owned pipeline(s), which are located entirely in Washington State. The portion of the Puget Sound Pipeline that the Board regulates is owned by Trans Mountain Pipeline ULC, originates at Sumas Pump Station and connects to the portion owned by Trans Mountain Pipeline (Puget Sound) LLC at the Canada / US border. NEB IR No. 2.073b – Attachment 1 is a map of the portion of the Puget Sound Pipeline in Canada. The Board also regulates Sumas Terminal and the NPS 24 and NPS 20 branch pipelines that connect Sumas Terminal to Sumas Pump Station. Normally, Sumas Terminal is utilized to stage batches of crude oil destined for the refineries in Washington State via the Puget Sound Pipeline. Sumas Terminal can also be used to stage batches on the Trans Mountain Pipeline, if necessary.

c) Trans Mountain is seeking approval, within the scope of the Project, for Trans Mountain Pipeline ULC owned facilities in Canada which will serve the Puget Sound Pipeline, the US based assets of which are owned by Trans Mountain Pipeline (Puget Sound) LLC. The facilities that Trans Mountain is seeking approval for include:

- The Sumas Terminal Line 2 Take-off (see Section 3.5.4, Volume 4A, Filing ID A3S0Y9);
- Tank 100 and the associated receipt and delivery infrastructure at Sumas Terminal (see Section 3.4.2, Volume 4A, Filing ID A3S0Y8);
- The additional pump unit at Sumas Pump Station (see Volume 4A, Section 3.3.1, Filing ID A3S0Y8);
- The border sending and receiving traps (see Volume 4A, Section 3.5.1, Filing ID A3S0Y9).

d) Attachment 2.073d-1 (NEB IR No. 2.073d – Attachment 1) is a map of the Puget Sound Pipeline System in the US. Table 2.073D-1 below provides basic technical information about the Puget Sound Pipeline System in the US.

TABLE 2.073D-1

PUGET SOUND SYSTEM DATA

Pipeline Segment	Length (km)	Diameter	Coating Type	Installation
Can/US Border to Laurel	24.8	NPS 20	Coal Tar Enamel	1954
Laurel to Burlington	44.4	NPS 20	Coal Tar Enamel	1955
Laurel to Ferndale	18.8	NPS 16	Coal Tar Enamel	1954
Burlington to Anacortes	14.6	NPS 16	Coal Tar Enamel	1955

Figures 2.073D-1 and 2.073D-2, below, provide MOP and elevation profiles for the Puget Sound Pipeline System from Sumas to Ferndale and from Sumas to Anacortes. The Sumas to Laurel segments (kmP0.0 to kmP33.4) are the same in each figure.

Figure 2.073D-1

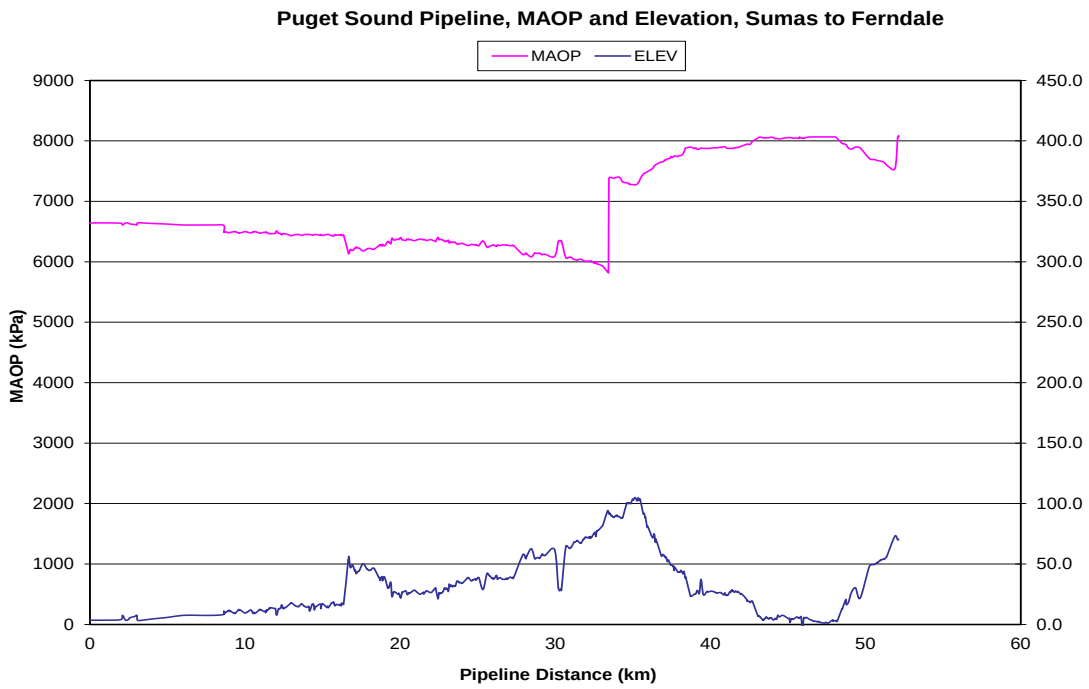
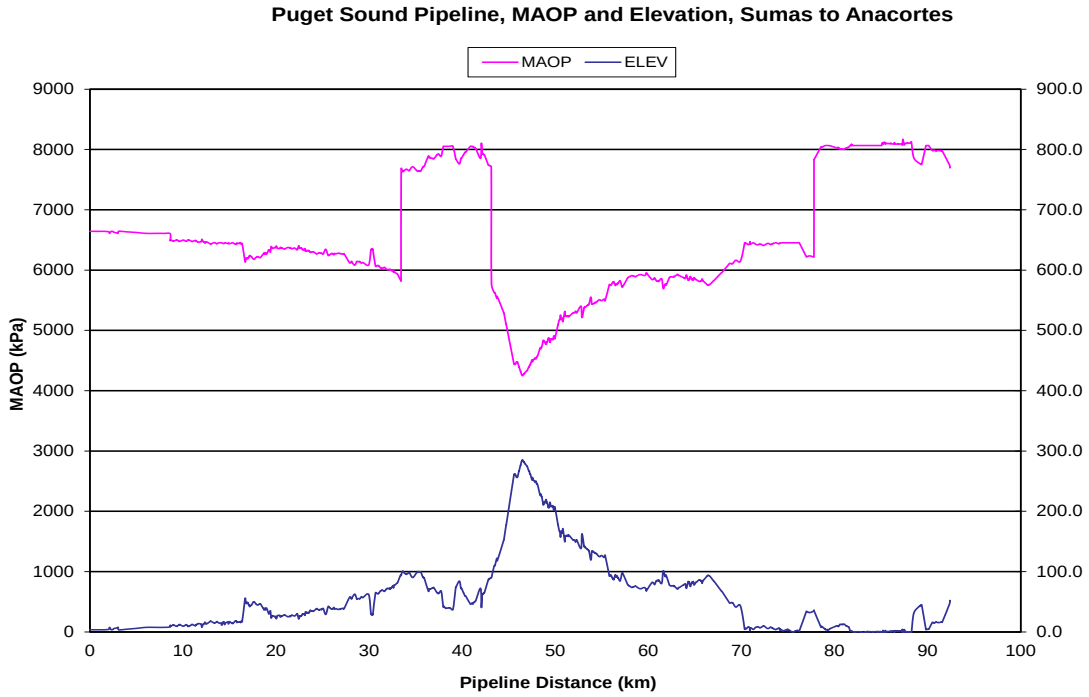


Figure 2.073D-2



e) Trans Mountain Pipeline (Puget Sound) LLC has not made application to regulatory authorities in Washington state for any modifications to its assets (which are entirely based in Washington State). The commercial or technical viability of the proposed Project does not depend on modifications to any assets owned by Trans Mountain Pipeline (Puget Sound) LLC. The references in the Facilities Application to increased volume and flow to the Puget Sound System, with respect to the proposed additional pump unit at Sumas Pump Station, relate to the ability to more efficiently move heavy batches and to provide improved reliability, given that Sumas Pump Station is the initiating station for the Puget Sound Pipeline System. Trans Mountain continues to review the capacity of the Puget Sound Pipeline System and will advise the Board if capacity changes are planned in the future.

2.074 Leak containment at the pump stations

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF pages 57 to 73 of 110

Preamble:

The reference provides information on the proposed pump station work for both Lines 1 and 2. It indicates that there will be a total of 12 new pump stations. Two of these stations will not be co-located with the existing pump stations.

Request:

Please provide a description of:

a) the design being considered to contain any accidentally leaked hydrocarbons at the proposed new pump stations; and

b) the existing methods or design upgrades being considered to contain accidentally leaked hydrocarbons at existing pump stations along the Project.

Response:

a) The design being considered to contain an accidental product release at a proposed new pump station will generally include the following:

- Piping connections to mainline pumps and pump suction, discharge, and check valves will be located inside the pump building.
- The pump building will have floor sumps with level switches that will cause an alarm to be generated.
- Grading around the outdoor pump station piping will direct drainage into a containment area located within the station property.
- A concrete pad and / or a liner system will be installed under the outdoor pump station piping (i.e. areas containing flanged connections at emergency isolation valves and mainline valves). The liner or culverts will extend towards the containment area.
- The containment area will hold surface run-off until the contents can be examined by operations personnel and verified to be acceptable for release.
- Discharge from the containment area will be controlled by a manually operated valve. The valve will normally be in the closed position. The containment area will hold leaked product until remedial measures can be implemented.
- A hydrocarbon detector will be mounted inside a protective well at the low point in the containment area. The hydrocarbon detector will float on the surface of water that may

accumulate in the containment area, identify an oil film, and cause an alarm to be generated.

- Spill containment, with hydrocarbon detection, will also be included at the location of sending and receiving traps.

b) The site containment systems (outside the pump buildings) that are in place to contain an accidental product release at existing pump station locations are summarized in Table 2.074B-1. All of the pump buildings at all of the existing pump stations have concrete containment systems, some of which drain to the waste oil sump tank. Trans Mountain believes that the existing site and pump building containment systems are adequate and does not intend to upgrade them as part of the Project.

TABLE 2.074B-1

EXISTING SITE (OUTSIDE THE PUMP BUILDINGS) CONTAINMENT

Location	Existing Site Containment
Edmonton	HDPE lined remote impoundment area
Stony Plain	Bentomat lined containment area
Gainford	Earthen containment area
Chip	Bentomat lined containment area
Niton	Earthen containment area
Wolf	Bentomat lined containment area
Edson	Earthen containment area
Hinton	Bentomat lined containment area
Jasper	Concrete containment area
Rearguard	Bentomat lined containment area
Albreda	Earthen containment area
Chappel	Bentomat lined containment area
Blue River	Bentomat lined containment area
Finn	Bentomat lined containment area
McMurphy	Polyurea lined containment area
Blackpool	Bentomat lined containment area
Darfield	Earthen containment area
Kamloops	Concrete containment area
Stump	Bentomat lined containment area
Kingsvale	HDPE lined containment area
Hope	Bentomat lined containment area
Wahleach	Bentomat lined containment area
Sumas	Earthen berm
Port Kells	Bentomat lined containment area

2.075 High voltage alternating current (AC) – direct current (DC) interference

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 41 of 110

Preamble:

The reference indicates that, in locations where the new pipeline runs parallel to high voltage AC power lines, each location will be evaluated and special designs will be developed as required for mitigating the potential for mutual interference between the pipeline and the power line in accordance with CAN/CSA-C22.3 No. 6 – M91: *Principles and Practices of Electrical Coordination between Pipelines and Electric Supply Lines*.

The reference also states that the detailed AC/DC mitigation requirements of the pipeline will be determined during the detailed engineering and design phase.

Request:

Please provide:

a) confirmation that Trans Mountain will comply with the current version of CSA-C22.3 No. 6, which was released in July 2013;

b) the minimum clearance between the pipeline and the power lines in the proximity of the right-of-way;

c) the measures to protect the pipe from induced voltage due to the proximity to power lines during construction;

d) the Project's facilities' protection scheme against direct or indirect lightning strikes; and

e) an indication of when the AC/DC mitigation requirements for the expansion system will be determined.

Response:

a) Trans Mountain has committed to comply with CSA-C22.3 No.6 – M91 as per the Application. Trans Mountain is aware of and understands the CAN/CSA 22.3 No.6-13 latest edition and its' application to the hazards of induced voltage and fault currents to pipelines. Trans Mountain does not accept the third paragraph of Section 5.3 of this standard and believes that this paragraph does not consider many issues inherent in potential damage to a pipeline nor does it allow for engineered solutions.

   Trans Mountain commits to reducing hazardous induced and conducted voltages on its pipelines to meet a maximum 15 VAC steady state voltage and to limit transient AC voltages to IEEE Standard 80 at all points of regular contact. Please refer to the response to BC Hydro IR No. 1.1.1.4 (A06785 Page 3 & 4 of 12) for further information.

Reference:

IEEE 80-2000, IEEE Guide for Safety in AC Substation Grounding.

b) Trans Mountain will in most cases comply with BC Hydro engineering practice of having a separation distance of 30 metres between the pipeline and powerline. However, as noted in response to BC Hydro IR No. 1.1.1.3 (A06785 Page 2 & 3 of 12) there are situations where it will be less and the separation distance will be determined in agreement with BC Hydro based on detailed engineering designs specific to existing site conditions.

c) It is not necessary to protect the pipe during construction from induction when above ground. Mitigation measures, where necessary to protect workers and the public, will primarily be based on primary contact protection and secondarily by restricted access and equipotential zones. Primary contact protection will be in the form of Class 0 high voltage gloves and electrical resistive footwear (ohm symbol). Restricted access will be in the form of temporary, non-conductive fencing. Equipotential zones will employ conductive ground mats that will be bonded together and to the pipeline. Pipeline sections will be bonded together during tie-in procedures and other in-ditch work. Ditch walls will be controlled with non-conductive blankets except for points of access and egress. Lowering in equipment will be bonded to pipeline in-ditch when closer than 1m from work crews or the pipeline. Bonded equipment will be protected above the ditch line with temporary barricades and conductive ground mats. These mitigation measures and other worksite safety procedures will ensure protection of work crews and the public during construction of the pipeline.

   Where the pipeline will be buried for longer than four months prior to completion of the project, permanent mitigation measures will be installed as soon as practical to protect workers and the pipeline integrity.

d) Trans Mountain will follow the recommendations of the latest edition of American Petroleum Institute (API) Recommended Practice 2003, Protection Against Ignitions Arising Out of Static, Lightning and Stray Currents. Trans Mountain will also follow the requirements of the latest edition of Canadian Standards Association Canadian Electrical Code, C22.1, Safety Standard for Electrical Installations.

References:

API Recommended Practice 2003 – Protection Against Ignitions Arising Out of Static, Lightning and Stray Currents.

CSA Canadian Electrical Code, C22.1 – Safety Standard for Electrical Installations.

e) The AC/DC mitigation requirements will be determined during the detailed engineering and design phase of the project which is currently underway. This will include determination of pipeline centerline, and potential offset distance between the pipeline and high voltage power line. Trans Mountain has committed to BC Hydro in response to BC Hydro IR No. 1.1.1.2 (A06785) to agree with BC Hydro by October 31, 2014 on how potential impacts to BC Hydro infrastructure and BC Hydro's existing Right-of-Way (ROW) rights will be

addressed. Following this agreement and at least three months prior to start of pipeline construction the AC/DC mitigation requirements for TMEP will be determined.

Summary of New Commitments:

- Trans Mountain commits to limiting the maximum steady state AC voltage to 15V along the entire project.
- Trans Mountain commits to limiting the transient AC voltages, at all points of regular contact, to those described in IEEE Standard 80.
- Safe work procedures and mitigation measures will be implemented during the construction phase to protect workers and public from accidental contact with hazardous voltages.
- Permanent mitigation measures will be installed on any portion of the pipeline that will be buried for longer than four months prior to completion of the project.

2.076 Pump stations and terminals – motor protection

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering:

i) PDF page 61 of 110
ii) PDF page 70 of 110
iii) A3S0Z5, Application Volume 4A, Project Design and Execution – Engineering, Appendix D – Tables, Table 5.1.2 – KMC Standards, Specifications, Manuals and Recommended Practices, PDF page 4 of 93

Preamble:

Reference i) states that all new pump stations will use VFDs for starting and controlling the speed of the mainline motors. As a minimum, one VFD will be installed at all locations with the exception of Edmonton and Kamloops, which are deemed critical pump stations. Edmonton will have a second VFD installed as a back-up system. Hydraulic considerations require a dedicated VFD for each unit at Kamloops.

Reference i) also indicates that initial discussions with BC Hydro suggest that additional VFDs, as many as one per pump unit, may be required in the North Thompson area at both existing and new pump stations. The final configuration of VFDs will be established during the detailed engineering and design phase.

Reference ii) specifies that the mainline motors will be protected by fuses, coordinated as determined in the coordination study and by a motor protection relay (MPR).

Reference ii) also states that the pump station protection system logic will be governed by the Operating Limits and Protective Device Settings document, which will be enhanced to include the new pump stations in the expanded Trans Mountain Pipeline System. A shutdown key will also be developed during the detailed engineering and design phase.

The Board notes that Reference iii) does not include a list of standards associated with the operation of motors.

Request:

For each terminal and pump station, please provide:

a) a single line diagram of the power sub-system showing:
   a.1) the connection between VFDs and pumps;
   a.2) overload, short circuit, and ground fault protection for pump motors and back-up protections;
   a.3) circuit breakers, contactors, and fuses;
   a.4) specifications of the fuses, with their characteristics; and
   a.5) alternate bus arrangements, if any;

b) a list of the applicable standards for the safe operation of motors;

c) the Operating Limits and Protective Device Settings document;

d) the number of pumps that will be controlled by a single VFD;

e) a description of the coordination between upstream and downstream protective devices during short circuit and ground faults, with their respective tripping arrangements and time-current characteristics;

f) the total load requirement for each VFD;

g) the VFD technical specifications;

h) details on short circuit and ground fault levels;

i) a description of the MPR and specifications;

j) the rationale behind using fuses instead of vacuum circuit breakers and whether the fuse characteristics will be adequate to clear the maximum fault currents without damaging the system; and

k) a description of the primary and back-up protection of the pump units, including their settings.

Response:

a) Attachment 2.076a-1 (NEB IR No. 2.076a – Attachment 1) includes preliminary high voltage (HV) electrical single line drawings for the terminals and pump stations. Given their preliminary nature, these drawings have not yet been fully reviewed and are subject to change during the detailed engineering and design phase. In addition, detailed information such as fuse sizes, buss data, breaker and contactor ratings, etc., will be established when vendor information for the electrical equipment becomes available in late 2015 or in 2016.

a.1) The connections between the variable frequency drives (VFDs) and the pumps, to the extent that they have been determined, may be shown on the drawings, but will not be finalized until the detailed engineering and design phase and / or when vendor engineering data becomes available.

a.2) Overload, short circuit, and ground fault protection for pump motors and back-up protections, to the extent that they have been determined, may be shown on the drawings, but will not be finalized until the detailed engineering and design phase and / or when vendor engineering data becomes available.

a.3) Circuit breakers, contactors, and fuses, to the extent that they have been determined, may be shown on the drawings, but will not be finalized until the detailed engineering and design phase and / or when vendor engineering data becomes available.

a.4) Specifications of the fuses, with their characteristics, to the extent that they have been determined, may be shown on the drawings, but will not be finalized until the detailed

engineering and design phase and / or when vendor engineering data becomes available.

a.5) Alternate buss arrangements, if applicable, will not be known until vendor engineering data becomes available.

b) The latest editions of the following standards and recommended practices will be used in the specification and installation of electric motors for all terminals and pump stations to ensure that they will operate safely.

CSA C22.1	Canadian Electrical Code, Part 1
CSA C22.2 No. 100-95	Motors and Generators
IEEE 112	IEEE Standard Test Procedure for Polyphase Induction Motors and Generators
ANSI/API 541	Form Wound Squirrel Cage Induction Motors, 500 Horsepower and Above
NEMA MG 1	Motors and Generators
NEMA MG 2	Safety Standard and Guide for Selection, Installation and Use of Electrical Motors and Generators
IEEE 43	Recommended Practice for Testing Insulation Resistance of Rotating Machinery
IEEE 522	Guide to Testing Turn to Turn Insulation On Form Wound Coils for Alternating-Current Rotating Electrical Machines
NEMA-ICS 61800	Adjustable Speed Drive Systems for AC Drive Systems Above 1000 V AC
ANSI/NETA ATS	Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems

c) The Operating Limits and Protective Device Settings (OLPDS) document is a single document which includes the entire Trans Mountain Pipeline System. The OPLDS document will be updated to include the new pump stations and ancillary facilities and the modifications to the existing pump stations, terminals, and ancillary facilities, as applicable, immediately prior to the operation of the expanded pipeline system or as individual elements are fully commissioned and are ready to enter service. New or modified limits and settings will be established during the detailed engineering and design phase, when detailed vendor information becomes available, and during construction and commissioning (for example, storage tanks must be surveyed or “strapped” prior to the final determination of the operating limits). Limits and settings that are established during detail engineering and design (i.e. that become design or equipment specification criteria) will be recorded in accompanying documents, awaiting incorporation into the OLPDS document.

The existing OLPDS document is the confidential intellectual property of Trans Mountain and cannot be provided as part of the Information Request process. However, excerpts from OLPDS are provided below.

- Operating Limits and Protective device settings are based on the following criteria for pressure and flow protection at all facilities. Actual set-point values will be determined by a qualified/certified engineer registered in the provinces of Alberta or British Columbia.

- Maximum Discharge Pressure downstream of a pumping station sensed by a pressure transmitter.
  - Operating Limit - This is for the maximum permissible set-point for control of discharge pressure at a station. This value is set to ensure that the pressure downstream of a pump station does not exceed MOP (maximum operating pressure) during normal operations.
  - Shed – This is a protective device setting that will quick stop the running pump that that is causing the high pressure. The value is set to ensure the pressure downstream of a pump station does not exceed the MATP (maximum allowable transient pressure) during an upset condition.
  - SSD (Station Shut Down) - This is a protective device setting that will quick stop all running pump(s) that that is(are) causing the high pressure. The value is set to ensure the pressure downstream of a pump station does not exceed the MATP (maximum allowable transient pressure) during an upset condition.
  - APS (Automatic Pipeline Shutdown) – This is a protective device setting that will shutdown the entire pipe line system. This indicates that several levels of protection have failed and the pressure has exceeded the MATP (maximum allowable transient pressure).
- Maximum Average Pressure calculated by averaging the pressure values sensed by the pump station suction and discharge pressure transmitters.
  - Operating Limit – This is for the maximum average pressure permissible at a pump station that will limit the pressure surge caused by an abrupt station shut down.
- Minimum Suction Pressure upstream of the pumping station as sensed by a pressure transmitter.
  - Operating Limit – This is the lowest pressure permissible during normal operation of a pump station. This is the minimum pressure a pump can be operated at to prevent damage to the pump.
  - Protective Device Limit – This is the lowest value of pressure that will cause the unit to automatically shut down to prevent damage to the pump.
- Maximum Suction Pressure upstream of a pumping station sensed by a pressure transmitter.
  - Operating Limit – This is the maximum permissible set-point value for control of suction pressure at a station where the Maximum Average Pressure protection is not necessary. This alarm is for information only and does not provide any protection.
- Flow Rate through a pumping station that has a flow meter as part of the piping configuration.

- o Minimum/Maximum Operating limits – These flow rate alarms notify the control centre to take appropriate action to adjust the flow or shut down the pipeline.

- Maximum Piping Pressure as sensed by a pressure transmitter located between the discharge nozzle of a pump and the discharge valve.

  - o Operating Limit – This is the maximum pressure permissible during normal operations within the pump station piping which is between the station suction and discharge valves.

  - o Protective Device Limit – This is the pressure within the station piping that will quick stop the pumping units that are producing high pressure to ensure the MATP (Maximum Allowable Transient Pressure) is not exceeded.

- Mainline Relief Pressure as sensed by a relief valve connected to the pipeline.

  - o Flow through the valve is directed to tankage or around a closed mainline valve downstream on the pipeline. The value of the relief valve setting is to ensure the MATP of the pipeline or facility is not exceeded during upset conditions.

- HULP (High Upstream Line Pressure) as sensed by a pressure transmitter located upstream of a mainline block valve.

    - o Protective Device Limit – This prevents mainline block valves from closing while the upstream pipeline pressure is too high.

- APS (Automated Pipeline Shutdown) is a functional part of the SCADA application that allows the pipeline to be shutdown when certain conditions arise such as inadvertent line blockage by a mainline valve or the overfilling of a tank used for relief service.

- MOP Warnings as determined by the Computational Pipeline Monitor (CPM) to indicate pressure on a point along the pipeline has exceeded the MOP for that location. The CPM calculates pressure at points along the pipeline based on flow parameters, fluid properties and pipeline profile.

- ESD (Emergency Shutdown) shuts down and isolates the pumping facility into safe mode based on specific protective device settings. The ESD function is intended to mitigate potentially hazardous situations to the environment and/or company facilities.

- Fire Protection as sensed by fire sensors located within the pump building. Indication of a fire results in an ESD of the facility.

- Combustible Gas Protection as sensed by LEL gas transmitters located in the pump building. Indication of combustible gas will start vent fans and/or ESD the facility.

- Pump Room Floor Sump High Level as sensed by a level switch located in the floor sump in the pump building. The level switch provides indication that liquid has collected in the sump.

- Waste Oil Sump Level as measured and detected by two instruments, one a continuous level transmitter and the second a point level detection device. High and High-High alarms when detected indicate that unintended liquids have discharged from the pump station to the sump. The result of either of these alarms is an ESD of the facility.
- Station Protective Device Fault provides indication that a protective device has failed or is malfunctioning. The result of the fault will result in the same action as when the associated protective device setting is reached.
- Site Containment Hydrocarbon Detector indicates that hydrocarbons have been detected in the pump station containment area. This is intended to mitigate the release of hydrocarbons off site.
- Pump Unit Protection is made up of many components to protect both the pump and the motor and results in a unit shut and/or lock out
    - Unit Lock Out – This provides protection from potential damage due to abnormal operating conditions.
    - Unit Quick Stop – shut down the pump unit prior to the discharge valve closure.
    - Unit Shut Down – shut down of the pump after the unit discharge valve is fully closed or the VFD has ramped down the speed of the motor.
    - Unit Protective Device Fault - provides indication that a protective device has failed or is malfunctioning. The result of the fault will result in the same action as when the associated protective device setting is reached.
    - Unit Incomplete Sequence – Indication that the unit has failed to complete its start up or shut down sequence.
    - Station Voltage Low – protects the motors from possible winding damage created by the low voltage condition.
    - Suction Valve Not Fully Open – protects the pump from possible low suction conditions.
    - Motor Bearing Temperature High – protects the motor when there is an abnormal condition with the bearings or the lubrication system.
    - Motor Winding High – protects the motor when the winding temperature has exceeded the design parameter.
    - Motor Electrical Fault – protects the motor when an electrical protective device has detected a fault that could damage the motor.
    - Motor Vibration High – protects the motor when vibration levels for the equipment have exceeded design levels.

- Maximum Power Input – alarms to the control centre that the motor kilowatt input for full load has been exceeded which could potentially create a high temperature condition and damage the motor windings.
- Pump Bearing Temperature High - protects the pump when there is an abnormal condition with the bearings or the lubrication system.
- Pump Case Temperature High – protects the pump from high case temperatures when the flow is restricted or blocked while the pump is running.
- Pump Seal Failure – indicates that the integrity that a pump mechanical seal has been compromised resulting in unintended flow to the waste oil sump.
- Pump Vibration High - protects the pump when vibration levels for the equipment have exceeded design levels.

d) At some of the proposed new pump stations and at some existing pump stations that are proposed to be modified, variable frequency drive (VFDs) will be able to control multiple pump motors; however, a VFD will only ever control one pump motor at any given time. At some pump stations, pump units will be associated with dedicated VFDs. The numbers of VFDs currently planned for the proposed Line 1 and Line 2 pump stations are indicated in the response to NEB IR No. 2.076f. At all terminals, each proposed booster pump motor will be associated with a dedicated VFD.

e) An electrical coordination study for the proposed expanded pipeline system will be performed by a professional engineer, registered in Alberta and British Columbia, during the detailed engineering and design phase and when vendor engineering data is available. The results of the study will be used to generate protection settings for the various relays, with the coordination of the settings and time / current curves following applicable legislative requirements and sound electrical engineering principles and practices. It is anticipated this study will be completed in Q3, 2016.

f) Table 2.076F-1 indicates the anticipated maximum load per variable frequency drive (VFD) at the proposed Line 1 and Line 2 pump stations.

TABLE 2.076F-1

EXPANDED TRANS MOUNTAIN PIPELINE SYSTEM

	Line 1 Pump Stations					Line 2 Pump Stations				
	Site Status	**Unit kW**	**# x HP**	**# VFD's**	**Load Per VFD kW**	**Site Status**	**Unit kW**	**# x HP**	**# VFD's**	**Load Per VFD kW**
Edmonton	Existing	1,865	4 x 2,500	0	0	New	3,730	5 x 5,000	1 + spare	4515
Stony Plain	Existing	3,730	2 x 5,000	1	4515					
Gainford	Existing	1,492	3 x 2,000	0	0	New	3,730	3 x 5,000	1	4515
Chip	Existing	3,730	2 x 5,000	1	4515					
Niton	Reactivated	1,492	2 x 2,000	0	0					
Wolf	Deactivated			0, transfer to Line 2	0	New	3,730	2 x 5,000	1	4515
Edson	Existing	1,492	3 x 2,000	0	0	New	3,730	3 x 5,000	1	4515
Hinton	Existing	3,730	2 x 5,000	1	4515	New	3,730	3 x 5,000	1	4515
Jasper	Existing	1,865	2 x 2,500	1	2258					
Rearguard	Existing	3,730	2 x 5,000	1 + 1 new	4515	New	3,730	2 x 5,000	2	4515
Albreda	Deactivated			0	0					
Chappel	Existing	3,730	2 x 5,000	1 + 1 new	4515					
Blue River	Deactivated			0, transfer to Line 2	0	New	3,730	3 x 5,000	1 + 2 new	4515
Finn	Existing	3,730	2 x 5,000	1 + 1 new	4515					
McMurphy	Existing	1,492	2 x 2,000	0	0					
Blackpool	Existing	3,730	2 x 5,000	1 + 1 new	4515	New	3,730	3 x 5,000	3	4515
Darfield	Existing	1,492	2 x 2,000	0	0					
Black Pines	New	1,865	2 x 2,500	2	2258	New	3,730	2 x 5,000	2	4515
Kamloops	Existing	447.6	1 x 600	0	0	New	3,730	4 x 5,000	4	4515
		1,492	4 x 2,000	0	0					
		1,865	2 x 2,500	0	0					
Stump	Deactivated			1	0					
Kingsvale	Existing	1,865	3 x 2,500	1	2258	New	3,730	2 x 5,000	1	4515
Hope	Deactivated			1	0					
Wahleach	Deactivated			1	0					
Sumas	Existing	1,492	2 x 2,000	0	0					
Port Kells	Existing	3,730	2 x 5,000	1	4515					
Burnaby										
Puget Sound Pipeline										
Sumas Puget Sound	Existing	1,492	2 x 2,000	0	0					
	New	1,865	1 x 2,500	0	0					

Note:
1. Variable frequency drive (VFD) maximum load includes a factor for motor efficiency of (0.95) and a factor for motor service factor (1.15). The motor service factor may only be used for brief periods, during upset conditions.

g) The technical specifications for the variable frequency drives (VFDs) for the proposed expansion of the Trans Mountain pipeline system will be developed during the detailed engineering and design phase. The latest editions of the following standards and guidelines will be applied to the specification and installation of VFDs.

CSA C22.1	Canadian Electrical Code Part 1
CSA C22.2 No. 14	Industrial Control Equipment
CAN/CSA-C88	Power Transformer and Reactor Bushings
CAN/CSA-C60871-1-01	Shunt Capacitors for A.C. Power Systems Rated Above 1000 Volts
CSA C838	Energy Efficiency Test Methods for Three Phase Variable Frequency Drive Systems
ANSI/IEEE 18	Shunt Power Capacitors
ANSI/IEEE 519	Guide for Harmonic and Reactive Compensation of Static Power Converters
ANSI/IEEE C37	Guide for the Protection of Shunt Capacitor Banks
ANSI/IEEE C57.12.00	IEEE Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
ANSI/IEEE C57.110	Recommended Practice for Establishing Transformer Capability When Supplying Non-sinusoidal Load Currents
IEEE 1566	IEEE Standard for Performance of Adjustable Speed AC Drives Rated 375 kW and Larger

h) Table 2.076H-1 provides fault levels for the proposed new pump stations. Fault levels for Burnaby and Westridge have not been determined. Additional information will be developed during the detailed engineering and design phase.

TABLE 2.076H-1

FAULT LEVEL AT 5kV SWITCHGEAR

Pump Station	3-Phase (kA Asym Mom)	3-Phase (kA Sym)	Line-to-Ground (A Sym)
Black Pines Line 1	48.8 kA	33.8 kA	15 A
Black Pines Line 2	48.8 kA	33.8 kA	15 A
Blackpool Line 1 [1]	40.6 kA	29.6 kA	15 A
Blackpool Line 2	40.6 kA	29.6 kA	15 A
Blue River Line 2	22.0 kA	15.1 kA	15 A
Edson Line 1 [1]	61.4 kA	43.2 kA	15 A
Edson Line 2	61.4 kA	43.2 kA	15 A
Edmonton Line 2	70.1 kA	49.3 kA	15 A
Gainford Line 1 [1]	79.2 kA	53.6 kA	15 A
Gainford Line 2	79.2 kA	53.6 kA	15 A
Hinton Line 1	73.1 kA	51.1 kA	15 A
Hinton Line 2	73.1 kA	51.1 kA	15 A
Kamloops Line 2	22.5 kA	15.4 kA	15 A
Kingsvale Line 1 [1]	54.7 kA	38.0 kA	15 A
Kingsvale Line 2	54.7 kA	38.0 kA	15 A
Rearguard Line 1	18.2 kA	12.8 kA	15 A
Rearguard Line 2	18.2 kA	12.8 kA	15 A
Sumas Line 1	25.6 kA	18.2 kA	400 A
Wolf Line 2	27.8 kA	17.3 kA	15A

Note:
1. In-line medium voltage reactor installed upstream of the existing main 5 kV buss to reduce the available fault current to acceptable levels for the existing buss ratings.

i) The motor protection relay (MPR) for the proposed Project will be an integrated digital protection and motor management relay designed for large motors and will be of a brand common in motor protection applications. The specification for the MPR will be developed during the detailed engineering and design phase.

j) The fuses described in Reference ii) will be part of a fused, visible disconnect circuit used as circuit isolation and short circuit protection for the equipment in the vacuum contactor or vacuum circuit breaker cell of the switchgear feeding the motor or variable frequency drive (VFD). They will typically be “E” rated fuses with ratings of 2,750 V to 38,000 V. A motor protection relay will be installed and function to open the vacuum contactor or vacuum circuit breaker to provide motor protection, as described in Reference ii).

k) Pump unit protection for the proposed Project is described in Reference ii). All protection will be capable of being primary or secondary (back-up), depending on the nature of the fault. The settings of the protective devices will be established during the detailed engineering and design phase and / or when vendor engineering data is available.

2.077 Pump stations – ground fault protection

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering:

i) PDF page 68 of 110
ii) PDF page 69 of 110

Preamble:

Reference i) states that there will be a buried ground grid around the operator building, electrical service buildings, VFD buildings, and around each pump station. All ground grids will be bonded together in two places. During the detailed engineering and design phase, an overall site grounding study will be performed to address issues of safe ground potential rise and step and touch potentials.

Reference ii) indicates that a 4160/600 or 4160/480 volt transformer will be installed at each pump station to provide service voltage for auxiliary services, including valve actuators and heating, ventilation, and air conditioning (HVAC) units. A fused load break switch will be used to protect the transformer.

Request:

Please provide:

a) an indication of when the overall site grounding study will be completed;

b) the protection scheme with a diagram for the transformer and associated loads; and

c) the value of the neutral grounding resistors of the transformer for limiting ground fault current.

Response:

a) Site grounding studies for the proposed new pump stations and existing pump stations proposed to be modified will be completed during the detailed engineering and design phase. It is anticipated that they will be complete by Q3, 2016.

b) Electrical single line diagrams for the high voltage systems at the pump stations are provided in the response to NEB IR No. 2.076a. The fuse ratings shown are preliminary. Discussion on coordination is provided in the response to NEB IR No. 2.076e.

c) The final value of the neutral grounding resistors at the proposed pump stations will be established during the detailed engineering and detailed design phase. The value on the preliminary single line diagrams provided in the response to NEB IR No. 2.076a is 2400 V, 15 A, 10 s, 160 Ω.

2.078 Pump stations and terminals – power system

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering:

i) PDF page 67 of 110
ii) PDF page 106 of 110

Preamble:

Reference i) indicates that HVAC equipment will be selected as appropriate for the pump, the electrical service building, the VFD, and operator buildings. The pump building will be ventilated, but not heated or air-conditioned.

Reference i) also states that, in Alberta, the electric utility owners (AltaLink Management Ltd. [AltaLink] and FortisAlberta Inc. [Fortis]) will design and construct any new substations, power lines, and electrical transmission or distribution system connections and improvements. In British Columbia, only the transmission system connections and improvements will be designed and constructed by BC Hydro.

Reference ii) states that Burnaby Terminal will have enough of an increase in power consumption to require a service upgrade by BC Hydro. Approximately 5 megawatts (MW) of additional power will be required for booster pumps and ancillary devices.

Request:

Please provide:

a) a list of any protective, metering, or electronic devices that will be located in the pump building;

b) the recommended operating temperature range for the devices listed in a);

c) single line diagrams of the proposed new substations, power lines, and electrical transmission or distribution system connections and improvements, showing:
   - c.1) the utility bus connection and all stages of power conversions;
   - c.2) how the proposed power system will be integrated with the existing system;
   - c.3) incoming feeds from AltaLink, Fortis, and BC Hydro systems, and the complete power sub-system within Trans Mountain facilities;
   - c.4) primary and back-up protective devices, circuit breakers, and fuses with current transformers, potential transformers, and metering devices;
   - c.5) connection of the VFD and its protection; and
   - c.6) any by-pass power sub-system if the primary system with the VFDs is not available; and

d) the total load in the system at Burnaby Terminal.

Response:

a) Trans Mountain intends to locate the following protective, metering, or electronic devices in the proposed pump buildings:

- Fire detector, 1 per unit
- Combustible gas detector, 1 per unit
- Floor sump level detector, 1 per 2 units
- Core differential current transformer, 1 per motor
- Filter differential pressure switch, 1 per motor
- Vibration transmitter, 1 per pump bearing
- Vibration transmitter, 1 per motor bearing
- Pressure transmitter, 1 per unit suction piping
- Pressure transmitter, 1 per unit discharge piping
- Flow switch, 1 per pump seal drain line
- Temperature element (RTD), 1 per pump bearing
- Temperature element (RTD), 1 per motor bearing
- Temperature element (RTD), 1 per pump case
- Temperature element (RTD), 6 active, 3 spare per motor winding (3 per motor phase)
- Thermal relief valve, 1 per pump suction piping
- Thermal relief valve, 1 per pipe section that can be isolated by valves
- Quick Stop switch, 1 per pumping unit
- Emergency Shut Down (ESD) switch, 1 per egress door
- Emergency egress lighting, 1 per egress door
- Lighting fixtures (on uninterruptable power supply (UPS)), numbers and locations to be determined
- Additional equipment, as applicable, to be established during the detailed engineering and design phase.

The types, numbers, and locations of the protective, metering, or electronic devices are subject to change based on recommendations arising from hazards and operability (HAZOP) reviews to be conducted during the detailed engineering and design phase.

b) The design operating temperature range for the devices to be located in the proposed pump buildings will be -40°C to +40°C. The maximum operating (surface) temperature of any electrical, electronic, or protective device shall not exceed 200°C ("T3" temperature code), in accordance with CSA Standard C22.1-12, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, Section 18, Rule 18-052.4.b.

c) Preliminary single line diagrams for the proposed new and modified pump stations and terminals, including the associated information, to the extent that it is available, have been provided in the response to NEB IR No. 2.076a.

d) The total load at Burnaby Terminal, after the proposed expansion, will be approximately 10 MVA. The load will be refined during the detail engineering and design phase and as equipment vendor engineering data becomes available. The load at Burnaby Terminal is

highly dependent on the size of the booster pumps for the Burnaby-Westridge delivery pipelines. The size of the booster pumps is, in turn, highly dependent on the pipeline maximum elevation (and somewhat dependent on the pipeline length), which has yet to be determined pending the feasibility of the Burnaby Mountain tunnel alternative.

