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National Energy Board Report

Trans Mountain Expansion Project

May 2016





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May 2016

OH-001-2014

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Prologue







Whenever I ride a ferry through the coastal waters of the Salish Sea between Victoria and Vancouver, or travel over the Coquihalla and across the prairies and forests of Alberta and B.C., the beauty of the environment that I am privileged to live in and share with so many others overwhelms me. I am humbled by the responsibility we all share to ensure the protection of the beauty of this country for future generations.

As a member of the Panel reviewing the Trans Mountain Expansion Project (Project) application, I have listened to Aboriginal groups, individuals, governments, organizations and companies who have shared their concerns for the protection of the land and waters throughout Alberta and B.C., and to those who seek better lives for themselves, their families and their communities through the creation of jobs and economic development. When I reflect on the vast amount of evidence that has been placed in front of us, both in writing and orally, the implications of the decisions and recommendations to be made weigh heavily.

As one of three Panel Members assessing this Project, I have considered what would occur if there was an incident resulting in an oil spill. Together with my fellow Panel Members, I have done all I can to protect the environment and keep people and communities safe. I have also considered the opportunities for Canadians from this Project.

This National Energy Board Report (Report) contains the Board's recommendation and decisions, and the reasons that support them.

David Hamilton
Panel Chair







We are the three Board Members – David Hamilton, Phil Davies and Alison Scott – assigned to oversee the review of this application on behalf of the National Energy Board (also referred to as the Board or the NEB).

This has been a long and demanding process for everyone involved. We recognize the dedication that has been required to participate. We have heard, and understand, the concerns that some participants have expressed, and appreciate their efforts to provide meaningful input.

We have heard from participants orally, and we have reviewed tens of thousands of pages of evidence, including answers to questions about evidence. During the course of this hearing, we heard from many of the 1,600 participants on what mattered to them. We heard their passionate and personal stories, many opposing and some supporting the Project.

We have reviewed and considered the opinions about the Project's impacts on the economy, the environment, Aboriginal traditional use of lands and waters, and the social fabric of communities and Canada. We heard that some people are fearful for the safety of their children and communities in the event of an oil spill. We heard about the deep-felt worry that the water will be contaminated, affecting drinking water, fish and animals. We heard concerns that people will be unable to use and enjoy the land and air because of possible spills and air emissions. We also heard from companies, unions, Aboriginal groups and organizations representing working people who said the Project would provide jobs and economic opportunities.

We acknowledge the contribution of our expert staff of highly skilled professionals, including engineers, emergency response specialists, environmental specialists, economists, financial analysts, safety specialists, social scientists and legal counsel who assisted in the review and analysis of the application, including the proposed plans and systems.

Finally, we acknowledge all that we have heard and read. The input we received from participants aided us greatly as we wrestled with the important question of whether this Project is in the public interest of Canadians. The following Report reflects our reasons and recommendations based on the evidentiary record and this input.

Our recommendation report – a roadmap for readers

The opening chapters of our Report provide an overview of the Project and our hearing process. The chapters contain a summary of our mandate and how we made our public interest determination, and then provides our Recommendation to the Governor in Council.

The technical analysis and considerations start in Chapter 4. All of the evidence filed on the Board's public registry for this hearing[1] or provided orally by Aboriginal groups was assessed in detail by the Panel and the Board's expert technical staff. This included all filed evidence, responses to information requests, oral traditional evidence and letters of comment. Not all of this evidence could be referenced in our Report but we carefully considered all of it. In instances where a number of intervenors made the same or similar points, we have not attempted to list all such intervenors in the Report.

We have endeavoured to include cross-references within the Report chapters and sections when a topic is dealt with in more than one chapter or section. Where we use acronyms, these are defined when they first appear in each chapter.

1 All of the documents filed in this hearing (listed in chronological order under those that filed the document) can be found at the following location on our website (navigating from our homepage): View Regulatory Documents > Facilities > Oil > Trans Mountain Pipeline ULC > 2013 Applications > 2013-12-16 - Application for Trans Mountain Expansion Project (OH-001-2014).