2.079 Pump stations and terminals – control system, Supervisory Control and Data Acquisition (SCADA), instrumentation, and communication

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering:

i) PDF page 61 of 110
ii) PDF pages 63 and 64 of 110
iii PDF page 65 of 110
iv) PDF page 69 of 110
v) PDF page 70 of 110
vi) PDF page 72 of 110
vii) PDF page 85 of 110
viii) PDF page 87 of 110
ix) A3S0Y9, Application Volume 4A, Project Design and Execution – Engineering, PDF page 20 of 35
x) A3S0Z5, Application Volume 4A, Project Design and Execution – Engineering, Appendix D – Tables, Table 5.1.2 – KMC Standards, Specifications, Manuals and Recommended Practices, PDF page 4 of 93

Preamble:

Reference i) states that the communications and control equipment previously located in the existing electrical service buildings will be relocated to the operator buildings. Minor revisions to the control infrastructure of the existing electrical service buildings will be required to accommodate this change.

Reference ii) states that there will be a common operator building at each shared pump station site. At existing sites, the operator building will also serve the new pump stations. The human-machine interface (HMI), programmable logic controller (PLC) equipment, and voice and data communication equipment will be located in the operator buildings. The existing operator buildings may require minor modifications to house new equipment.

Reference iii) states that the pumps will have a leak detection system that will activate an alarm in the control centre in the event of a mechanical seal failure.

Reference iv) provides the list of instrumentation, control, and communication equipment at each pump station.

Reference v) states that the PLC will initiate a unit lockout if the vibration exceeds the protective device setting.

Reference vi) states that controllers will be integral to the PLC and that the final control devices will be a pump station control valve or the VFDs.

Reference vii) provides the instrumentation characteristics and features. Two of those characteristics are:

- transmitters will be two-wire 4 to 20 mA DC with digital communications superimposed on the analog signal; and
- trip settings will be implemented in the PLC and derived from the analog signal.

Reference viii) states that the metering system will be controlled by flow computers and a PLC, consistent with those currently in service. Control and shutdown functions for equipment and systems protection will be installed at the equipment and will be independent of inputs from the SCADA system or its operation.

Reference ix) states that satellite communication will be installed at each Remote Main Line Block Valve (RMLBV) site and the PLC will report directly to the SCADA system. There will not be back-up communications systems at RMLBV sites.

The Board notes that Reference x) does not include a list of standards associated with SCADA.

Request:

Please provide:

a) a list of standards that will be used in designing and operating the SCADA system, and the interface between SCADA and the leak detection system;

b) a block diagram showing:
   b.1) the control system, including PLCs, flow meters, VFDs, control valves, block valves, local HMI, the network connection to the PLCs, and its integration with SCADA;
   b.2) a description of the leak detection system mentioned in Reference iii);
   b.3) the existing primary and back-up communication links of the SCADA system and their integration; and
   b.4) the block valve sites, the architecture connecting with the SCADA host, the PLCs, and associated HMIs;

c) a flow diagram of the control logic in the event of communication and PLC failure;

d) a diagram explaining how digital communication is superimposed on the 4-20 mA analog line and how that is consistent with the network hardware requirements and communication protocol;

e) the type of digital communication that will be used between PLCs;

f) the functions of the digital communications that are superimposed on analog signals;

g) a description of the changes required to accommodate the modifications in the electrical service buildings and operator buildings, as described in References i) and ii);

h) information that will be stored on the SCADA historic data log;

i) the mitigation measures in case of failure of:
   i.1) the control system;
   i.2) communications; and

i.3) RMLBVs;

j) the pump reset conditions;

k) the shutdown conditions and priorities;

l) a description of the access control for individuals to prevent unwanted operations in the block valve site facilities;

m) an explanation of the control system required to work with the block valves;

n) a description of how the control valves are tested in pre- commissioning phase, during scheduled maintenance, and in the event of a breakdown;

o) a description of the alarm management system, including:
   o.1) policy and strategy on alarms;
   o.2) alarm prioritization;
   o.3) the process to add alarms and modify existing ones;
   o.4) the number of alarms during normal operations and during a plant upset;
   o.5) the type(s) of alarms that will require operator action;
   o.6) alarm screen format; and
   o.7) operator qualifications, as well as training, roles, and responsibilities;

p) a description of the lock-out and tag-out methods that will be used; and

q) a description of:
   q.1) the flow control system; and
   q.2) the metering system.

Response:

a) The following standards and recommended practices will be used in the adaption of the existing supervisory control and data acquisition (SCADA) system to the expanded pipeline system:

   - API 1164 – SCADA Security
   - API 1165 – Recommended Practice for Pipeline SCADA Displays
   - API 1168 – Pipeline Control Room Management

   The SCADA to leak detection system interface is a proprietary interface, developed by the SCADA vendor, consisting of two daemon programs. One retrieves data points from the SCADA system and sends them to the leak detection system and the other receives alarm data points from the leak detection system and stores them on the SCADA system for reporting, alarming, and display purposes. Both daemon programs are automatically started up with the sockets monitored and alarmed.

b) A block diagram of the control system for the proposed expanded pipeline system will be developed during the detailed engineering and design phase.

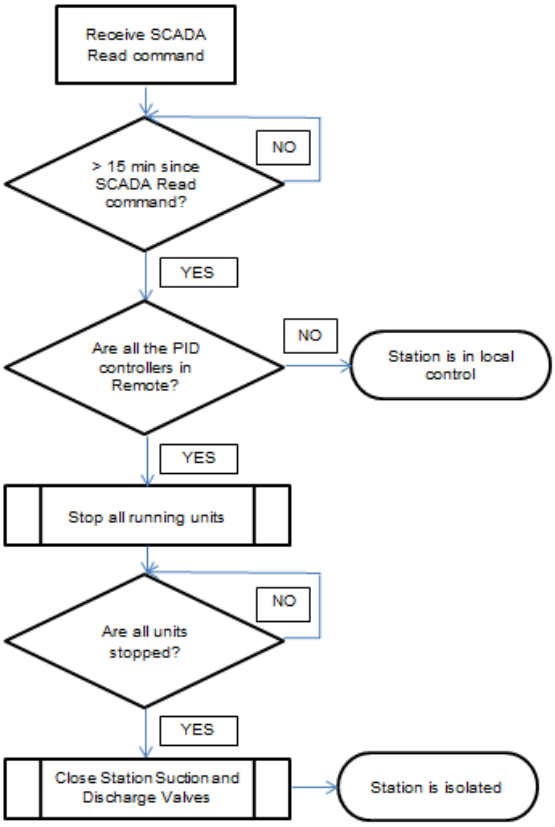
b.1) The design of the control system, including the interconnection between various devices and components such as programmable logic controllers (PLCs), flow meters, variable frequency drives (VFDs), control valves, block valves, local human machine interfaces (HMI), the network connection to the PLCs, and integration with the supervisory control and data acquisition (SCADA) system, will be established during the detailed engineering and design phase.

b.2) Refer to the response to NEB IR No. 2.084.

b.3) At existing sites, with the exception of Chappel, Stump, and Westridge, primary and back-up SCADA communications are provided via telephone lines. At Chappel and Stump, primary and back-up SCADA communications are provided by satellite systems. At Westridge, primary SCADA communications are provided by telephone line and back-up communications are provided by a cellular system.

b.4) Refer to the response to NEB IR No. 2.079b.1.

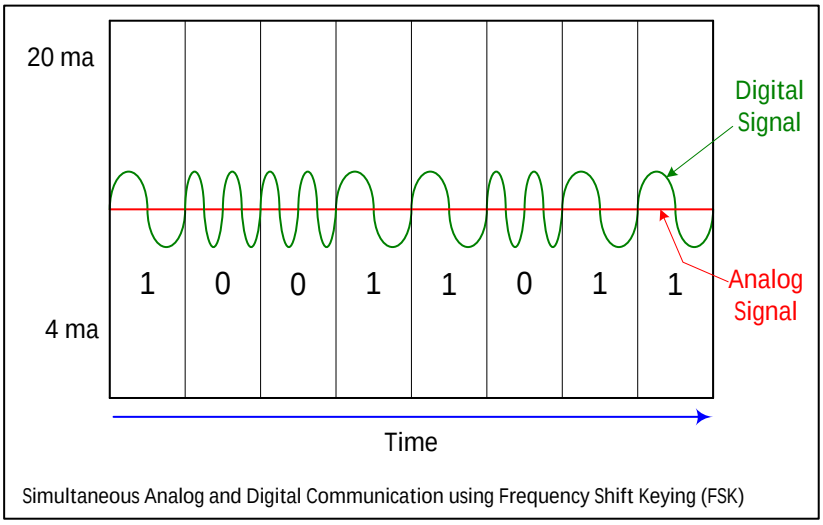
c) Supervisory control and data acquisition (SCADA) communications and programmable logic controller (PLC) failures are discussed in Section 3.3.15.6, Section 3.3.16, Section 3.3.17, Volume 4A (Filing ID A3S0Y8) and Section 7.1.6, Volume 4C (Filing ID A3S0Z3) of the Facilities Application. If SCADA communications to a pump station fail, the PLC will place the pump station into a safe mode as represented by the following flow diagram:



If a PLC fails, all the PLC outputs will fail to off or safe. This removes the various permissives for pump unit operation and the pump units will stop.

d) The digital communications scheme for the proposed Project, which will be used for configuring, calibrating, and maintaining process transmitters, is based on the telephone communications principle of Frequency Shift Keying (FSK). The digital signal is made up of two frequencies, 1,200 Hz and 2,200 Hz representing bits “1” and “0”. Sine waves of these two frequencies are superimposed on the direct current analog signal and provide simultaneous analog and digital communications. The average value of the FSK signal is zero; therefore the 4 to 20 mA analog signal is not affected. The digital communications signal has a response time of approximately 2 to 3 data updates per second without interrupting the analog signal. A minimum loop impedance of approximately 230 Ω is required for communications.

The following sketch shows a digital signal superimposed on an analog signal.



The FSK digital communications scheme is part of the Hart Communications Protocol and is used by multiple vendors of process transmitters.

e) The communications protocols between the various components in the control system networks at the pump stations and terminals could be either Industrial Ethernet IP or Allen Bradley Control Net or a combination of both, to be determined during the detailed engineering and design phase.

f) Refer to the response to part d) above. The analog signals from the process transmitters will be used for monitoring and control.

g) An addition, approximately 3 m by 4.25 m will be added to the operator building at the relevant sites. Power, heating, ventilating, and air conditioning (HVAC), and communications will be extended to the addition. A control panel, to house communications and programmable logic controllers (PLCs), and an uninterruptible power supply (UPS), to support the new equipment, will be installed.

Communications equipment currently located in the electrical services building (ESB) will be relocated to the control panel in the operator building. Satellite communications equipment will be housed in the new control panel and serve as back-up for the supervisory control and data acquisition (SCADA) and leak detection systems communications. The processor in the existing PLC will be replaced by a remote input / output (I/O) adapter. The processor in the existing PLC will be relocated to a new PLC rack in the operator building and a remote I/O card will installed to communicate with the existing PLC I/O via the remote I/O adapter. Connections to the human machine interface (HMI) equipment will be routed to the control panel in the addition.

A new PLC rack, equipped with a processor and a remote I/O adapter, for control of the Line 2 pump station, will also be installed in the new control panel.

Smoke detectors will be included in the addition and tied into the existing control and alarm systems. Fire extinguishers will be included in the addition.

h) The supervisory control and data acquisition (SCADA) system collects all instantaneous data from the real-time database and summarizes the data for use in displays or reports. The instantaneous data is summarized over various time periods including hourly, daily, monthly, and yearly. Both the instantaneous and summarized data are stored on-line for a specific time in a collection of relational databases implemented on a Sybase SQL database server.

i.1) With respect to supervisory control and data acquisition (SCADA) system failure and programmable logic controller (PLC) failure, refer to the response to part c) above. In addition, Primary Control Centre (PCC) redundancy is described in Section 7.1.1, Volume 4C of the Facilities Application (Filing ID A3S1L1), SCADA system redundancy is described in Section 7.1.4, Volume 4C (Filing ID A3S1L1), and emergency shut down (ESD) system operation, in the context of SCADA system failure, is described in Section 7.1.5, Volume 4C (Filing ID A3S1L1). Protective systems at pump stations and terminals are designed to function independently of the PCC or SCADA systems if critical operating parameters are outside of the normal ranges.

i.2) If poll response percentages from the primary communications system at a pump station or terminal drop below a set value, the SCADA system will invoke a secondary poll process which is configured to automatically activate the back-up communications system. When the primary communications system has achieved an acceptable poll response rate, the backup communications will automatically disconnect, allowing the primary communications system to resume operating. In the event of a communications failure, the Control Centre Operator (CCO) will follow prescribed procedures to evaluate the problem and restore the primary communications. The CCO will contact the Kinder Morgan Network Operations Centre (NOC) to inform them of the problem. The NOC will work with the service providers to determine the problem and find a solution. If the back-up communications systems also fails (or if the primary communications system is not restored) and there is no communication for 15 minutes, an automated facility shutdown process will be initiated. Refer to the response to part c) above.

i.3) If communications to a remote mainline block valve (RMLBV) is lost, the CCO will follow prescribed procedures to evaluate the problem and restore the communications as described in part 1.2) above. If communications cannot be restored in a timely manner, the CCO and the supervisor of the PCC will determine if the pipeline can continue to operate safely. If further operation is deemed unsafe, the pipeline will be shut down and appropriately isolated, with the assistance from field operations as necessary.

j) A pump unit which trips on low suction pressure or on alternating current (AC) under-voltage may be restarted once the condition causing the trip has been re-established to a value required for safe operation. A pump unit that has been locked out by any pump, motor, or pump station protective device can only be reset by an operations technician attending the site and rectifying the cause. A pump unit lock-out cannot be reset for operation while a fault remains.

k) Trans Mountain interprets “shutdown conditions” to mean any automated protective device operation that may result in one or more pump unit trips and / or isolation actions and that has not been originated by a Control Centre Operator (CCO) or by an operations technician controlling a pump station or terminal under the direction of the CCO. The following acronyms are used in this response and defined here for clarity.

- APS - Automated pipeline shutdown
- ESD - Emergency shutdown
- Quick Stop - Immediate shutdown without utilizing the normal shutdown sequence
- SSD - Station shutdown (Quick Stop all running units)

ESD conditions, which will take precedence over all other protective functions, include:

- Fire
- Combustible gas
- Maximum discharge pressure (may result in SSD)
- Waste oil sump tank high level
- ESD push-button activated
- APS conditions (SCADA function)
- Protective device fault

Protective conditions, which will cause actions necessary to mitigate the condition, include:

- Maximum suction pressure
- Minimum suction pressure
- High flow rate
- Maximum piping pressure
- Relief pressure
- High upstream line pressure
- Station suction or discharge valves not fully open
- Storage tank high-high level
- Storage tank containment area hydrocarbon detection

- Site containment area hydrocarbon detection
- Pump unit lock-out pushbutton activation
- Pump unit protective device fault
- Pump unit incomplete sequence
- Pump station low voltage
- Pump unit suction valve not fully open
- Motor bearing temperature high
- Motor winding temperature high
- Motor electrical fault
- Motor vibration high
- Pump bearing temperature high
- Pump case temperature high
- Pump seal failure
- Pump vibration high
- Variable frequency drive (VFD) fault

l) A multi-layer, multi-step procedure involving fencing, locks, alarms, and additional security devices and logic, will be implemented to maintain remote mainline block valve (RMLBV) site security and unwanted operations. The specific details of all security systems are confidential. Trans Mountain is willing to provide additional details of RMLBV security measures to the Board along with a request that they be filed confidentially pursuant to Section 16.1 of the *National Energy Board Act* if requested.

m) The control system required for a remote mainline block valve (RMLBV) is similar to all valves utilizing reversing contactors. The specific details of the control system for RMLBVs are confidential. Trans Mountain is willing to provide additional details of RMLBV control to the Board along with a request that they be filed confidentially pursuant to Section 16.1 of the *National Energy Board Act*, if requested.

n) In the pre-commissioning phase, a control valve will be tested at the manufacturer's facility using a factory acceptance test (FAT) specification to be developed for the specific valve type, in accordance with the applicable legislative requirements and additional Trans Mountain requirements. This will include pressures tests commensurate with the flange rating, seat leakage classification verification tests, fugitive emissions tests, and may include various operational or performance tests. During scheduled maintenance activities, the manufacturer's recommended maintenance procedures will be followed. In the event of a breakdown, the valve will be sent to a manufacturer recommended valve shop or returned to the manufacturer for repair and the valve will go through the FAT process, as applicable, prior to being reinstalled and re-commissioned.

o) o.1) The Kinder Morgan Canada (KMC) supervisory control and data acquisition (SCADA) Alarm Management Program (AMP) has been in place since 2008. The program is governed by the SCADA Alarm Management Principles and Philosophy (SAMPP) document which was completed in 2009. This document is based on API 1167, Pipeline SCADA Alarm Management and also defines the framework to be followed for continuous improvement of the alarm system. The AMP is managed by the SCADA Alarm Review

Committee (SARC). The committee's mandate is to ensure the alarm system is safe, effective, and efficient. The committee has representation from various internal stakeholders including the Control Centre, Technical Services, and Operations. The committee meets on a regular basis to review alarm performance metrics, alarm issues identified by the Control Centre, and to develop strategies to reduce the number of alarms.

o.2) SCADA alarms are prioritized by severity. The alarm severity is determined by evaluating against the following criteria:

- The consequence of taking no action;
- The urgency or time available to make a response.

A more detailed evaluation criteria matrix is included within the SAMPP.

o.3) Changes to the SCADA system including the addition, deletion, and modification of alarms are managed formally as documented in KMC SCADA – Change Management Procedure. Changes to alarms must be approved by the Control Centre Supervisor before they implemented for Control Centre Operators (CCOs).

o.4) KMC strives to meet the maximum alarm rate targets that are recommended in API 1167, Pipeline SCADA Alarm Management. As per API 1167, these targets are followed as recommendations, not as fixed limits.

o.5) Alarms are determined using the following rules:

- Events that do not require a CCO operator response will not be allowed to produce alarms;
- Alarms will be placed, configured, and handled so that a single process event does not produce multiple alarms all signifying the same root cause;
- Alarms will not be created during routine process variable changes, control sequences executing normally, or from normal operations.

o.6) Each alarm severity level has a unique presentation (colour and sound) so that differing levels are easily distinguishable. Unacknowledged alarms will flash within the SCADA alarm window until they are acknowledged.

o.7) Information on CCO qualifications and training is included in Section 4.3, Volume 4C of the Facilities Application (Filing ID A3S1L1). A new CCO is designated to train towards qualification on a specific desk. To be considered fully qualified on a desk, a CCO must successfully complete all of the mandatory or designated orientation and core "skill packets" as well as all of the assigned skill packets for that desk. To be qualified, the CCO must also maintain currency on that desk. Every CCO has the responsibility to monitor and control pipeline or terminal operations in accordance with the Control Centre Operations Job Description and the Control Centre Procedures, described in Section 7.1.2, Volume 4C (Filing ID A3S1L1). Only fully qualified CCOs are authorized to operate without the direct supervision of another fully qualified CCO. Information on the response to leak alarms and

pipeline restart is provided in Section 7.1.11.5 and Section 7.1.11.6, Volume 4C (Filing ID A3S1L1), respectively.

p) A mainline pump unit lockout may be caused by:

- seal failure
- pump or motor vibration
- pump or motor high temperature
- pump incomplete sequence
- motor electrical protection
- unit valve movement off the open position limit
- manual actuation of the lock-out button
- unit lockout on the human machine interface (HMI) control pop-up
- lock-out button on the pump control station panel

The Unit Lockout / Reset red light on the station control panel will be illuminated. The unit will also appear red on the HMI station overview. A unit reset by a operations technician will be required.

q.1) The proportional, integral, and derivative (PID) control system for the proposed Line 1 and Line 2 pipelines will utilize flow control at Edmonton, Kamloops, and Sumas (the initiating or mid-system injection pump stations), as applicable, with pressure over-ride control for both suction pressure and discharge pressure. All of the other stations along the system will use a pressure control system.

- Suction – an increase in the suction pressure causes an increase in the controller output and a decrease in suction pressure causes a decrease in the controller output (direct acting);

- Discharge – an increase in the discharge pressure causes a decrease in the controller output and a decrease in discharge pressure causes an increase in controller output (reverse acting);

- Flow – an increase in flow causes a decrease in the controller output and a decrease in flow causes an increase in controller output (reverse acting);

- A low selector function selects the lowest output from any of the above controllers that are present in the control scheme at a given station and passes this signal to the control valve or variable frequency drive (VFD).

- The control action is “increase open”, i.e. increase in the current output from the controller will open the control valve or increases the output frequency of the VFD resulting in a motor and pump speed increase.

q.2) A description of the proposed Edmonton Terminal metering system is provided in Section 3.4.1.10.1, Volume 4A of the Facilities Application (Filing ID A3S0Y8). Flow metering at pump stations (except for the initiating stations) will only be used for leak detection purposes. It is compensated for density, pressure, and temperature in a flow computer with

the corrected flow passed to the programmable logic controller (PLC), to the supervisory control and data acquisition (SCADA) system, and to the computational pipeline monitor (CPM). At the initiating stations, the flow signal will also be used as the process variable for flow control.

2.080 Pump stations – power supply

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering:

i) PDF page 61 of 110
ii) PDF page 67 of 110

Preamble:

Reference i) states that Edmonton and Kamloops are considered critical pump stations.

Reference ii) provides a description of the proposed utility suppliers for all pump stations.

Request:

In case of a sudden unplanned power outage, please provide for all pump stations:

a) a list of hazards that could cause a sudden unplanned power outage, and the associated mitigation measures that will be taken during the design stage;

b) any pipeline integrity-related issues as a result of a sudden unplanned power outage and the associated mitigation measures that will be taken during the design stage;

c) a description of safe shutdown procedures, product flow, and use of uninterruptible power supply (UPS); and

d) a discussion of any additional measures that will be taken at the two critical pump stations, if any.

Response:

a) Utility power supply failure, caused by power line or substation damage or equipment failure is the only possible cause of a sudden unplanned power outage at a pump station. Stand-by power, either by uninterruptable power supply (UPS) or back-up generator, will be provided to ensure the continuous functioning of the SCADA, controls, and emergency shut-down (ESD) systems, including station isolation from the mainline(s). Emergency egress lighting (connected to the stand-by power) and reflective signage will be provided to ensure the safety of operations personnel during a power outage.

   As discussed in Section 5.2.9 and Section 5.2.10, Volume 4B of the Facilities Application (Filing ID A3S1K6), Trans Mountain will implement controls, in accordance with the applicable legislative requirements, to prevent damage to over-head and underground power systems during construction.

b) The sudden shut-down of all of the pump units at a pump station due to power failure has the potential to cause a pressure surge in the pipeline. A surge study will be completed during the detailed engineering and design phase and any recommendations, to mitigate potential pressure surges and any potential associated pipeline integrity-related issues, as

applicable, will be incorporated into the design and into the operating limits and protective device settings.

c) In the case of a sudden unplanned power outage at a pump station, all pump units will immediately stop, and flow through the pump station will naturally decrease to a low rate. The uninterruptable power supply (UPS), which will always be on line and powering assigned loads, will maintain power to protective devices and systems, including emergency shut down (ESD) systems (including station isolation valves), programmable logic control (PLC) systems, supervisory data acquisition (SCADA) systems, and communications systems, all deemed essential services. The Control Centre Operator (CCO) will follow established procedures to isolate the pump station from the pipeline, if appropriate under the circumstances, and take any other measures necessary to ensure the safety of the pipeline system.

d) Edmonton Pump Station and Kamloops Pump Station are deemed “critical stations” because of the hydraulic characteristics of the Trans Mountain pipeline system. Flow is not possible without these pump stations. However, no additional measures will be employed at these pump stations to mitigate the effects of an unplanned power outage, as there is no practical or cost effective way to provide back-up power at the level required to operate the multiple pump units necessary to achieve flow.

2.081 Pump stations and terminals – UPS and back-up power

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 106 of 110

Preamble:

The reference states that, at the Burnaby Terminal, a standby generator will be installed to provide emergency power to all Motor Operated Valves (MOVs) and designated emergency equipment during a power outage. In addition, a UPS will be installed at the Burnaby Terminal to maintain communications and critical information during the transfer from utility power to generator power.

Request:

Please provide:

a) information on other standby generators that may be installed in other terminals;

b) a description of:
   - b.1) the function of the UPS and the back-up generator;
   - b.2) the critical loads for the UPS and duration;
   - b.3) how the load transfer occurs;
   - b.4) the transition time to UPS; and
   - b.5) how critical information is stored; and

c) a list of standards that will be used for UPS maintenance.

Response:

a) As part of the proposed expansion of Westridge Marine Terminal, the existing standby generator will be replaced by a standby generator of appropriate size for the larger essential services loads.

b.1) The uninterruptable power supply (UPS) will provide power to control systems, supervisory control and data acquisition (SCADA) systems, and communications systems at all pump stations and terminals. At pump stations where there are no sending or receiving traps, the UPS will also provide sufficient power to isolate the pump station from the main line (i.e. close the pump station suction and discharge valves) during an emergency shut-down (ESD). At pump stations with sending or receiving traps, a standby generator will be installed (or the existing standby generator will be integrated into the new pump station) to provide the added power for ESD isolation. At terminals, the standby generator will also provide power to isolate the proposed booster pumps during an ESD. At locations without standby generators, provision will be made for a portable generator to be “plugged in” to the essential services portion of the low voltage motor control center to maintain power during maintenance outages.

b.2) Critical loads for the UPS are control systems, SCADA systems, and communications systems at all pump stations and terminals and station isolation valves at stations without sending or receiving traps. The UPS will be sized to supply power to control systems, SCADA systems, and communications systems for a minimum of six hours and, at pump stations without traps, to operate each station isolation valve for two complete cycles. A cycle is defined as transit from open to closed and transit from closed to open. Isolation requires one transit or half of a cycle for both valves.

b.3) An "on-line" type UPS will be specified. No transition from utility power to UPS power will occur as the power to the essential services will always be supplied from the UPS. Direct utility power supply to the essential services will only occur when there is a UPS fault. Generator power will require a short time to come on line, as the generator control system must sense the power outage, determine that the outage is not a voltage flicker, start the generator, allow a short warm-up time, and then operate the transfer switch.

b.4) As discussed in the response to NEB IR No. 2.081b.3, there will not be any transition time to UPS power.

b.5) Trans Mountain interprets the question to be "How is critical operating data and status information stored?" Because the UPS will always be supplying power to the control systems, there will be no interruption in the local storage of data on the human-machine interface (HMI) or at the Control Centre during a utility power outage.

c) Uninterruptable power supply (UPS) maintenance will be contracted to the UPS vendor's service company. Accordingly, a list of the maintenance standards will not be available until the UPS is purchased. Maintenance will occur annually, at a minimum, or more often if indicated in the manufacturer's recommendations. Maintenance will be supervised by Kinder Morgan Canada operations personnel.

2.082 Pump stations and terminals – UPS and back-up power

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering: PDF page 71 of 110
ii) *National Energy Board Onshore Pipeline Regulations*, paragraph 12(a)
iii) CSA Z662-11, Clause 4.14.3.3

Preamble:

Reference i) states that an automatic emergency shutdown may be initiated by a fire detector, a fire detector fault switch, a combustible gas detector, a combustible gas detector fault switch, a floor sump high level switch or hydrocarbon detector, a waste oil sump high level switch, a waste oil sump high-high level switch, or a main line high discharge pressure transmitter.

Reference ii) states that a pump station has to be equipped with an alternate source of power capable of operating the station's emergency shutdown system.

Reference iii) establishes that emergency shutdown systems in pump stations must:

- block liquid as appropriate out of a station, except fuel supplies to essential station auxiliaries;
- provide a means for the shutdown of all pumping equipment and fuel- fired and electrical facilities in the vicinity of headers and pump buildings, except that electrical equipment may remain energized, provided it meets the requirements of the applicable code (CSA C22.1); and
- be operable from at least one manual push-button.

Request:

Please provide confirmation that:

a) the pump stations in Trans Mountain's expanded system will comply with the requirements established in References ii) and iii); and

b) the emergency shutdown push button switches will have a protective cover to prevent them from being accidentally pressed.

Response:

a) The pump stations in Trans Mountain's proposed expanded system will comply with the requirements established in References ii) and iii).

b) Emergency shut-down (ESD) push button switches will have a protective cover to prevent them from being accidentally pressed.

2.083 Pump stations – station piping

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, Table 3.3.6 – New Pump Station Design Criteria, PDF page 65 of 110

Preamble:

The reference states that station piping will be designed in accordance with the following parameters:

Item	Line 1	Line 2
Pipe Size	508 mm (NPS 20)	610 mm (NPS 24)
Design Pressure	9,930 kPa (1,440 psig)	9,930 kPa (1,440 psig)
Pressure Class	PN 100	PN 100
Minimum Design Temperature	-29°C	-29°C
Maximum Design Temperature	38°C	38°C
Material Grade	290 (MPa)	359 (MPa)

Request:

Please provide:

a) the rationale for selecting the following parameters for station piping:
   a.1) grade;
   a.2) size; and
   a.3) minimum and maximum temperature; and

b) the technical specifications for any below-ground piping if they are different than the specifications in the reference.

Response:

a.1) The proposed pipe sizes, material grades, and minimum design temperature are based on Kinder Morgan Canada (KMC) Standard MP1110, Station and Terminal Piping Design. Within MP1110, the grade is determined by the pressure class (in order to keep the pipe wall thickness within a readily available range), which is in turn determined by the pipeline operating pressure.

a.2) With respect to size, refer to the response to NEB IR No. 2.083a.1. Within MP1110, the pipe size is determined by the flow rate, to avoid excessive hydraulic losses.

a.3) With respect to the minimum design temperature, see the response to NEB IR No. 2.083a.1. The rationale for the maximum design temperature is based on the current tariff maximum receipt temperature of 38°C at Edmonton as indicated in the response to NEB IR No. 1.94e (Filing ID A3W9H9 and A3W9R5-A3W9R8).

b) Trans Mountain intends to avoid below-ground pump station piping wherever possible. In the event that below-ground pipe is necessary, the material specifications for the below-ground pipe will not differ from above-ground pipe. Although the -29°C minimum temperature rating is not necessary for below ground pipe, it is appropriate to keep the specification the same for continuity. However, the external coating specification for below-ground pipe will differ from the specification for above-ground pipe, as above ground coating types and thicknesses are not suitable for below-ground service.

2.084 Pump stations - protection

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 70 of 110

Preamble:

The reference states that pumps will be protected for high bearing temperature, high case temperature, seal failure, excessive discharge piping pressure, and excessive vibration.

Request:

Please provide detailed information on the mechanisms that will be implemented to protect the mainline pumps from the conditions mentioned in the reference.

Response:

High bearing temperature will be sensed by a resistance temperature detector (RTD) inserted into the bearing in close proximity to the bearing surface. The signal from the RTD will be interpreted by the motor protection relay (MPR) which is designed with additional, assignable RTD inputs for the driven load. At a temperature set point (High), below the maximum value determined by the pump manufacturer, the programmable logic controller (PLC) reading the MPR status will generate an alarm signal, which will be routed to the Control Centre. The Control Centre Operator (CCO) will then transfer pumping load to another pump unit or shut down the pump unit. At the maximum (High-High) temperature set point, the PLC will immediately shut down and lock out the pump unit. The pump unit must then be attended by an operations technician (for appropriate diagnostics and repairs) before it can be returned to service.

High case temperature will be sensed by a resistance temperature detector (RTD) inserted into a thermo-well installed in the pump case. The signal from the RTD will be interpreted by the motor protection relay (MPR) which is designed with additional, assignable RTD inputs for the driven load. At approximately 60°C, the PLC reading the MPR status will shut down and lock out the pump unit. The pump unit must then be attended by an operations technician (for appropriate diagnostics and repairs) before it can be returned to service.

Seal failure will be sensed by a flow switch in each seal drain line. Mechanical seals weep, to provide lubrication and cooling, during normal operation. At a flow rate slightly above the normal flow rate provided by the manufacturer, the PLC reading the flow switch status will shut down and lock out the pump unit. The pump unit must then be attended by an operations technician (for appropriate diagnostics and repairs) before it can be returned to service.

High (excessive) discharge piping pressure will be sensed by a pressure transmitter installed between each pump unit discharge nozzle and pump unit discharge valve, at pump stations with variable frequency drives (VFDs), and upstream of the control valve, at pump stations with control valves. At a pressure determined by Trans Mountain, at or below the maximum operating pressure (MOP), depending on number of hydraulic considerations, the PLC reading

the pressure transmitter analog signal will Quick Stop the last pump unit in series not being controlled by the VFD, at a pump station with a single VFD, or the last unit in series, at a pump station without a VFD or with multiple VFDs. Using the same philosophy, subsequent units will Quick Stop until the high discharge piping pressure condition is rectified. Quick Stop is defined as an immediate shut-down without sequencing valve operations, as is done during an operational shut-down. The pump unit(s) may be re-started when it is determined by the CCO that doing so will not result in subsequent high discharge piping pressure shut-downs.

High (excessive) vibration will be sensed by a vibration velocity transmitter installed at each pump bearing housing. At a predetermined value, not to exceed 12.7 mm (0.5 in.) per second, the PLC will shut down and lock out the pump unit. The pump unit must then be attended by an operations technician (for appropriate diagnostics and repairs) before it can be returned to service.

2.085 Overpressure protection system

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering:

i) PDF page 65 of 110
ii) PDF page 71 of 110

Preamble:

Reference i) states that thermal relief valves will be provided to protect piping and equipment connected to the pipe. It indicates that, in general, any section of pipe that can be isolated during operations or maintenance will have a thermal relief valve installed.

Reference ii) indicates that pipeline overpressure protection will be provided by PLC-monitored redundant pump station discharge pressure transmitters, located downstream of the pump station discharge valve. The highest pressure measured by the pressure transmitters will be selected and the PLC will cause the action prescribed in the Operating Limits and Protective Device Settings document to occur should the licensed MOP of the pipeline be exceeded.

Request:

Please provide a detailed description of the overpressure protection system for:

a) the pipeline; and

b) related facilities.

Response:

a) Pipeline over pressure protection will be provided by a multi-layered approach.

Two pressure transmitters will be installed on the pipeline downstream of the last valve at each pump station. The output of the two pressure transmitters will be assessed by the pump station programmable logic controller (PLC) and the highest pressure of the two will be selected and used for pressure control and protection. The difference between the transmitter outputs will also be monitored by the PLC and an alarm will be generated if the difference is excessive.

The discharge pressure controller, described in the response to NEB IR No. 2.079q, will attempt to maintain the discharge pressure of each pump station at a level below the licenced maximum operating pressure (MOP) of the pipeline immediately downstream of the pump station. If the pump station is operated at the MOP for more than 10 consecutive seconds or if the MOP is momentarily exceeded by more than 1.5%, the PLC will send an alarm to the Control Centre and the Control Centre Operator (CCO) will take immediate actions to reduce the discharge pressure. If the pump station discharge pressure exceeds the pipeline MOP by more than 3%, the staged pump unit Quick Stop process described in the response to NEB IR No. 2.084 will occur until the condition no longer exists. If the pump

station discharge pressure exceeds the pipeline MOP by greater than 7%, the pump station PLC will cause a pump station shut-down (SSD) which will Quick Stop all running units. The CCO may restart one or more pump units when the conditions contributing to the overpressure condition have been identified and corrected. If the station discharge pressure exceeds the maximum allowable transient pressure (MATP) of the pipeline, which is 110% of the MOP, it indicates that several layers of protection have failed and an automatic pipeline shut-down (APS), the shut down of all pump stations, will occur. The pipeline will remain shut down until an incident investigation and integrity assessment have been completed.

In addition to these overpressure protection measures, a hydraulic surge study will be completed during the detailed engineering and design phase and the recommendations will be incorporated into the pipeline system design, as applicable. Typically, recommendations will include the addition of full-flow pressure relief valves and / or tanks at specific locations.

b) All of the pressure containing equipment and piping at all proposed facilities, including pump stations, terminals, and ancillary facilities will:

   i. be designed to withstand the maximum pressure that can be created by the pipeline system or by the facility itself at that facility, or

   ii. be assessed to ensure that the overpressure protection systems provided for the pipeline will also protect the facility, and / or

   iii. be provided with one or more pressure relief devices, such as thermal relief valves or full-flow relief valves and relief tanks, as applicable.

In the case of booster pumps, pressure control and over pressure protection similar to main line pump units, as described in the response to NEB IR No. 2.085a, will be employed.

2.086 Pipe material, grade, and category

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering:

i) PDF page 50 of 110
ii) PDF page 52 of 110
iii) *National Energy Board Onshore Pipeline Regulations*, subsection 38(3)

Preamble:

Reference i) states that, for low vapour pressure pipelines, CSA Z662 specifies that the pipe, at a minimum, must comply with requirements for Category (Cat) I. However, the Project will specify pipe that meets the stricter criteria of Cat II in order to maximize fracture initiation resistance and ensure premium product quality. The reference also states that all pipe material to be installed below grade for the proposed Line 2 pipeline will be Cat II pipe. All pipe material to be installed above grade will be Cat III.

Reference ii) states that, as part of the process to tie in the existing Trans Mountain Pipeline segments into the proposed Line 2 pipeline, welding will be necessary on the existing Trans Mountain Pipeline while it is liquid-filled. The carbon equivalent of the existing Trans Mountain Pipeline is typically less than 0.50 per cent, but may be greater at the tie-in location. Appropriate metallurgical tests will be conducted prior to initiating the tie-in to ensure application of appropriate welding specifications and welding procedures. Trans Mountain is currently developing welding procedures for conditions where the pipeline is liquid- filled and the carbon equivalent is equal to, or less than, 0.52 per cent.

Reference iii) states that, despite National Energy Board Onshore Pipeline Regulations (OPR) subsections 38(1) and 38(2) and section 16, if a company intends to perform welding on a liquid-filled pipeline with a carbon equivalent of 0.50 per cent or greater and to treat it as a permanent installation, the company shall submit the welding specifications and procedures and the results of the procedure qualification tests to the Board for approval.

Request:

Please provide:

a) a rationale for choosing Cat III pipe for all above-ground piping;

b) an indication of when the metallurgical tests will be completed; and

c) confirmation that Trans Mountain will comply with OPR subsection 38(3).

Response:

a) As per reference i), CSA Z662 for a low vapour pressure (LVP) pipeline requires the pipe to be a minimum of Cat I. Trans Mountain has specified a higher quality Cat II pipe for the minimum design temperature of -5°C for the buried pipeline. The above ground sections of

the pipeline has a minimum design temperature of -45°C and if Cat II was specified at this design temperature there would be a limited number of pipe mills that could manufacture the pipe for the specified conditions.

For the proposed locations of installation and the heavier wall pipe that would be specified, the potential for initiation and propagation of a failure is considered minimal, considering the pipe is above ground and contains LVP petroleum. The resistance to failure initiation is also deemed sufficient given the absorbed energy of 40J to be specified for Category III pipe.

b) The metallurgical tests referenced will be completed as part of the qualification of the welding procedures, and are part of the qualification program to be completed, evaluated and accepted as a precursor to implementation of field welding.

c) Confirmed.

2.087 Route selection

Reference:

i) A3S0Z5, Application Volume 4A, Project Design and Execution – Engineering, Appendix D – Tables, Table 5.1.3 – Corridor Assessment Classification, PDF page 6 of 93
ii) A3W9H8, Trans Mountain response to Board IR No. 1, IR 1.40, PDF pages 236 to 251 of 421
iii) A3X9S2, Trans Mountain response to Board IR regarding Project corridor, PDF page 2 of 10
iv) CSA Z662-11, Clauses 4.22 and 6.2.11

Preamble:

Reference i) provides a classification for corridor assessment. However, it does not specify the location, number of kilometres, or the percentage of the total length of pipeline that will be under each classification.

Table 1.40A-1 in Reference ii) provides a list of all alternative route deviations from the previously proposed pipeline corridor and the revised proposed pipeline corridor that are currently being considered by Trans Mountain.

Reference iii) confirms the preferred corridor between Burnaby and Westridge has changed. This new route has two options: a Burnaby Mountain HDD route option that would use two separate HDDs to install the pipelines between the Burnaby Terminal and the Westridge Marine Terminal; and a trenchless direct route option where a tunnel would be used to install the pipelines through Burnaby Mountain.

Reference iv) establishes the requirements for installing pipe using HDD.

Request:

a) Please provide the pipeline locations that will be under each classification in Reference i).

b) If any trenchless technology is going to be used in the preferred route or its deviations (with the exception of watercourse crossings and the segment between Burnaby and Westridge), please provide:
   b.1) a preliminary feasibility report detailing the assessment that was completed to determine that the trenchless technology could be successfully completed;
   b.2) a description of the contingency plan to be followed at each crossing if the trenchless technology is not successful;
   b.3) if HDD is the chosen method, an execution plan according to Reference iv); and
   b.4) an indication of when final feasibility studies will be available for all crossings where trenchless technologies would be attempted.

Response:

a) Reference i) lists the criteria for the 4 level corridor constructability classification used by the routing specialists during the field assessments of the existing Trans Mountain right-of-way

corridor as described in Section 2.8.2.2 of Volume 4A, *Field Assessment of Existing TMPL Right-of-Way*, (Filing ID: A3S0Y8, pages 36 to 37 of 110). The constructability assessments of the existing Trans Mountain right-of-way was one of several inputs considered when setting the route for the proposed pipeline corridor for the project.

A summary of the number of kilometres and the percentage of the length of the existing pipeline corridor that has been assessed to be under each classification level is shown in Table 2.087A-1. The complete corridor constructability assessment classification for the existing Trans Mountain right-of-way is listed in Table 2.087A-2. Desktop assessments have been used in place of field assessments for segments where access permission has not been granted for the project. All of the station references in Tables 2.087A-1 and 2.087A-2 are to the Kilometre Post (KP) markers of the existing Trans Mountain pipeline, not to be confused with the Reference Kilometre (RK) markers of the proposed expansion pipeline.

TABLE 2.087A-1

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT SUMMARY

	ASSESSMENT CLASSIFICATION 1		**ASSESSMENT CLASSIFICATION 2**		**ASSESSMENT CLASSIFICATION 3**		**ASSESSMENT CLASSIFICATION 4**	
PIPELINE SEGMENT	**Length (km)**	**Portion (%)**	**Length (km)**	**Portion (%)**	**Length (km)**	**Portion (%)**	**Length (km)**	**Portion (%)**
Edmonton, AB to Hinton, AB (KP 0.0 to KP 319.8)	219.1	69.8%	53.9	17.2%	37.9	12.1%	3.2	1.0%
Hargeaves, BC to Darfield, BC (KP 468.1 to KP 742.0)	91.3	33.3%	133.1	48.6%	46.0	16.8%	3.5	1.3%
BlackPines, BC to Wahleach, BC (KP 783.7 TO KP 1046.1)	82.8	31.6%	120.5	45.9%	46.8	17.8%	12.3	4.7%
Wahleach, BC to Burnaby, BC (KP 1046.1 TO KP 1147.2)	51.3	50.8%	25.3	25.0%	14.5	14.3%	10.0	9.9%
Burnaby, BC to Westridge, BC (KP 0.0 to KP 4.1)	-	-	0.6	14.6%	0.6	14.6%	2.9	70.7%
Total – All Looping Segments	444.6	46.5%	333.4	34.9%	145.7	15.2%	31.9	3.3%

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
EDMONTON, AB TO HINTON, AB (KP 0.0 TO KP 319.8)			
KP 0.0	KP 1.6	1.6	3
KP 1.6	KP 2.6	1.0	2
KP 2.6	KP 4.4	1.8	3
KP 4.4	KP 5.3	0.9	1
KP 5.3	KP 5.6	0.3	2
KP 5.6	KP 7.2	1.6	1
KP 7.2	KP 8.7	1.5	2
KP 8.7	KP 9.0	0.3	1
KP 9.0	KP 9.5	0.5	2
KP 9.5	KP 13.7	4.2	3
KP 13.7	KP 14.0	0.3	1
KP 14.0	KP 16.5	2.5	3
KP 16.5	KP 16.7	0.2	1
KP 16.7	KP 17.4	0.7	3
KP 17.4	KP 18.1	0.7	2
KP 18.1	KP 19.6	1.5	3
KP 19.6	KP 20.4	0.8	2
KP 20.4	KP 21.1	0.7	3
KP 21.1	KP 21.4	0.3	1
KP 21.4	KP 24.7	3.3	3
KP 24.7	KP 25.0	0.3	1
KP 25.0	KP 25.3	0.3	3
KP 25.3	KP 29.2	0.3	2
KP 29.2	KP 56.6	27.4	1
KP 56.6	KP 57.4	0.8	2
KP 57.4	KP 59.0	1.6	1
KP 59.0	KP 60.7	1.7	2
KP 60.7	KP 61.6	1.0	1
KP 61.6	KP 62.3	0.7	2
KP 62.3	KP 77.1	14.7	1
KP 77.1	KP 80.1	3.1	3
KP 80.1	KP 81.2	1.0	2
KP 81.2	KP 94.7	13.5	1
KP 94.7	KP 95.0	0.3	2
KP 95.0	KP 116.7	21.7	1
KP 116.7	KP 117.8	1.1	2
KP 117.8	KP 152.6	34.8	1
KP 152.6	KP 152.9	0.3	2
KP 152.9	KP 153.3	0.4	1
KP 153.3	KP 153.5	0.1	2
KP 153.5	KP 155.6	2.1	1
KP 155.6	KP 155.7	0.1	2
KP 155.7	KP 162.8	7.1	1
KP 162.8	KP 163.1	0.3	2
KP 163.1	KP 166.8	3.8	1
KP 166.8	KP 167.4	0.6	2

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION (continued)

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
KP 167.4	KP 174.9	7.5	1
KP 174.9	KP 175.1	0.2	2
KP 175.1	KP 177.1	2.0	1
KP 177.1	KP 177.3	0.2	3
KP 177.3	KP 178.5	1.2	1
KP 178.5	KP 178.9	0.4	2
KP 178.9	KP 180.4	1.5	1
KP 180.4	KP 181.9	1.5	2
KP 181.9	KP 184.0	2.1	1
KP 184.0	KP 185.8	1.8	2
KP 185.8	KP 186.3	0.5	1
KP 186.3	KP 186.8	0.4	2
KP 186.8	KP 186.9	0.2	3
KP 186.9	KP 190.0	3.1	1
KP 190.0	KP 190.8	0.8	2
KP 190.8	KP 192.5	1.7	3
KP 192.5	KP 193.2	0.7	1
KP 193.2	KP 193.6	0.4	2
KP 193.6	KP 195.0	1.4	1
KP 195.0	KP 195.5	0.5	2
KP 195.5	KP 196.1	0.6	1
KP 196.1	KP 196.9	0.8	3
KP 196.9	KP 201.4	4.5	1
KP 201.4	KP 202.9	1.5	2
KP 202.9	KP 205.1	2.2	1
KP 205.1	KP 206.0	0.9	2
KP 206.0	KP 208.9	2.8	1
KP 208.9	KP 209.3	0.4	2
KP 209.3	KP 209.7	0.4	1
KP 209.7	KP 211.0	1.3	2
KP 211.0	KP 211.6	0.6	3
KP 211.6	KP 212.2	0.6	2
KP 212.2	KP 213.0	0.8	3
KP 213.0	KP 215.3	2.3	1
KP 215.3	KP 215.8	0.5	3
KP 215.8	KP 218.9	3.0	1
KP 218.9	KP 224.2	5.4	2
KP 224.2	KP 226.3	2.1	1
KP 226.3	KP 227.5	1.2	2
KP 227.5	KP 228.4	0.9	3
KP 228.4	KP 228.9	0.5	1
KP 228.9	KP 229.8	0.9	2
KP 229.8	KP 234.0	4.2	1
KP 234.0	KP 234.2	0.2	2
KP 234.2	KP 235.0	0.8	1
KP 235.0	KP 240.0	5.0	3
KP 240.0	KP 240.6	0.6	1
KP 240.6	KP 241.0	0.4	3

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION (continued)

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
KP 241.0	KP 241.4	0.4	2
KP 241.4	KP 244.0	2.6	1
KP 244.0	KP 244.4	0.4	2
KP 244.4	KP 248.2	3.8	1
KP 248.2	KP 248.3	0.1	2
KP 248.3	KP 250.5	2.2	1
KP 250.5	KP 250.7	0.2	2
KP 250.7	KP 250.9	0.2	1
KP 250.9	KP 251.1	0.2	2
KP 251.1	KP 252.1	1.0	1
KP 252.1	KP 252.3	0.2	2
KP 252.3	KP 253.7	1.4	1
KP 253.7	KP 255.3	1.6	2
KP 255.3	KP 255.7	0.4	1
KP 255.7	KP 256.1	0.4	3
KP 256.1	KP 256.9	0.8	2
KP 256.9	KP 257.3	0.4	3
KP 257.3	KP 258.9	1.6	1
KP 258.9	KP 259.2	0.3	2
KP 259.2	KP 260.2	1.0	1
KP 260.2	KP 260.4	0.2	2
KP 260.4	KP 261.2	0.8	3
KP 261.2	KP 262.1	0.9	1
KP 262.1	KP 262.7	0.6	2
KP 262.7	KP 264.9	2.2	1
KP 264.9	KP 265.8	0.9	2
KP 265.8	KP 267.2	1.4	1
KP 267.2	KP 267.6	0.4	2
KP 267.6	KP 268.2	0.6	1
KP 268.2	KP 273.4	5.2	2
KP 273.4	KP 275.1	1.7	1
KP 275.1	KP 275.5	0.4	2
KP 275.5	KP 275.6	0.1	4
KP 275.6	KP 276.2	0.6	1
KP 276.2	KP 276.3	0.1	4
KP 276.3	KP 276.9	0.6	1
KP 276.9	KP 278.5	1.6	2
KP 278.5	KP 279.1	0.6	4
KP 279.1	KP 279.9	0.8	2
KP 279.9	KP 282.8	2.9	1
KP 282.8	KP 283.5	0.7	2
KP 283.5	KP 283.9	0.4	1
KP 283.9	KP 286.2	2.3	2
KP 286.2	KP 286.9	0.7	1
KP 286.9	KP 287.0	0.1	2
KP 287.0	KP 288.3	1.3	1
KP 288.3	KP 288.8	0.5	2
KP 288.8	KP 289.1	0.3	3

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION (continued)

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
KP 289.1	KP 289.5	0.4	4
KP 289.5	KP 291.2	1.7	1
KP 291.2	KP 295.1	3.9	3
KP 295.1	KP 295.6	0.5	4
KP 295.6	KP 296.0	0.4	1
KP 296.0	KP 296.6	0.6	4
KP 296.6	KP 297.6	1.0	2
KP 297.6	KP 298.3	0.7	3
KP 298.3	KP 300.0	1.7	2
KP 300.0	KP 300.9	0.9	4
KP 300.9	KP 301.6	0.7	1
KP 301.6	KP 303.0	1.4	2
KP 303.0	KP 306.0	3.0	1
KP 306.0	KP 306.6	0.6	3
KP 306.6	KP 307.2	0.6	2
KP 307.2	KP 307.4	0.2	1
KP 307.4	KP 307.5	0.1	3
KP 307.5	KP 308.7	1.2	1
KP 308.7	KP 308.8	0.1	2
KP 308.8	KP 311.8	3.0	1
KP 311.8	KP 312.1	0.3	2
KP 312.1	KP 313.4	1.3	1
KP 313.4	KP 313.6	0.2	2
KP 313.6	KP 317.8	4.1	1
HARGREAVES, BC TO DARFIELD, BC (KP 468.1 to KP 742.0)			
KP 468.1	KP 468.3	0.2	1
KP 468.3	KP 474.2	5.9	2
KP 474.2	KP 474.5	0.3	3
KP 474.5	KP 475.2	0.7	1
KP 475.2	KP 478.2	3.0	2
KP 478.2	KP 480.1	1.9	3
KP 480.1	KP 481.6	1.5	2
KP 481.6	KP 482.8	1.2	1
KP 482.8	KP 483.2	0.4	3
KP 483.2	KP 484.2	1.0	1
KP 484.2	KP 484.9	0.7	2
KP 484.9	KP 487.5	2.6	1
KP 487.5	KP 489.8	2.3	2
KP 489.8	KP 491.4	1.6	1
KP 491.4	KP 492.0	0.6	3
KP 492.0	KP 492.3	0.3	1
KP 492.3	KP 492.6	0.3	3
KP 492.6	KP 495.9	3.3	2
KP 495.9	KP 497.1	1.2	1
KP 497.1	KP 503.5	6.4	2
KP 503.5	KP 504.3	0.8	1
KP 504.3	KP 505.1	0.8	2
KP 505.1	KP 505.7	0.6	1

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION (continued)

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
KP 505.7	KP 505.9	0.2	2
KP 505.9	KP 506.6	0.7	1
KP 506.6	KP 506.8	0.2	2
KP 506.8	KP 507.1	0.3	1
KP 507.1	KP 507.3	0.2	2
KP 507.3	KP 510.9	3.6	1
KP 510.9	KP 511.1	0.2	2
KP 511.1	KP 511.4	0.3	3
KP 511.4	KP 512.5	1.1	2
KP 512.5	KP 514.4	1.9	3
KP 514.4	KP 518.1	3.7	2
KP 518.1	KP 519.0	0.9	3
KP 519.0	KP 519.9	0.9	2
KP 519.9	KP 524.1	4.2	1
KP 524.1	KP 524.3	0.2	2
KP 524.3	KP 524.8	0.5	1
KP 524.8	KP 524.9	0.1	2
KP 524.9	KP 526.8	1.9	1
KP 526.8	KP 527.4	0.6	2
KP 527.4	KP 527.8	0.4	1
KP 527.8	KP 529.9	2.1	2
KP 529.9	KP 530.2	0.3	1
KP 530.2	KP 530.3	0.1	2
KP 530.3	KP 530.6	0.3	4
KP 530.6	KP 530.7	0.1	3
KP 530.7	KP 531.2	0.5	2
KP 531.2	KP 534.4	3.2	1
KP 534.4	KP 534.6	0.2	2
KP 534.6	KP 534.8	0.2	1
KP 534.8	KP 535.3	0.5	3
KP 535.3	KP 535.5	0.2	1
KP 535.5	KP 535.6	0.1	2
KP 535.6	KP 536.0	0.4	3
KP 536.0	KP 536.2	0.2	2
KP 536.2	KP 537.2	1.0	1
KP 537.2	KP 537.6	0.4	2
KP 537.6	KP 538.6	1.0	1
KP 538.6	KP 541.9	3.3	2
KP 541.9	KP 542.3	0.4	1
KP 542.3	KP 542.8	0.5	2
KP 542.8	KP 548.1	5.3	1
KP 548.1	KP 548.2	0.1	2
KP 548.2	KP 554.6	6.4	3
KP 554.6	KP 555.2	0.6	2
KP 555.2	KP 555.7	0.5	1
KP 555.7	KP 556.7	1.0	2
KP 556.7	KP 556.8	0.1	3
KP 556.8	KP 558.7	1.9	2

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION (continued)

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
KP 558.7	KP 559.5	0.8	3
KP 559.5	KP 563.6	4.1	2
KP 563.6	KP 563.8	0.2	3
KP 563.8	KP 574.5	10.7	2
KP 574.5	KP 575.1	0.6	1
KP 575.1	KP 582.7	7.6	2
KP 582.7	KP 585.9	3.2	3
KP 585.9	KP 588.1	2.2	1
KP 588.1	KP 589.9	1.8	3
KP 589.9	KP 590.9	1.0	1
KP 590.9	KP 591.7	0.8	3
KP 591.7	KP 591.9	0.2	2
KP 591.9	KP 595.0	3.1	1
KP 595.0	KP 596.0	1.0	4
KP 596.0	KP 599.6	3.6	2
KP 599.6	KP 601.6	2.0	1
KP 601.6	KP 605.3	3.7	2
KP 605.3	KP 606.5	1.2	4
KP 606.5	KP 607.3	0.8	1
KP 607.3	KP 609.7	2.4	2
KP 609.7	KP 613.8	4.1	1
KP 613.8	KP 616.0	2.2	2
KP 616.0	KP 620.3	4.3	3
KP 620.3	KP 621.8	1.5	2
KP 621.8	KP 622.3	0.5	3
KP 622.3	KP 624.9	2.6	1
KP 624.9	KP 625.1	0.2	4
KP 625.1	KP 628.8	3.7	2
KP 628.8	KP 629.4	0.6	3
KP 629.4	KP 630.5	1.1	2
KP 630.5	KP 633.4	2.9	3
KP 633.4	KP 634.2	0.8	2
KP 634.2	KP 635.6	1.4	3
KP 635.6	KP 636.2	0.6	1
KP 636.2	KP 637.4	1.2	3
KP 637.4	KP 640.5	3.1	2
KP 640.5	KP 641.6	1.1	1
KP 641.6	KP 642.4	0.8	3
KP 642.4	KP 643.7	1.3	2
KP 643.7	KP 645.0	1.3	1
KP 645.0	KP 647.8	2.8	2
KP 647.8	KP 651.5	3.7	1
KP 651.5	KP 653.0	1.5	3
KP 653.0	KP 654.1	1.1	1
KP 654.1	KP 656.9	2.8	2
KP 656.9	KP 657.1	0.2	3
KP 657.1	KP 659.9	2.8	2
KP 659.9	KP 661.4	1.5	1

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION (continued)

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
KP 661.4	KP 662.3	0.9	3
KP 662.3	KP 664.5	2.2	1
KP 664.5	KP 664.9	0.4	2
KP 664.9	KP 665.0	0.1	3
KP 665.0	KP 665.5	0.5	2
KP 665.5	KP 667.4	1.9	3
KP 667.4	KP 668.8	1.4	2
KP 668.8	KP 671.2	2.4	1
KP 671.2	KP 673.7	2.5	2
KP 673.7	KP 675.8	2.1	1
KP 675.8	KP 677.7	1.9	2
KP 677.7	KP 678.2	0.5	1
KP 678.2	KP 679.4	1.2	2
KP 679.4	KP 679.5	0.1	3
KP 679.5	KP 680.0	0.5	2
KP 680.0	KP 680.9	0.9	1
KP 680.9	KP 681.0	0.1	2
KP 681.0	KP 681.4	0.4	3
KP 681.4	KP 682.2	0.8	1
KP 682.2	KP 682.4	0.2	3
KP 682.4	KP 683.0	0.6	1
KP 683.0	KP 683.3	0.3	3
KP 683.3	KP 683.7	0.4	2
KP 683.7	KP 685.0	1.3	1
KP 685.0	KP 685.5	0.5	3
KP 685.5	KP 687.5	2.0	2
KP 687.5	KP 688.9	1.4	1
KP 688.9	KP 689.4	0.5	2
KP 689.4	KP 689.5	0.1	3
KP 689.5	KP 690.4	0.9	1
KP 690.4	KP 692.6	2.2	2
KP 692.6	KP 693.8	1.2	1
KP 693.8	KP 694.4	0.6	2
KP 694.4	KP 696.0	1.6	1
KP 696.0	KP 696.7	0.7	3
KP 696.7	KP 697.0	0.3	1
KP 697.0	KP 697.4	0.4	2
KP 697.4	KP 698.3	0.9	1
KP 698.3	KP 698.9	0.6	2
KP 698.9	KP 699.1	0.2	3
KP 699.1	KP 702.6	3.5	1
KP 702.6	KP 703.1	0.5	2
KP 703.1	KP 704.4	1.3	1
KP 704.4	KP 705.0	0.6	3
KP 705.0	KP 710.1	5.1	1
KP 710.1	KP 710.4	0.3	2
KP 710.4	KP 711.3	0.9	3
KP 711.3	KP 713.6	2.3	2

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION (continued)

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
KP 713.6	KP 713.9	0.3	3
KP 713.9	KP 722.3	8.4	2
KP 722.3	KP 722.5	0.2	3
KP 722.5	KP 724.2	1.7	2
KP 724.2	KP 725.4	1.2	1
KP 725.4	KP 726.3	0.9	2
KP 726.3	KP 726.9	0.6	1
KP 726.9	KP 727.6	0.7	3
KP 727.6	KP 728.4	0.8	1
KP 728.4	KP 728.7	0.3	3
KP 728.7	KP 729.7	1.0	2
KP 729.7	KP 731.1	1.4	3
KP 731.1	KP 732.5	1.4	2
KP 732.5	KP 733.2	0.7	1
KP 733.2	KP 734.0	0.8	4
KP 734.0	KP 734.5	0.5	2
KP 734.5	KP 734.8	0.3	1
KP 734.8	KP 735.0	0.2	2
KP 735.0	KP 735.8	0.8	3
KP 735.8	KP 736.1	0.3	2
KP 736.1	KP 736.4	0.3	3
KP 736.4	KP 736.6	0.2	1
KP 736.6	KP 737.6	1.0	2
KP 737.6	KP 738.0	0.4	1
KP 738.0	KP 739.0	1.0	2
KP 739.0	KP 739.4	0.4	3
KP 739.4	KP 740.3	0.9	2
KP 740.3	KP 740.7	0.4	3
KP 740.7	KP 741.5	0.8	2
KP 741.5	KP 742.0	0.5	1
BLACK PINES, BC TO BURNABY (TANK FACILITY), BC (KP 783.7 TO KP 1147.2)			
KP 783.7	KP 783.9	0.2	1
KP 783.9	KP 784.3	0.4	2
KP 784.3	KP 786.2	1.9	1
KP 786.2	KP 787.7	1.5	3
KP 787.7	KP 787.8	0.1	4
KP 787.8	KP 788.0	0.2	3
KP 788.0	KP 791.9	3.9	2
KP 791.9	KP 794.1	2.2	1
KP 794.1	KP 794.8	0.7	2
KP 794.8	KP 796.7	1.9	3
KP 796.7	KP 797.0	0.3	1
KP 797.0	KP 797.4	0.4	3
KP 797.4	KP 797.8	0.4	2
KP 797.8	KP 798.0	0.2	4
KP 798.0	KP 798.3	0.3	1
KP 798.3	KP 798.6	0.3	3
KP 798.6	KP 800.0	1.4	2

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION (continued)

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
KP 800.0	KP 800.2	0.2	3
KP 800.2	KP 800.4	0.2	2
KP 800.4	KP 801.1	0.7	1
KP 801.1	KP 801.6	0.5	2
KP 801.6	KP 802.2	0.6	3
KP 802.2	KP 802.5	0.3	1
KP 802.5	KP 803.0	0.5	3
KP 803.0	KP 803.1	0.1	4
KP 803.1	KP 803.6	0.5	3
KP 803.6	KP 804.2	0.6	4
KP 804.2	KP 804.9	0.7	1
KP 804.9	KP 805.8	0.9	2
KP 805.8	KP 806.0	0.2	3
KP 806.0	KP 807.2	1.2	4
KP 807.2	KP 808.7	1.5	3
KP 808.7	KP 810.4	1.7	2
KP 810.4	KP 811.0	0.6	1
KP 811.0	KP 811.4	0.4	2
KP 811.4	KP 813.5	2.1	1
KP 813.5	KP 813.9	0.4	3
KP 813.9	KP 814.1	0.2	1
KP 814.1	KP 814.8	0.7	2
KP 814.8	KP 815.9	1.1	1
KP 815.9	KP 816.8	0.9	2
KP 816.8	KP 817.2	0.4	3
KP 817.2	KP 817.6	0.4	2
KP 817.6	KP 818.1	0.5	1
KP 818.1	KP 818.4	0.3	4
KP 818.4	KP 819.6	1.2	1
KP 819.6	KP 820.1	0.5	2
KP 820.1	KP 820.5	0.4	1
KP 820.5	KP 821.2	0.7	3
KP 821.2	KP 822.6	1.4	2
KP 822.6	KP 823.5	0.9	3
KP 823.5	KP 824.6	1.1	2
KP 824.6	KP 828.0	3.4	1
KP 828.0	KP 828.8	0.8	2
KP 828.8	KP 829.0	0.2	3
KP 829.0	KP 829.5	0.5	4
KP 829.5	KP 830.5	1.0	2
KP 830.5	KP 831.3	0.8	3
KP 831.3	KP 831.6	0.3	2
KP 831.6	KP 837.2	5.6	1
KP 837.2	KP 838.8	1.6	2
KP 838.8	KP 839.0	0.2	3
KP 839.0	KP 840.1	1.1	2
KP 840.1	KP 840.4	0.3	3
KP 840.4	KP 841.0	0.6	2

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION (continued)

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
KP 841.0	KP 841.3	0.3	3
KP 841.3	KP 845.0	3.7	2
KP 845.0	KP 847.6	2.6	1
KP 847.6	KP 849.0	1.4	2
KP 849.0	KP 851.5	2.5	1
KP 851.5	KP 856.0	4.5	2
KP 856.0	KP 856.7	0.7	1
KP 856.7	KP 863.7	7.0	2
KP 863.7	KP 866.1	2.4	1
KP 866.1	KP 873.4	7.3	2
KP 873.4	KP 875.1	1.7	3
KP 875.1	KP 882.0	6.9	2
KP 882.0	KP 885.0	3.0	1
KP 885.0	KP 886.7	1.7	2
KP 886.7	KP 889.5	2.8	1
KP 889.5	KP 894.4	4.9	2
KP 894.4	KP 901.3	6.9	1
KP 901.3	KP 902.2	0.9	2
KP 902.2	KP 902.3	0.1	3
KP 902.3	KP 902.5	0.2	1
KP 902.5	KP 902.7	0.2	3
KP 902.7	KP 903.4	0.7	1
KP 903.4	KP 903.6	0.2	2
KP 903.6	KP 911.3	7.7	1
KP 911.3	KP 911.7	0.4	2
KP 911.7	KP 912.7	1.0	3
KP 912.7	KP 913.9	1.2	1
KP 913.9	KP 915.6	1.7	2
KP 915.6	KP 917.2	1.6	1
KP 917.2	KP 919.3	2.1	2
KP 919.3	KP 921.5	2.2	1
KP 921.5	KP 921.6	0.1	2
KP 921.6	KP 923.4	1.8	1
KP 923.4	KP 924.7	1.3	2
KP 924.7	KP 925.1	0.4	1
KP 925.1	KP 926.1	1.0	2
KP 926.1	KP 926.5	0.4	3
KP 926.5	KP 927.1	0.6	1
KP 927.1	KP 927.9	0.8	2
KP 927.9	KP 928.1	0.2	4
KP 928.1	KP 929.7	1.6	1
KP 929.7	KP 939.3	9.6	2
KP 939.3	KP 939.4	0.1	4
KP 939.4	KP 942.4	3.0	2
KP 942.4	KP 943.1	0.7	1
KP 943.1	KP 945.8	2.7	2
KP 945.8	KP 946.3	0.5	3
KP 946.3	KP 947.4	1.1	2

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION (continued)

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
KP 947.4	KP 953.2	5.8	1
KP 953.2	KP 953.4	0.2	2
KP 953.4	KP 954.4	1.0	1
KP 954.4	KP 955.5	1.1	2
KP 955.5	KP 956.1	0.6	1
KP 956.1	KP 957.4	1.3	2
KP 957.4	KP 957.6	0.2	3
KP 957.6	KP 958.8	1.2	2
KP 958.8	KP 961.2	2.4	1
KP 961.2	KP 961.4	0.2	2
KP 961.4	KP 963.0	1.6	1
KP 963.0	KP 964.3	1.3	2
KP 964.3	KP 964.5	0.2	1
KP 964.5	KP 965.0	0.5	2
KP 965.0	KP 965.3	0.3	3
KP 965.3	KP 965.5	0.2	2
KP 965.5	KP 966.8	1.3	3
KP 966.8	KP 967.7	0.9	2
KP 967.7	KP 968.8	1.1	1
KP 968.8	KP 969.2	0.4	3
KP 969.2	KP 970.0	0.8	1
KP 970.0	KP 971.5	1.5	2
KP 971.5	KP 973.2	1.7	4
KP 973.2	KP 974.3	1.1	2
KP 974.3	KP 975.7	1.4	1
KP 975.7	KP 977.7	2.0	4
KP 977.7	KP 978.1	0.4	3
KP 978.1	KP 979.8	1.7	2
KP 979.8	KP 981.3	1.5	3
KP 981.3	KP 981.5	0.2	4
KP 981.5	KP 984.7	3.2	3
KP 984.7	KP 985.0	0.3	1
KP 985.0	KP 985.5	0.5	2
KP 985.5	KP 986.9	1.4	4
KP 986.9	KP 987.7	0.8	2
KP 987.7	KP 990.2	2.5	3
KP 990.2	KP 990.3	0.1	2
KP 990.3	KP 990.7	0.4	3
KP 990.7	KP 992.8	2.1	2
KP 992.8	KP 996.0	3.2	3
KP 996.0	KP 996.9	0.9	2
KP 996.9	KP 997.2	0.3	3
KP 997.2	KP 999.3	2.1	2
KP 999.3	KP 999.9	0.6	3
KP 999.9	KP 1000.5	0.6	2
KP 1000.5	KP 1003.1	2.6	3
KP 1003.1	KP 1003.7	0.6	4
KP 1003.7	KP 1005.8	2.1	3

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION (continued)

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
KP 1005.8	KP 1008.2	2.4	2
KP 1008.2	KP 1008.5	0.3	3
KP 1008.5	KP 1009.2	0.7	2
KP 1009.2	KP 1011.8	2.6	3
KP 1011.8	KP 1012.0	0.2	2
KP 1012.0	KP 1013.7	1.7	3
KP 1013.7	KP 1014.4	0.7	4
KP 1014.4	KP 1015.1	0.7	1
KP 1015.1	KP 1016.5	1.4	3
KP 1016.5	KP 1019.0	2.5	2
KP 1019.0	KP 1019.5	0.5	3
KP 1019.5	KP 1020.5	1.0	4
KP 1020.5	KP 1022.3	1.8	2
KP 1022.3	KP 1022.7	0.4	4
KP 1022.7	KP 1023.2	0.5	2
KP 1023.2	KP 1023.5	0.3	3
KP 1023.5	KP 1027.0	3.5	2
KP 1027.0	KP 1027.3	0.3	3
KP 1027.3	KP 1027.7	0.4	1
KP 1027.7	KP 1028.0	0.3	2
KP 1028.0	KP 1030.0	2.0	1
KP 1030.0	KP 1030.6	0.6	2
KP 1030.6	KP 1031.4	0.8	4
KP 1031.4	KP 1032.2	0.8	2
KP 1032.2	KP 1033.5	1.3	3
KP 1033.5	KP 1035.0	1.5	2
KP 1035.0	KP 1035.9	0.9	3
KP 1035.9	KP 1036.1	0.2	4
KP 1036.1	KP 1036.3	0.2	3
KP 1036.3	KP 1036.8	0.5	2
KP 1036.8	KP 1037.1	0.3	3
KP 1037.1	KP 1037.8	0.7	2
KP 1037.8	KP 1038.4	0.6	3
KP 1038.4	KP 1039.2	0.8	2
KP 1039.2	KP 1039.6	0.4	1
KP 1039.6	KP 1039.7	0.1	2
KP 1039.7	KP 1039.9	0.2	1
KP 1039.9	KP 1040.1	0.2	3
KP 1040.1	KP 1040.7	0.6	2
KP 1040.7	KP 1042.0	1.3	3
KP 1042.0	KP 1042.4	0.4	2
KP 1042.4	KP 1043.9	1.5	1
KP 1043.9	KP 1045.0	1.1	2
KP 1045.0	KP 1046.1	1.1	1
KP 1046.1	KP 1049.0	2.9	2
KP 1049.0	KP 1049.4	0.4	3
KP 1049.4	KP 1049.6	0.2	2
KP 1049.6	KP 1063.5	13.9	1

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION (continued)

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
KP 1063.5	KP 1063.7	0.2	2
KP 1063.7	KP 1063.9	0.2	1
KP 1063.9	KP 1064.0	0.1	3
KP 1064.0	KP 1064.7	0.7	1
KP 1064.7	KP 1066.1	1.4	2
KP 1066.1	KP 1066.3	0.2	1
KP 1066.3	KP 1066.6	0.3	3
KP 1066.6	KP 1067.3	0.7	1
KP 1067.3	KP 1067.7	0.4	3
KP 1067.7	KP 1070.6	2.9	1
KP 1070.6	KP 1082.1	11.5	2
KP 1082.1	KP 1082.9	0.8	1
KP 1082.9	KP 1085.5	2.6	2
KP 1085.5	KP 1087.1	1.6	1
KP 1087.1	KP 1087.3	0.2	3
KP 1087.3	KP 1088.8	1.5	2
KP 1088.8	KP 1089.2	0.5	3
KP 1089.2	KP 1090.0	0.8	2
KP 1090.0	KP 1118.4	28.4	1
KP 1118.4	KP 1119.7	1.3	3
KP 1119.7	KP 1120.0	0.3	2
KP 1120.0	KP 1120.6	0.6	3
KP 1120.6	KP 1120.9	0.3	2
KP 1120.9	KP 1121.5	0.6	4
KP 1121.5	KP 1121.9	0.4	3
KP 1121.9	KP 1125.1	3.2	4
KP 1125.1	KP 1125.2	0.1	2
KP 1125.2	KP 1125.6	0.4	1
KP 1125.6	KP 1126.7	1.1	3
KP 1126.7	KP 1127.0	0.3	1
KP 1127.0	KP 1127.8	0.8	2
KP 1127.8	KP 1128.0	0.2	3
KP 1128.0	KP 1128.8	0.8	1
KP 1128.8	KP 1129.8	1.0	2
KP 1129.8	KP 1130.0	0.2	3
KP 1130.0	KP 1130.2	0.2	2
KP 1130.2	KP 1130.5	0.3	1
KP 1130.5	KP 1130.9	0.4	3
KP 1130.9	KP 1131.1	0.2	1
KP 1131.1	KP 1131.4	0.3	2
KP 1131.4	KP 1133.8	2.4	3
KP 1133.8	KP 1136.0	2.2	4
KP 1136.0	KP 1138.0	2.0	3
KP 1138.0	KP 1142.0	4.0	4
KP 1142.0	KP 1146.0	4.0	3
KP 1146.0	KP 1147.2	1.2	2
BURNABY TANK FACILITY TO WESTRIDGE MARINE TERMINAL (KP 0.0 – KP 3.3)			
KP 0.0	KP 0.6	0.6	2

TABLE 2.087A-2

EXISTING TRANS MOUNTAIN PIPELINE CORRIDOR ASSESSMENT CLASSIFICATION (continued)

START STATION	END STATION	SEGMENT LENGTH (km)	ASSESSMENT CLASSIFICATION
KP 0.6	KP 3.5	2.9	4
KP 3.5	KP 4.1	0.6	3

b.1) Preliminary feasibility assessments for the non-watercourse HDDs will be done in 2014 after the preliminary geotechnical assessments are completed in Q3 and Q4 2014. The preliminary geotechnical assessments will be desktop based and utilise available data, including but not limited to local and regional mapping, LiDAR, and 3rd party subsurface information where available. The preliminary non-watercourse HDD feasibility assessments will be available in Q4 2014;

b.2) The HDD sections are required in areas of extreme congestion where conventional trenched construction is extremely difficult or not feasible. Contingency plans for each location will consist primarily of an alternate trenchless method due to the absence of viable alternate routes around the congested areas;

b.3) As required in CSA Clause 6.2.11.1, an execution plan will be requested from the selected contractor for each of the designed HDDs prior to construction; and

b.4) Final feasibility assessments for the non-watercourse HDDs will be done in 2015 after the results of the Stage-2 geotechnical field investigations are known. The on-site portion of the geotechnical field work is to begin in the summer of 2015. The final non-watercourse HDD feasibility assessments will be available in Q4 2015.

2.088 Depth of cover

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 53 of 110
ii) A3S0Z5, Application Volume 4A, Project Design and Execution – Engineering, Appendix D – Tables, Table 5.1.13 – Minimum Depths of Cover, PDF page 24 of 93
iii) CSA Z662-11, Clauses 4.11 and 4.12.2.1

Preamble:

Reference i) states that the depths of cover for the Line 2 pipeline will be a minimum of 0.9 metres in mineral soil and 0.6 metres in rock. Additional cover will be required at road crossings, watercourse crossings, railway crossings, and other locations as conditions require.

Reference ii), reproduced below, shows the depths of cover for the Project:

Location	Minimum Depth of Cover (m)
Pipeline Trench in Mineral Soil	0.9
Pipeline Trench in Rock	0.6
Roads Primary (Cased/Uncased)	
Travel Surface	1.5
Ditches	1.2
Roads Secondary (Cased/Uncased)	
Travel Surface	1.5
Ditches	1.2
Railway (Uncased) per Standard TC-E10	
Below Base of Rail	3.05
Below Ditch or Grade	1.83
Pipeline within Rail Rights-of-Way	1.52
Railway (Cased) per Standard TC-E10	
Below Base of Rail	1.68
Below Ditch or Grade	0.91
Pipeline within Rail Rights-of-Way	1.52
Watercourse Crossings	1.2
Facility Sites	1.5
Below Grade Main Line Block Valve	1.2

Reference iii) establishes the requirements for depth of cover.

Request:

Please explain how the depth of cover for "Facility Sites" and "Below Grade Main Line Block Valve" in Reference ii) comply with CSA Z662-11 requirements.

Response:

CSA Z662, Oil and Gas Pipeline Systems, does not specify minimum depths of cover for facility sites nor for buried valves. The depth of cover specified for the TMEP is a continuation of the specification employed on Trans Mountain's Anchor Loop Project in 2008. In accordance with CSA Z662, 4.12.3.1, Uncased Road Crossings, the combination of heavy wall pipe and deeper burial within the facility fenced areas, and the application of select backfill, the design will meet

the requirements for uncased road crossings and facilitates vehicle crossing of the pipeline within the facilities. Below grade mainline block valves will extend above grade and will be protected or vehicular traffic restricted in proximity.

2.089 Leak detection system

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 69 of 110

A3S1L1, Application Volume 4C, Project Design and Execution – Operations and Maintenance:

ii) PDF page 48 of 102
iii) PDF page 52 of 102

Preamble:

Reference i) states that each new pump station will have an ultrasonic meter installed on the discharge side. The flows measured will be used by the computational pipeline monitoring (leak detection) system.

Reference ii) states that Kinder Morgan Canada is also in the process of reviewing other technologies for leak detection, including external methods and an alternative computational method that monitors flow and pressure signals and bases leak detection on a probabilistic analysis of those signals. A final determination on whether to incorporate these technologies into the Trans Mountain Pipeline leak detection system will be made in the detailed engineering and design phase.

Reference iii) states that acoustical leak detection tools use highly sensitive microphones combined with data processing and inertial monitoring to detect small leaks in the pipeline. They have a detection threshold of 0.14 litres per minute.

Request:

Please provide:

a) a description of the capabilities of the leak detection system in Reference i), including the size of the smallest leak that could be detected using currently proposed technology;

b) a list of any other technologies for leak detection that Kinder Morgan Canada is considering for the Trans Mountain Pipeline; and

c) an indication of when the decision will be made regarding whether other technologies for leak detection will be used.

Response:

a) Refer to the response to GoC Parks IR No. 1.1.06, PDF page 4 of 14 (Filing ID A3X6G6).

b) Refer to the responses to Province BC IR No. 1.1.04e, PDF page 14 of 187 (Filing ID A3Y2Z1) and Farquhar E IR No. 1.07b (Filing ID A3X6F0).

c) Refer to the response to Province BC IR No. 1.1.04i, PDF page 15 of 187 (Filing ID A3Y2Z1). Trans Mountain is willing to provide annual updates to the Board on the status of the commercial availability and the anticipated or proven effectiveness of alternate leak detection technologies and any decisions to implement them for the proposed Project, both prior to initial operations and during ongoing operations.

2.090 Slack flow

Reference:

A3S0Y9, Application Volume 4A, Project Design and Execution – Engineering, PDF page 20 of 35

Preamble:

The reference states that downstream of the Coquihalla summit in British Columbia, one or more pressure control valves at one or more pressure control stations may be required on each pipeline to eliminate slack flow. The pressure control station(s) will likely be at the existing Hope Pump Station, but the location(s) and details will be finalized during the detailed engineering and design phase.

Request:

Please provide:

a) a description of the specific measures that would be implemented to eliminate slack flow;

b) a description of the measures currently taken to eliminate slack flow in Line 1; and

c) a list of locations of existing and proposed pressure control stations and valves.

Response:

a) The most recent steady state hydraulic study, completed after the Facilities Application was filed, an excerpt from which is included in the response to NEB IR No. 1.94f (Filing ID A3W9H9), indicates that proposed Line 1 will not be in slack flow downstream of the Coquihalla summit at the design flow rate and with the selected discharge pressure at Kingsvale Pump Station and the selected suction pressure at Sumas Pump Station. However, Trans Mountain is continuing to assess the feasibility of sustained operations in this flow regime. It is likely, as is the case today, that slack flow will continue to be a feature of operations in this segment (refer to the response to NEB IR No. 2.090b). Trans Mountain will consider the application of back pressure control, but it may not be feasible due to the existing pipe configuration and specifications in the area.