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Summary of Recommendation





Canadian public interest

The National Energy Board (NEB or Board) finds that the Trans Mountain Expansion Project (Project) is in Canada's public interest, and recommends the Governor in Council (GIC) approve the Project and direct the Board to issue the necessary Certificate of Public Convenience and Necessity (CPCN) and amended CPCNs. Should the GIC approve the Project, the associated regulatory instruments (Instruments) issued by the Board would come into effect.

Should the GIC approve the Project, the Board considers it necessary that the CPCNs and Instruments be subject to 157 conditions.[2] These conditions would address issues such as safety, protection of the environment and other considerations that are identified throughout this NEB Report.

To set the context for its recommendation, the overarching consideration for the Board's public interest determination was: can this Project be constructed, operated and maintained in a safe manner. The Board found the Project would meet this threshold.

While this initial consideration was fundamental to the Board's determination, a finding that a pipeline can be constructed, operated and maintained in a safe manner does not mean it is necessarily in the public interest - there are other considerations that the Board must weigh in coming to its public interest determination, as discussed below. However, the analysis would go no further if this fundamental question were to be answered in the negative; an unsafe pipeline can never be in the public interest.

If constructed, the Project would approximately triple the capacity of the Trans Mountain Pipeline system in Western Canada. Together, the current and expanded pipeline would ship oil from Edmonton, Alberta, to Burnaby, British Columbia. At that point, oil would be loaded on to tankers at the Westridge Marine Terminal (WMT) for export to Washington State, California and Asia.

A full description of the Project is provided in Chapter 1 of the NEB Report, but it is important to note that marine shipping beyond the WMT is not part of the Project and is not within the Board's regulatory jurisdiction. Other governmental departments and agencies are charged with those responsibilities.

Environmental assessment

The Board completed a comprehensive environmental assessment of the Project in accordance with its authority under the *National Energy Board Act* (NEB Act) and the *Canadian Environmental Assessment Act, 2012* (CEAA 2012). Although marine shipping is not regulated by the Board, as part of its overall public interest determination under the NEB Act, the Board considered the potential environmental and socio-economic effects of Project-related marine shipping. This included the potential effects of accidents or malfunctions.

2 Conditions are found in the NEB Report, Appendix 3.

Over 85 per cent of the pipeline route for the Project parallels existing disturbances, including the right-of-way for Trans Mountain's existing pipeline. This is important as it reduces the requirements for new right-of-way disturbance, minimizes the potential impacts of construction, and reduces effects on nearby residents and communities. While much of the route parallels existing disturbances, this is not always the case in urban areas.

With the implementation of Trans Mountain's environmental protection procedures and mitigation, and the Board's recommended conditions, pursuant to its authority under the CEAA 2012, the Board finds that the Project is not likely to cause significant adverse environmental effects. However, effects from the operation of Project-related marine vessels would contribute to the total cumulative effects on the Southern resident killer whales, and would further impede the recovery of the Southern resident killer whale population, an endangered species that lives in the Salish Sea. Therefore, pursuant to its authority under the NEB Act, the Board finds that the operation of Project-related marine vessels is likely to result in significant adverse effects to the Southern resident killer whale, and that it is likely to result in significant adverse effects on Aboriginal cultural uses associated with these marine mammals.

The Board is mindful that Project-related marine vessels would follow an established shipping route that currently has high volumes of vessel traffic and that, even if the Project does not proceed, the intensity of commercial and recreational traffic along the shipping route is predicted to increase in the future. The Board is encouraged by current initiatives being undertaken by Trans Mountain, Fisheries and Oceans Canada, and other organizations to support the recovery of the Southern resident killer whales.

The Board also considered greenhouse gas emissions from the Project and from Project-related marine vessel traffic. The Board would impose a condition requiring Trans Mountain to develop an offset plan for the Project's construction-related greenhouse gas emissions. The intent of the offset plan would be to confirm that there are no net greenhouse gas emissions from the Project construction.