   The most recent hydraulic study for proposed Line 2, an excerpt from which is included in the response to NEB IR No. 1.94f (Filing ID A3W9H9), indicates that there will be the potential for slack flow downstream of the Coquihalla summit at the design flow rate and that back pressure control is appropriate. Increased pipe wall thickness for several kilometers upstream (the exact length to be determined) and for approximately two kilometers downstream of Hope Relief Station will be included in the design, along with back pressure control at Hope Relief Station. The back-pressure control facility (station) will have one or more control valves actuated by a proportional, integral, and derivative (PID) controller. The pressure set point of the controller will be adjustable to allow effective operation during transitional flow scenarios (i.e. pipeline start up and shut down). The Control Center will

determine the set points as required, within a limited range, based on procedures, to be developed, and calculations done by the computational pipeline monitoring (CPM) system.

The Hope Relief Station currently protects the existing pipeline downstream of the Coquihalla summit and will protect Line 1 in the future. A pressure relief valve will be installed upstream of the back pressure control valve(s) on Line 2.

The design basis for both the pressure control and pressure relief systems will be determined during the detailed design and engineering phase.

At all other locations in the pipeline system, slack flow will not occur at the design flow rates on Line 1 or Line 2. Further study is required to assess atypical flow rate scenarios and shut-down and start-up conditions for both Line 1 and Line 2. It may be necessary and / or desirable to allow slack flow to develop in these transitional flow scenarios. Where it is possible and / or desirable to avoid slack flow during pipeline shut down scenarios, mainline valves will be selectively closed to maintain line pack.

b) The existing pipeline is in slack flow downstream of the Coquihalla summit during normal operations. The existing pipeline has operated this way since it was constructed and was designed accordingly. The slack flow section of line has been inspected multiple times with state of the art in-line inspection (ILI) technology in recent years, and a hydrostatic test was performed successfully on the section in late 2013. In the event that the computational pipeline monitoring (CPM) system calculates that slack flow may occur elsewhere in the existing pipeline, a warning message is sent to the Control Centre Operator (CCO) who will take appropriate measures to adjust pressure set points to prevent the pipeline from reaching slack conditions. The CCO will continue to monitor the pipeline to ensure that it is properly packed.

c) There are no existing back pressure control stations or valves. Refer to the response to part a), above, regarding the proposed back pressure control station.

2.091 Cathodic protection (CP) system

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 56 of 110

Preamble:

The reference states that the CP system will be common to both the Line 1 and Line 2 pipelines. Some modifications and additions to the existing CP ground-beds will be required.

Request:

Please provide:

a) a detailed description of the common CP system for Line 1 and Line 2;

b) supporting information to demonstrate the common CP system's effectiveness, taking into consideration that Line 1 and Line 2 have different types of coatings; and

c) the list of proposed modifications and additions to the existing CP ground-beds.

Response:

a) The CP system utilized for Trans Mountain is very similar in most areas, including the CP systems designed and installed for the Anchor Loop Project in 2007/2008, specifically designed for protection of parallel pipelines. Typical system design includes the use of semi-deep or deep well groundbed systems or alternatively distributed anode systems where required. The groundbed systems protecting these two lines are run off of common rectifiers with current control devices in place to control the amount of current protecting each pipeline. Test taps are generally installed every 2-3 km along the pipe to enable monitoring of the effectiveness of the CP system. Bonding between pipelines or to other facilities occurs where potential interference is an issue.

   Final configuration of the CP system for Line 1 and Line 2 will be determined through detailed engineering design.

b) The TMX Anchor Loop project that was constructed in 2007/2008 is an example of a CP system on the Trans Mountain pipeline that is common to an older pipeline (NPS 24 coal tar enamel pipeline) and a more recently constructed pipeline with a different coating system (NPS 36 FBE pipeline). The groundbed systems protecting these two lines are run off of common rectifiers with current control devices in place to control the amount of current protecting each pipeline.

   As indicated in Volume 8.1.6 Monitoring Programs, the effectiveness and performance of the two pipelines and common CP system are subjected to monthly verification of rectifiers and ground-beds, and annual test lead surveys. Trans Mountain will provide, by August 22, 2014, a report that shows the effectiveness of the cathodic protection system on the two

pipelines that parallel on the TMX Anchor Loop segment. It is expected that the CP system on the TMEP will be a similar as the Anchor Loop segment for those areas where the two pipelines are contiguous.

c) Information on the modifications and additions to the existing CP ground-beds is not currently available and will be developed through detailed engineering and design.

Summary of New Commitments:

- Trans Mountain to submit to the NEB by August 22, 2014 a report demonstrating the effectiveness of the CP system on the two parallel pipelines systems from Hinton – Hargreaves (Anchor Loop).

2.092 Seismic design – standards

Reference:

A3S1F6, Application Volume 4A, Project Design and Execution – Engineering, Appendix J – Seismic Assessment Desktop Study Report, PDF page 19 of 112

Preamble:

The reference states that, at present, there are no guidelines in force in Canada that prescribe a performance standard for seismic design with respect to pipelines. It also states that Trans Mountain is responsible for establishing performance standards that consider both overall risk management and regulations that might apply to the design of individual components. The most appropriate design standards may differ for various components of the Trans Mountain Pipeline Line 2 project.

The reference further states that Trans Mountain Pipeline Line 2 pipeline facility upgrades and design will be consistent with the 2006 Building Code of British Columbia (BCBC) and the 2010 National Building Code of Canada (NBCC). It indicates that this is consistent with the approach of other utility agencies operating in British Columbia, including FortisBC, BC Hydro, and Metro Vancouver. This is also consistent with design standards adopted by other oil and gas pipeline projects currently under review by regulatory agencies in western Canada.

The design of a structure is typically based on a conservative seismic event, such as the 1:2475 event identified in Reference i).

Request:

Please provide:

a) confirmation that Trans Mountain will establish performance standards for the seismic design of the pipeline and related facilities as described in Reference i), and an estimate of when the standards will be established;

b) the factors that will be considered in adopting a particular performance standard for seismic design;

c) a copy of the performance standards for seismic design;

d) mapping to identify where the more probable 1:475 seismic events could have an effect; and

e) a description of how the lower magnitude findings will be applied to the performance standards for seismic design.

Response:

a) Trans Mountain is in the process of developing performance standards for the seismic design of the pipeline and related facilities. Seismic design of the new pipelines and facilities (including pump stations and terminals) proposed as part of the Project will be in accordance with the latest editions of the National Building Code of Canada, the Alberta

Building Code, the British Columbia Building Code, and other recognized standards and practices, as applicable to the structures and locations at the time of detailed engineering design and construction. Seismic design of storage tanks, including consideration of sloshing and other effects, will be in accordance with the latest edition of the American Petroleum Institute Standard 650 (API 650) Welded Tanks for Oil Storage, Appendix E, a recognized North American standard. Trans Mountain is confident that these approaches will ensure that the new pipelines and facilities will be able to withstand these large seismic scenarios with minimal damage or loss of integrity. Regarding schedule, (the response to NEB IR No. 1.82 (A3W9H9 page 12 and 13 of 62) indicates that) Trans Mountain will initiate detailed seismic assessment studies for the pipeline corridor in summer 2014, as part of engineering and detailed design, and the studies will continue as pipeline centreline and detailed design is advanced, in 2015.

b) Some of the factors to consider during seismic design development include:

1. **Seismic Wave Propagation**
   Wave propagation provisions are considered in terms of longitudinal axial strain, that is, strain parallel to the pipe axis induced by ground strain. Flexural strains due to ground curvature are typically neglected since they are small for typical diameters.

2. **Earthquake Induced Permanent Ground Displacement**
   Slope instability and liquefaction induced permanent ground displacement (PGD) has the potential to cause flexural strains in buried pipe, and almost always induces axial strains. Both effects – axial and bending – need to be considered in the structural analysis of the buried pipeline.

3. **Performance Objective**
   A seismic performance objective will be identified for pipeline design. Two performance objectives are often considered (1) based on elastic response for more frequent earthquakes and (2) based on plastic response and structural integrity for a maximum design earthquake. The following examples come from the American Lifelines Alliance, Guidelines for the Design of Buried Steel Pipe, Appendix A, 2001 (with addenda through February 2005). Design limit states are then established to satisfy the performance objective for a given earthquake loading condition.

Performance Objective	Description/Application
Pressure Integrity	· Intent is to maintain pressure (no leaks) following the design earthquake. · Assumes that significant pipeline distortion is possible and pipeline repair or replacement may be necessary. · Assumes ovalization of the pipe cross-section with a possibility of local wrinkling of the pipe wall. Pipe repair would be required to return the pipe to normal service.
Operable	· Intent is for pipeline to remain operable following the design earthquake, with no repairs (although inspection should be performed). · Assumes a single event and provides criteria related to the maximum moment capacity of the pipe.

c) Trans Mountain is in the process of developing performance standards. Refer to the response to NEB IR No. 2.092a for additional information.

d) The seismic design of the TMEP will be based on ground motion parameters with a 1 in 2475 annual probability of exceedance (APE). This adopted design criteria has a much smaller probability of exceedance and corresponding larger ground motion parameters than the higher frequency seismic events with a 1 in 475 APE. Hence the seismic design of the TMEP based on 1 in 2475 APE ground motions will automatically result in a more conservative design compared to one utilising the 1 in 475 APE ground motions.

   The project has therefore not considered it necessary to produce any 1 in 475 APE hazard maps at this time as all areas of potential seismic hazard that would be identified under the 1 in 475 APE are also identified under the 1 in 2475 APE. Mapping associated with the 1 in 2475 APE is provided in Application Volume 4A, Project Design and Execution – Engineering, Appendix J – Seismic Assessment Desktop Study Report (Filing ID A56002).

e) Refer to the responses to NEB IR No. 2.092a and 2.092d, which describe plans for developing the seismic design criteria and the applicability of a 1:475 vs 1:2475 annual probability of exceedance (APE) ground motions respectively. As described in NEB IR No. 2.092d, by electing to adopt the 1 in 2475 APE ground motions, this adopted design criteria has larger ground motion parameters than the higher frequency seismic events with a 1 in 475 APE. Therefore, the level of performance necessitated to meet the 1 in 2475 APE event will meet or exceed the equivalent performance specification for the 1 in 475 APE, and as such, performance standards for the higher frequency but lower magnitude events will be inherently incorporated into the 1 in 2475 APE design.

Summary of New Commitments:

- Trans Mountain will develop seismic performance standards during detailed design

2.093 Seismic design – ground-motion predictions

Reference:

A3S1F6, Application Volume 4A, Project Design and Execution – Engineering, Appendix J – Seismic Assessment Desktop Study Report, PDF page 33 of 112

Preamble:

The reference states that the ground-motion predictions presented in Appendix B, Drawings 2 through 6, are for Site Class C conditions, defined by Finn and Wightman (2003) as very dense soil and soft rock, with average shear wave velocity in the uppermost 30 metres of the soil profile (VS30) between 360 and 760 metres per second. Median peak ground velocities for Site Class C conditions are presented in Drawing 7. Deaggregations, presented in Appendix A, are calculated for 15 sites along the pipeline route using peak ground accelerations for Site Class C.

Request:

Please provide:

a) an explanation for the use of Site Class C conditions for ground- motion predictions and median peak ground velocities at all locations; and

b) confirmation that Trans Mountain will carry out ground-motion predictions with site-specific Site Classification conditions as part of the detailed engineering and design, or justification for not doing so.

Response:

a) The Geological Survey of Canada (GSC) provides all ground motion parameters (i.e. peak ground acceleration, PGA, and all spectral accelerations, Sa) for a single "reference" ground condition. This reference is needed to ensure that the seismic hazard values are numerically comparable for all sites. The National Building Code of Canada (NBCC 2010) has adopted "Site Class C", defined by a 360 to 750 m/s average shear wave velocity in the uppermost 30 m, as the Canada-wide reference ground condition as it: represents the larger number of strong motion recordings in well-instrumented locations such as California; is in the mid-range between very hard rock and very soft soil (thus minimizing uncertainty in the amplification or deamplification factors); and is similar to the ground conditions that were implied by the strong ground motion relationships used for the previous generations of seismic hazard maps.

   In the Seismic Assessment Desktop Study, ground motion parameters were obtained from the GSC, and hence were based on the Site Class C reference ground condition. Regarding the use of median peak ground velocities, values for PGA and Sa were used to determine the peak ground velocity. As the PGA and Sa values provided by GSC are median values, median peak ground velocities were calculated.

b) Trans Mountain confirms that ground-motion predictions with site-specific Site Classification conditions will be utilised as part of the detailed engineering and design at all locations where site specific seismic investigations will be undertaken.

2.094 Seismic design – site-specific studies and investigations

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 40 of 110

Preamble:

The reference states that "those areas along the route identified as having elevated liquefaction or landslide potential will then have site-specific studies and investigations undertaken during the detailed engineering and design phase to ensure the adequacy of the pipeline design."

Request:

Please provide:

a) a definition of the word "elevated" as used in above quotation; and

b) confirmation that site-specific studies and investigations will be undertaken for all areas identified as having liquefaction or landslide potential using both the 1:2475 and 1:475 probabilities.

Response:

a) As used in the above quotation, "elevated" represents the moderate, high and very high liquefaction potential areas identified in the Seismic Assessment Desktop Study (Filing ID A3S1F6).

b) The seismic design of TMEP will be based on ground motion parameters with a 1 in 2475 annual probability of exceedance (APE). This adopted design criteria has a much smaller probability of exceedance and corresponding larger ground motion parameters than the higher frequency seismic events with a 1 in 475 APE. Hence the seismic design of the TMEP project based on 1 in 2475 APE ground motions will automatically result in a more conservative design compared to one utilising the 1 in 475 APE ground motions.

   An initial evaluation of magnitude and frequency of hazards is outlined in the semi-quantitative hazard assessment (SQHA) and will be integrated into the Risk Assessment Report as part of Technical Supplement #1 to be filed with the NEB on August 1, 2014, as per NEB IR No. 1.79.

   The findings from the Seismic Assessment Desktop Study and results from the Risk Assessment Report will be used to design, prioritize and implement detailed site-specific geotechnical investigations focusing on assessing seismic hazards. These site-specific geotechnical investigations will target moderate, high and very high liquefaction potential areas (identified in the Seismic Assessment Desktop Study) and will include drilling boreholes and other geotechnical measurements to collect subsurface ground information. The results from the Risk Assessment Report will be used to develop a prioritised list of

seismically susceptible landslide sites for site investigation as part of detailed engineering and design.

This site-specific information will be used in a more detailed seismic analysis to assess the seismic hazards with 1 in 2475 APE ground motion parameters. The project has therefore not considered it necessary to perform any analysis based on 1 in 475 APE hazard values.

2.095 Seismic design – liquefaction

Reference:

A3S1F6, Application Volume 4A, Project Design and Execution – Engineering, Appendix J – Seismic Assessment Desktop Study Report, PDF page 51 of 112

Preamble:

The reference states that the peak ground velocity calculated from Sa(0.5) is approximate and that site-specific design should reference peak ground velocity determined by site-specific deterministic or probabilistic hazard analyses. Also, site-specific permanent ground displacements should reference site-specific determinations of these ground-motion parameters.

The reference further states that quantitative liquefaction probabilities or permanent ground displacements cannot be reliably assigned or related to the qualitative susceptibility ratings owing to the diversity of the terrain and consequent variability in texture, thickness, and groundwater levels, within each susceptibility category. Quantitative liquefaction probabilities and permanent ground displacement estimates can be developed when site-specific subsurface geotechnical investigations are completed.

Request:

Please provide:

a) confirmation that the final seismic hazard study will be conducted in the areas identified as having high to very high seismic susceptibility as shown in the seismic hazard maps; and

b) [Trans Mountain has renumbered sub-parts “c.1 to c.5” as “b.1 to b.5” in this Information Request list.]

   confirmation that the final seismic study will include, but not be limited to, the following elements:
   - b.1) design considerations for the more probable 1:475 earthquake event in addition to the proposed 1:2475 event;
   - b.2) a soil liquefaction assessment (by both laboratory testing and field data;
   - b.3) an evaluation of seismic settlements (both permanent seismic displacement – vertical and lateral, and due to post-liquefaction volumetric reconsolidation);
   - b.4) a site response analysis, if applicable; and
   - b.5) detailed plans for mitigating the liquefaction hazard.

Response:

a) Trans Mountain confirms that the final seismic hazard study will be conducted in the areas identified as having high to very high (as well as moderate) susceptibility to liquefaction as shown in the seismic hazard maps. Please refer to the response to NEB IR No. 2.094b for additional details regarding the seismic study components.

b.1) Please refer to the response to NEB IR No. 2.094b;

b.2) Trans Mountain confirms that the final seismic study will include a soil liquefaction assessment (by both laboratory testing and field data);

b.3) Trans Mountain confirms that the final seismic study will include an evaluation of seismic settlements (both permanent seismic displacement – vertical and lateral, and due to post-liquefaction volumetric reconsolidation);

b.4) Trans Mountain confirms that the final seismic study will include a site response analysis, if applicable; and

b.5) Detailed plans for mitigating the liquefaction hazard will be developed as part of detailed engineering and design, subsequent to the final seismic study, and in combination with construction and other engineering and design considerations.

2.096 Terrain mapping and geohazard inventory report

Reference:

i) A3S1C5, Application Volume 4A, Project Design and Execution – Engineering, Appendix H – Terrain Mapping and Geohazard Inventory Report, PDF page 18 of 29
ii) A3S1C6, Application Volume 4A, Project Design and Execution – Engineering, Appendix H – Terrain Mapping and Geohazard Inventory Report, PDF page 2 of 18

Preamble:

Reference i) states that field inspection and data collection of surficial geology, terrain, slope stability and natural hazards was completed to verify and update the terrain stability mapping. The field program consisted of three campaigns in June, August, and September 2013. Information such as slope gradient and morphology, aspect, drainage, surficial material type and texture, coarse fragment lithology, presence and type of rock outcrops, presence of geomorphic processes, and terrain stability assessment was collected.

Reference ii) provides an inventory report of terrain mapping and geohazards.

Request:

Please provide a photographic report for the three campaigns, including relevant photographs with descriptions, showing representative terrain and potential geohazards in each physiographic region along the proposed route, in support of the findings of the Terrain Mapping and Geohazard Inventory Report.

Response:

A photographic report of the three campaigns will be provided as part of Technical Update #2, including relevant photographs with descriptions, showing representative terrain and potential geohazards in each physiographic region along the proposed route, in support of the findings of the Terrain Mapping and Geohazard Inventory Report.

Summary of New Commitments:

- Commitment to reissue the Terrain report and map legend incorporating the above corrections as part of Technical Update #2.

2.097 Terrain stability ratings

Reference:

A3S1C5, Application Volume 4A, Project Design and Execution – Engineering, Appendix H – Terrain Mapping and Geohazard Inventory Report:

i) PDF page 13 of 29
ii) PDF page 16 of 29

A3S1F6, Application Volume 4A, Project Design and Execution – Engineering, Appendix J – Seismic Assessment Desktop Study Report:

iii) PDF page 2 of 112
iv) PDF page 13 of 112
v) A3S1C7, Application Volume 4A, Project Design and Execution – Engineering, Appendix H – Terrain Maps, PDF page 5 of 5
vi) A3S1D5, Application Volume 4A, Project Design and Execution – Engineering, Appendix H – Terrain Maps, PDF page 4 of 4

Preamble:

Reference i) provides the terrain stability ratings assigned to all terrain polygons, based on slope angle, surficial material type, and observable geomorphological processes occurring within the polygon.

Reference ii) provides the criteria used to define natural hazard classes and a description for each class.

Reference iii) is the terrain mapping legend, including Terrain Stability Class and Natural Hazard Class description. The Terrain Stability Class and Natural Hazard Class description provided in the legend do not correspond with the descriptions of the classes provided in the report (Reference ii).

Reference iv) is a terrain map (Drawings 6 and 48 of 54) showing Natural Hazard Potential and Terrain Stability for proposed Line 2 pipeline segments. The terrain stability class and hazard potential for RK 109 do not appear to be consistent with the criteria in References i) and ii). The terrain has been classified as a glacial till in a moderate slope modified by gully slopes and seepage (Ma-VL). Terrain class for the polygon has been indicated as III, and a slow earth slide has been identified in the Geohazards Inventory.

Reference v) is a terrain map (Drawing 48 of 54) showing Natural Hazard Potential and Terrain Stability for proposed Line 2 pipeline segments. Terrain stability class and hazard potential for RK 1064 do not appear to be consistent with the criteria in References i) and ii).

Request:

Please provide:

a) correction of the Project Terrain Mapping Legend to reconcile the classes in the legend with the class description for terrain stability and natural hazard potential in the report (References i) and ii));

b) information regarding the quality assurance and quality control process for the final mapping deliverables, including a discussion of the lack of air photo interpretation, any limitations due to the survey intensity level, and any difficulties encountered during field surveys; and

c) corrections to:
   c.1) the information identified in the preamble; and
   c.2) drawings, if additional inconsistencies are found during the review.

Response:

a) Terrain mapping legend and class descriptions in the report will both be modified to the following:

Terrain Stability Class

I	Polygon is stable and no significant slope instability or erosion problems are present.
II	Polygon is stable and there is a very low likelihood of slope instability or erosion initiating in the polygon following cut and fill construction. Minor slumping is expected along soil cuts, especially for 1 or 2 years following construction.
III	Polygon is stable and there is a low to moderate likelihood of slope instability or erosion initiating in the polygon following cut and fill construction. Minor slumping is expected along soil cuts, especially for 1 or 2 years following construction.
IV	Polygon is marginally stable and it is expected to contain areas with a moderate to high likelihood of slope instability or erosion initiating in the polygon following cut and fill construction. Wet season construction will further increase the likelihood of construction-related slope instability or erosion.
V	Polygon is unstable and is expected to contain areas with a high likelihood of slope instability or erosion initiating in the polygon following cut and fill construction. Wet season construction will further increase the likelihood of construction-related instability or erosion.

Natural Hazard Class

L	No existing hazard, or hazard is dormant.
M	Hazard is inactive. Vegetated tracks may be observed in airphotos. Smaller more frequent events, such as rock fall, may affect a small area of the polygon. No evidence that the hazard has been active within 20 years but trigger is present. Hazard is moderately likely to occur within the lifetime of the project.
H	Hazard is currently active or shows evidence of activity in the last 20 years. Hazard is likely to occur within the life of the project.

b) As stated in Section 2.1 of the Terrain and Geohazard report (Filing ID A3S1C5), air photo interpretation was completed for the entire route. A further discussion of field surveys including intensity level and limitations can be found in the response to Simpcw F N IR No. 1.012 (Filing ID A3Y3Q5).

Information relating to the quality assurance (QA) and quality control (QC) process for the final mapping deliverables included as follows:

Quality Assurance

Quality assurance was provided by Denny Maynard, M.Sc., P.Geo., Senior Geoscientist of Denny Maynard & Associates Ltd. Quality assurance was provided throughout the mapping process to ensure accuracy of linework and terrain classification. Review was completed by examining mapping in both kmz format, with reference to stereo airphotos, or by reviewing the digital mapping using Summit Evolution software.

Quality Control

Quality control was implemented through the use of senior and project level terrain specialists. As with the quality assurance process, mapping was reviewed by the senior terrain specialist by examining mapping in both kmz format, with reference to stereo airphotos, or by reviewing the digital mapping using Summit Evolution software. Mapping was reviewed following field inspections and updated based on field results. Alignment sheets were reviewed and inconsistent symbols were corrected.

c) In relation to Reference iv) describing a polygon classified as Ma-V (till in a moderate slope modified by gulley slopes) which has a hazard class of L (low), the polygon has been reclassified to Ma-VFs (till in a moderate slope modified by gulley slopes and slow earth slides) which has a hazard class of M (moderate).

In relation to reference v). It is not known which polygon this addresses. Corrections have been made to this mapsheet regarding the slope stability classes of source zones of rockfall and debris flows.

Additional corrections to the terrain stability mapping identified by information in the preamble have been addressed as part of NEB IR No. 2.097a. Corrections to the drawings will be issued as part of a revised Terrain Mapping and Geohazard Inventory Report as part of Technical Update #2 on August 22, 2014.

Summary of New Commitments:

- A revised version of the Terrain report and map legend with the above corrections will be issued.
- Commitment to reissue the Terrain Mapping and Geohazard Inventory Report incorporating the above corrections as part of Technical Update #2.

2.098 Geohazards and terrain stability

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 40 of 110
ii) A3S0Z5, Application Volume 4A, Project Design and Execution – Engineering, Appendix D – Table 5.1.4 – Primary Terrain Stability Considerations and Standard Mitigation Measures, PDF page 7 of 93
iii) A3S1C5 and A3S1C6, Application Volume 4A, Project Design and Execution – Engineering, Appendix H – Terrain Mapping and Geohazard Inventory Report

A3S4V5, Application Volume 7, Risk Assessment and Management of Pipeline and Facility Spills:

iv) PDF page 41 of 84
v) PDF page 42 of 84
vi) A3S4V7, Application Volume 7, Risk Assessment and Management of Pipeline and Facility Spills, Appendix A – Threat Assessment Report, PDF page 31 of 60

Preamble:

Reference i) states that the route for the proposed new Line 2 pipeline segments was selected to avoid or minimize exposure to slope instability, rock falls, debris flows, seismicity, and erosion. It also states that the primary element assessed by the routing specialist was constructability.

Reference ii) is a table that lists primary terrain stability considerations and identifies standard mitigation measures for each type of geohazard. A list of standard mitigation measures is provided; however, no preliminary discussion of their suitability for the identified geohazards is included in the application.

Reference iii) is the Terrain Mapping and Geohazards Inventory Report. It provides a description of geohazard types categorized as hydrotechnical, ground movement and geotechnical hazards, seismic hazards, snow and ice hazards, and other ground hazards (erosion and sedimentation, and acid rock drainage and metals leaching). A brief description of each hazard is provided; however, no discussion is presented of how each identified hazard may affect the integrity of the proposed pipeline and how the construction of the pipeline may affect the stability of the terrain.

Reference iv) is a description of the methodology to estimate failure frequency for geohazards that may cause pipeline failure.

Reference v) lists areas that would have elevated high consequences if a release were to occur. Both sections refer to risks related to potential release of containment due to geohazard occurrence, but do not address the potential risks to areas that may be affected by geohazards triggered by pipeline construction.

Reference vi) states that, when the second stage is completed (i.e., data collected from site visits is collected and analyzed), the extent of outside force threats, including the potential magnitude of movement and estimates of movement frequency, will be established.

Request:

Please provide:

a) an explanation of how geohazards and other types of terrain instability were integrated into the pipeline routing process as stated in Reference ii);

b) a discussion of potential constructability problems related to each type of geohazard and terrain stability along the proposed line;

c) a discussion of how the construction of the pipeline may affect the current stability of the terrain;

d) a clear outline of the second stage as it relates to geohazards and terrain stability magnitude-frequency investigations as stated in Reference v), including a list of critical areas for further detailed investigation during the detailed engineering phase as related to geohazards and other types of terrain instability (e.g., detailed landslide hazard assessment, geotechnical investigations, and debris flood/debris flow hazard studies); and

e) an explanation of how the identified geohazards will be included in the quantitative risk assessment.

Response:

a) A description of the pipeline corridor and route centreline selection process is provided in Volume 4A Section 2.8 (Filing ID A3S0Y8). As described in Section 2.8, where alternative pipeline corridors were developed, evaluation of these alternatives was undertaken with members of the corridor review team. This team included representation specialising in geohazards and terrain instability. As illustrated in Volume 5A Section 4.1 (Filing ID A3S1L4), geotechnical information was incorporated into evaluations of alterative study corridors. An example evaluation is presented in Table 4.2-1. Within this table, geotechnical information considered included:

   - The length of route alternative crossing with slopes greater or lesser than 50% of the fall line;
   - The length of the route alternative with natural hazard potential subjectively ranked as high, moderate, or low; and,
   - The length of the route alternative with a thin veneer of overburden or exposed bedrock.

   This data was obtained from digital elevation models (DEMs) along with information obtained as part of terrain mapping and terrain stability field assessments.

b) The table below summarises potential constructability problems related to each type of geohazard and terrain stability as well potential mitigation options.

Geohazard Class	Geohazard Category	Potential Problem / Mitigation
Snow Slope Geohazards	Snow avalanches	Potential constructability problems associated with snow avalanche are primarily related to site access and workforce safety in winter. Should snow avalanches occur along access routes to the site, these avalanches have the potential to block routes and disrupt construction. Should avalanches occur where active construction is occurring, there is the potential for workplace safety concerns. Mitigation methods to prevent or minimize constructability problems can include appropriate scheduling of construction as well as assessment and appropriate mitigation of avalanche potential by qualified specialists ahead of and during construction.
Rock Slope Geohazards	Rockfall	Potential constructability problems associated with rockfall are primarily related to impact to unprotected structures including the pipeline prior to backfilling, workforce safety, as well as the potential for impact to 3rd parties due to rockfall initiated as part of construction operations. Rocks detaching and either falling or falling then bouncing/rolling down slopes have the potential to impart large amounts of energy into structures. The potential for triggering rockfall can occur as the right-of-way is developed and where slopes in rock are necessary to be cut or blasting is required. Mitigation measures include designing cuts to minimize rockfall potential, locating structures and the pipeline to avoid rockfalls, undertaking stabilizing measures such as scaling, anchoring or the use of mesh, or constructing berms or catchment areas. Trans Mountain applied some of these methods during construction of the TMX Anchor Loop Project through Jasper National Park and Mount Robson Provincal Park in 2007 and 2008.
	Extremely rapid rockslides	Potential constructability problems associated with rapid rockslides are similar to those for rockfall and are primarily related to impact to unprotected structures including the pipeline prior to backfilling and workforce safety. Mitigation measures include designing cuts to minimize instability, locating structures and the pipeline to avoid rockslide prone areas, undertaking stabilizing measures such as bolting and the installation of drains, or constructing berms or catchment areas.
Soil Slope Geohazards	Debris slides/avalanches	Potential constructability problems associated with debris slides/avalanches are related to where triggering conditions lead to the initiation of rapid movement of debris including soil and rock into the construction zone. Triggering conditions include extreme climatic events such as heavy and sustained precipitation, rapid snow melt, and disturbance upslope. Risk is to unprotected structures including the pipeline prior to backfilling and workforce safety. Mitigation measures include the assessment of upslope stability, suspension of work during potential triggering conditions, and the construction of catchment areas or berms.
	Earth landslides	Potential constructability problems associated with earth landslides include the potential for the initiation or reactivation of landslides as a result of construction related vibrations, oversteepening of slopes, alteration of drainage, or the placement of fill. Prevention requires the assessment of soil type (e.g. sensitive marine clay) and susceptibility to landsliding, and monitoring during construction. Mitigation includes reducing slope angles, control of drainage, construction of toe buttresses, and removal of fill on slopes.
Seismic Geohazards	Fault displacement	Due to the low frequency of occurrence of fault activity, the potential for constructability problems is limited.
	Lateral spreading	Due to the low frequency of occurrence of significant seismic events, the potential for constructability problems is limited.
Hydrotechnical Hazards	Debris flows/floods	Potential constructability problems associated with debris flows/floods are related to where triggering conditions lead to the initiation of rapid movement of debris including soil and rock into the construction zone within a confined watercourse. Triggering conditions include extreme climatic events such as heavy and sustained precipitation, rapid snow melt, and disturbance in the upslope watershed. Risk is to unprotected structures including the pipeline prior to backfilling and workforce safety. Mitigation measures include suspension of work during potential triggering conditions and the construction of catchment areas or berms.
	Avulsion	Potential constructability problems associated with avulsion would only occur during extreme flow events are would be related to exposure and subsequent in-flow damage to the pipeline. Mitigation includes appropriate scheduling of construction to avoid peak flow.

Geohazard Class	Geohazard Category	Potential Problem / Mitigation
Hydrotechnical Hazards (cont'd)	Scour	Potential constructability problems associated with scour would only occur during extreme flow events and would be related to exposure and subsequent in-flow damage to the pipeline. Mitigation includes appropriate scheduling of construction to avoid peak flow.
	Lateral erosion	Potential constructability problems associated with lateral erosion would only occur during extreme flow events and would be related to exposure and subsequent in-flow damage to the pipeline. Mitigation includes appropriate scheduling of construction to avoid peak flow.
	Outburst-type floods	Due to the low frequency of occurrence of outburst-type floods, the potential for constructability problems is limited.
General Soil Stability	Raveling & Erosion	Potential constructability problems associated with raveling and erosion include difficulty with constructing across loose soil slopes where side-cuts are necessary. Such slopes have the potential to ravel whereby soil continues to migrate downslope until a stable slope angle is achieved. Where uncontrolled, this situation has the potential to result in oversized slope cuts. Mitigation includes the assessment of soil type (e.g. loose unconsolidated sands), assessment of stability, monitoring during construction, and the modification of slope cut angles or reduction of side-cut depth where practical.

c) Pipeline construction can involve alteration to the local terrain including the removal of vegetation, redirection of surface water drainage, alteration to general slope grades (including cutting of in-situ soils and the placement of fill), and the cutting into and removal of bedrock slopes. Depending upon the degree of terrain alteration and the level of current stability of the terrain, such construction can increase or decrease the stability. Example scenarios whereby construction may affect the current stability of the terrain include:

Landslides

Construction of the pipeline across the toe of landslide has the potential to affect the stability of the landslide. If large quantities of material are removed from the toe of the landslide, the stability can be reduced and landslides re-activated or accelerated. Conversely, placement of additional fill at the toe has the potential to act as a buttress, increasing the stability, potentially halting or stabilising active landslides or further increasing the stability of sites prone to sliding. Construction of the pipeline across the head or above the head of the landslide may similarly affect the stability by loading or unloading the top of the slide, and consequently decreasing or increasing the stability respectively.

In addition to the direct effect that placement or removal of soil has on stability, modification to the local drainage can also impact the stability at a landslide site. Should local drainage be directed or concentrated onto a landslide-susceptible site, terrain stability can be reduced. Conversely, by properly controlling surface water (such as through the installation of water diversion bars on slopes and along the right-of-way), stability can be maintained or improved. For existing or potential landslide sites, the installation of horizontal drains into the subsurface of the landslide mass can also be used to reduce internal pore-water pressure and increase the terrain stability.

Rockfall and Rockslides

Highly fractured slopes in rock or those with foliation or bedding planes inclined approximately parallel to the slope have the potential to generate rockfall or rockslides. Cutting into these slopes may expose fractured or foliated rock structure and increase the potential for rockfall or rockslides to initiate. For rockfall or rockslide sites that may be

previously unstable, or where construction may expose or increase the potential for rockfall or rockslides, mitigation measures to restore or improve the stability can include minimising the amount and angle of cutting of slopes, scaling and trimming of exposed rock, installation of bolting, the application of catchment nets, or construction of deflection berms.

Erosion

Removal of vegetation on slopes has the potential to result in soil erosion in loose unconsolidated soils. Redirection of surface water through construction activities onto such slopes can exacerbate the erosion and lead to the development of rilling and gully formation. Through appropriate construction management, drainage measures can be installed and vegetation can be restored following construction to prevent erosion.

d) Details regarding the second stage as it relates to geohazards and terrain stability magnitude-frequency investigations have not been developed to date. An initial evaluation of magnitude and frequency of hazards are outlined in the semi-quantitative hazard assessment (SQHA) and will be integrated into the Risk Assessment Report as part of Technical Update No. 1 to be filed with the NEB on August 1st, 2014, as per the response to NEB IR No. 1.79 (A3W9H9 page 7 of 62). Using the results from the Risk Assessment Report, a prioritised list of geohazards for site investigation will be developed. From this list, further Terrain Stability Field Assessments and geohazard site investigations will be completed in 2014 and 2015 as part of detailed engineering and design. These assessments will include further site specific seismic investigations, investigations of ground movement hazards (including detailed landslide hazard assessments and geotechnical investigations of rockfall and rockslide sites) and investigations of hydrotechnical hazards (including debris flood/debris flow hazard studies and scour and erosion sites).

e) A semi-quantitative hazard assessment (SQHA) of geohazards has been completed along the proposed Line 2 route corridor, and will be filed with the NEB as part of Technical Update No. 1 on August 1 2014. This assessment includes a revised inventory of potential geohazards along the route and an estimated frequency for each hazard event that could lead to loss of containment of the pipeline. A description of the methodology used to assess the geohazards is included in the report. The results of this hazard assessment will be incorporated into the overall semi-quantitative risk assessment along with other hazard types as part of the Preliminary Risk Assessment Document included as part of Technical Update No. 1. The risk assessment that will be filed as part of Technical Supplemental No. 1 reflects the baseline risk, prior to the implementation of all mitigation measures that will ultimately be incorporated into the final design through the implementation of the risk-based design process. Nevertheless, in the SQHA report, examples of potential mitigation measures for each of the geohazards and hydrotechnical hazards presented will be provided. As will be described in the SQHA report, these mitigation measures, once incorporated into the final design, will reduce failure likelihood (and hence risk) by modifying one or of the four factors that influence geohazard / hydrotechnical hazard failure susceptibility: occurrence potential, frequency, spatial probability of impact, and vulnerability.

Through the implementation of the risk-based design approach, mitigation measures are pre-emptively identified and incorporated at the design stage to address all principal risks.

Because risk-based design is a process that focuses on identifying and pre-empting risk, it is a more rigorous approach than more traditional design approaches that don't incorporate the findings of specific risk assessments to identify and pre-empt risks.

Summary of New Commitments:

- A list of critical areas for further detailed investigation during detailed engineering phase as related to geohazards and other types of instability as part of Technical Update No. 1.

2.099 Geohazards during pipeline construction

Reference:

i) A3S4V5, Application Volume 7, Risk Assessment and Management of Pipeline and Facility Spills, PDF page 41 of 84
ii) A3S4V7, Application Volume 7, Risk Assessment and Management of Pipeline and Facility Spills, Appendix A – Threat Assessment Report, PDF page 31 of 60

Preamble:

The Board notes that pipeline construction may contribute to the potential for landslides and erosion problems in unstable terrain. These geomorphological processes may adversely impact people, streams, roads etc.

Reference i), states that the quantitative risk incorporates "only those significant hazards that have the potential to result in a loss of containment".

Reference ii) does not appear to address the threats of existing and potential geohazards that could be caused by pipeline construction.

Request:

Please provide a risk assessment and risk management plan for the threats of existing and potential geohazards that could be caused by pipeline construction.

Response:

A risk assessment addressing the threats of existing and potential geohazards that could be specifically caused by pipeline construction has not been conducted as the selection of a finalised route and determination of the required construction geometries and techniques will be undertaken as part of detailed design and engineering. Please refer to the response to NEB IR No. 2.098e relating to the provision of the semi-quantitative hazard assessment (SQHA) of geohazards and Risk Assessment Document to be filed August 1, 2014.

A risk management plan will be developed as part of detailed engineering and design, and will be updated as additional site specific information is obtained through detailed investigations, and modified as geohazards are encountered during construction. As part of the risk management plan, best practices will be adopted during construction to ensure that the potential for geohazards to be initiated, or where already occurring to be exacerbated, is minimised during pipeline construction or operation, including when traversing geohazard-prone terrain, such as zones of potential rockfall, erosion, or landslides. This geohazard-prone terrain has been identified initially as part of the SQHA, and will be refined as further site investigations are carried out through detailed engineering and design. In all cases, recognised standards of practice and Codes for the relevant jurisdiction will be adhered to, including the incorporation of appropriate factors of safety specific to mitigate against the various types of geohazards, both for protection of the pipeline, the public and natural resources. Effective management of the geohazards within the vicinity of the pipeline in many cases is a common interest to both the safety of the pipeline and the protection of the public and natural resources. Design and

development of the construction methodology and mitigation measures will be completed by qualified professional geotechnical engineers.

Summary of New Commitments:

- Development of a Risk Management Plan as part of detailed engineering and design.

2.100 Hydrology – Strahler Stream Order Classification

Reference:

i) A3S1D8, Application Volume 4A, Project Design and Execution – Engineering, Appendix I – Route Physiography and Hydrology Report, PDF page 19 of 97
ii) A3S1E1, Application Volume 4A, Project Design and Execution – Engineering, Appendix I – Route Physiography and Hydrology Report (Appendix B), PDF page 11 of 17

Preamble:

Reference i) does not provide any discussion of the Strahler Stream Order Classification that is referenced on all of the maps in Reference ii) (Appendix B of Appendix I). In addition, the stream order does not appear to be consistent on all maps.

Request:

Please provide:

a) a discussion on the Strahler Stream Order Classification; and

b) confirmation that all maps have consistent application of the classification order.

Response:

a) The Strahler Stream Order is a dimensionless order designation for water courses described by Strahler (1957) and aimed at providing a measure of the complexity of a hydrometric network. In this classification, the smallest headwater streams are defined as first-order. Where two first-order streams join, the water course immediately downstream of the junction is referred to as a second-order water course, and so forth until the mouth of the water course. Where a lower-order stream (e.g. second-order) joins a higher-order stream (e.g. third-order), the area downstream of the junction retains the higher number (i.e. it remains a third-order stream).

   For this study, the Strahler Stream Order classification was applied to the National Hydrometric Network. The Strahler Stream Order network was shown to help clarify the stream network density in the study areas.

Reference:

Strahler, A. N. 1957, Quantitative analysis of watershed geomorphology. Transactions of the American Geophysical Union 38 (6): 913–920.

b) Trans Mountain confirms that all maps in Reference ii are subject to the same application of the Strahler order classification. However, to improve map readability, stream orders of category 1 and 2 are not represented when the watershed area is greater than 1,000 km² and stream orders between 1 and 4 are not represented when the watershed area is greater than 10,000 km².

2.101 Hydrology – watercourse crossing selection

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 44 of 110

A3S1D8, Application Volume 4A, Project Design and Execution – Engineering, Appendix I – Route Physiography and Hydrology Report:

ii) PDF page 21 of 97
iii) PDF page 22 of 97
iv) A3S2C1, Application Volume 5C, Environmental and Socio- Economic Assessment – Biophysical Technical Reports, TR 5C-7 – Fisheries (British Columbia) Technical Report, PDF page 3 of 106

A3S2S3, Application Volume 6B, Pipeline Environmental Protection Plan, Appendix I – Aquatic Resources:

v) PDF page 11 of 461
vi) PDF pages 356 to 393 of 461
vii) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 54 of 110

Preamble:

Reference i) provides the watercourse selection method as part of the engineering design principles. It defines that a watercourse has a bed and banks for a minimum of 100 metres at the crossing. Using this definition, 468 watercourses were identified.

Reference ii) provides a hydrologic desktop review of 474 notable water crossings out of 1,256 potential crossings (Reference iii)).

Reference iv) is a fisheries report that identifies 800 potential watercourse crossings. Reference v) is the Environmental Protection Plan that identifies the mitigation measures for 902 water crossings (Reference vi)).

Reference vii), Section 3.2.20.1, describes how watercourse crossings will be dealt with during the pipeline system engineering and design phase.

Request:

Please provide:

a) a description of the purposes of each of the four different watercourse crossing databases with details on how and why the numbers of crossings differ (e.g., difference between Stage 2 water crossings as a design principle and notable water crossings in the hydrology report);

b) information on how the watercourse selection method for engineering design utilized the hydrology report data and, if that data was not used, an explanation for its exclusion;

c) an explanation of why only Stage 2 watercourse crossings are identified in Reference vii) as requiring attention during engineering design;

d) the timing for geotechnical and hydrologic field investigation for all watercourse crossings to confirm desktop assumptions for engineering design; and

e) the methodology for integrating the information from the four different watercourse crossing databases for design and construction in Reference vii).

Response:

a) There were only two watercourse crossing databases used for this project; Terrain data (TRIM) was used to develop the fisheries list (1038 crossings) which was refined down to 468 crossings based on several criteria (fish species, fish habitat sensitivity, defined bed and banks, etc., as per Volume 4A, 2.11 Watercourse Crossing Method Selection). The Canvec Stream Network (Natural Resources Canada) was used to develop the hydrological list (unknown total) which was refined down to 474 crossings based on scour potential (Volume 4A, Appendix I, Table 3-1, Route Physiography and Hydrology Report). The two quantities differ because each was generated using different criteria. Refer to the response to NEB IR No. 2.104 for additional information.

The watercourse decision flowchart was the tool used to determine if a crossing is Stage 1 or Stage 2. This flowchart produces anticipated construction methods based on fisheries sensitivity and watercourse physical characteristics (channel width and flow rate during construction.) The hydrological characteristic that is not considered by the flowchart is scour potential during flood events. The 474 significant crossings in the hydrology report are the crossings identified as requiring additional study to determine the scour potential. There will be Stage 1 and Stage 2 crossings with scour potential that will be addressed with site specific design drawings.

The NEB's preamble to this IR No. 2.101 includes references to four different crossing totals.

1) Reference i) has 468 watercourses (Fish habitat list)

2) Reference ii) has 474 watercourses (Hydrology list). The 1256 total crossings is an error in Table 3-1, Route Physiography and Hydrology report; this is actually the total pipeline distance in km that was studied.

3) Reference iv) has potentially 800 watercourses (Fish habitat list prior to refining down to 468)

4) Reference vi) has a total 730 watercourses from EPP Tables I-1 and I-2 (EPP Mitigation list, based on the preliminary Fish Habitat list). It is unknown how the total of 902 watercourses referenced in the preamble was derived.

Reference ii) from the Route Physiography and Hydrology report has been revised to fix the segment lengths. The number of watercourse crossings hasn't changed.

TABLE 101A-1

SUMMARY OF WATERCOURSE CROSSINGS FOR THE PROPOSED TMEP ROUTE BY PHYSIOGRAPHIC REGION AND CATCHMENT SIZE

Physiographic Region	E. AB Plains	W. AB Plains	S. AB Uplands	Rocky Mtns	Rocky Mountain Trench	Columbia Mtns	Shuswap	Thompson	Cascade Mtns	Georgia Depression	Total
Route Length (km)	128	134	77	13	21	88	125	214	98	102	**996**
Catchment Area (km^2)											
<2	10	12	14	2	2	71	27	22	65	35	260
2-10	6	2	5	-	3	15	20	17	17	8	93
10-50	5	13	6	-	2	6	6	9	9	6	62
50-100	-	2	2	-		5	1	4	1	1	16
100-500	2	4	-	-	1	3	6	5	3	-	24
500-1000	1	1	-	-	-	-	1	1	3	-	7
>1000	1	2	-	1	-	1	3	2	-	2	12
Total Waterway Crossings	25	36	27	3	8	101	64	60	98	52	474
Crossings per km	**0.2**	**0.3**	**0.4**	**0.2**	**0.4**	**1.1**	**0.5**	**0.3**	**1**	**0.5**	**0.4**

Source: Table 3-1, Filing ID A3S1D8, page 22 of 97.

b) As described in the response to NEB IR No. 2.101a, the crossing method selection process utilized the watercourse flow rates and channel widths, but was not dependant on the scour potential. During the detailed design phase, the scour potential of the 474 hydrologically significant crossings will be determined and mitigation incorporated into the designs as required.

c) During the detailed engineering design phase, site specific designs will be undertaken for any Stage 1 watercourses that require scour mitigation designs and any identified as having additional constructability challenges.

d) HDD field investigations were started in 2013 and will be completed by October 2014, with reports issued by end of January 2015. Hydrologic field investigations for non-HDD crossings will be started in August 2014 and will continue to the end of 2015.

e) A master watercourse crossing table will be created by combining the Fish Habitat list and the Hydrology list to ensure that all watercourses have been captured and accounted for. Any watercourses not already identified in the hydrology list will receive additional

engineering review to confirm if they required additional hydrological assessment and design.

Summary of New Commitments:

- A master watercourse crossing table will be created by combining the Fish Habitat list and the Hydrology list to ensure that all watercourses have been captured and accounted for and submitted as part of Technical Update No. 2 on August 22, 2014.

2.102 Hydrology – stream flow data

Reference:

A3S1D8, Application Volume 4A, Project Design and Execution – Engineering, Appendix I – Route Physiography and Hydrology Report, PDF page 20 of 97

Preamble:

The reference provides information on stream flow data.

Request:

a) Please discuss how the desktop study or other methodology comprehensively addresses the issues of bed scour and lateral erosion of rivers. In particular, include reference to open cut and isolation methods and depth of cover below the scour depth of the channel.

b) Please describe the connection between stream flow data in the reference and the process of developing crossing design based on the hydrological assessment.

c) Please provide a clear outline of the limitations of the hydrologic desktop review with details about the next stages of the hydrologic assessment.

d) Please provide a desktop scour analysis for all of the Stage 2 and notable crossings, or at least those that require isolation methods.

e) Please confirm that bed scour and lateral erosion will be incorporated into the design for crossings with details on how that will occur.

Response:

a) The intent of the Route Physiography and Hydrology Report is to provide a high level perspective on the hydrological variability encountered along the TMEP. It does not include an assessment of the potential for bed scour and lateral erosion of rivers (or other hydrotechnical hazards), nor was the intent of the report to provide crossing design information. During detailed engineering, scour will be assessed using a number of quantitative methods that require information on the channel substrate, morphology, cross-section data, channel gradient, and peak flows. While the hydrology assessment completed as part of the referenced report allows an assessment of peak flows, other parameters require a site visit and survey data in some instances in order to undertake detailed assessments. Bank erosion will also be assessed quantitatively using historical air photographs supplemented by site investigations. The results from the scour and bank erosion assessments will be incorporated into the determination of suitable depth of cover to prevent scour under the 1:200 year event and appropriate setback distances for bends. As part of these detailed assessments, historic monthly hydrographs will be developed to assist in evaluating construction methods including suitability for isolation.

b) Assessing the hydrologic variation of the water course crossings along the proposed route is the first step in identifying an appropriate design. The next stage of the assessments will be

undertaken as part of detailed engineering and design. During this assessment the unique hydraulic and geomorphologic conditions at each crossing will be evaluated. This evaluation considers hydrotechnical hazards, such as bed scour, channel degradation, bank erosion, encroachment, and channel avulsion.

The stream flow data are used to develop the following for use in detailed design, including:

- The historic monthly hydrographs developed for individual crossings will assist in evaluating construction methods, including suitability for isolation.
- Estimated peak flows are an important input when evaluating potential scour at water course crossings. In addition to peak flow estimates, scour assessments require information on channel morphology, gradient, cross-sectional data, and substrate.
- When evaluating bank erosion from historic air photographs, it is sometimes possible to correlate significant bank erosion with a known flood event, which can then be tied to a specific return period. Understanding these relations, is an important component of designing appropriate setback distances for pipeline sag bends.

c) The intent of the Route Physiography and Hydrology Report is to provide a high level perspective on the hydrological variability encountered along the TMEP. This report defines 11 physiographic regions characterized by consistent geological, topographic and hydroclimatic conditions. Average seasonal flows and estimated peak flows for various return periods are provided for major rivers and described in a general manner for the multiple smaller watercourse crossings.

No site specific field investigations have been completed as part of this work, and hence the document provides conclusions at a preliminary or general screening level. Estimations of flood frequency are limited to catchments that have sufficient published information, which can therefore be applied as part of a desktop study. Estimates for smaller, ungauged catchments in the Route Physiography and Hydrology Report are based on interpolation of regional relationships and utilise adjacent gauged rivers, and are therefore limited to the availability of applicable peak flow information.

Additional investigation and hydrologic assessment will be carried out as part of the detailed engineering and design phase. The detailed engineering and design phase involves the determination of the preferred crossing method and crossing design for every crossing along the TMEP based on the quantification of the magnitude and frequency of occurrence of hydrotechnical hazards such as bed scour, channel degradation, bank erosion, encroachment, and avulsion. The quantification of these hydrotechnical hazards relies on the analysis of remotely-sensed datasets (e.g. LiDAR) and site specific data collected during hydrotechnical field investigations and detailed surveys.

d) Scour analyses are part of the larger hydrotechnical hazard assessment, itself part of the detailed engineering and design phase which is currently underway. Scour analyses are not available at this time as site-specific data collection has only recently been initiated. Estimates of scour require information on channel morphology, gradient, cross-sectional

data, substrate and peak flows. While some of this information is currently available (e.g. peak flows from the hydrologic assessment and channel gradients from LiDAR data), critical data have yet to be collected that allow for a thorough scour analysis (most notably cross-section data and substrate conditions) at conventional crossing sites.

e) The detailed engineering and design phase involves the determination of the preferred crossing method and crossing design for every crossing along the TMEP based on the quantification of the magnitude and frequency of occurrence of hydrotechnical hazards, including bed scour and bank erosion.

During detailed engineering, scour will be assessed using a number of quantitative methods that require information on the channel substrate, morphology, cross-section data, channel gradient, and peak flows. While the hydrology assessment completed as part of the referenced report provides an initial assessment of peak flows, other parameters require a site visit, and survey data in some instances, in order to undertake detailed assessments. Bank erosion will also be assessed quantitatively using historical air photographs supplemented by site investigations. The results from the scour and bank erosion assessments will be incorporated into the determination of suitable depth of cover to prevent scour under the 1:200 year event and appropriate setback distances for bends in the event of long-term bank erosion. As part of these detailed assessments, historic monthly hydrographs will be developed to assist in evaluating construction methods including suitability for isolation.

As per the above, Trans Mountain confirms that bed scour and lateral erosion will be incorporated into the design for crossings.

2.103 Hydrological analysis

Reference:

A3S1D8, Application Volume 4A, Project Design and Execution – Engineering, Appendix I – Route Physiography and Hydrology Report, PDF page 27 of 97

Preamble:

The Board notes that only four of the six stations used in the hydrologic analysis are on the map (Drawing No. 15) and one station identified on the map (05DF003) is not used in the analysis.

Request:

Please provide:

a) the missing information on the drawing and in the analysis; and

b) the effect of map amendments on the analysis if there are changes

Response:

a) Drawings 15 has been revised to include the two missing hydrometric gauges 07BB014 and 05FA012 and remove hydrometric gauge 05DF003 and 07BA002 (also not used in the analysis) (refer to NEB IR No. 2.103a - Attachment 1). The data from the two missing hydrometric gauges were already included in the analysis, hence no revision to the analysis is required.

b) Analyses were based on hydrometric gauges reported in tables in the main body of the Route Physiography and Hydrology Report. Maps included in Appendix I to the Route Physiography and Hydrology Report were corrected as per the response to part a) above, but these corrections have no effect on the analyses.

2.104 Hydrology – watercourse crossings

Reference:

A3S1D8, Application Volume 4A, Project Design and Execution – Engineering, Appendix I – Route Physiography and Hydrology Report:

i) PDF page 30 of 97
ii) PDF page 37 of 97
iii) PDF page 62 of 97
iv) PDF page 70 of 97
v) PDF page 77 of 97
vi) PDF page 84 of 97
vii) PDF page 90 of 97
viii) A3S0Z5, Application Volume 4A, Project Design and Execution – Engineering, Appendix D – Tables, Table 5.1.5 – Preliminary Watercourse Stage 2 Review Crossings, PDF pages 9 to 12 of 93

A3S1E1, Application Volume 4A, Project Design and Execution – Engineering, Appendix I – Route Physiography and Hydrology Report:

ix) Appendix A – Route Physical Geography Table, PDF pages 6 to 10 of 17
x) Appendix B – Notable Water Crossings Catchment Details, PDF pages 11 to 13 of 17

Preamble:

References i) to vii) identify notable watercourse crossings as having watershed areas greater than 50 square kilometres.

Reference viii) identifies watercourse crossings that are not included in the tables of notable watercourse crossings in References i) to vii).

Reference ix) identifies major watercourse crossings that are not identified as notable in the watercourse crossing summaries.

Reference x) identifies watercourse crossings as notable, but these are not included in the watercourse crossing summaries.

Request:

Please provide:

a) any exceptions to the 50 square kilometre watershed area limit for notable watercourse crossings where less than the 50 square kilometre limit was used;

b) the data from key water crossings identified in Stage 2 design assessment and a list of identified notable major crossings;

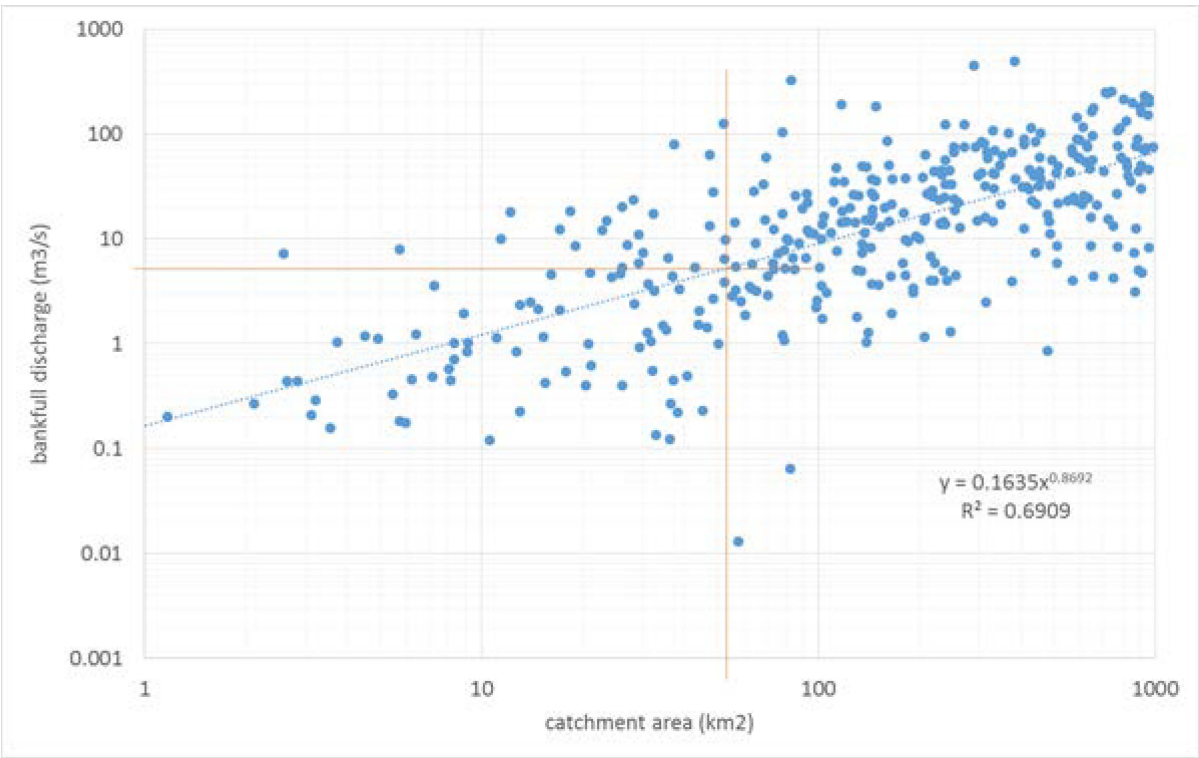
c) an explanation for the discrepancy in notable watercourse crossings between tables; and

d) the revised watercourse crossing summaries for each physiographic region if the inclusion of additional watercourse crossings is considered valid.

Response:

a) Unnamed Creek (RK 90.1, catchment area 36 km^2) is the only exception to the 50 km^2 watershed area limit for notable watercourse crossings.

Notable watercourse crossings were defined using the watershed catchment area as a proxy for bankfull discharge. Bankfull discharge is considered as being the most effective flow for doing work that results in average channel morphological characteristics (Dunne and Leopold, 1978). Bankfull discharge is usually equated to the median annual peak flow, or the annual peak flow that is exceeded, on average 50% of the time. A flood frequency analysis conducted at the regional level and based on flow data available through the Water Survey Canada hydrometric network allowed for the determination of a preliminary relation between bankfull discharge and catchment area as illustrated below:



Based on previous experience, a bankfull discharge threshold value of 5 m^3/s was chosen to identify catchments with assumed potential for significant forming processes (e.g. bank erosion, scour). It was assumed, for instance, that a 4 m wide 1 m deep channel at bankfull discharge would not have sufficient energy to generate significant scour beyond the minimum design standard burial depth of 1.5 m.

Due to the fact that the proposed pipeline crosses water courses at ungauged locations and in the absence of site specific data at the time of report preparation, bankfull discharge could not be used as a selection criterion. Catchment area was used instead, with a threshold value of 50 km^2 based on the above relationship. Notable water course crossings were subsequently defined based on the fact that their related catchment area was greater than 50 km^2.

It is further noted that watershed and hydrologic characteristics were defined for all water course crossings during the preparation of the Route Physiography and Hydrology Report; however, detailed information was only presented for notable crossings in the report to avoid excessive documentation.

Reference:

Dunne T. and Leopold L.B. 1978. Water in Environmental Planning. W.H. Freeman. 818pp.

b) Please refer to the responses to NEB IR No. 2.105b and 2.105c.

c) Notable water course crossings were reported for each physiographic region in a separate table in the Route Physiography and Hydrology Report. Table 3-6, p 30 of 97, is missing one catchment defined as notable and should be revised as follows:

Geographic Location	RK	Catchment Area (km^2)
Blackmud Creek	24.2	565
Whitemud Creek	28.1	333
North Saskatchewan River	33.5	26,488
Unnamed Creek	90.1	36
Sturgeon River	126.8	110

The list of water course crossings defined as notable cannot be compared to that of Stage 2 water crossings. The selection criteria used to define notable crossings was based on those crossings with a catchment area of greater than 50 km^2 to represent crossings with higher potential for susceptibility to hydrotechnical hazards. One crossing (identified above at RK 90.1) was included due to an initial catchment area erroneously calculated as being greater than 50 km^2 and was further revised to 36 km^2. This crossing remains listed as a notable watercourse crossing for consistency in the report, including the previous preparation of a set of crossing overview maps (Filing ID A3S1E2 Page 3 and 4 of 8).

Stage 2 water crossings were based on constructability and fish habitat sensitivity as determined by the selection screening process provided in Volume 4A, Section 2.11.1 (Filing ID A3S0Y8 Page 44 of 110).

d) Table 3-6, (Filing ID A3S1D8 PDF page 30 of 97), is missing one catchment defined as notable (Unnamed Creek, RK 90.1) and should be revised as follows:

Geographic Location	RK	Catchment Area (km^2)
Blackmud Creek	24.2	565
Whitemud Creek	28.1	333
North Saskatchewan River	33.5	26,488
Unnamed Creek	90.1	36
Sturgeon River	126.8	110

2.105 Hydrology – watercourse crossing update

Reference:

A3S1E1, Application Volume 4A, Project Design and Execution – Engineering, Appendix I – Route Physiography and Hydrology Report:

i) Appendix A – Route Physical Geography Table, PDF pages 6 to 10 of 17
ii) Appendix B – Notable Water Crossings Catchment Details, PDF pages 11 to 13 of 17
iii) A3S0Z5, Application Volume 4A, Project Design and Execution – Engineering, Appendix D – Tables, Table 5.1.5 – Preliminary Watercourse Stage 2 Review Crossings, PDF pages 9 to 12 of 93

Preamble:

Reference i) identifies five major river crossings that are not included in the list in Reference ii) (Wedgewood Ravine, Little Brule Ck, January Ck, Semmihault Ck, and Sumas Canal).

Reference iii) identifies 84 Stage 2 Review Crossings where HDD or Isolation techniques are to be used when installing the pipeline. Of these 84 crossings, 33 are not included on the list of crossings assessed in Reference ii).

Request:

Please provide:

a) the connection of the crossings assessed in the Physiography and Hydrology Report to the type of crossing (HDD, isolation, or open cut) planned for the pipeline;

b) a revised version of Reference ii), including the type of planned crossing method; and

c) a revised Reference i) to include geographic location/channel name, RK, catchment area, proposed crossing method, and associated drawing number.

Response:

a) The intent of the Physiography and Hydrology Report was to provide a general overview of the physiography and hydrology along the route, wherein general watershed and hydrologic characteristics were defined for all water course crossings; however, detailed information was only presented for notable crossings in the report. Crossing design was not taken into consideration in the Route Physiography and Hydrology Report, but such design is expected to utilise the information contained in the report as part of detailed engineering and design, along with results of site specific assessments, at crossings. Therefore, there is no direct connection between the crossings assessed in the report to the type of crossing planned for the pipeline.

b) The list of crossing is taken from Appendix B – Notable Water Crossings Catchment Details (Filing ID A3S1E1, PDF pages 11 to 13 of 17).

Proposed primary crossing methods are taken from Application Volume 4A, Project Design and Execution – Engineering, Appendix D – Tables, Table 5.1.5 – Preliminary Watercourse Stage 2 Review Crossings, (Filing ID A3S0Z5, PDF pages 9 to 12 of 93).

Also refer to NEB IR No. 2.105b – Attachment 1.

c) The table has been revised to incorporate the above comments and is provided as NEB IR No. 2.105c - Attachment 1.

- Geographic location/channel name and RK were taken from the previously submitted table.
- Catchment areas were reported in the revised table.
- Proposed crossing methods were taken from reference iii) A3S0Z5, Application Volume 4A, Project Design and Execution – Engineering, Appendix D and reported in the revised table.
- Associated drawings numbers were reported in the revised table. Note that some drawings in reference ii) Appendix B – Notable Water Crossings Catchment Details, PDF pages 11 to 13 of 17, were incorrectly labelled. The revised table includes correctly numbered drawing labels and previously (incorrectly) numbered drawing labels. For instance, reference ii) Appendix B – Notable Water Crossings Catchment Details presents two drawings for Sturgeon River (RK 135.0), previously labelled B14 and B10. These drawings labels have been revised to B9 and B10 and reported in the table as B9 and B10 (B14 and B10). Individual drawings have not been resubmitted as part of this Response to Information Request.

2.106 Hydrology - route physiography and hydrology report

Reference:

A3S1E5, Application Volume 4A, Project Design and Execution – Engineering, Appendix I – Route Physiography and Hydrology Report, PDF pages 1 and 3 of 14

Preamble:

The reference shows, at Appendix B, RK 498 and 499 Hydraulic Analysis (Fraser River), two analyses at the same location, but they have very different numbers for the data in the Monthly Flow / Runoff Depth / Precipitation / Temperature Table.

Request:

Please provide:

a) an explanation for the discrepancies in the values between the two analyses, given that they are from the same location; and

b) revised drawings if any of the data is in error.

Response:

a) Data were reported incorrectly in the summary tables. This error has been corrected and revised drawings are available in the response to NEB IR No. 2.106b.

b) Drawings B34 and B36 of Appendix B have been revised and provided (refer to NEB IR No. 2.106b - Attachments 1 and 2).

2.107 Physiography

Reference:

A3S1D8, Application Volume 4A, Project Design and Execution – Engineering, Appendix I – Route Physiography and Hydrology Report:

i) PDF page 27 of 97
ii) PDF page 33 of 97
iii) PDF page 34 of 97
iv) PDF page 40 of 97
v) PDF page 41 of 97
vi) PDF page 85 of 97

Preamble:

In Reference i), Table 3-4, only four of the six stations used in the analysis are on the map (Drawing 15) and one station identified on the map (05DF003) is not used in the analysis.

In Reference ii), Climate Stations Table 3-8 and Drawing 04, the Edson Airport Station is not clearly labelled on the map. The station is labelled as "Edson" on the map. Edson station has 0 millimetres as the annual precipitation on the map. The Ronan Station is not on the map.

In Reference iii), Hydrometric Stations Table 3-9, only two of the four stations used in the analysis are in Drawing 16.

In Reference iv), Climate Stations Table 3-13 and Drawing 4, the Nordegg RS and Grande Cache RS Stations are not on the map. Hinton Valley Station has 0 millimetres as the annual precipitation on the map.

In Reference v), Hydrometric Station Table 3-14 and Drawing 16, the Wildhay River Near Hinton Station is not on the map but the station is located within the map area.

In Reference vi), Table 3-47, Drawing 8, Vancouver Golf weather station is not shown on Drawing 8.

Request:

Please provide corrections or clarifications to the information identified in References i) to vi).

Response:

Drawings 4, 8, 15 and 16 have been corrected to reflect the information presented in the Route Physiography and Hydrology Report, and are included as NEB IR No. 2.107 - Attachments 1 through 4 respectively.

2.108 Integrated management systems

Reference:

i) *National Energy Board Onshore Pipeline Regulations*, section 6.1
ii) *National Energy Board Onshore Pipeline Regulations*, section 6.5
iii) A3S0Q7, Application Volume 1, Summary, PDF pages 68 to 70 of 113
iv) A3S0Q8, Application Volume 2, Project Overview, Economics and General Information, PDF page 28 of 45

A3S4V5, Application Volume 7, Risk Assessment and Management of Pipeline and Facility Spills:

v) PDF page 48 of 84
vi) PDF pages 49 to 51 of 84

Preamble:

The Board requires all pipeline companies under its jurisdiction to meet the requirements of the OPR, including having a management system approach for pipeline safety. Companies must establish, implement, and maintain a management system, as set out in Reference i), to effectively manage and reduce risk, and promote continual improvement. The management system must include the organizational structures, resources, accountabilities, policies, processes, and procedures that are required for an organization to meet its obligations for safety, security, and environmental protection. The Board's expectations regarding management system processes are set out in Reference ii). The goal is that companies establish and implement the processes and documentation required for a systematic, explicit, comprehensive, and proactive management system.

A requirement of the company's management system is that it includes the following programs:

- emergency management program;
- integrity management program;
- safety management program;
- security program; and
- environmental protection program.

Trans Mountain has identified that it has an Integrated Safety and Loss Management System (ISLMS) for operations and maintenance, and an Environment, Health and Safety Management System (References iii), v) and vi)). In addition, Trans Mountain specifically mentions the importance of its Integrity Management Program and its Emergency Management Program (Reference iii)). Reference vi)) describes how Trans Mountain adapted its ISLMS to meet the OPR and specifies that a lifecycle approach is taken and all the key programs also are structured in management system elements. A schematic showing the integration of all of the components of the management systems is supplied in Reference vi)e). However, there are limited details on how the system is integrated and how risk is managed in all key programs for continual improvement. Trans Mountain also identified an Operations Management System (Reference iv)), but did not provide information on how it is related to the ISLMS.

Request:

Please provide:

a) information on the relationship of the Operations Management System to the ISLMS;

b) an explanation of how the management system is integrated to manage risk in all aspects of the pipeline system beyond the references to the Management System description and details located in Volume 7 – Emergency Preparedness and Response, and also where it is specified as primarily applying to operations and maintenance in Volume 1;

c) confirmation that the Integrity Management Program will include the requirements of OPR section 6.5 and the recommendations of CSA Z662-11 Annex N;

d) a discussion of how the management system will address process safety for protection of the pipeline and the public; and

e) details of how Trans Mountain ensures that continual improvement occurs.

Response:

a) Kinder Morgan Canada Inc.'s (KMC) management system framework has evolved since submission of the Trans Mountain Expansion Project (TMEP) application. KMC's management systems and protection programs are being consolidated into one comprehensive management system, the Integrated Safety and Loss Management System (ISLMS), to support and protect the safety and security of the public, its employees and contractors, the environment and KMC's business assets. KMC is moving forward with integration of the protection programs previously identified in the Operations Management System and the EHS Management System into the ISLMS. It should be noted many processes are new; consequently, as KMC accumulates experience our expectation is these new processes will evolve.

   The ISLMS outlines KMC's commitment to establishing, implementing and monitoring processes and controls to ensure that it is conducting business in a safe, environmentally responsible and sustainable manner. The ISLMS is supported by the Safety and Loss Management Policy Statement, Kinder Morgan Environmental, Health and Safety Policy and the Code of Business Conduct and Ethics and applies to all activities involving the design, construction, operations and abandonment of pipeline systems. It is applicable to all pipeline systems that KMC operates, including the Trans Mountain Pipeline System.

   KMC's ISLMS will manage risk in all aspects of the pipeline system by ensuring:

   - the requirements of all applicable regulations are met;
   - all activities are carried out by appropriately trained and qualified personnel;
   - adequate resources are allocated;
   - proactive interaction with stakeholders;

- performance targets are established and monitored to support continuous improvement; and,
- the necessary programs and systems are in place that are effectively implemented and appropriately monitored to ensure the desired outcomes are achieved.

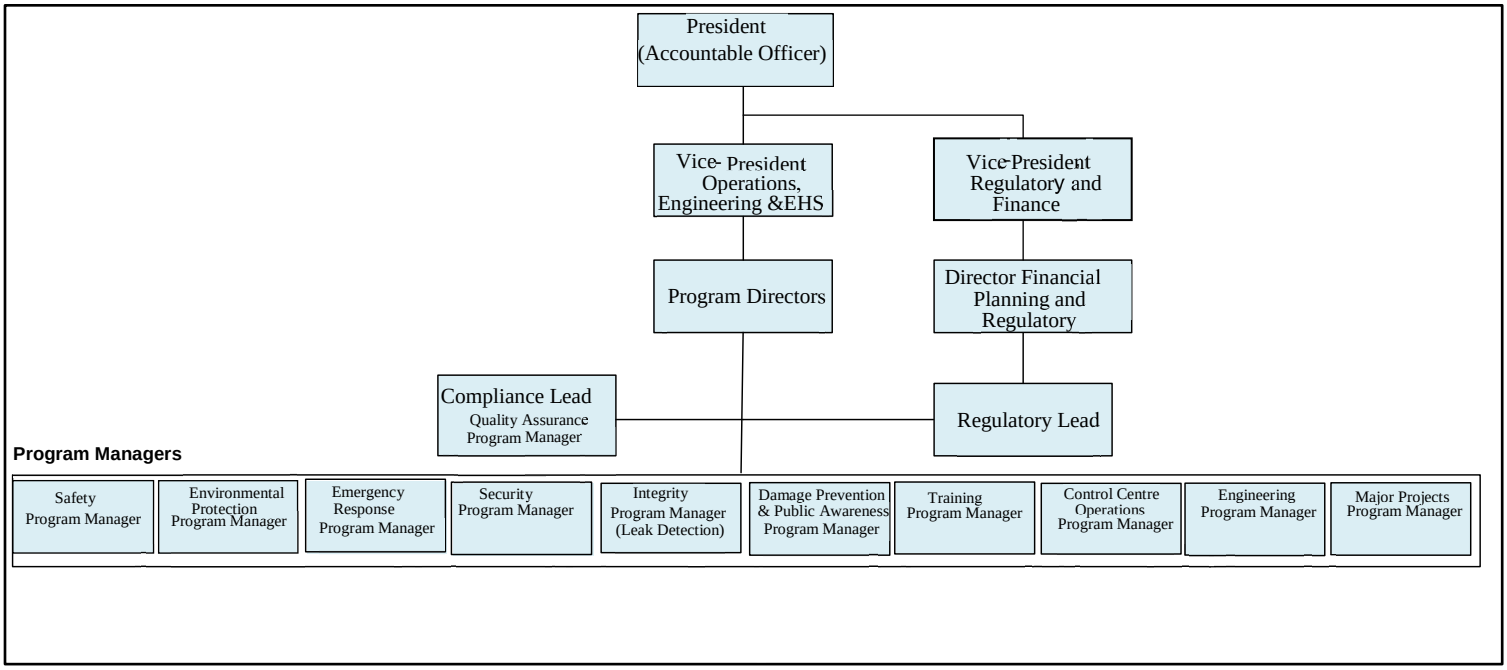
The ISLMS outlines the requirements that will apply to the following protection programs:

- Safety, Security, Environmental Protection, and Emergency Response;
- Pipeline and Facility Integrity;
- Damage Prevention and Public Awareness;
- Control Centre Operations and Leak Detection;
- Design and Construction; and,
- Operations and Maintenance.

The ISLMS utilizes comprehensive documented polices and integrated processes across the protection programs, including processes for:

- Setting Goals, Objectives and Targets;
- Identifying Hazards;
- Conducting Risk Assessments;
- Ensuring Compliance to Legal Requirements;
- Managing Change;
- Developing Competency Requirements and Training Programs;
- Document Control;
- Investigating and Reporting Incidents and Near Misses;
- Conducting Compliance Audits
- Records Management;
- Quality Assurance; and,
- Management Reviews.

The following ISLMS organizational structure supports the development, implementation, monitoring and updating of the ISLMS.



b) Please refer to the response to NEB IR No. 2.108a.

c) Confirmed.

d) Kinder Morgan Canada Inc.'s (KMC) management system addresses existing and potential process safety risks within its protection programs by utilizing hazard identification and risk assessment processes. KMC's protection programs monitor and update hazard lists and risk assessments, allowing process safety risks to be identified, prioritized and addressed in annual plans for:

- Operations and Maintenance;
- Pipeline and Facilities Integrity;
- Damage Prevention and Public Awareness;
- Emergency Response; and
- Control Room Operations Management.

e) Kinder Morgan Canada Inc. (KMC) has established and implemented a Quality Assurance Program (QAP) within the ISLMS, as outlined in the new management system requirements in the Onshore Pipeline Regulation. The QAP provides a mechanism for coordination between the protection programs and promotes continuous improvement of the management system and protection programs. The ISLMS QAP continuously monitors the adequacy and effectiveness of ISLMS in achieving its stated goals. The QAP has processes for reviewing performance measures, identifying deficiencies and opportunities

for improvement, developing corrective actions, tracking identified actions through to completion and ensuring senior management oversight throughout the process.

The Quality Assurance Committee (QAC) implements the QAP objectives and senior management provides oversight and ensures commitment and follow-through on action plans. The QAC meets quarterly, is chaired by the Compliance Lead and includes the Regulatory Lead and all Program Managers identified in the ISLMS Organizational Structure (please see the response to NEB_IR_No._2.108a). Additionally, the QAC meets twice annually with senior management in separate management review meetings, to establish and monitor safety and loss management goals, objectives and targets and establish and track priorities through to completion. Senior Management includes the President, Vice Presidents and Directors identified in the ISLMS Organizational Structure.

The QAP will ensure continuous improvement by:

- promoting integration and coordination between the protection programs, through the QAC;
- ensuring processes are in place for conducting regular inspections and audits;
- ensuring sufficient human resources are allocated to meet the requirements of the management system through completion of an annual human resources assessment;
- ensuring all protection programs maintain an up-to-date legal requirements listing;
- establishing and implementing an annual self-assessment and certification process to monitor compliance to applicable legal requirements, identify deficiencies and preventative and corrective actions;
- establishing and monitoring KMC's performance in meeting its safety and loss management goals through a comprehensive executive-level dashboard;
- proactively monitoring and prioritizing deficiencies, opportunities for improvement, preventative and corrective actions through a ranked priorities register; and,
- ensuring senior management oversight in the achieving the goals of the QAP through management review meetings.

The QAP is based on a "PLAN-DO-CHECK-ACT" continuous improvement model. There are seven key components:

1. The Quality Assurance Committee
2. Legal Requirements Listing
3. Self Assessment and Certification
4. Compliance Audits
5. Performance Measures and Targets
6. Priorities Register and Ranking
7. Management Reviews and Annual Report

ACT
PLAN
Quality Assurance Committee
Legal Requirements
Self-Assessment and Certification
Compliance Audits
Performance Measures & Targets
Priorities Register and Ranking
Management Reviews and Annual Report
Quality Assurance Program
CHECK
DO

2.109 Isolation valves

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF pages 52 and 53 of 110
ii) A3S0Z5, Application Volume 4A, Project Design and Execution – Engineering, Appendix D – Tables, Tables 5.1.10, 5.1.11, and 5.1.12, PDF pages 17 to 23 of 93

Preamble:

Reference i) defines RMLBVs as those MLBVs not located at pump stations. The proposed locations for RMLBVs will initially be determined in accordance with CSA Z662, Clause 4.4 – Valve Location and Spacing. To limit the consequences associated with a pipeline leak or rupture, the following additional factors will also be considered in selecting the proposed RMLBV locations: topography, the location of environmentally sensitive features and terrain, population density, accessibility of electrical power, maintenance flexibility, release volume analyses, release volume dispersion modelling, and the risks to High Consequence Areas (HCAs).

Reference i) further states that check valves will be installed at suitable locations, such as at the downstream side of major watercourse crossings (e.g., rivers), where generally ascending topography is favorable for a check valve function.

Reference ii), Tables 5.1.10, 5.1.11, and 5.1.12 provide the types of valves and their locations for Line 1 and Line 2. Valve types include: automated RMLBV, manual RMLBV, automated MLBV, manual MLBV, and check valves.

Request:

Please provide:

a) a description of each valve type identified in Reference ii), including their typical valve closure times; and

b) the rationale for selecting each valve type at a given location.

Response:

a) Table 5.1.10 – Line 1 Valve Locations. The block valves are Kerotest gate valves with manual operators. The closure time is between 12 to 14 minutes.

   Table 5.1.11 – TMPL Line 1 Reactivated Pipeline Segments. The block valves are manual and automated Kerotest gate valves. The manual block valves have a typical closure time between 12 to 14 minutes. The automated block valves have a typical closure time between 12 to 14 minutes. The check valves are swing type and will close when flow stops and attempts to reverse in the pipeline. The new proposed block and check valves to be added have not yet been designed and selected but will be functionally the same.

Table 5.1.12 – Preliminary Valve Locations TMPL Line 2. The existing block valves are manual and automated M&J gate valves and StreamFlo swing check valves. The existing automated block valves have electric actuators and have been set up for closure times between 12 to 14 minutes and they will have operator controls modified to close in 5 minutes. The manual block valves have a closure time between 12 to 14 minutes. The check valves will close when flow attempts to reverse in the pipeline. The new proposed block and check valves have not yet been designed and selected but will be functionally the same with operators designed to close in 5 minutes.

b) Gate valves are the default valve type for use as block valves in liquid pipeline service. They seal tightly when closed and are very effective at isolating segments of a pipeline during an emergency and during maintenance operations. They are robust valves that typically provide many years of reliable service.