The Board also took into consideration the likelihood and potential consequence of a spill from the Project or from a Project-related tanker. The Board found that while the consequences of large spills could be high, the likelihood of such events occurring would be very low given the extent of the mitigation and safety measures that would be implemented.

Aboriginal interests

The Board's process is designed to be thorough and accessible to Aboriginal groups so that they may make their concerns known to the Board on potential impacts on their interests, and have those concerns considered and addressed. The Board interprets its responsibilities under the NEB Act in a manner that is consistent with the *Constitution Act, 1982*, including section 35(1), which recognizes and affirms the existing Aboriginal and treaty rights of Aboriginal peoples.

Having considered all the evidence submitted in this proceeding, the consultation undertaken with Aboriginal groups, the impacts on Aboriginal interests, the proposed mitigation measures, including conditions to minimize adverse impacts on Aboriginal interests, and Trans Mountain's commitments to and Board-imposed requirements for ongoing consultation, the Board is satisfied that its recommendation and decisions with respect to the Project are consistent with section 35(1) of the *Constitution Act, 1982*.

The Government of Canada has stated that there will be additional consultation following the issuance of this Report.

Should the Project proceed, the Board would impose conditions requiring Trans Mountain to continue its consultation with potentially affected Aboriginal groups throughout the life of the Project. Those conditions would require Trans Mountain to report to the Board on its consultation with Aboriginal groups during construction and through the first five years of operations, among other things. This consultation would include the development of a number of plans related to environmental protection and emergency response programs.

Weighing Project-related benefits and residual burdens

The following two tables summarize the key benefits and residual burdens of the Project and Project-related marine shipping. Each table indicates whether a benefit or burden would apply locally (e.g., within the immediate vicinity of the Project such as a municipality along the route), regionally or nationally.

The Board finds that the benefits associated with the Trans Mountain Expansion Project, taken as a whole, are considerable.

Benefits associated with:	Brief description	Type of impact	Report chapter(s)
Market diversification	The Board finds there would be a **considerable** benefit gained by providing Canadian shippers with more flexible and diverse markets, the ability to manage risk associated with competing in multiple markets, the ability to manage development and operational risk, and a likely reduction of discounts to Canadian crude.	Regional National	12
Jobs	The Board finds a **considerable** benefit in the form of jobs created across Canada: • Pipeline construction - 400-600 workers per spread • Tank construction - between 60 and 370 workers • Westridge Marine Terminal construction - 95 workers • Over the first 20 years of operation – 443 jobs/year (313 in B.C., with remainder in AB)	Local Regional National	11
Competition among pipelines	The Board finds a **considerable** benefit would be gained from the increase in flexibility and optionality for those producers looking to get their product to markets, and that all western Canadian producers are likely to benefit from the Project in the longer term, through greater customer choice and efficiencies gained through competition among pipelines.	Regional National	12
Spending on pipeline materials	The Board finds there would be a **considerable** benefit to local and regional economies from the direct spending on pipeline materials in Canada and spending within the regions where the Project is located.	Local Regional	11
Community Benefit Program	The Board finds a **modest** benefit to local communities and the environment along the Project from the establishment of a Community Benefit Program, including: • local emergency management capacity enhancements; • improvements to community parks and infrastructure; • support for events and educational programs; and • Environment Stewardship Program.	Local Regional	10 11
Enhanced marine spill response	The Board finds there would be a **modest** benefit from the enhanced marine spill response planning for and capacity to respond to spills from vessels not associated with the Project (e.g., fuel spills from container ships and cruise ships).	Local Regional	14
Capacity development	The Board finds that a **modest** benefit from local economic and educational opportunities, and the development of capacity of local and Aboriginal individuals, communities and businesses.	Local Regional	11
Government revenues	The Board finds that direct Project expenditures will likely result in **considerable** revenues to various levels of government.	Local Regional National	11

A number of concerns are identified in this NEB Report. Many of the issues underlying these concerns can be mitigated, and the Board assessed and weighed the likely success of potential mitigation options in reaching its recommendation. Other mitigation would be found in the commitments from Trans Mountain and through conditions that the Board would attach to the new CPCN, amended CPCNs and Instruments. Nevertheless, some impacts or residual burdens remain, and they must be considered and weighed in the Board's recommendation under Part III of the NEB Act.