   Check valves provide benefit through isolation of back flow in the event of a pipeline failure and are limited to locations that are generally downstream of river crossings with ascending topography.

2.110 Valve locations

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF pages 52 and 53 of 110
ii) A3V8V6, Board IR No. 1 to Trans Mountain IR 1.91, PDF pages 86 and 87 of 96
iii) A3W9H9, Trans Mountain response to Board IR No. 1, IR 1.91, PDF pages 34 and 35 of 62
iv) CSA Z662-11, Clause 1.4

Preamble:

Reference i) states the proposed locations of RMLBVs will initially be determined in accordance with CSA Z662, Clause 4.4 – Valve Location and Spacing. To limit the consequences associated with a pipeline leak or rupture, the following additional factors will also be considered in selecting the proposed RMLBV locations: topography, the location of environmentally sensitive features and terrain, population density, accessibility of electrical power, maintenance flexibility, release volume analyses, release volume dispersion modelling, and the risks to High Consequence Areas (HCAs).

Reference ii) provides the Board request for the engineering assessment undertaken by Trans Mountain to determine the number of valves.

Reference iii) provides Trans Mountain's response. Trans Mountain stated that, according to CSA Z662 Table 4.7, the minimum valve spacing for a low vapour pressure pipeline is not required (NR). The primary valve locations for Line 2 and proposed two delivery lines were based on practical considerations such as co-location of pre-existing valve sites on adjacent pipelines, accessibility and site suitability for construction and operation. As a form of engineering assessment, Trans Mountain is committed to establishing the final valve locations through an iterative risk based design process. For the sections proposed to be reactivated, a separate valve optimization analysis will be performed based on the overflow analysis which has not yet been completed.

Reference iv) states that CSA Z662 is intended to establish essential requirements and minimum standards for the design, construction, operation, and maintenance of oil pipeline systems, that the Standard is not a design handbook, and competent engineering judgment should be employed with its use.

Request:

For the scope of the Project, please provide:

a) Trans Mountain's risk-based design criteria used in selecting the proposed valve locations;

b) the release volumes from a full-bore rupture that Trans Mountain is planning to limit using the design criteria explained in a); and

c) a draft of the engineering assessment undertaken by Trans Mountain to determine the valve spacing.

Response:

a) Trans Mountain responded to Upper Nicola Band IR No. 1.30r as follows:

As committed to in the response to NEB IR No. 1.81a, Trans Mountain will submit a risk assessment for Line 2 in Q3 of 2014. As described in the response to Allan R IR No. 1.17l, this risk assessment is being undertaken in support of a risk-based design so that mitigation measures may be incorporated into the design to address the principal risks. In the context of this risk-based design, risk is defined as a compound measure of both failure likelihood (spill frequency) and consequences of a spill. High Consequence Areas as defined in Section 3 of Volume 7 of the Application are all highlighted in the risk assessment as being of particular environmental sensitivity, and spills in these areas are afforded accordingly higher levels of consequence rating. The types of risk mitigation measures that will be considered in the risk-based design process include both failure prevention and spill mitigation measures to ensure that risk is managed to levels that are As Low As Reasonably Practicable (ALARP). Inherent within the ALARP principle is acknowledgement that risk is associated with virtually all human endeavours. The management of risk to levels that are commensurate with ALARP requires a systematic means of identifying and measuring risks, along with the associated drivers of risk so that risk-appropriate means can be selected to manage those risks. The ALARP principle also recognizes the prioritization of resources and diminishing levels of return associated with the implementation of risk mitigation techniques.

In the context of the valve placement optimization and incorporation into the risk assessment, the following risk-based design criteria are considered and provide the basis for the evaluation of the benefit of additional valve placement as a risk mitigation measure:

- Potential outflow volumes, which in turn are influenced by:
  - Topography and elevation profile;
  - Location and type of adjacent valves;
  - Leak detection and response times;
  - Valve closure rates;
  - Flow rate;
  - Product characteristics;
- Consequence assessment, which in turn are influenced by;
  - Potential outflow volumes (see above);
  - Location, number and type of HCAs intersected, which include rivers, streams, wetlands, acquifers, parks, other environmentally sensitive ecological areas, First Nation reserve lands, and high population areas
- Predicted failure frequency (derived through a threat-specific analysis)

An evaluation of the above criteria through the risk-based design process is undertaken by employing the ALARP principle to establish the risk-sensitivity to the location, type and

placement of additional valves. In this respect, the ALARP principal dictates that the placement of additional valves should be employed until a point of diminishing sensitivity of the risk response is achieved.

b) As described in the response to part a) above, Trans Mountain is using an evaluation of the *Risk Score* (defined as the product of failure likelihood and consequence) as the basis of the risk evaluation, and for the purposes of assigning risk mitigation measures, rather than outflow volume. Trans Mountain feels that this is a more rigorous approach than simply limiting outflow volumes to some fixed value, since a criterion that is based solely on outflow volume is not capable of evaluating other factors that would otherwise be salient to a risk assessment, such as environmental sensitivity or likelihood of occurrence. By using risk score as the basis of the evaluation, a number of different strategies can be used to mitigate risk, depending on the factors that have been identified as being the principal drivers of risk, thereby enabling the selection of optimal risk mitigation strategies that are best suited for each circumstance.

By way of example, there are some circumstances where, due to the position within a pipe segment and its associated elevation profile, that outflow volume is relatively insensitive to the addition of block valves. Under such circumstances, there may be much more effective measures available to mitigate risk (such as increasing wall thickness, or increasing the depth of cover, where risk magnitude is governed principally by 3rd Party Damage).

c) As indicated in the responses to NEB IR No. 2.110a and 2.110b, Trans Mountain is employing risk-based design as the basis of identifying optimal risk-mitigation measures (including valve placement), and incorporating those risk mitigation measures into the final design. This risk-based design process constitutes the engineering assessment through which final design, (including the types and locations of all valves) will be arrived at. Risk-based design is an iterative process that utilizes evaluations of risk to identify areas where risk mitigation measures can be incorporated into design, and directs the selection of appropriate measures. The preliminary risk assessment that will guide the risk-based design process was committed for submission to the NEB (A3W9H9, Trans Mountain's response to NEB IR No. 1.81a, PDF pages 11 of 62), and it is now anticipated that this risk assessment will be submitted on August 1, 2014.

It should be noted that the preliminary risk assessment that will be filed on August 1 will not reflect the final "fully-mitigated" risk, but instead, will highlight areas where risk mitigation measures, including the installation of additional valves should be included in the design. Preliminary valve locations that are reflected in the preliminary risk assessment were not selected on the basis of a comprehensive engineering assessment such as will be the case for final design, but instead were selected on the basis of the CSA Z662 Oil and Gas Pipeline system requirements and practical considerations of co-location with existing valve sites, access, and availability of power.

Once an optimized valve placement design for Line 2 has been developed through the risk-based design process, Trans Mountain will file a written report that summarizes the risk-based design process that was undertaken for valve optimization, and provides the rationale for the final valve placement design. It is Trans Mountain's intent that this report, which will

be submitted prior to December 1, 2014, will serve as the written engineering assessment report for valve placement location.

Summary of New Commitments:

- Submission of preliminary risk assessment by August 1, 2014.
- Submission of written report that summarizes the risk-based design process that was undertaken for valve optimization, and provides the rationale for the final valve placement design by December 1, 2014.

2.111 Valve locations

Reference:

i) A3V8V6, Board IR No. 1 to Trans Mountain, IR 1.91, PDF pages 86 and 87 of 96
ii) A3W9H9, Trans Mountain response to Board IR No. 1, IR 1.91, PDF pages 34 and 35 of 62
iii) A3W9H9, Trans Mountain response to Board IR No. 1, IR 1.93, PDF pages 38 to 45 of 62

Preamble:

Reference i) is the Board request for the engineering assessment undertaken by Trans Mountain to determine the number of valves for Line 1, Line 2, the existing delivery line, and the proposed two delivery lines.

Reference ii) provides Trans Mountain's response to Board IR 1.91. The response does not provide any information related to Line 1 or the existing delivery line.

Reference iii) provides Trans Mountain's response to Board IR 1.93. For Line 1, depending on the products, the current flow rate is 47,700 cubic metres per day (m^3/d) [300,000 barrels per day (bbl/d)] and, after the expansion, it would be 59,570 m^3/d (368,000 bbl/d). For the existing delivery line, depending on the products, the current flow rate is 72,000 m^3/d (453,000 bbl/d) and, after the expansion, it would be 111,290 m^3/d (700,000 bbl/d).

Request:

Please provide Trans Mountain's plan, with dates, to re-assess the current valve locations for Line 1 and the existing delivery line, recognizing the proposed increased capacities.

Response:

Trans Mountain has an established and ongoing process for assessment and upgrades of remotely operable valve locations to isolate the pipeline in the event of an incident and to mitigate the potential consequences from a pipeline spill. This process includes annual updates to a risk assessment of Line 1, outflow modelling, and overland flow modelling. As previously committed, the Line 1 Risk Assessment will be submitted in Technical Update No. 1 on August 1, 2014.

The results of the Risk Assessment as well as other integrity programs provides a relative ranking of the risks along the Line 1 pipeline corridor, and provides input to the prioritization of system improvements to continuously reduce operational risk for the pipeline. The prioritization serves to inform our routine capital management program, with capital improvements focussed on increased pipeline safety. This process has resulted in the installation of new valves and the automation of existing valves to mitigate potential spill volumes and associated consequence. The status of existing or planned valve upgrades including automation of existing valves is as follows:

- K289 (DS Trail Creek) – automate existing RMLBV, construction initiated 2013, commissioning in progress

- K984 (Boston Bar Creek) – automate existing RMLBV, construction initiated 2013, commissioning in progress
- K985 (Deneau) –automate existing RMLBV, construction 2014, in-service Q4 2014

Valve upgrades planned for 2015:

- K967 (Thar) – automate RMLBV, valve installed 2013
- K975 (Hole-in-the-wall) – automate existing RMLBV
- K205 (McLeod River) – new automated RMLBV (replacement)
- K206 (McLeod River) – new check valve downstream of crossing (replacement)

Trans Mountain will undertake a reassessment of potential outflow volumes using the increased average throughput volumes expected on Line 1 post expansion. These results will be analyzed to determine the requirement for additional remotely operable valves or to remotely operate existing manual valves. The analysis will include consideration of outflow volumes in the event of a spill, topography, access to power, and if additional valves are required, an effort will be made to co-locate incremental valves on Line 1 for the 73% of Line 1 that is contiguous with Line 2 with the proposed valves for Line 2. It is anticipated that that as part of the risk based design for Line 2, the final valve configuration will be completed approximately November 2014. The assessment for the valve configuration for Line 1 will be completed coincidental with the Line 2 final valve configuration.

Given the relatively short length of the existing Westridge delivery line, the topography along the pipeline route, location of the pipeline in roadway for much of the route, and the existing automated isolation valves located at Burnaby Terminal, below Inlet Drive, and at Westridge Terminal, additional block valves have limited impact on mitigation of potential spill volumes.

2.112 Capacity

Reference:

i) A3V8V6, Board IR No. 1 to Trans Mountain, IR No. 1.93, PDF pages 89 and 90 of 96
ii) A3W9H9, Trans Mountain response to Board IR No. 1, IR 1.93, PDF pages 38 to 45 of 62

Preamble:

In Reference i), the Board requested, if the original design flow rate is less than the proposed 58,570 m^3/d (368,400 bbl/d) design flow rate, an explanation of why only the sections to be reactivated are in the Project scope instead of the entire Line 1.

Reference ii) is Trans Mountain's response to Board IR 1.93, where Trans Mountain states that it does not consider the original design flow rate when the line was built to be relevant to the proposed Project. The sections of the existing Trans Mountain Pipeline that are currently in service, and that will form parts of Line 1, have MOPs that are accepted and permitted by the Board. The location and configuration (the number and size of pump units) of the pump stations for the proposed Project have been selected to make use of the available MOPs, where applicable, but not to exceed them. As indicated in Figure 1.93E.3-1, historical throughputs on the Trans Mountain system reached approximately 60,000 m^3/d (380,000 bbl/d) in 1972 and 1973. This was achieved primarily by adding pump stations to the original system. Subsequently, as transportation demand fell, pump stations were removed from the system and the capacity was reduced. Pump stations and pump units were added again to increase the capacity to the current level. The purpose of the configuration proposed for the Project is to achieve the 58,570 m^3/d (368,400 bbl/d) deemed necessary to support the planned annual shipments of light crude oil and refined product contract and spot volumes on Line 1.

Reference ii) further states that the design flow rate, at the time when the existing 609.6 millimetre (NPS 24) segments (that will form part of Line 1 after Project completion) were built, was 23,850 m^3/d (150,000 bbl/d) with 4 pump stations, although the pipeline wall thicknesses were selected to be able to achieve 47,700 m^3/d (300,000 bbl/d) with 13 or 14 pump stations.

Request:

For the sections of the existing Trans Mountain Pipeline that are currently in service, and that will form parts of Line 1, please provide:

a) a diagram similar to Figure 1.93E.3-1, showing the historical throughputs from 1953 to 2013;

b) copies of the following documents:
   b.1) the original design basis memorandum or, if not available, an equivalent document; and
   b.2) if applicable, any subsequent updates to the requested document in b.1);

c) a discussion, referencing the documents in b), of how the original design of the existing segments meet the proposed capacity, including a clear indication of how the pipeline wall

thickness that was selected to achieve 47,700 m^3/d (300,000 bbl/d) is applicable for the new flow rate of 58,570 m^3/d (368,400 bbl/d);

d) confirmation that Trans Mountain has conducted an engineering assessment to demonstrate that the existing segments are suitable for operation under the new hydraulic profiles, flow, and pressure regimes; and

e) the date of the engineering assessment stated in d).

Response:

a) Figure 1.93e.3-1, included in the response to NEB IR No. 1.93 (Filing ID A3W9H9) indicates the historical throughputs for the entire Trans Mountain pipeline system, including the segments of the existing pipeline that are currently in service and will form parts of Line 1. The only exceptions are the a) the existing NPS 30 segment from Edson to Hinton, which was constructed in 1957 and was inactive from 1985 to 1994; b) the existing NPS 30 segment from Black Pines to Kamloops which was constructed in 1957 and was inactive from 1985 to 2006; and c) the existing NPS 24 segment from Sumas to Burnaby, which did not (does not) transport the Washington State volumes. With respect to c), however, when the Sumas to Burnaby segment is making deliveries to Burnaby, the flow rate matches the Edmonton to Sumas flow rate.

b.1) The original design basis memorandum (DBM) for the segments of the existing pipeline system that are currently in service, and that will be included in Line 1, or an equivalent document is not available. Trans Mountain has detailed information on pipe manufacture, grade, wall thickness, elevation, in-line inspection, and hydrostatic test data for these segments, all of which has been updated as work has been performed on the segments over the operating history. As an alternative to a DBM, Trans Mountain will complete an engineering assessment for these line segments by August 22, 2014. Refer to the response to NEB IR No. 2.112d.

b.2) Refer to the response to part b.1) above.

c) As discussed in the response to NEB IR No. 1.93e.3 (Filing ID A3W9H9), the capacity of any pipeline is highly variable, depending on the number of pump stations utilized and the densities and viscosities of the commodities being transported. The limiting factor is the ability to supply power and the cost of power as more and more pump stations are added to increase capacity. The original design capacity of the Trans Mountain pipeline has little relevance to its potential capacity, as it was originally designed with fewer pump stations. The key criterion in the consideration of expansion scenarios for any pipeline is that the licenced maximum operating pressure (MOP) of the various pipeline segments will not be exceeded. This is the case for the existing segments that will be reconfigured to form the proposed Line 1. In the case of the Trans Mountain Pipeline system, an immediate increase in throughput will also be achieved by the removal of heavy crude oil batches from the existing segments that will be reconfigured to form Line 1. Light crude oil can be pumped at a much higher rate than heavy crude oil without increasing the pressure required.

d) Trans Mountain is undertaking an engineering assessment on the existing operating TMPL segments that will be included in Line 1 after TMEP is completed, taking into consideration proposed new hydraulic profiles, flow and pressure regimes. The engineering assessment will be submitted as part of Technical Update No. 2 on August 22, 2014.

e) The engineering assessment will be submitted to the NEB on August 22, 2014.

Summary of New Commitments:

- Trans Mountain to submit to NEB on August 22, 2014, an engineering assessment of the existing operating TMPL segments to demonstrate they are suitable for operation under the new hydraulic profiles, flow and pressure regimes of the proposed Line 1 resulting from the completion of TMEP.

2.113 Major Industrial Accident Council of Canada (MIACC) criteria

Reference:

i) A3W9S2, Trans Mountain response to Board IR No. 1, IR 1.98a, Risk Assessment, Final Report, Edmonton Terminal Portion, PDF page 5 of 36
ii) A3W9S4, Trans Mountain response to Board IR No. 1, IR 1.98a, Risk Assessment, Final Report, Sumas Tank Farm Portion, PDF page 5 of 50
iii) A3W9S5, Trans Mountain response to Board IR No. 1, IR 1.98a, Risk Assessment, Final Report, Burnaby Terminal Portion, PDF page 5 of 54
iv) A3W9S6, Trans Mountain response to Board IR No. 1, IR 1.98a, Risk Assessment, Final Report, Westridge Marine Terminal Portion, PDF page 5 of 47

Preamble:

The above four references have concluded that the risks of the proposed Edmonton Terminal, Sumas Tank Farm, Burnaby Terminal, and Westridge Marine Terminal portions are within the acceptable criteria as recommended by the MIACC. According to the references, in the MIACC, the "acceptable level of risk" to the public is set at 1.0 x 10-6 for

Canada, which is the annual probability of a fatality to an individual as a result of an industrial incident. This number is not regulated, but is referred to in standards and regulations in Canada.

Reference i) states that new facilities in the Edmonton Terminal are to be located in the Knightsbridge Industrial Park in Strathcona County. Strathcona County refers to the MIACC criteria as their guide for risk assessments for development proposals in their area.

Reference ii) and Reference iv) state that, in Canada, the determination of acceptable level of risk is made with reference to MIACC criteria as the guide and best practice. The specific requirements for each jurisdiction in terms of acceptable levels of risk may vary, but the MIACC criteria are broadly accepted throughout Canada. Hence, for the Sumas Terminal and the Westridge Marine Terminal portions, the risk assessments are guided by the MIACC criteria.

Reference iii) states that, currently, the City of Burnaby does not have a requirement for a risk assessment to be conducted on heavy industrial operations or for new planned projects that could have a possible unwanted impact on their community. Hence, for the Burnaby Terminal portion, analysis is guided by the MIACC criteria.

Request:

Please provide:

a) A list of other common, applicable risk criteria with descriptions that could be found nationally and internationally; and

b) A rationale for using MIACC risk acceptable criteria for the provided risk assessments over the other criteria described in a).

Response:

a) Trans Mountain is not aware of any regulated risk criteria in Canada other than where municipalities have written criteria into land use planning bylaws. The standard approach in Canada is to refer to the best practice developed through the Major Industrial Accidents Council of Canada (MIACC) (now managed through the Canadian Society for Chemical Engineering, Process Safety Management Subject Division).

In Canada there are references to the use of the MIACC criteria in land use planning procedures and bylaws in Edmonton, Strathcona County, and Sturgeon County:

- Edmonton Bylaw 14127 – January 11, 2006, Section 14.6 "Assessment of Risk for Industrial Activities";
- Strathcona County Land Use Bylaw 8-2001, Section 15: Industrial & Business, 15.3.6(c); Strathcona County, 2005, "Guidelines for the Preparation of a Risk Assessment Review Statement" (In accordance with Strathcona County Bylaw 8 - 2003, Schedule "C", Section 15.3.6(d)), March 2005, and;
- Sturgeon County 2006, "Alberta's Industrial Heartland Area Structure Plan - Bylaw No. 1118/07 (Section 5.4.5)".

In Canada there is one risk assessment resource from the Canadian Standards Association:

- CAN/CSA 850 - 97 (reaffirmed in 2002), "Risk Management Guideline for Decision Makers", Ottawa, ON.

Outside of Canada there are several countries where risk criteria are addressed in regulation. Five references are included below:

- AS/NZS 4360, 2004, "Australia/New Zealand Standard - Risk Management", Sydney Australia;
- AS/NZS, 2011, Hazardous Industry Planning Advisory Papers (HIPAP's), Department of Planning, Sydney Australia, HIPAP - 3 "Risk Assessment", HIPAP - 4 "Risk Criteria for Safety Planning", & HIPAP - 10 "Land Use Safety Planning", www.planning.nsw,gov.au;
- Australia, 1992, "Criteria for the Assessment of Risk from Industry - Environmental Protection Authority Guidelines - Bulletin 611", Perth Australia;
- Duijm, Nijs Jan, Danish Ministry of the Environment, 2009, "Acceptance Criteria in Denmark and the EU", Danmarks Tekniske Universitet, www2.mst.dk/udgiv/publications/2009, and;
- Center for Chemical Process Safety – American Institute of Chemical Engineers, 2009, "Guideline for Developing Quantitative Safety Risk Criteria - Appendix "B"", www.onlinelibrary.wiley.com/doi/10.1002/9780470552940.app1/pdf.

b) The Municipal Industrial Accidents Council of Canada (MIACC) is an approach used in Canada to address the outcomes of the Bhopal (India) disaster of 1984. The organization involves partner members from federal, provincial, and municipal governments, industry, and academia, including Canada's most knowledgeable people in the area of industrial risk and land use planning. The work involves collaboration with other countries in the development of the tools needed to provide for a means to allow industry and the public to co-exist in an acceptable way.

The MIACC criteria are very much in line with those in the international references provided in the response to NEB IR No. 2.113a. The MIACC criteria are kept current through the efforts of the Canadian Society for Chemical Engineering, Process Safety Management Subject Division, and remain consistent with the global view on risk acceptability, while meeting Canadian needs.

In Canada there is no regulated requirement to do risk assessments other than in those jurisdictions that have determined a need. In those jurisdictions the MIACC criteria is cited as the required approach. For these reasons the MIACC criteria is acceptable.

2.114 Hazard analysis

Reference:

i) A3W9S4, Trans Mountain response to Board IR No. 1, IR 1.98a, Risk Assessment, Final Report, Sumas Tank Farm Portion, PDF page 7 of 50
ii) A3W9S5, Trans Mountain response to Board IR No. 1, IR 1.98a, Risk Assessment, Final Report, Burnaby Terminal Portion, PDF page 7 of 54
iii) A3W9S6, Trans Mountain response to Board IR No. 1, IR 1.98a, Risk Assessment, Final Report, Westridge Marine Terminal Portion, PDF page 7 of 47

Preamble:

The references state that hazard identification involves identifying specific undesirable consequences. These consequences can be broadly classified as human impacts, environmental impacts, asset damage impacts, and business damage impacts.

Request:

Please indicate whether seismic-related events, including tsunamis, were considered in the above-referenced risk assessments. If seismic-related events were not considered, provide the rationale for not considering them.

Response:

Seismic related events, including tsunami, were not considered in the terminal risk assessments provided in the responses to NEB IR No. 1.98a (Filing ID A3W9S4, A3W9S5, and A3W9S6). These risk assessments were specifically intended to address the risk of tank and containment area fires which by their nature (since they produce large amounts of heat and smoke) have the potential for impacts outside of terminal properties. As discussed in the response to Doherty D IR No. 1.08a (Filing ID A3Y2K2) and repeated here, Trans Mountain's approach will be to design the terminals to withstand specific seismic events.

Section 2.9.3, Volume 4A of the Facilities Application (Filing ID A3S0Y8) briefly describes the principles to be used in the seismic design of the new pipelines and facilities (including pump stations and terminals) proposed as part of the Project. Seismic design of earthen, concrete, and steel structures, including foundations and marine piles, containment berms, pipe racks, other support systems, and piping, will be in accordance with the latest editions of the National Building Code of Canada, the British Columbia Building Code, and other recognized standards and practices, as applicable to the structures and locations. Seismic design of storage tanks, including consideration of sloshing and other effects, will be in accordance with the latest edition of the American Petroleum Institute (API) Standard 650, Welded Tanks for Oil Storage, Annex E, the recognized North American standard. Seismic design will be undertaken by experienced and competent professional engineers, registered in British Columbia. Geotechnical programs, which will include borehole and other investigative methods to obtain sub-surface data, will be conducted, and the results and recommendations of registered professional engineers and geologists will be used to inform the seismic designs. Fabrication of components, construction, and installation will be rigorously inspected to ensure that the prescribed designs are followed

and structural integrity will be verified by testing, as applicable. General information on design and quality verification principles is included in Sections 2.1 through 2.7, Volume 4A (Filing ID A3S0Y8) and Sections 3.4.8 through 3.4.13, Volume 4B of the Facilities Application (Filing ID A3S1K5). Numerous other references to design principles and features and quality assurance methods exist throughout Volume 4A and 4B of the Facilities Application. Trans Mountain is highly confident that these approaches will ensure that the new pipelines and facilities will be able to withstand large earthquake scenarios with minimal damage or loss of integrity.

Although the design philosophy is similar, some additional discussion on tsunamis is included in the response to Doherty D IR No. 1.08b (Filing ID A3Y2K2) and is partially repeated here. With regard to tsunami, refer to the responses to GoC NRCan IR No. 1.01.0a, IR No. 1.01.0b, and IR No. 1.01.0c (Filing ID A3X6G0). The potential threat of both earthquake generated and landslide generated tsunami to the proposed Westridge Marine Terminal (WMT) will be revisited during the detailed engineering and design phase and the results of the evaluations will be used to inform the design criteria.

2.115 Design improvements – risk assessments

Reference:

i) A3W9S2, Trans Mountain response to Board IR No. 1, IR 1.98a, Risk Assessment, Final Report, Edmonton Terminal Portion, PDF pages 33 to 36 of 36
ii) A3W9S4, Trans Mountain response to Board IR No. 1, IR 1.98a, Risk Assessment, Final Report, Sumas Tank Farm Portion, PDF pages 34 to 36 of 50
iii) A3W9S5, Trans Mountain response to Board IR No. 1, IR 1.98a, Risk Assessment, Final Report, Burnaby Terminal Portion, PDF pages 32 to 40 of 54
iv) A3W9S6, Trans Mountain response to Board IR No. 1, IR 1.98a, Risk Assessment, Final Report, Westridge Marine Terminal Portion, PDF pages 31 to 34 of 47

Preamble:

The above four references provide the conclusions of the risk assessment for the proposed four terminals. However, these documents do not provide a connection between the findings and their impact on the Project's design.

Request:

Please provide a list of design improvements that Trans Mountain is considering as a result of the risk assessment for each facility; in particular as they relate to tanks, tanks spacing, dikes, secondary containment volumes, pumps, and facility piping.

Response:

One of the risks identified for the proposed expansion of Burnaby Terminal, in the response to NEB IR No. 1.98a - Attachment 3 (Filing ID A3W9S5), is the radiant heat from potential secondary containment area pool fires and the possibility of injury (second degree burns after 90 seconds of exposure) at a heat level of 4kW/m^2. Although the risk assessment establishes that the Municipal Industrial Accidents Council of Canada (MIACC) criteria are being met, Trans Mountain is considering some changes to draw the predicted 4 kW/m^2 radiant heat contour line somewhat further away from the residential area to the south of the property (at the eastern end). Since radiant heat generation in a pool fire is related to the surface area of the burning liquid, the changes under consideration are the reduction in the surface area of the proposed Tank 85 / 89 / 71 / 73 shared containment, by maintaining existing Tank 73 in its own containment, and the reduction in the surface area of the Tank 75 / 77 / 79 shared containment, by providing proposed Tank 79 with its own containment. The latter change will require Tank 79 to be significantly smaller in diameter (and volume) than proposed and, as a result, Trans Mountain is considering increasing the diameter (and volume) of Tank 74 and Tank 76 to partially compensate. Trans Mountain is currently reviewing the other risk assessments to determine if any additional design changes warrant consideration. As discussed in the response to NEB IR No. 1.98, the review of potential design features and possible improvements will continue through the detailed engineering and design phase and fire protection systems, which are not credited in the risk analysis, are already proposed to reduce the likelihood and consequences of tank related fires. Trans Mountain will update the Board if and when any material changes are determined to be practically viable.

2.116 Decommissioning of facilities at Edmonton and Burnaby

Reference:

i) A3S0Q9, Application Volume 2, Project Overview, Economics and General Information, PDF page 3 of 10.
ii) *National Energy Board Onshore Pipeline Regulations*, sections 1 and 45.1

Preamble:

Reference i) lists the major components of the associated facilities of the Project as constructing 20 new tanks at the Edmonton (5), Sumas (1) and Burnaby (14) terminals, preceded by the demolition of 2 existing tanks at Edmonton (1) and Burnaby (1), for a net total of 18 tanks to be added to the system.

Reference ii) defines "decommission" as permanently ceasing operation such that the cessation does not result in the discontinuance of service. It also establishes the requirements to decommission a pipeline or part of one.

Request:

For all the facilities that will be decommissioned at the terminals mentioned in Reference i), please provide:

a) drawings showing the scope of the work;

b) a list of proposed decommissioning activities;

c) a hazard assessment for the decommissioning activities; and

d) an assessment of any potential environmental and socio-economic effects of the proposed activities.

Response:

a) Drawings showing the scope of the proposed storage tank removals at Edmonton Terminal (existing Tank 9) and Burnaby Terminal (existing Tank 74) are not yet available. Such drawings will be prepared during the detailed engineering and design phase and during detailed construction planning in 2015.

b) For the proposed storage tank removals at Edmonton Terminal (existing Tank 9) and Burnaby Terminal (existing Tank 74), Trans Mountain intends to decommission the existing tanks and associated infrastructure. Activities at each site will include:

- Disconnect and remove the tank line piping, valves, electrical, and instrumentation equipment.

- Pump out any remaining product in the bottom of the tank and drain the tank line piping.

- Clean the tank and purge the tank line piping (a vapour scrubber is typically utilized for tank cleaning in Burnaby to reduce the potential for nuisance odours in adjacent residential areas).
- Cut the tank into manageable sections (for recycling).
- Excavate, cut up, and remove (for recycling, if practical) the tank line piping, to the extent required, assuming that some portions of the tank line may be retained to serve the proposed replacement tank or other existing or proposed new tanks.
- Break up and remove (for recycling, if practical) the concrete ring-wall foundation Tank 9).
- Demolished the secondary containment berms to the extent required to reconfigure them to tie-in with the proposed new containment berm systems.

c) Safety (and environmental protection) hazard assessments, particularly for the proposed storage tank removals at Edmonton Terminal (existing Tank 9) and Burnaby Terminal (existing Tank 74) have not been completed. Hazard assessments for demolition activities will be developed as part of detailed construction planning in late 2015 or early 2106.

d) Activities associated with the demolition of the two existing tanks at Edmonton and Burnaby are listed in the response to NEB IR No. 2.116b. Based on these proposed activities and the environmental and socio-economic setting for the Edmonton and Burnaby terminals, the environmental and socio-economic elements potentially interacting with tank decommissioning include: soil and soil productivity; air emissions; greenhouse gas (GHG) emissions; acoustic environment; vegetation; and infrastructure and services.

The activities to be conducted are expected to produce potential effects generally similar to tank construction activities in nature and magnitude and include soil contamination, increased air emissions, GHG emissions and noise during decommissioning activities, weed introduction and spread, and increase in waste flow to regional landfills. Mitigation related to air emissions, GHG emissions, noise and weeds provided in the Facilities Environmental Protection Plan (EPP) in Volume 6C (Filing IDs A3S2S6 and A3S2S7) will be implemented during the activities to reduce the potential effects. The tank and piping to be demolished will be cleaned to approved Trans Mountain standards. A vapour scrubber will be utilized for tank cleaning at Burnaby Terminal to reduce the potential for nuisance odours. The dismantled tank infrastructure, including the steel and concrete, will be recycled, if practical. All other components of the existing infrastructure that are decommissioned will be hauled to an approved waste disposal facility according to the Waste Management Standard in Section 8.0 in Appendix C of the Facilities EPP. If any contaminated soil is encountered, it will be removed prior to construction of the expanded facilities at the Edmonton and Burnaby terminals as per the Contamination Discovery Contingency Plan (Section 1.0 of Appendix B) and the Waste Management Standard (Section 8.0 of Appendix C) of the Facilities EPP.

Potential accidents and malfunctions arising from tank decommissioning activities include small spills and transportation accidents. However, accidents and malfunctions are unlikely

to occur with the implementation of the recommended mitigation measures provided in Section 7.9.3 of Volume 5A (Filing ID A3S1R0).

Significance evaluations for the potential residual environmental and socio-economic effects associated with decommissioning the existing tanks are considered to be generally of low magnitude and reversible in the short-term, and have been previously discussed in the effects assessment for tank installation and operations in Section 7.5 of Volumes 5A and 5B for each applicable element (Filing IDs A3S1Q9 and A3S1S7). Of particular note, the removal of the existing tank infrastructure is expected to result in a temporary increase in waste flow to regional landfills. This potential residual effect is considered to be of low magnitude and is discussed in Section 7.2.5.6 of Volume 5B (Filing ID A3S1S7).

The tanks to be demolished are located within existing, fenced, previously disturbed industrial sites lacking topsoil. Given the existing disturbance at the Edmonton and Burnaby terminals, the limited interaction with environmental and socio-economic elements, and the implementation of the recommended mitigation measures in the Facilities EPP and Trans Mountain standards, it is concluded that the residual environmental and socio-economic effects associated with decommissioning the existing tanks will be not significant.

2.117 Westridge Marine Terminal – regulatory authorities

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 109 of 110
ii) A3S0Z0, Application Volume 4A, Project Design and Execution – Engineering, PDF page 2 of 7

Preamble:

Reference i) provides the purpose and description of the Westridge Marine Terminal.

Reference ii) states that, during the development of the dock complex layout, approximately 20 different possible layouts were considered. The layout selected has been reviewed and conditionally approved as most optimal for navigational safety by senior representatives of Port Metro Vancouver (PMV), the Pacific Pilotage Authority, and the BC Coast Pilots (BCCP). The reference also states that it is unlikely that the layout will materially change during the detailed engineering and design phase.

Request:

Please provide:

a) a list of regulatory agencies, along with their roles, that oversee the design, construction, and operation activities of the existing and proposed facilities for loading, including docks, storing, and delivering crude oil;

b) a list of regulatory authorities that have jurisdiction over the extent of development in the Burrard inlet; and

c) the conditions, if any, that PMV, the Pacific Pilotage Authority, and BCCP imposed in their approval of the dock complex layout.

Response:

a) The primary regulating authority for the Westridge Marine Terminal and development in the Burrard Inlet is Port Metro Vancouver (PMV). Under the *Canada Marine Act* and the *Port Authorities Operations Regulations*, PMV is responsible for the operation and development of all assets within the Port Metro Vancouver area, an area that includes more than 600 kilometres of shoreline, including Burrard Inlet. PMV undertakes its own permitting process, which is a two-step process and would require Trans Mountain to obtain a project permit followed by necessary building permits from PMV. As part of its assessment of developments within its jurisdiction, PMV considers issues such as public safety, interference with navigation, changes in water depth and silting, and soil, air and water quality.

Other than the National Energy Board, the other primary regulatory agencies that oversee design, construction and operation of the Westridge Marine Terminal and other developments in the Burrard Inlet include the following:

- Transport Canada is the primary regulator of marine shipping activities in Canada under the *Canada Shipping Act, 2001*. Transport Canada also oversees the TERMPOL review process and is responsible for applying and enforcing the *Navigation Protection Act* (which requires approvals for any activity that substantially interferes with navigation) and regulations in Part 11 of the *Response Organization and Oil Handling Facilities Regulations*.

- The Department of Fisheries and Oceans Canada is responsible for issuing approvals for activities that may cause serious harm to fish and fish habitat pursuant to the *Fisheries Act*.

- Environment Canada is responsible for issuing Disposal at Sea approvals for dredging activities under the *Canadian Environmental Protection Act.*

- The Canadian Coast Guard is responsible for emergency response as well as overseeing navigation aids (such as the location and details of navigation marker lights that would be established on the Westridge Marine Terminal dock).

- The Pacific Pilotage Authority (PPA), which is a Crown corporation created under the *Pilotage Act*, is responsible for licensing marine pilots and pilot boats for Canadian waters in and around British Columbia. The PPA also designates compulsory pilotage zones (which includes the area where the Westridge Marine Terminal is located).

- The BC Ministry of Environment and Environmental Assessment Office are responsible for issuing environmental approvals and conducting environmental assessments for certain types of marine port activities within provincial jurisdiction.

- Municipalities (i.e., Burnaby, Vancouver, Port Moody, West Vancouver, and North Vancouver) also regulate development within their jurisdiction through various regulatory and zoning bylaws.

b) Please refer to the response to part a) above.

c) Port Metro Vancouver (PMV), the Pacific Pilotge Authority (PPA) and the BC Coast Pilots (BCCP) were provided with the results of Trans Mountain's fast time simulation for the proposed dock layout for the Westridge Marine Terminal, which confirmed the safety of navigation and safe maneuvering in and around the proposed dock layout. After reviewing the simulation results, these bodies confirmed that the proposed dock layout was the preferred layout.

Following issuance of a Certificate of Public Convenience and Necessity for the Project from the National Energy Board, Trans Mountain has committed to run approach and departure maneuvers using full-mission Bridge Simulation to confirm the earlier simulation results.

In addition, the Westridge dock design has also been submitted to TERMPOL review and Trans Mountain awaits any comments and feedback from the TERMPOL Review Committee.

2.118 Additional information on tanks

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF pages 73 to 107 of 110

Preamble:

The reference provides information on the Edmonton, Sumas, and Burnaby Tank Terminals. The reference states that there will be 20 new tanks after Project completion.

The Board requires further information specific to each tank.

Request:

Please provide:

a) the purpose of each terminal;

b) the basis for selecting the number of tanks;

c) for each proposed tank in each terminal, a description of:

   c.1) product type (i.e., service);

   c.2) nominal capacity;

   c.3) working capacity;

   c.4) dimensions;

   c.5) roof type;

   c.6) spill protection method;

   c.7) overfill protection method;

   c.8) odour control method;

   c.9) fire detection and fire protection method;

   c.10) lightning protection method;

   c.11) corrosion control method; and

   c.12) leak detection method; and

d) Process and Instrument Diagrams (P&IDs) for each tank that carries a different product, including a legend with each diagram.

Response:

a) The general purpose of the existing terminals in Edmonton, Sumas, and Burnaby is outlined below.

Edmonton Terminal

- Commodities received at Edmonton Terminal (*i.e.*, crude oil, refined products), from various feeder pipelines, are directed to either storage tanks or directly to Edmonton Pump Station for delivery into the mainline pipeline.
- Commodities directed to storage tanks are held for sequencing into batches for delivery into the mainline pipeline.

Sumas Terminal

- Crude oil received at Sumas Terminal from the mainline pipeline is directed to storage tanks that are used to sequence batches for deliveries (via Sumas Pump Station) to the Puget Sound Pipeline System and on to refineries in Washington State.

Burnaby Terminal

- Commodities received at Burnaby Terminal (*i.e.*, crude oil, refined products), from the mainline pipeline, are directed to storage tanks or delivered directly to a pipeline feeding the Suncor refined products terminal in Burnaby (refined products).
- Commodities directed to storage tanks are held for sequenced deliveries to pipelines feeding the Chevron refinery (crude oil, iso-octane) and Westridge Marine Terminal (crude oil).

The purpose of the Edmonton, Sumas, and Burnaby terminals will be unchanged after the proposed expansion.

b) The final numbers and sizes of the proposed new tanks at the Edmonton, Sumas, and Burnaby terminals are still being determined, although the number and sizes are not expected to change materially from the numbers and sizes in Section 3.4, Volume 4A of the Facilities Application (Filing ID A3S0Y8). Trans Mountain has developed an integrated dynamic simulation model for the entire proposed pipeline system from the feeder pipelines in Edmonton to Westridge Marine Terminal (WMT). Iterative model runs are currently being undertaken with the intent to verify and/or optimize, if practical (given the space constraints at all terminals), the numbers and sizes of the tanks, the potential tank assignments (commodity types), and other system parameters. Dynamic simulation modelling is expected to be complete by the end of 2014.

c.1) Refer to the response to NEB IR No. 2.118b. The intended commodity type designations (*i.e.*, services) for the proposed storage tanks have not been finalized. In general, however, all tanks will be designed to handle all of the crude oil types that will be shipped on the Trans Mountain system.

c.2) The nominal (shell) capacity of each proposed storage tank is provided in Table 3.4.3, Section 3.4.1.4 (Filing ID A3S0Y8), Table 3.4.5, Section 3.4.2.4 (Filing ID A3S0Y9), and Table 3.4.7, Section 3.4.3.4 (Filing ID A3S0Y9), Volume 4A of the Facilities Application.

c.3) Working capacity (the volume contained between the low working level and the high working level) depends on the details of the tank design (*i.e.*, fixed roof, floating roof, seal system, tank bottom, etc.). Working capacity is generally expected to be in the range of 85 to 90 per cent of the nominal capacity. The working capacity of each proposed storage tank will be determined during the detailed engineering and design phase and confirmed by tank "strapping" during commissioning.

c.4) The anticipated tank dimensions are summarized in Table 2.118C.4-1.

TABLE 2.118C.4-1

PROPOSED STORAGE TANK DIMENSIONS

Location	Tank No.	Capacity		Diameter (m)	Height (m)
		(m^3)	(bbl)		
Edmonton Terminal	1	63,600	400,000	61.6	21.3
	2	63,600	400,000	61.6	21.3
	3	34,980	220,000	45.7	21.3
	4	34,980	220,000	45.7	21.3
	9	11,920	75,000	32.3	14.6
Sumas Terminal	100	27,820	175,000	45.6	17.1
Burnaby Terminal	74	45,310	285,000	56.1	18.3
	75	45,310	285,000	56.1	18.3
	76	45,310	285,000	56.1	18.3
	77	45,310	285,000	56.1	18.3
	78	53,260	335,000	61.0	18.3
	79	53,260	335,000	61.0	18.3
	80	45,310	285,000	56.1	18.3
	89	45,310	285,000	56.1	18.3
	91	45,310	285,000	56.1	18.3
	93	45,310	285,000	56.1	18.3
	95	45,310	285,000	56.1	18.3
	96	39,750	250,000	52.7	18.3
	97	45,310	285,000	56.1	18.3
	98	39,750	250,000	52.7	18.3

c.5) Trans Mountain anticipates that the tank roof types will be:

- Edmonton Terminal: External floating roof (steel pontoon type).
- Sumas Terminal and Burnaby Terminal: Fixed roof (steel) or geodesic dome (aluminum). The type of internal floating roof (light-weight aluminum or steel pontoon) will be determined during the detailed engineering and design phase.

Trans Mountain may consider an external floating roof configuration for selected tanks at Sumas or Burnaby Terminal if the updated air quality studies, currently in progress and to be filed with the NEB as Technical Report No. 1 in August, 2014, show with a high degree

of confidence that the applicable ambient air quality objectives will be met and that nuisance odours will not be an issue for adjacent residents.

c.6) All proposed tanks will be located within secondary containment designed in accordance with Canadian Standards Association (CSA) Standard Z662 and the National Fire Protection Association (NFPA) Code 30. Although not a statutory requirement, secondary containment volume will meet the additional requirements of the Alberta Fire Code (AFC) or the BC Fire Code (BCFC), whichever is applicable to the location.

c.7) Trans Mountain will provide overfill protection in accordance with American Petroleum Institute (API) Standard 2350. All proposed tanks will be equipped with a radar gauging system for liquid level measurement and overfill protection. Redundant instrumentation for overfill protection will also be provided. For tanks not designated as mainline relief tanks, the overfill protection system will automatically cause the tank valve to close if the liquid reaches a predetermined level. The overfill protection arrangement will be finalized during the detailed engineering and design phase.

c.8) Trans Mountain is currently working with technology vendors and air quality modelling experts to determine the optimum practical odour control system for the proposed tanks, as necessary for each specific terminal location and individual tank. Technology selection and application is expected to be complete by the end of 2014.

c.9) Several types of fire detection technologies are available for tanks, including linear wire heat detector technology, linear fiber heat detector technology, and triple infrared detector technology. The most suitable technology for the proposed tanks will be selected during the detailed engineering and design phase.

When the design basis for the proposed fire protection systems is finalized, during the detailed engineering and design phase, specifications and drawings will be developed under the supervision of experienced and competent professional engineers, specializing in fire protection. Trans Mountain also retains the services of an industrial fire-fighting specialist to provide advice on conceptual and detailed design.

Trans Mountain anticipates that the proposed tank fire protection systems will be designed to address the following fire scenarios:

- Storage tank floating roof rim seal fire (automated application).
- Storage tank full surface fire (application by portable monitors).
- Release to secondary containment (application of foam to suppress odours and combustible vapours).

c.10) Lightning protection for the proposed tanks will be determined during the detailed engineering and design phase, following the requirements of American Petroleum Institute (API) Standard 650 and other recognized lighting protection standards and guidelines.

c.11) Corrosion control for the proposed tanks will include:

- Internal coating of the tank bottom and approximately 1.0 m of the lower shell.
- External coating of the shell, nozzles, fixed steel roof (where fixed steel roofs are utilized), and other miscellaneous external tank appurtenances.
- Cathodic protection system to control corrosion on the underside of the tank bottom.

c.12) The under-tank leak detection system proposed for each new storage tank will consist of perforated pipes which will drain to a sump adjacent to the tank. The leak detection system design will be in accordance with American Petroleum Institute (API) Standard 650, Annex I.

d) Piping and instrumentation diagrams (P&IDs) for the proposed tanks have not yet been completed. Trans Mountain intends to complete the P&IDs during the detailed engineering and design phase. P&IDs will essentially be the same for all proposed tanks, regardless of the product to be stored in the tank. The only differences between the P&IDs for different tanks will be the information on the tank dimensions and capacity and the tank valve arrangements, depending on whether or not the tank will be designated for mainline relief service.

2.119 Construction in existing terminals

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF pages 73 to 107 of 110

Preamble:

According to Reference i), 20 new tanks are proposed at the existing Edmonton, Sumas, and Burnaby Terminals. The new tanks would be built within close proximity to the existing tanks.

Request:

For each terminal, please provide:

a) the risk assessments with mitigation measures, considering the risks due to construction activities in the vicinity of the live operational tanks;

b) a summary of any study completed to assess the stability and settlement of the existing tanks during construction of the new tanks;

c) a description of how access for heavy construction equipment would be provided without disturbing the containment function of the berms; and

d) an explanation of how an accidental release from an existing tank will be managed when the existing containment berms and secondary containments are disturbed during construction.

Response:

a) A risk assessment related to construction activities in the vicinity of existing operational storage tanks, with mitigation measures, has not yet been completed. However, Trans Mountain is highly confident that the proposed new storage tanks at Edmonton, Sumas and Burnaby can be safely constructed in the vicinity of existing operational tanks, based on the recent successful experience, over a three year period, with constructing 16 new large diameter storage tanks immediately adjacent to the existing operating tanks at Edmonton Terminal. Site specific safe work procedures and mitigation measures for Edmonton, Sumas, and Burnaby will be developed during detailed construction planning in 2015.

b) Trans Mountain has not performed a study to assess potential stability or settlement issues related to the existing tanks during construction of the proposed new storage tanks. As discussed in the response to NEB IR No. 2.119a, the construction of 16 new storage tanks, immediately adjacent to existing operating tanks, has been successfully completed at Edmonton Terminal, without any issues related to stability or settlement of the existing tanks. The risk of stability and settlement issues will be evaluated by geotechnical and civil engineers during detailed construction planning in 2015 and mitigation measures will be developed as necessary. Trans Mountain is highly confident that the proposed new storage tanks at Edmonton, Sumas, and Burnaby can be constructed without impacting the stability of or causing settlement of the existing tanks.

c) Trans Mountain anticipates that access can be provided for construction equipment into existing secondary containment areas, without disturbing the containment function of existing berms, by utilizing the existing secondary containment accesses (where practical), modifying the existing secondary containment accesses to accommodate construction equipment, or building temporary accesses into the secondary containment areas. If necessary, temporary secondary containment berms may be constructed in selected areas to allow better access into the existing secondary containment areas or through the existing secondary containment berms. Secondary containment access plans will be developed during detailed construction planning in 2015.

d) As discussed in the response to NEB IR No. 2.119c, Trans Mountain anticipates that the proposed new storage tanks can be constructed without disturbing the containment function of the existing berms or by providing temporary berms. For example, in the case where a proposed new storage tank at Burnaby Terminal will be located in a shared containment area with an existing tank, the berms for the expanded secondary containment area can be constructed while the existing containment berms remain in place. When the berms for the expanded secondary containment area are completed, the existing berms not required for the expanded secondary containment area can be removed.

For the proposed Edmonton Terminal West Tank Area expansion, temporary modifications to intermediate secondary containment berms are expected to be necessary to accommodate construction of the proposed new storage tanks, without disturbing the containment function of the overall West Tank Area. Similarly, the proposed expansion at the Sumas Terminal will require modifications to the secondary containment for existing Tank 104 to be completed before starting construction on proposed Tank 100.

Plans for constructing the proposed new storage tanks, without disturbing the containment function of existing berms or by providing temporary berms, will be developed during detailed construction planning in 2015.

2.120 Containment berms

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering:
i) PDF pages 78 and 89 of 110
ii) PDF pages 79 and 90 of 110
iii) Flammable and Combustible Liquids Code, NFPA 30, 2012 Edition

Preamble:

Figures 3.4.1 and Figure 3.4.3 in Reference i) provide proposed plot plans for the Edmonton and Sumas Terminals, respectively. According to the figures, construction of some of the proposed tanks would involve disturbing the existing containment berms. Thus, some of the existing tanks and new tanks would not be individually contained.

Reference ii) discusses sharing secondary containments due to space limitations.

Clause 22.11.2 of Reference iii), provides requirements for impounding around tanks.

Request:

Please explain:

a) how sharing containment between tanks containing different types of products would be feasible in the event of a leak or spill from a single event;

b) other foreseeable issues that could arise from sharing containment, and applicable mitigation measures; and

c) how the proposed plot plans and common containment design meet Clause 22.11.2 of Reference iii).

Response:

a) All proposed storage tanks will be located within secondary containment designed in accordance with Canadian Standards Association (CSA) Standard Z662 and the National Fire Protection Association (NFPA) Code 30. Although not a statutory requirement, Trans Mountain has committed to comply with the additional secondary containment volume requirements of the Alberta Fire Code (AFC) and the British Columbia Fire Code (BCFC), as applicable for the location. Given that it is a feature of all relevant codes and a very common practice in North America and internationally, Trans Mountain believes that using shared secondary containment for tanks is a reasonable approach. Trans Mountain is not aware of any reason why tanks containing different types of crude oil (or crude oil and refined products) should not share containment areas.

b) Refer to the responses to NEB IR No. 2.119a and 2.120a. Given the commonality of shared containment and based on Trans Mountain's experience in constructing and operating tanks within shared containment areas, Trans Mountain does not foresee any issues with the use

of shared containment for the proposed expansions at Edmonton Terminal or Sumas Terminal (or Burnaby Terminal). Trans Mountain has existing and effective safe work procedures for constructing and operating tanks in shared containment areas, which will be adapted to the new tank configurations at Edmonton, Sumas, and Burnaby.

c) Refer to the response to NEB IR No. 2.120a. Trans Mountain will meet the requirements of Clause 22.11.2 of NFPA Code 30 for the proposed expansions at Sumas Terminal and Burnaby Terminal. Common secondary containment is contemplated in Clause 22.11.2.2, which refers to “the largest tank within the diked area”, implying that there may be more than one tank. All of the requirements of Clause 22.11.2 (including those listed in Clauses 22.11.2.1 through 22.11.2.8) can be achieved with the proposed plot plans and common containment design. The proposed expansion at Edmonton Terminal, which will utilize the existing remote impoundment, will be in accordance with the requirements of Clause 22.11.1 of NFPA Code 30.

2.121 Fueling at the Westridge Marine Terminal

Reference:

A3S0Z1, Application Volume 4A, Project Design and Execution – Engineering, PDF page 1 of 1

Preamble:

Reference i) states that the number of loadings of Aframax class tankers is expected to increase to the equivalent of up to 34 per month. The number of barge loadings and un-loadings is not expected to change from the current number.

The Board notes that international tankers normally consume bunker fuel.

Request:

Please provide the rationale for not considering the bunker fuel service facility for visiting tankers in the project scope.

Response:

Trans Mountain considered the possibility of providing bunker fuel service at Westridge Marine Terminal (WMT) but did not include a bunkering facility in the scope of the proposed expansion for the following reasons:

- Trans Mountain does not currently provide bunker fuel service to tankers calling at WMT and does not desire to enter the bunker fuel business in the future. Trans Mountain's core business and expertise is in pipeline transportation and tanker loading.
- If a tanker requires bunker fuel, the tanker operator and/or agent will arrange to obtain it from one of a number of local suppliers. Bunkering is typically carried out from a barge while the tanker is at anchor.
- Currently, only a small percentage of tankers that call at WMT bunker in the Port Metro Vancouver area. Tanker operators have the choice to purchase bunker fuel at many ports and will choose the most economical port, when practical, to improve overall voyage returns.
- Given the Movement Restricted Area (MRA) draft restrictions, tanker operators prefer not to bunker east of the Second Narrows to avoid unnecessarily limiting cargo capacity.
- Physical space is very limited at WMT and Trans Mountain's goal is to minimize the footprint of the facility to the greatest extent practical.
- A bunkering facility at WMT would have a significant cost, which may not be suitably recoverable from bunkering revenue.

However, Trans Mountain has considered that occasionally a tanker operator may wish to obtain bunker fuel from a barge while at WMT. Trans Mountain intends to allow this, upon request. Procedures will be developed prior to the commencement of the expanded operations at WMT to ensure that any approved bunkering activities will be carried out within the

containment boom and in accordance with international best practices for safety and environmental protection.

2.122 Loading and unloading arms at the Westridge Marine Terminal

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 109 of 110
ii) A3S0Y9, Application Volume 4A, Project Design and Execution – Engineering, PDF page 9 of 35
iii) A3S5F6, Application Volume 8C – TERMPOL 3.15 General Risk Analysis and Intended Methods of Reducing Risks, PDF page 58 of 100
iv) A3S4V5, Application Volume 7, Risk Assessment and Management of Pipeline and Facility Spills, PDF page 33 of 84

Preamble:

Reference i) states that one of the two purposes of the Westridge Marine Terminal is unloading jet fuel from tankers and barges. The reference establishes that the jetty will receive jet fuel from three different classes of tankers/vessels. The reference further states that, in addition to the current dock which was constructed in 1957, the terminal has three tanks with a total volume of 62,800 cubic metres (395,000 bbl) currently used for storing jet fuel. Under the proposed Project, the current dock would be demolished and one new dock complex with three berths, each capable of loading up Aframax class vessels and one berth capable of receiving jet fuel, would be constructed.

Reference ii) indicates that, to achieve the peak loading rate of 4,635 cubic metres per hour (700,000 bbl/d), it is expected that each berth will require three 406 millimetre (NPS 16) diameter loading arms. A spare loading arm may be provided at one or more berths for redundancy. Berth 1 will also be fitted with one 305 millimetre (NPS 12) diameter jet fuel unloading arm. The spacing between loading arms will be approximately 4.0 metres.

Reference ii) also states that each berth will also be fitted with one 305 millimetre (NPS 12) diameter vapour recovery arm.

Reference iii) describes the risk controls that reduce risk for oil spill to sea during the berthing operations, cargo transfer activities, and de-berthing operations, including emergency release couplers (ERC) and emergency shutdown (ESD) valves.

Reference iv) states that one of the control measures to prevent or mitigate a product release and/or fire is the use of emergency stop buttons near the loading connection with ability for the vessel to initiate immediate cessation of cargo loading.

Request:

a) Please provide design specifications with schematics of loading and unloading arms.

b) Please specify the number of spare loading arms selected, their locations, and the rationale for the number of arms selected.

c) Please provide the working envelope for the loading arms, including interfaces.

d) Please list the guidelines, such as the Oil Companies International Marine Forum (OCIMF) guidelines, that have been taken into consideration when calculating the spacing between loading arms.

e) Please describe the proposed connection between the tanker's vapour recovery flange and the berth's vapour recovery arm.

f) Please discuss how to mitigate potential issues that could arise from having different types of flanges in the tank and the vapour recovery arm.

g) Please describe how the recovery arm would be integrated with the three loading arms and spares;

h) Please confirm whether or not an emergency release system (ERS), in addition to an ERC, has been considered for the loading arm, as well as mooring dolphins in case of an emergency disconnection of the loading arms.
   h.1) If an ERS has been considered, provide scenarios where the ERS will be activated.
   h.2) Otherwise, provide a rationale for not having an ERS.

i) Please provide the measures that will be implemented to stop oil spills when unloading the vessel.

j) Please provide the design measures taken for timely activation of the emergency disconnection system of Marine Loading Arms and Mooring Dolphins in the jetty's control room.

k) Please provide details, including the basis and design philosophy, for the jetty's control room and control system.

Response:

a) The design specifications and schematics for the loading arms for the proposed expansion of Westridge Marine Terminal (WMT) are not yet available. These will be developed during the detailed engineering and design phase, in advance of the tendering for the supply of the loading arms.

   The foremost international design specification for marine loading arms is the Oil Companies International Marine Forum (OCIMF) Design and Construction Specification for Marine Loading Arms. This document is used by all major energy companies and loading arm vendors and will be incorporated into Trans Mountain's WMT-specific specifications. Trans Mountain will also consider incorporating, as applicable, the requirements of a number of process and material specifications provided by bodies such as:

   - Canadian Standards Association (CSA)
   - American National Standards Institute (ANSI)
   - American Society of Mechanical Engineers (ASME)
   - National Fire Protection Association (NFPA)
   - National Electric Manufacturers Association (NEMA)
   - Steel Structures Painting Council (SSPC)

- United States Coast Guard (USCG)

Reference:

Oil Companies International Marine Forum (OCIMF), 1999, Design and Construction Specification for Marine Loading Arms, London, www.ocimf.com

b) The peak crude oil loading rate of 4,635 m^3/hr (700,000 bbl/d) identified in Section 3.4.4.6.4, Volume 4A of the Facilities Application (Filing ID A3S0Y9) is equivalent to 29,000 bbl/hr. The maximum flow rate capacity of one 406 mm diameter (NPS 16) loading arm (as per OCIMF *Design and Construction Specification for Marine Loading Arms* – refer to the response to NEB IR No. 2.122a) is 26,000 bbl/hr; therefore, the required number of loading arms at each berth is two.

In Section 3.4.4.6.4, Trans Mountain misstated that the required number of loading arms at each berth is three. This was intended to include the provision of an installed spare loading arm, allowing the loading at each berth to be carried out at the full design rate if one loading arm were to be out of service. Even with two loading arms operational, each loading arm will only be required to operate at approximately 56% of its maximum flow rate capacity. In summary, Trans Mountain intends to provide three loading arms at each berth, one of which (at each berth) will be considered an installed spare.

c) The working envelope for the proposed loading arms at Westridge Marine Terminal (WMT) is not available and will be established during the detailed engineering and design phase. Information on manifold elevations relative to freeboard and manifold positions relative to hull side, for the full range of design vessels, will be acquired. Consideration of the largest vessels, unloaded, at the highest tide and the smallest vessels, loaded, at lowest tide, in conjunction with the manifold elevations relative to freeboard, will establish the vertical extent of the working envelope. Consideration of the maximum extent of vessel movements away from and along the berth, in conjunction with the manifold positions, will establish the horizontal extent of the working envelope.

d) The primary reference for calculating the spacing between loading arms is the OCIMF *Design and Construction Specification for Marine Loading Arms* (refer to the response to NEB IR No. 2.122a). It is common practice to match the spacing of the loading arms with the most typical vessel manifold flange spacing to minimize loading arm lateral travel and stress. Loading arms are designed with some ability to slew laterally to accommodate variability in the spacing of vessel manifold flanges.

e) Typically, a tanker manifold contains one vapour recovery flange at each end of the manifold. One of the vapour recovery flanges will be mated with the vapour recovery arm, similarly to the connection for the loading arms, via a hydraulic quick connect / disconnect coupler.

f) Trans Mountain does not anticipate any potential issues that could arise. It is not uncommon to have differences between the tanker manifold flanges and the loading arm and vapour recovery arm presentation flanges. Tankers typically carry a range of adapter

fittings to address this situation. Westridge Marine Terminal (WMT) may also decide to have their own adapter fittings to accommodate manifold flanges of different types or sizes.

g) The proposed vapour recovery arm at each berth at Westridge Marine Terminal (WMT) will be adjacent to the proposed loading arms, similar to how the flanges are arranged on vessel manifolds. The actuation and control systems for the vapour recovery arm will be the same as for the loading arms. Since vessel loading will not be permitted without a functioning vapour recovery system, Trans Mountain will consider the need for installed or uninstalled (ready for quick installation) spare vapour recovery arms or alternate back-up connection systems, such as portable hoses (similar to what is currently used at WMT), during the detailed engineering and design phase.

h) Notwithstanding the reference to emergency release couplers (ERCs) in Termpol 3.15, General Risk Analysis and Intended Methods of Reducing Risk, TR8C-12, Volume 8C of the Facilities Application (Filing ID A3S5F6), Trans Mountain is reviewing (with Det Norske Veritas (DNV), marine terminal design consultants, and vendors) the advantages and disadvantages of including emergency release couplers (ERCs) and emergency release systems (ERS), for the proposed loading arms, at the expanded Westridge Marine Terminal (WMT). Trans Mountain interprets ERS to be the various components and systems which activate prior to the activation of an ERC to release. ERCs and ERSs are complex systems and a decision whether or not to apply them at WMT must be considered carefully. ERCs and ERSs are always included in the designs for liquefied natural gas (LNG) terminals, but are not commonly utilized at oil terminals, typically only applied where strong currents, high winds, and large waves or intensive interaction from passing vessels are expected. The meteorological and oceanographic studies and the preliminary passing vessel analysis that Trans Mountain has undertaken for WMT indicate that none of these effects will be present. During the detailed engineering and design phase, Trans Mountain will assess the potential for tsunami, caused by seismic events and landslides, to determine if these events warrant the application of ERCs and ERSs at WMT. Trans Mountain is committed to the safety of the public and the protection of the environment during vessel loading operations but is not yet able to establish that the application of complex, automated ERC and ERS technology is appropriate for WMT.

   The quick release mooring hooks on the breasting and mooring dolphins, referred to in Section 3.4.4.3.4, Volume 4A of the Facilities Application (Filing ID A3S0Y9) will not release automatically and must be activated by a terminal operator, either at the location of the mooring hook or from the control room, when the vessel is ready to depart the berth and the tension has been released by the vessel winches. It is undesirable to detach mooring lines while they are under tension and, as such, quick release mooring hooks are not considered part of an ERS.

i) The operational procedures and safety systems described in Termpol 3.11, Cargo Transfer and Transshipment Systems, in TR 8C-9, Volume 8C (Filing ID A3S4T6), will apply to the jet fuel unloading system, as appropriate. Trans Mountain does not intend to unload crude oil as a normal operation at the proposed expanded Westridge Marine Terminal (WMT).

Provision will be incorporated into the design to allow vessel to vessel crude oil transfer in special circumstances.

j) Refer to the response to NEB IR No. 2.122h. If it is determined that emergency release couplers (ERCs) and the associated emergency release systems (ERS) are appropriate for application to the loading arms at the expanded Westridge Marine Terminal (WMT), the specific design measures for their timely activation, to be incorporated into the control room systems, will be developed during the detailed engineering and design phase. The specific design measures for the timely activation of the quick release mooring hooks at the mooring dolphins, to be incorporated into the control room systems, will also be developed during the detailed engineering and design phase.

k) The philosophy for the control of Westridge Marine Terminal (WMT) is described in Section 3.4.4.13, Volume 4A (Filing ID A3S0Y9) and Section 7.1.10, Volume 4C (Filing ID A3S1L1) of the Facilities Application. The design basis for and the details of the control room and control systems at WMT will be developed during the detailed engineering and design phase.

For a general description of the functional requirements of the control system and protocols related to berth operations, see Termpol 3.10, Site Plans and Technical Data, in TR 8C-8 (Filing ID A3S4T3), Termpol 3.11, Cargo Transfer and Transshipment Systems, in TR 8C-9 (Filing ID A3S4T6), Termpol 3.13, Berth Procedures and Provisions, in TR 8C-11 (Filing ID A3S4V0), and Termpol 3.16 & 3.17, Port Information and Terminal Operations Manual, in TR 8C-13 (Filing ID A3S5J7 and A3S5J8) of the Facilities Application.

2.123 Trestles and catwalks at the Westridge Marine Terminal

Reference:

A3S0Y9, Application Volume 4A, Project Design and Execution – Engineering, Figure 3.4.18 – Typical Access Trestle Section, PDF page 5 of 35

Preamble:

The reference shows the access trestles and catwalks.

Request:

Please provide:

a) dimensions, including the height of the structure above the concrete; and

b) the rationale for having an elevated roadway rather than a roadway directly on the concrete.

Response:

a) All of the dimensions, as well as the relative placement of the pipe supports, piping and cable trays shown in Figure 3.4.18, Section 3.4.4.3.4, Volume 4A of the Facilities Application (Filing ID A3S0Y9) are conceptual, were based on preliminary engineering analysis and design, and were provided for illustrative purposes. The dimensions and configurations will change during the detailed engineering and design phase. Trans Mountain anticipates that the vertical distance between the top of the concrete pile-cap and the top of the roadway surface will be approximately 2 m.

b) The roadway shown in Figure 3.4.18, Section 3.4.4.3.4, Volume 4A of the Facilities Application (Filing ID A3S0Y9) is not considered to be elevated. The roadway elevation is approximately 6.0 m relative to Geodetic Datum, which is similar to the top of the deck of the dock complex and the existing shore elevation. In the trestle cross section depicted, the roadway surface is supported by steel girders approximately 1.5 m deep. The girders span between pile caps, which are supported by steel piles, and are spaced approximately 40 m apart. This configuration is similar to many composite steel / concrete highway bridges. As discussed in the response to NEB IR No. 2.123a, the concept depicted was based on preliminary engineering and was provided for illustrative purposes.

2.124 Breasting dolphins at the Westridge Marine Terminal

Reference:

A3S0Y9, Application Volume 4A, Project Design and Execution – Engineering, PDF page 6 of 35

Preamble:

The reference specifies that the primary functions of the breasting dolphins are to absorb the energy of the berthing vessel and to provide contact points and spring line mooring points for the moored vessel. Each breasting dolphin will support an independent fender system that consists of a fender panel supported by rubber energy absorbing elements located behind the panel. Each breasting dolphin will also support a quick release hook and an electric capstan. The breasting dolphin structures will be accessed via catwalks. Each breasting dolphin will be equipped with a ladder extending from the top of the dolphin to approximately 1.0 metre below the lower low water level (large tide) to permit access from the water, if required.

Request:

Please provide the rationale used in selecting the immersed depth of fender on the breasting dolphins.

Response:

The reference to "1.0 m below the lower low water level (large tide)" in Section 3.4.4.3.4, Volume 4A of the Facilities Application (Filing ID A3S0Y9) refers to the access ladders, not to the fenders. The intent is that the access ladders will extend to below the lowest expected water level to allow an operator or a vessel crew member who has fallen into the water to self-rescue. The immersed depth of the fenders will be designed to accommodate the maximum vertical range of vessel hull movement expected. The elevation of the bottom of the fenders will be determined by the design vessel having the lowest loaded freeboard at the lower low water level (large tide), since the vessel's hull must not be able to slip beneath the fenders. Therefore, the fenders may not have any part immersed at the lowest water levels. The dimensions of the fenders will be determined during the detailed engineering and design phase.

2.125 New tanks in the Westridge Marine Terminal

Reference:

i) A3S0Z0, Application Volume 4A, Project Design and Execution – Engineering, PDF page 1 of 7
ii) A3S0Y9, Application Volume 4A, Project Design and Execution – Engineering, Table 3.4.14 – Tanks under Consideration for the Westridge Marine Terminal, PDF page 7 of 35

Preamble:

Reference i) provides the scope of the Project at the Westridge Marine Terminal. It does not mention any new tanks.

Reference ii) states that Trans Mountain is considering three tanks to be built at the Westridge Marine Terminal; however, the pipeline surge tank may be eliminated.

Request:

a) Please confirm whether or not the three tanks mentioned in Reference ii) are part of the Project scope;

b) If the three tanks form part of the Project scope, for each tank, please provide:
   b.1) nominal capacity;
   b.2) working capacity;
   b.3) spill protection method;
   b.4) overfill protection method;
   b.5) odour control method;
   b.6) fire detection and fire protection method;
   b.7) lightening protection method;
   b.8) corrosion control methods;
   b.9) leak detection method;
   b.10) secondary containment capacity;
   b.11) Process and Instrument Diagrams (P&IDs) for each tank that carries a different product, including a legend for each diagram; and
   b.12) a proposed plot plan of the terminal clearly showing the locations of the tanks and secondary containments.

c) Please describe the method that will be used to replace the pipeline surge tank, including the effectiveness of the method.

Response:

a) At this time, Trans Mountain is not able to confirm whether or not the three tanks under consideration for the proposed Westridge Marine Terminal (WMT) expansion will remain as part of the Project scope.

   The purpose of the two proposed synthetic crude tanks is described in Section 3.4.4.6.1, Volume 4A of the Facilities Application (Filing ID A3S0Y9) and in the response to NEB IR

No. 2.126b. The synthetic crude tanks may not be required in the final design, depending on the vapour recovery technology selected. Trans Mountain continues to evaluate vapour recovery technology with the desire to eliminate the two synthetic crude tanks that are currently proposed as part of this system, if it is technically feasible to do so. The vapour recovery technology selection process is ongoing and requires iterative collaboration with the leading vendors of the technology to ensure that the selection provides high recovery rates while being energy efficient, reliable, and practical to operate. Please refer to the response to NEB IR No. 2.126f. Trans Mountain is anticipating being able to make the final technology selection before the end of Q3 2014.

The proposed pipeline surge relief tank is for over-pressure relief service and is not associated with the vapour recovery unit (VRU) equipment. Trans Mountain also has a desire to eliminate the proposed relief tank, if it is technically feasible to do so. The requirement for a relief tank will be determined during the detailed engineering and design phase, after the completion of transient hydraulic studies.

b.1) The nominal (shell) capacity of the proposed vapour recovery unit (VRU) synthetic crude tanks at Westridge Marine Terminal (WMT) is provided in Table 3.4.14, Section 3.4.4.4, Volume 4A of the Facilities Application (Filing ID A3S0Y9). The nominal capacity of the proposed surge tank will be determined during the detailed engineering and design phase.

b.2) Working capacity (the volume contained between the low working level and the high working level) depends on the details of the tank design (*i.e.*, fixed roof, floating roof, seal system, tank bottom, *etc.*). Working capacity is generally expected to be in the range of 85 to 90 per cent of the nominal capacity. The working capacity of each proposed tank will be determined during the detailed engineering and design phase and confirmed by tank "strapping" during commissioning.

b.3) All proposed tanks will be located within secondary containment designed in accordance with Canadian Standards Association (CSA) Standard Z662 and the National Fire Protection Association (NFPA) Code 30. Although not a statutory requirement, secondary containment volume will meet the additional requirements of the BC Fire Code (BCFC).

b.4) Trans Mountain will provide overfill protection in accordance with American Petroleum Institute (API) Standard 2350. All proposed tanks will be equipped with a radar gauging system for liquid level measurement and overfill protection. Redundant instrumentation for overfill protection will also be provided. For tanks not designated as mainline relief tanks, the overfill protection system will automatically cause the tank valve to close if the liquid reaches a predetermined level. The overfill protection arrangement will be finalized during the detailed engineering and design phase.

b.5) Trans Mountain is currently working with technology vendors and air quality modelling experts to determine the optimum practical odour control system for the proposed tanks, as necessary for each individual tank. Technology selection and application is expected to be complete by the end of 2014.

b.6) Several types of fire detection technologies are available for tanks, including linear wire heat detector technology, linear fiber heat detector technology, and triple infrared detector technology. The most suitable technology for the proposed tanks will be selected during the detailed engineering and design phase.

When the design basis for the proposed fire protection systems is finalized, during the detailed engineering and design phase, specifications and drawings will be developed under the supervision of experienced and competent professional engineers, specializing in fire protection. Trans Mountain also retains the services of an industrial fire-fighting specialist to provide advice on conceptual and detailed design.

Trans Mountain anticipates that the proposed tank fire protection systems will be designed to address the following fire scenarios:

- Storage tank floating roof rim seal fire (automated application).
- Storage tank full surface fire (application by portable monitors).
- Release to secondary containment (application of foam to suppress odours and combustible vapours).

b.7) Lightning protection for the proposed tanks will be determined during the detailed engineering and design phase, following the requirements of American Petroleum Institute (API) Standard 650 and other recognized lighting protection standards and guidelines.

b.8) Corrosion control for the proposed tanks will include:

- Internal coating of the tank bottom and approximately 1.0 m of the lower shell.
- External coating of the shell, nozzles, fixed steel roof (where fixed steel roofs are utilized), and other miscellaneous external tank appurtenances.
- Cathodic protection system to control corrosion on the underside of the tank bottom.

b.9) The under-tank leak detection system proposed for each new tank will consist of perforated pipes which will drain to a sump adjacent to the tank. The leak detection system design will be in accordance with American Petroleum Institute (API) Standard 650, Annex I.

b.10) Trans Mountain has a statutory obligation to comply with Canadian Standards Association (CSA) Standard Z662, which requires that the capacity of a shared secondary containment area be 110% of the volume of the largest tank within the area. Although not a statutory requirement, Trans Mountain has committed to comply with the British Columbia Fire Code (BCFC), which requires that the capacity of a shared containment area be 100% of the volume of the largest tank plus 10% of the volume of the other tanks within the area. Under the requirements of CSA Z662 and BCFC, the secondary containment volume for a single tank is 110% of the volume of the tank. For the two proposed VRU tanks (shared) and for the relief tank (single), the CSA Z662 and BCFC calculation methods will result in the same containment volumes relative to the tank size. As the final design of the secondary containment areas has not been completed, the exact volumes are not available.

b.11) Piping and instrumentation diagrams (P&IDs) for the proposed tanks have not yet been completed. Trans Mountain intends to complete the P&IDs during the detailed engineering

and design phase. P&IDs will essentially be the same for all proposed tanks, regardless of the product to be stored in the tank. The only differences between the P&IDs for different tanks will be the information on the tank dimensions and capacity and the tank valve arrangements (which will be different for the VRU tanks and the relief tank).

b.12) A plot plan for WMT, that clearly shows the proposed locations of the three tanks and secondary containment, is provided in Figure 3.4.14, Section 3.4.4.1.4, Volume 4A of the Facilities Application (Filing ID A3S0Y8). Refer to Items 1 and 2 on the plot plan for the location of the relief tank and associated secondary containment. Please refer to Items 31, 32, and 33 for the location of the VRU synthetic crude tanks and associated secondary containment.

c) A transient hydraulic analysis (or surge study) will be completed for the pipelines between Burnaby Terminal and Westridge Marine Terminal (WMT), and for the piping infrastructure within WMT, to determine the maximum surge pressure that needs to be designed for. If it is cost effective and practical to specify high enough pressure piping at WMT to handle the surge pressure, rather than the PN 20 (ANSI 150#) piping typically used for terminal process systems, the relief tank may be eliminated. Transient hydraulic analysis is a well established method at providing the information needed to select either high pressure piping or a relief system.

2.126 Vapour handling at the terminals

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF pages 73 of 110

ii) A3S0Z0, Application Volume 4A, Project Design and Execution – Engineering, PDF page 1 of 7

A3S0Y9, Application Volume 4A, Project Design and Execution – Engineering:

iii) PDF page 8 of 35

iv) PDF page 9 of 35

Preamble:

Reference i) provides information about the three proposed tank terminals and the marine terminal.

Reference ii) states that two Vapor Recovery Units (VRUs) and one Vapour Combustion Unit (VCU) will be located at the Westridge Marine Terminal. The vapour streams displaced from the vessels during loading will normally go to the VRUs, which will remove odorous components and capture the majority of the hydrocarbon vapours for reinjection onto the vessels being loaded or onto future vessels. During periods when one of the VRUs is shut down for maintenance or repair, the VCU will be used. The VCU will also be used if three vessels are being loaded simultaneously, which is expected to be less than 5 per cent of the time.

Reference ii) further states that opportunities to eliminate the pipeline pressure relief tank are being investigated. The planned reduction to two VRUs and the consideration of other vapour recovery technologies may result in a reduction of the foreshore expansion.

Reference iii) states that the preliminary VRU technology selected includes an absorption vessel for removing odorous sulfur compounds and an activated carbon adsorption vessel for removing hydrocarbons heavier than ethane. Gases generated by vessels for cargo tank inerting, such as nitrogen and carbon dioxide, and the lighter hydrocarbon vapours, specifically methane and ethane, cannot be captured by the absorption vessel and will be vented to atmosphere.

Reference iv) states that, given its low utilization (less than half of the utilization of the existing VCU), a much higher-cost VRU is not considered necessary or appropriate for the third vapour handling unit.

Request:

Please provide:

a) descriptions of the VRUs considered for the tanks in the Edmonton, Sumas, and Burnaby Terminals, including the method of recovery, type of vapours that would be recovered and not recovered, and cost;

b) the basis for using two separate VRU tanks in place of one tank;

c) the estimated amounts of the lighter hydrocarbon vapours that cannot be captured;

d) descriptions of other VRUs that are capable of capturing lighter hydrocarbon vapours, if any, and the considerations given to their use for the Project;

e) descriptions of other methods, if any, that can be used with the proposed VRUs to capture the lighter hydrocarbon vapours;

f) a discussion of the "other technologies" described in Reference i);

g) the capabilities, advantages, and disadvantages of VCUs compared to VRUs;

h) the cost savings of using VCUs in place of VRUs; and

i) a discussion of whether a third tank would be required, should a third VRU be considered.

Response:

a) Trans Mountain has not considered vapour recovery units (VRUs) for the proposed new tanks at Edmonton, Sumas, and Burnaby. VRUs, as described in Section 3.4.4.6.1, Volume 4A of the Facilities Application (Filing ID A3S0Y9) are for application to high-flow vapour streams, relatively rich in hydrocarbons, such as those produced by the displacement of vapours from vessel cargo tanks. As described Section 3.4.2.4, Volume 4A (Filing ID A3S0Y8) and Section 3.4.3.4, Volume 4A (Filing ID A3S0Y8), Trans Mountain is considering tank vapour adsorption units (TVAUs) at Sumas Terminal and Burnaby Terminal for odour control. Trans Mountain is not considering TVAUs at Edmonton Terminal as there are no odour concerns at that location. The TVAUs are intended to capture H_2S and mercaptans but not to capture or recover any other vapours. There will be no regeneration system for the TVAUs – once the medium is saturated, it will be disposed of. Trans Mountain has not received budgetary proposals from the technology vendors for the TVAUs. However, based on preliminary indications, Trans Mountain believes that the cost of each TVAU will be on the order of several hundred thousand dollars. This does not include the cost of the fixed roofs, to support the application of TVAUs, which will be in the order of $2 million per tank.

b) As described in Section 3.4.4.6.1, Volume 4A of the Facilities Application (Filing ID A3S0Y9), one of the proposed vapour recovery unit (VRU) tanks is for the supply and handling of un-enriched or partially enriched synthetic crude oil and one VRU tank is for the storage of fully enriched synthetic crude oil. The enrichment occurs as the synthetic crude oil absorbs the hydrocarbon vapours in the activated carbon regeneration phase. Some recycle of the partially enriched synthetic crude oil is expected to be possible, but after several cycles the enriched synthetic crude oil will not be able to be used in the process and must be stored for future loading onto a vessel. Trans Mountain anticipates some variability in the scheduling of vessels intending to load synthetic crude oil. The provision of the enriched synthetic crude oil tank allows for vapour recovery to continue without impact from synthetic crude oil vessel logistics.

c) Based on preliminary measurements during heavy crude oil loading operations at Westridge Marine Terminal, Trans Mountain estimates that 5% to 10%, by weight, and 15% to 20%, by volume, of the hydrocarbon vapours in the vapour streams will be comprised of methane and ethane, which will not be captured by the vapour recovery units (VRUs). Variances outside these ranges are likely for different types of crude oil. Further study is required to characterize the expected composition of the vapour streams. Trans Mountain intends to conduct further measurements and analysis during the loading of different types of crude oil over the next several months. Trans Mountain notes that methane and ethane are not considered volatile organic compounds (VOCs).

d) Trans Mountain is not aware of any commercially available system, suitable for the scale of the proposed operation at Westridge Marine Terminal (WMT), for recovering methane and ethane vapours.

e) Please refer to the response to NEB IR No. 2.126d. Methane and ethane vapours can be destroyed by combustion after they pass through the VRUs, although Trans Mountain is not proposing such a system for Westridge Marine Terminal (WMT) at this time.

f) The reference to other technologies in Section 3.4.4.1.4, Volume 4A of the Facilities Application (Filing ID A3S0Y8) is expanded upon somewhat in Section 3.4.4.6.1, Volume 4A (Filing ID A3S0Y9). Trans Mountain, through the engagement of technology vendors, is investigating options for the handling of the volatile organic compound (VOC) vapours extracted from the activated carbon unit in the vapour recovery unit (VRU) during the regeneration phase (*i.e.*, excluding the H_2S and mercaptans removed by the pre-treatment unit and the CO_2, methane, ethane, and other compounds not recovered by the activated carbon unit). The other technologies that Trans Mountain has considered include the compression of the vapours into a liquid state and refrigeration of the vapours into a liquid state, for reinjection into a passing crude oil loading stream. At this time, the compression option appears promising. In addition, Trans Mountain has explored the use of membrane technology within the VRU in place of activated carbon technology. However, after some analysis, this was determined by the vendor not to be suitable for the proposed operation at Westridge Marine Terminal (WMT). Trans Mountain is anticipating being able to make the final technology selection before the end of Q3, 2014.

g) Vapour combustion units (VCUs) have the advantage of being able to destroy all odourous compounds, including H_2S and mercaptans, and all hydrocarbon vapours, including methane and ethane, in one stage. Because of their simplicity, they also have the advantage of being much less expensive to purchase than vapour recovery units (VRUs). The disadvantage of VCUs is that they produce large volumes of combustion products, such as CO_2. For marine loading operations, they also require large amounts of gas (propane or natural gas) to support combustion at various times during the vessel loading cycles (because the vapour stream is not always rich enough). This adds significantly to the volume of combustion products produced.

h) Trans Mountain has yet not received budgetary proposals from the technology vendors for the specific application of vapour recovery units (VRUs) and a vapour combustion unit (VCU) at Westridge Marine Terminal (WMT). Proposals are expected by the end of July,

2014. However, based on preliminary indications, it is Trans Mountain understanding that a VRU, due to its complexity, has a purchase cost of three to four times that of VCU. Directionally, the nominal purchase cost of a VCU is approximately $1 million. A VRU, due to its larger footprint, heavy vessels, and various pumps and hardware also requires more costly foundations than a VCU, making the differential cost greater.

i) Trans Mountain does not expect that a third synthetic crude oil tank would be required if a third vapour recovery unit (VRU) were used instead of, or in addition to, a vapour combustion unit (VCU). The two proposed VRUs, for the reasons identified in the response to NEB IR No. 2.126b, will share the two proposed synthetic crude oil tanks. The utilization of the third VRU would be approximately 5%, so the amount of additional vapour recovered would not materially affect the synthetic crude tank capacity requirements.

2.127 Fire protection - Westridge Marine Terminal

Reference:

i) A3S0Y9, Application Volume 4A, Project Design and Execution – Engineering, PDF page 11 of 35
ii) A3S4V5, Application Volume 7, Risk Assessment and Management of Pipeline and Facility Spills, PDF page 33 of 84

Preamble:

Reference i) describes the fire protection system at the Westridge Marine Terminal.

Reference ii) outlines the control measures to prevent or mitigate a product release and/or fire.

Request:

Please provide a detailed description of the design measures being considered for the provision of water curtains or other cooling systems for protecting the jetty structure in case of a fire on a tanker.

Response:

Trans Mountain has not yet undertaken all of the considerations necessary to complete the design basis (or any of the detailed design) for the fire protection system at Westridge Marine Terminal (WMT) related to the protection of the proposed dock complex structures from tanker fires. During the detailed design and engineering phase, Trans Mountain, supported by marine terminal fire protection specialists, will review legislative requirements, industry guidelines, and international best practices to determine the appropriate fire protection approach for this particular scenario.

2.128 Edmonton Terminal – secondary containment

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 79 of 110

Preamble:

The reference states that the proposed additional tanks in the West Tank Area (WTA) of Edmonton Terminal require additional containment capacity that will be provided in accordance with CSA Z662 and the Alberta Fire Code (AFC); specifically, 100 per cent of the working volume of the largest tank plus 10 per cent of the working volume of the other tanks that share the common impoundment. This containment capacity will be partially provided by the Remote Impoundment (RI), which was recently constructed to serve the East Tank Area (ETA). The remaining containment capacity will be provided within the WTA common impoundment area.

The reference further states that the combination of the 1 in 100 year 24-hour accumulated precipitation from the ETA and WTA will exceed the additional design capacity of the RI. Therefore, a new stormwater retention area, the Remote Impoundment Annex (RIA), will be constructed at the north end of the WTA to handle accumulated precipitation from the WTA.

Request:

Please provide:

a) the capacity and dimensions, including depth, of the RIA;

b) the capacity of the secondary containment:
   b.1) required by CSA Z662 and the AFC;
   b.2) partially provided by RI; and
   b.3) provided by the WTA common impoundment area;

c) the worst-case scenario, with the released amounts, that is considered in selecting the secondary containment capacity;

d) confirmation that the selected secondary containment is adequate for the WTA terminal in the event of a multiple-tank rupture from a single event:
   d.1) at the WTA; and
   d.2) at the WTA and the ETA;

e) the rationale for the confirmation provided in d); and

f) the rationale for not considering the amount of water from a possible firefighting activity in selecting the secondary containment capacity and how this will be managed.

Response:

a) Based on the preliminary design work completed to date, the design storage volume of the proposed remote impoundment annex (RIA) at Edmonton Terminal is estimated to be

about 14,300 m^3 (90,000 bbl). The RIA is somewhat pie-shaped with dimensions that are approximately 150 m x 20 m x 125 m x 40 m, which results in a plan area of about 4,000 m^2. The preliminary depth of the RIA is estimated to be about 7 m, from the top of the retaining wall to the bottom of the impoundment.

b.1) Trans Mountain has a statutory obligation to comply with Canadian Standards Association (CSA) Standard Z662, which requires that the capacity of a shared secondary containment area be 110% of the volume of the largest tank within the area. For the proposed expansion at Edmonton Terminal, in the West Tank Area (WTA), Trans Mountain has committed to comply with the secondary containment capacity requirements of the Alberta Fire Code (AFC), which requires that the capacity of a shared containment area be 100% of the volume of the largest tank plus 10% of the volume of the other tanks within the area.

As the final design of tanks and the secondary containment areas has not been completed, the exact volumes are not available. However, based on the preliminary design work completed to date, the secondary containment volume required by the AFC, for the existing tanks and the proposed new tanks, is estimated to be about 93,800 m^3 (590,000 bbl), which is greater than the volume required by CSA Z662.

b.2) The remote impoundment (RI) is sized, based on the requirements of National Fire Protection Association (NFPA) Code 30, Clause 2.11.1, to have a capacity equal to the working volume of the largest tank in the WTA, approximately 61,200 m^3 (385,000 bbl). Since the largest tank being added in the WTA is equivalent to the size of the largest tank in the East Tank Area (ETA), the RI can also serve the WTA in accordance with NFPA 30. Since the RI was originally designed for and is normally open to the ETA, it has additional capacity for the water from a 1 in 100 year 24 hour precipitation event, approximately 31,800 m^3 (200,000 bbl), flowing from its catchment area. However, the combination of the 1 in 100 year 24 hour accumulated precipitation from the ETA and WTA will exceed the additional design capacity of the RI. The purpose of the proposed remote impoundment annex (RIA) is to handle the accumulated precipitation from the WTA. Storm water from the WTA will first collect in the RIA and will be released into the RI if space is available and following storm water management procedures, to be developed. Hydrocarbon spills will fill any remaining space in the RIA, and then overflow into the RI through the upper level outlet. The automated valve on this outlet will close if the liquid level in the RI reaches its design capacity and the remaining volume will be contained in the WTA common impoundment.

b.3) Based on the responses to NEB IR No. 2.128b.1 and 2.128b.2, the secondary containment requirement in the WTA common impoundment area is 32,600 m^3 (205,000 bbl). Based on the preliminary design work completed to date, the capacity of the WTA secondary containment, including the RIA, is estimated to be approximately 47,700 m^3 (300,000 bbl). The WTA containment capacity exceeds the net requirement of 32,600 m^3 because of allowances made for the possibility of additional tanks or larger replacement tanks in the WTA in the future.

c) Trans Mountain considers the worst-case release scenario for the West Tank Area (WTA) at Edmonton Terminal, after the proposed expansion, to be the working volume of the

largest tank, approximately 61,200 m^3 (385,000 bbl). The selection of the secondary containment capacity is based on the requirements of Alberta Fire Code (AFC) (for total volume) and National Fire Protection Association (NFPA) Code 30 (for remote impoundment volume) as discussed in the response to part c), above. The total available containment will significantly exceed the worst-case release scenario.

d.1) None of the codes and standards that set out requirements (statutory for Trans Mountain or otherwise) for containment volume at storage tank terminals, including Canadian Standards Association (CSA) Standard Z662, National Fire Protection Association (NFPA) Code 30, the National Fire Code (NFC), or the Alberta Fire Code (AFC), contemplate simultaneous multiple-tank failures. Given that storage tanks are designed to the rigorous requirements of American Petroleum Institute (API) Standard 650, are spaced according to the applicable requirements of the listed codes and standards, and that working tanks are only filled to capacity for part of the time they are in operation, multiple-tank failure scenarios are expected to have extremely low, near zero, probabilities. As discussed in the response to NEB IR No. 2.128b, the secondary containment capacity requirements of AFC provide for significant additional volume above the working volume of a single tank, so that release volume from some multiple-tank failure scenarios, however unlikely, would be contained.

d.2) For the reasons discussed in NEB IR No. 2.128b and NEB IR No. 2.128d.1, design to the requirements of AFC and NFPA 30 for the West Tank Area (WTA), the East Tank Area (ETA), and the remote impoundment will provide enough total secondary containment volume, approximately 206,700 m^3 (1,300,000 bbl), for many multiple-tank failure scenarios. However, Trans Mountain does not consider the simultaneous failure of multiple tanks in the WTA and the ETA to be a credible scenario.

e) Refer to the response to part d), above.

f) Firefighting water is inherently considered in determining the secondary containment capacity for the proposed expansion at Edmonton Terminal. Alberta Fire Code (AFC), Clause 4.3.7.3.3, implies that the 10% marginal volume for each additional tank, included in AFC, Clause 4.3.7.3.2.b, is intended for precipitation and firefighting water. Trans Mountain intends to utilize a combination of the existing remote impoundment, the proposed remote impoundment annex, and the proposed West Tank Area (WTA) shared secondary containment, as appropriate, to manage firefighting water.

2.129 Sumas Terminal – secondary containment

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 90 of 110

Preamble:

The reference states that the berm between Tank 103 and Tank 104 in the Sumas Terminal will be partially removed to allow space for the installation of the new tank (Tank 100) and replaced with a concrete wall. Some of the cut slope northeast of Tank 104 will be removed to retain the existing containment capacity in the Tank 104 containment area. Tank 100 will share containment with Tank 103. The realignment of the berm between Tank 103 and Tank 104 and the excavation for the Tank 100 foundation and associated perimeter space will ensure that the shared containment capacity is in accordance with CSA Z662 and the BC Fire Code (BCFC); specifically, 100 per cent of the working volume of Tank 100 plus 10 per cent of the working volume of Tank 103.

Request:

Please provide:

a) a map of the terminal plot plan clearly labelling new and shared secondary containments;

b) the capacity of the secondary containment required by CSA Z662 and the BCFC;

c) the worst-case scenario, with the released amounts, that is being considered in selecting the secondary containment capacity;

d) confirmation that the selected secondary containment is adequate for the Sumas Terminal when the potential for a multiple-tank rupture from a single event is considered;

e) the rationale for the confirmation provided in d);

f) the expected capacity from 1 in 100 year 24-hour accumulated precipitation in the terminal;

g) the location, capacity, dimensions, and a brief description of stormwater management for the proposed containments to retain the precipitation amounts described in f); and

h) the rationale for not considering the amount of water from a possible firefighting activity in the secondary containment capacity, and how this will be managed.

Response:

a) Refer to NEB IR No. 2.129a – Attachment 1 for a plan of the proposed shared secondary containment for Tank 100 and Tank 103 at Sumas Terminal. The secondary containment for Tank 104 will be modified to hold 110% of its volume considering the modification required to accommodate Tank 100.

b) For the case of two tanks in a shared secondary containment area the requirements of Canadian Standards Association (CSA) Z662 and the British Columbia Fire Code (BCFC) are identical. At Sumas Terminal, the capacity of the proposed shared secondary containment area for Tank 100 and Tank 103 is required to be 110% of the volume of the largest tank (Tank 100), or approximately 29,900 m^3 (188,000 bbl). As the final design of the shared secondary containment area has not been completed, the exact volume is not available.

c) Refer to the response to part b), above. Trans Mountain considers the worst-case release amount at Sumas Terminal to be the working volume of proposed Tank 100, approximately 27,130 m^3 (170,600 bbl). The selection of the secondary containment capacity is based on the requirements of Canadian Standards Association (CSA) Z662 and the British Columbia Fire Code (BCFC).

d) None of the codes and standards that set out requirements (statutory for Trans Mountain or otherwise) for containment volume at storage tank terminals, including Canadian Standards Association (CSA) Standard Z662, National Fire Protection Association (NFPA) Code 30, the National Fire Code (NFC), or the British Columbia Fire Code (BCFC), contemplate simultaneous multiple-tank failures. Given that storage tanks are designed to the rigorous requirements of American Petroleum Institute (API) Standard 650, are spaced according to the applicable requirements of the listed codes and standards, and that working tanks are only filled to capacity for part of the time they are in operation, multiple-tank failure scenarios are expected to have extremely low, near zero, probabilities.

   As discussed in the response to NEB IR No. 2.129b, the secondary containment capacity requirements of CSA Z662 and BCFC provide for some additional volume above the working volume of a single tank. With respect to the proposed shared containment area for Tank 100 and Tank 103, the total volume of containment will not be less than 110% of the volume of Tank 100. In addition, the capacity calculation method to achieve the 110% requires the deduction of the volume of Tank 103 below the top of berm elevation (the assumption being that only one tank fails). Based on the configuration of the berms at Sumas Terminal, the deducted volume will amount to approximately 20% of the volume of Tank 103 or approximately 4,800 m^3 (30,000 bbl). However, in the hypothetical case of both tanks failing, the deducted volume can be added back, making the total available containment capacity approximately 34,700 m^3 (218,000 bbl) or approximately 70% of the volume (at high working level) of both tanks. In the hypothetical case of both tanks failing, any oil not contained in the Tank 100 and Tank 103 shared containment area would also overflow into the secondary containment area for Tank 102 and/or Tank 101.

e) Although Trans Mountain has provided confirmation and the rationale, in the response to NEB IR No. 2.129d, that the secondary containment at Sumas Terminal will be adequate for a number of multiple-tank failure scenarios, Trans Mountain would like to address seismic considerations in the design and the potential for an earthquake (a single event) to cause a multiple-tank failure scenario.

   The seismic design of the proposed Tank 100 at Sumas Terminal, including consideration of sloshing and other effects, will be in accordance with the latest edition of the American

Petroleum Institute (API) Standard 650, Welded Tanks for Oil Storage, Annex E, the recognized North American standard. All designs, including seismic considerations, will be undertaken by experienced and competent professional engineers, registered in British Columbia. Geotechnical programs, which will include borehole and other investigative methods to obtain sub-surface data, will be conducted, and the results and recommendations of registered professional engineers and geologists will be used to inform the seismic designs. Trans Mountain will also consider applicable topography and soil conditions in the design of the tank, tank foundation, and containment system.

Fabrication of components, construction, and installation will be rigorously inspected to ensure that the prescribed designs are followed and structural integrity will be verified by testing, as applicable. General information on design and quality verification principles is included in Sections 2.1 through 2.7, Volume 4A (Filing ID A3S0Y8) and Sections 3.4.8 through 3.4.13, Volume 4B (Filing ID A3S1K5) of the Facilities Application. Numerous other references to design principles and features and quality assurance methods exist throughout Volume 4A and 4B of the Facilities Application. Trans Mountain is highly confident that these approaches will ensure that the new facilities will be able to withstand large earthquake scenarios with minimal damage or loss of integrity.

Given the extreme unlikelihood of the circumstance necessary to cause a volume equivalent to the total proposed secondary containment volumes for Tank 100 and Tank 103 to be released (i.e. both tanks at 70% capacity, an earthquake producing seismic forces exceeding the tank design criteria, and both tanks failing), Trans Mountain believes that the containment volume proposed for the expansion at Sumas Terminal is sufficient.

f) Trans Mountain interprets “expected capacity” to mean expected volume. The volume of water from a 1 in 100 year, 24-hour duration rainfall at Sumas Terminal is estimated to be approximately 13,500 m^3 (85,000 bbl). The volume that could collect in the Tank 100 and Tank 103 shared containment (without any being released during the 24-hour period) is estimated to be approximately 2,100 m^3 (13,200 bbl).

g) Storm-water runoff in the proposed Tank 100 and Tank 103 shared secondary containment at Sumas Terminal will collect in the northwest corner. Storm-water collected from other areas of the terminal will continue to drain to the existing collection and release locations. The shared secondary containment will hold storm-water until the contents can be examined by operations personnel and verified to be acceptable for release to the natural drainage course on the south side of the terminal. Trans Mountain will provide a motor operated valve (MOV) on the proposed new secondary containment drain system, in a safe location outside of the secondary containment berm. The MOV will be normally closed; only opened to release collected storm-water. The MOV will be operable at the valve or at a local control station positioned beside the access road. In the extremely unlikely event of a product release into the shared secondary containment while storm-water is being drained, a hydrocarbon detector located within the secondary containment will automatically cause the MOV to close. Released storm-water will also flow through an oil / water separator.

h) Firefighting water is inherently considered in determining the secondary containment capacity for the proposed expansion at Sumas Terminal. British Columbia Fire Code

(BCFC), Clause 4.3.7.3.3, implies that the 10% marginal volume, above the volume of the largest tank, included in BCFC, Clause 4.3.7.3.2.b, is intended for precipitation and firefighting water. Trans Mountain intends to utilize the shared secondary containment to manage firefighting water.

2.130 Burnaby Terminal – secondary containment

Reference:

A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 99 of 110

Preamble:

The reference states that, due to space limitations, the storage tanks that will be added for Project at Burnaby Terminal will generally share containment areas with other tanks, and containment capacity will be provided in accordance with CSA Z662 and the BCFC. The containment for Tanks 96, 97, and 98 will be partially provided by the remote impoundment adjacent to the tanks. In addition, existing Tanks 71, 73, 85, and 86 will be annexed into shared containment areas. When the Project is completed, there will be 17 tanks within shared containment areas and 9 tanks with individual containment areas.

The reference also states that, to achieve efficient stormwater management, the new shared secondary containment areas will be connected to an intermediate stormwater retention area via below-ground piping. This, in-turn, will be connected to the tertiary containment area, also via below-ground piping. The existing secondary containment areas are connected directly to the tertiary containment area. Stormwater released from the intermediate containment area will flow through an oil/water separator en-route to the tertiary containment area. The intermediate stormwater retention area will be sized to provide surge capacity (i.e., to allow stormwater to be released from multiple shared containment areas without exceeding the capacity of the oil/water separator).

Request:

Please provide:

a) a map of the terminal plot plan clearly labelling new and shared secondary containments;

b) the capacity of the secondary containment required by CSA Z662 and the BCFC;

c) the worst-case scenario, with the released amounts, that is considered in selecting the secondary containment capacity;

d) confirmation that the selected secondary containment is adequate for the Burnaby Terminal when the potential for a multiple-tank rupture from a single event is considered;

e) the rationale for the confirmation provided in d);

f) the expected volume from 1 in 100 year 24-hour accumulated precipitation event at the terminal;

g) the capacity of the proposed containment to retain the precipitation amounts described in f); and

h) the rationale for not considering the volume of water from a possible firefighting activity in the secondary containment capacity, and a discussion of how this will be managed.

Response:

a) Refer to NEB IR No. 2.130a – Attachment 1 for a plan of the proposed new and shared secondary containment areas at Burnaby Terminal.

b) Trans Mountain has a statutory obligation to comply with Canadian Standards Association (CSA) Standard Z662, which requires that the capacity of a shared secondary containment area be 110% of the volume of the largest tank within the area. For the proposed expansion of Burnaby Terminal, Trans Mountain has committed to comply with the secondary containment capacity requirements of the British Columbia Fire Code (BCFC), which requires that the capacity of a shared containment area be 100% of the volume of the largest tank plus 10% of the volume of the other tanks within the area. For some tanks, secondary containment will be partially provided by remote impoundment, in accordance with the requirements of National Fire Protection Association (NFPA) Code 30.

   As the final designs of the various shared secondary containment areas have not been completed, the exact volumes are not available. However, based on the preliminary design work completed to date, it is estimated that, after the proposed expansion at Burnaby Terminal is complete, the total secondary containment volume will be approximately 530,000 m^3 (3,350,000 bbl), which is more than 60% of the total proposed storage tank capacity (at high working levels) and more than 10 times the capacity (at high working level) of the largest tank. Further, the volume of the existing tertiary containment, which will be retained in the expansion, is approximately 80,000 m^3 (500,000 bbl), increasing the total containment volume to more than 70% of the total proposed product storage volume and nearly 12 times the capacity of the largest tank.

   Also refer to the responses to NEB IR No. 2.130c and IR No. 2.130d for additional discussion on the secondary containment volumes for the proposed Burnaby Terminal expansion.

c) Trans Mountain considers the worst-case release scenario for the largest of the shared secondary containment areas at Burnaby Terminal, after the proposed expansion, to be the working volume of the largest tank, approximately 51,700 m^3 (325,000 bbl). The selection of the secondary containment capacity is based on the requirements of the British Columbia Fire Code (for total volume) and National Fire Protection Association (NFPA) Code 30 (for partial remote impoundment volume) as discussed in the response to part b), above. The total available containment in each shared containment area will exceed the worst-case release scenario for each shared containment area. Also refer to the response to NEB IR No. 2.130d.

d) None of the codes and standards that set out requirements (statutory for Trans Mountain or otherwise) for containment volume at storage tank terminals, including Canadian Standards Association (CSA) Standard Z662, National Fire Protection Association (NFPA) Code 30, the National Fire Code (NFC), or the British Columbia Fire Code (BCFC), contemplate

simultaneous multiple-tank failure scenarios. Given that storage tanks are designed to the rigorous requirements of API 650, are spaced according to the applicable requirements of the previously listed codes and standards, and that working tanks are only filled to capacity for part of the time they are in operation, multiple-tank failure scenarios are expected to have extremely low, near zero, probabilities. However, based on the response to NEB IR No. 2.130b, Trans Mountain can confirm that the aggregate containment at Burnaby Terminal, after the proposed expansion is adequate for a number of multiple-tank failure scenarios.

With respect to the shared containment areas, for the case of three identical tanks within a shared containment area, the total volume of containment in accordance with BCFC will not be less than 120% of the volume of one tank. In addition, for a three-tank case, the capacity calculation method to achieve 120% requires the deduction of the volume of two of the tanks below the top of berm elevation (the assumption being that only one tank fails). Based on the configuration of the berms at Burnaby Terminal, the deducted volume will amount to approximately 20% of the volume of each tank or 40% of the volume of one tank. However, in the hypothetical case of three tanks failing, the deducted volume can be added back, making the total available containment capacity approximately 160% of one tank. Therefore, the amount that would not be contained in secondary containment, in the case of a complete structural failure of three tanks in the same shared containment area, assuming all three tanks are filled to capacity, is approximately 140% of the volume of one tank, or approximately 72,300 m^3 (455,000 bbl). This volume would be contained in the tertiary containment area.

Given the extreme unlikelihood of the circumstance necessary to cause a volume equivalent to the total proposed secondary containment volume at Burnaby Terminal to be released (i.e. many tanks at high operating levels, an event producing forces exceeding the tank design criteria, and many tanks failing simultaneously), Trans Mountain believes that the containment volume proposed for the expansion at Burnaby Terminal is sufficient.

e) Although Trans Mountain has provided confirmation and the rationale, in the response to part d) above, that the secondary containment at Burnaby Terminal will be adequate for a number of multiple-tank failure scenarios, Trans Mountain would like to address seismic considerations in the design and the potential for an earthquake (a single event) to cause a multiple-tank failure scenario.

The seismic design of the proposed new storage tanks at Burnaby Terminal, including consideration of sloshing and other effects, will be in accordance with the latest edition of the American Petroleum Institute (API) Standard 650, Welded Tanks for Oil Storage, Annex E, the recognized North American standard. All designs, including seismic considerations, will be undertaken by experienced and competent professional engineers, registered in British Columbia. Geotechnical programs, which will include borehole and other investigative methods to obtain sub-surface data, will be conducted, and the results and recommendations of registered professional engineers and geologists will be used to inform the seismic designs. Trans Mountain will also consider applicable topography and soil conditions in the design of tanks, tank foundations, and containments systems.

Fabrication of components, construction, and installation will be rigorously inspected to ensure that the prescribed designs are followed and structural integrity will be verified by testing, as applicable. General information on design and quality verification principles is included in Sections 2.1 through 2.7, Volume 4A (Filing ID A3S0Y8) and Sections 3.4.8 through 3.4.13, Volume 4B (Filing ID A3S1K5) of the Facilities Application. Numerous other references to design principles and features and quality assurance methods exist throughout Volume 4A and 4B of the Facilities Application. Trans Mountain is highly confident that these approaches will ensure that the new facilities will be able to withstand large earthquake scenarios with minimal damage or loss of integrity.

f) The accumulated volume of water from a 1 in 100 year, 24-hour duration rainfall at Burnaby Terminal is estimated to be approximately 95,000 m^3 (600,000 bbl). The volume that could collect in all of the proposed shared containment areas (without any being released during the 24-hour period) is estimated to be approximately 16,700 m^3 (105,000 bbl).

g) Refer to the response to part f) above. The proposed intermediate storm-water retention area will be sized to allow storm-water to be released from multiple secondary containment areas simultaneously. Based on the preliminary design work completed to date, the volume of the intermediate storm water retention area is estimated to be approximately 22,000 m^3 (140,000 bbl). However, as the final design of the secondary containment areas has not been completed, the exact volumes are not available.

h) Firefighting water is inherently considered in determining the secondary containment capacity for the proposed expansion at Burnaby Terminal. British Columbia Fire Code (BCFC), Clause 4.3.7.3.3, implies that the 10% marginal volume for each additional tank, included in BCFC, Clause 4.3.7.3.2.b, is intended for precipitation and firefighting water. Trans Mountain intends to utilize the elements listed below to manage firefighting water.

- Proposed shared secondary containment areas.
- Proposed partial remote impoundment area.
- Proposed intermediate storm-water retention area.
- Existing tertiary containment area.

2.131 Jet fuel facility – Westridge Marine Terminal

Reference:

i) A3S0Y8, Application Volume 4A, Project Design and Execution – Engineering, PDF page 109 of 110
ii) A3S0Y9, Application Volume 4A, Project Design and Execution – Engineering, PDF page 9 of 35

Preamble:

Reference i) states that the purpose of the Westridge Marine Terminal is to load various types of crude oil onto Aframax or Panamax class tankers or tank barges and to unload jet fuel from tankers and barges. The reference also states that, in addition to the current dock, which was constructed in 1957, the terminal has three tanks with a total volume of 62,800 cubic metres (395,000 barrels), currently used for storing jet fuel. Under the proposed Project, the current dock would be demolished and one new dock complex would be constructed with three berths, each capable of loading Aframax class vessels, and one of the berths also being capable of receiving jet fuel.

The reference further states that the Westridge Marine Terminal currently has one dock with one berth. In addition to the dock, the terminal has three storage tanks, having a total volume of 62,800 cubic metres (395,000 bbl), currently used for storing jet fuel. The jet fuel is delivered from the storage tanks to the Vancouver International Airport by Trans Mountain's affiliate, Trans Mountain (Jet Fuel) Inc.

Reference ii) establishes that Berth 1 will be fitted with one 305 millimetre (NPS 12) diameter jet fuel unloading arm.

Request:

Please provide:

a) descriptions of the existing and proposed facilities for unloading, including docks, storing, and delivering jet fuel, indicating any regulatory agencies that oversee the design, construction, and operation activities in each of the facilities;

b) the rationale for proposing new facilities under Board jurisdiction, if any, where existing facilities are not under Board jurisdiction;

c) a clearly labelled schematic for the facilities described in a); and

d) a risk assessment for the facilities described in a) that are under Board jurisdiction, which includes the design improvements, if any, that would be implemented to reduce risks.

Response:

a) The jet fuel facilities located at Westridge Marine Terminal (WMT) are not regulated by the National Energy Board. Trans Mountain is not proposing any changes to the jet fuel system at WMT as part of this application and discussion regarding the jet fuel system is being provided for information purposes only.

b) Please refer to the response to part a) above.

c) Please refer to NEB IR No. 2.131c – Attachments 1, 2, and 3 for details of the jet fuel system at Westridge Marine Terminal (WMT). Attachment 1 (NEB IR No. 2.131c – Attachment 1) shows the proposed replicated unloading system at Berth 1. Attachment 2 (NEB IR No. 2.131c – Attachment 2) shows the tie-point to the existing system and the tanks. Attachment 3 (NEB IR No. 2.131c – Attachment 3) shows the delivery system to the jet fuel pipeline.

d) A risk assessment for the replication of the existing jet fuel unloading system at proposed Berth 1 at Westridge Marine Terminal (WMT) has not been completed, given that the purpose and function of the system is unchanged. However, Trans Mountain will design and construct the replicated facilities using the same principles, standards, procedures, and practices that will be applied to the proposed new crude oil loading systems at WMT, thereby incorporating some improvements over the existing jet fuel unloading arm system. The risk assessments provided for Westridge Marine Terminal in the response to NEB IR No. 1.98 (Filing ID A3W9H9, A3W9S7, A3W9S8, A3W9T2) are applicable to the replicated jet fuel unloading system.

2.132 Westridge Marine Terminal

Reference:

A3S5F4, Application Volume 8C, TERMPOL 3.15 General Risk Analysis and Intended Methods of Reducing Risks, PDF pages 27 and 28 of 36

Preamble:

The reference states that the 3 berths are accessed by a single common access trestle, approximately 70 metres long.

The reference shows a picture of the Terminal Design Layout (Moffatt and Nichol 2013).

The reference also explains that, to reduce the risk of accidents at segment 1 and 2, only one tanker at a time will be escorted by tugboats to or from the jetty.

Request:

Please provide:

a) the basis for determining the single common access trestle length of 70 metres; and

b) the considerations and provisions in the marine terminal design to avoid the following three scenarios:
   - b.1) if an unexpected disconnection were to occur in Berth 1, the inner tanker at Berth 1 might turn, move toward the shore and come in close proximity of the onshore facilities;
   - b.2) if a fire were to occur on one tanker while two tankers are loading side by side at Berth 1 and Berth 2 simultaneously, and there is an unfavourable wind blowing from the on-fire tanker towards the other tanker; and
   - b.3) if an incident caused three tankers to be released from the dock at the same time.

Response:

a) The 70 m length of the proposed common access trestle at Westridge Marine Terminal (WMT), from edge of the proposed shoreline to the “Y” junction where the trestle splits into two, was determined once the preferred berth locations and orientations were established as described in Section 3.4.4.1.4, Volume 4A of the Facilities Application (Filing ID A3S0Y9). The locations, orientation, dimensions, and connectivity of the structural elements, such as the trestles, were established within the constraints of the preferred berth positions and considering the efficiency of the overall design. The length and orientation of the common access trestle is expected to change somewhat as further design evolution and optimization occurs.

b.1) It is the existing practice at Westridge Marine Terminal (WMT) to ensure that vessels are securely moored at all times. Trans Mountain intends to continue this practice after the proposed expansion. Given the well established principles and methods that will be used in the design of the WMT mooring systems, and the operational procedures that exist and

will be extended to the expanded operation, it is extremely unlikely that an unexpected release of a vessel could occur. Key safeguards which will ensure against the possibility of the simultaneous release of all mooring lines are discussed below.

- The mooring system will be designed in accordance with Oil Companies International Marine Forum (OCIMF) Mooring Equipment Guidelines as well as other recognized standards and guidelines, as applicable. The system will be commissioned with the assistance of the vendor and will be subject to a comprehensive maintenance program to ensure proper functioning at all times.

- Vessels berthed at WMT will be required to follow marine industry best practices, which include ensuring that mooring equipment, including winches and lines, is well maintained and that winch brakes have been tested and adjusted (if required) at regular intervals. Verification will be carried out by the Loading Master, during the initial screening of nominated vessels, as part of the Tanker Acceptance Standards.

- Mooring lines will be properly tensioned, with the load shared between lines running in common directions, and the winch brakes will be manually tightened. Verification will be carried out by the Loading Master as part of the completion of the Ship/Shore Safety Checklist.

- The mooring lines will be monitored, both visually and using the line load monitoring and management system, as the vessel's freeboard changes due cargo transfer and the vessel rises or falls with the tide. Close liaison will be maintained between the Loading Master, the vessel crew, and WMT operations personnel.

- The ability to use anchors will be maintained at all times. There are no pipeline or cable crossings in the immediate vicinity of WMT that could cause concern about anchor use.

- Given the frequency of vessel movements at WMT there may be a berthing tug at the utility berth or in close proximity to WMT, available to assist if required.

Given the typically benign weather conditions at WMT, it is extremely unlikely that weather factors could cause mooring failure. In addition, passing cargo vessels are required to maintain low speeds, minimizing wave action at WMT.

In extremely unlikely case of the failure of all of the mooring safeguards and mitigation measures, the most likely scenario is that a drifting vessel would ground on the foreshore slope before any part of its hull could cross the shoreline. The on-shore facilities will be set well back from the shoreline, providing an added measure of protection. In addition, a double-hull vessel, drifting the short distance from Berth 1 to the foreshore slope, would not ground with enough force to cause an oil spill.

In conclusion, Trans Mountain does not foresee any credible scenario in which a vessel could contact or compromise the integrity of the on-shore facilities.

b.2) Given the degree of fire prevention and mitigation incorporated into the design and operation of modern tankers, the possibility of a fire onboard that could be a significant cause for concern to an adjacent vessel is remote. Vessels at Berths 1 and Berth 2 will be separated by approximately 80 m. Various risks, including vessel fires, will be assessed during HAZOP reviews to be carried out in the detailed engineering and design phase and contingency plans will be developed, as appropriate. In addition, Trans Mountain notes the following:

- Vessels at Berths 1 and Berth 2 will be separated by approximately 80 m.
- The prevailing winds in Burrard Inlet flow east-west (predominantly easterly) with more westerly winds during summer.
- If a fire occurs on a vessel at Berth 1, loading operations at Berth 2 will be immediately suspended.
- While one option is to remove a vessel on fire from her berth, contingency planning considerations for Berth 1 and Berth 2 will include the potential removal of the adjacent vessel first.

b.3) Refer to the response to NEB IR No. 2.132b.1. Based on preliminary logistical analysis completed to date, Trans Mountain anticipates that there may be three vessels simultaneously moored at WMT only 40% of the time. Given the robustness of the mooring systems described, Trans Mountain does not consider a scenario where three vessels are simultaneously released from their berths to be credible.

2.133 Pipeline abandonment

Reference:

i) A1K6I7, Principles for the End State of Land Post-Retirement and Next Steps – Attachment 1, PDF page 4 of 9
ii) A3F4F3, MH-001-2012 Reasons for Decision – Abandonment Cost Estimates, PDF Page 77 of 126
iii) A3X4G5, MH-001-2013 Reasons for Decision – Set-Aside and Collection Mechanisms, PDF page 121 of 176
iv) A3S1L1, Application Volume 4C, Project Design and Execution – Operations and Maintenance, PDF page 73 of 102

Preamble:

Reference i) sets out the Board's abandonment principles, one of which is that a company should involve stakeholders in the development of abandonment plans.

In Reference ii), the Board encouraged applicants to actively consult landowners and landowner associations well in advance of the next review of their cost estimates and throughout the pipeline lifecycle.

Reference iii) sets out the Board's direction to Group 1 companies, including Trans Mountain, to file preliminary abandonment plans.

In Reference iv), Trans Mountain indicates that a comprehensive stakeholder engagement program on the application for abandonment would occur at the time of abandonment, which Trans Mountain expects would be in more than 50 years.

Request:

Please provide a planning process for the abandonment plan that includes stakeholder consultation throughout the lifecycle of the Project..

Response:

Refer to Section 12.3, Volume 4C of the Application for the Preliminary Abandonment Plan.

In MH-001-2012 Reasons for Decision, the Board required companies to create specific landowner communication programs regarding their collection and set-aside mechanisms. Trans Mountain has not yet developed its communication plans for abandonment for its existing line. Trans Mountain will finalize its communication program by Q2 2015 related to the existing line. The program will include the areas identified by the Board, and will at a minimum address:

- consultation with landowners on how they prefer to receive ongoing communication with respect to abandonment funding;
- Education material related to abandonment;
- Phases of the communication program and what to expect next;

- Annual updates on the status of funds collected;
- Trans Mountain will conduct communication throughout the life of the system;
- Planning for the long term and next steps including the identification of, if any, facilities that are being considered for abandonment; and
- A detailed engagement program would be developed and implemented, at such time as a pipeline or facility is anticipated to be subject to abandonment.

Trans Mountain intends to follow this same plan for the expanded pipeline, if approved.

Summary of New Commitments:

- Trans Mountain is committed to ongoing communication throughout the life of the system. Trans Mountain will finalize and file its communication program by Q2 2015.
- A detailed stakeholder engagement program will be developed and implemented, at such time as a pipeline or facility is deemed to be appropriate for abandonment.

2.134 Change in operating conditions

Reference:

i) A3S0Q7, Application Volume 1, Summary, PDF page 67 of 113
ii) A3W9H9, Trans Mountain response to Board IR No. 1, IR 1.87, PDF page 22 of 62

Preamble:

Reference i) states that the new pipe segments and two existing active pipeline segments on Trans Mountain's system will be combined to create Line 2. The two existing active pipeline segments are:

- 151 kilometres long, 914 millimetre outside diameter (NPS 36), from Hinton, Alberta, to Hargreaves, British Columbia, built in 2008; and
- 43 kilometres long, 762 millimetre outside diameter (NPS 30), from Darfield to Black Pines, British Columbia, built in 1957.

Reference ii) states that there will be no pressure upgrade involved in the incorporation of the two existing active pipe segments into Line 2. Nevertheless, as with any operating pipeline, any change in operating condition (such as a change in throughput, which may influence potential outflow volume) will be reflected in the regular re-evaluation of risk.

Request:

For the two existing pipeline segments in Reference i), please provide:

a) copies of the following documents:
   a.1) the original design basis memorandum or, if not available, an equivalent document; and
   a.2) if applicable, any subsequent updates to the requested document in a.1);

b) taking into consideration the documents in a), a discussion of how the original design of the existing segments meets the design requirements of Line 2;

c) the following pressure profile diagrams (pressure versus time):
   c.1) daily maximum pressures for the last 90 days;
   c.2) daily maximum pressures for the last year;
   c.3) monthly maximum pressures for the last three years; and
   c.4) monthly maximum pressures since operation started;

d) confirmation that Trans Mountain has conducted an engineering assessment to demonstrate that the two existing segments are suitable for operation under the new hydraulic profiles, flow, and pressure regimes; and

e) the date of the engineering assessment stated in d).

Response:

a) Attached (NEB IR No. 2.134a – Attachment 1) is the original DBM for the NPS 36 pipeline which includes the Hinton, Alberta to Hargreaves, British Columbia sections of pipeline. No updates since the segment initiated operation have been made to this document.

   The NPS 30 Darfield to Black Pines was constructed in 1957 and a DBM is not available. Trans Mountain is committed to provide an engineering assessment to demonstrate serviceability of the pipeline segment for Line 2 service. Please refer to the response to NEB IR No 2.134d.

b) Trans Mountain will provide a discussion of how the original design of the existing segments meets the requirements of Line 2 as part of the engineering assessment to be filed as part of Technical Update No. 2. Please refer to the response to NEB IR No. 2.134d for additional information.

c) Trans Mountain will provide the requested information as part of the engineering assessment for the referenced segments of pipeline. Please refer to the response to NEB IR No. 2.134d.

d) Trans Mountain will file an engineering assessment as part of Technical Update No. 2 August 22, 2014. The assessment will include the information requested in NEB IR No. 2.134a, 2.134b, and 2.134c.

e) Please refer to the response to part d) above.

Summary of New Commitments:

- Provide the pressure profile diagrams as part of the engineering assessment for the referenced segments of pipeline (refer to NEB IR No. 2.134d).

- Provide an engineering assessment as part of the August 22, 2014 Technical Update No. 1 including all of the information requested in NEB IR No. 2.134a, 2.134b, and 2.134c.