Burdens associated with:	Brief description	Type of impact	Report chapter(s)
Southern resident killer whales	The Board finds that the operation of Project-related marine vessels would likely result in **significant** adverse effects to the Southern resident killer whale. Although the effects from Project-related marine vessels on the Southern resident killer whale would be a small fraction of the total cumulative effects, the Board recognizes that the increase in Project-related marine vessels would further contribute to cumulative effects that are already jeopardizing the recovery of the Southern resident killer whale.	Local Regional National	14
Aboriginal cultural use associated with Southern resident killer whales	The Board finds that that the operation of Project-related marine vessels would likely result in **significant** adverse effects on Aboriginal cultural use associated with Southern resident killer whales. The Board acknowledges concerns raised by a number of Aboriginal groups about the social and cultural effects that would result from impacts of Project-related marine shipping on the Southern resident killer whale.	Local Regional	14
Marine greenhouse gas emissions	The Board finds that greenhouse gas emissions from Project-related marine vessels would likely be **significant**. Given that there are no regulatory reporting thresholds or specific requirements for marine greenhouse gas emissions in Canada, and that the modelled emissions would result in measurable per cent increases, the magnitude of these emissions is high. While the Board understands that emissions from Project-related marine vessels would be a small percentage relative to Canadian greenhouse gas emissions, the Board finds the greenhouse gas emissions from Project-related marine vessels are likely to be significant.	Regional National	14
Municipal development plans	The Board finds that the Project may pose a **modest** burden on municipalities with respect to potentially constraining future plans for municipal development. There is the potential for reduced flexibility and/ or additional municipal time constraints with respect to planned or possible future municipal projects that may be impacted by the Project.	Local	11
Aboriginal groups' ability to use the land and water during construction and operation	The Board finds that there would be **modest** burdens sustained by Aboriginal groups as their ability to use the lands, waters and resources for traditional purposes would be temporarily impacted by construction and routine maintenance activities, and that some opportunities for certain activities such as harvesting or accessing sites or areas of traditional use would be temporarily interrupted. For activities directly affected by the WMT, the Board finds that these effects would persist for the operational life of the Project, as traditional activities would not occur within the expanded water lease boundaries. The Board finds that while the effects would be long term in duration, they would be reversible in the long term and would be confined to the water lease boundary for the WMT.	Local	11
Landowners' and land users' ability to use the land and water during construction and operation	The Board finds that there would be **modest** burdens sustained by landowners and land users as their ability to use the land and water would be affected by construction and routine maintenance activities during operations. Construction and routine maintenance activities will cause temporary, limited effects on recreational and commercial hunting, fishing, agricultural practices and access to property, and will cause nuisance disturbance, such as noise.	Local	11
Project spill (i.e., from pipeline, tank terminals, pump stations, or Westridge Marine Terminal)	The Board finds that there is a very low probability of a Project spill (i.e., from pipeline, tank terminals, pump stations, or WMT that may result in a significant effect (high consequence). The Board finds this level of risk to be **acceptable**.	Local Regional	2 9 10 11
Spill from a Project-related tanker	The Board finds that there is a very low probability of a marine spill from a Project-related tanker that may result in a significant effect (high consequence). The Board finds this level of risk to be **acceptable**.	Local Regional	2 14

The task of balancing Project-related benefits versus residual burdens was difficult. Many of the benefits would be national or regional in scope, fewer strictly local. With respect to the residual burdens, the reverse would be true: local and regional communities would shoulder the larger share.

In weighing the benefits and residual burdens, the Board placed significant weight on the economic benefits of the Project, many of which would be realized throughout Canada, particularly in British Columbia, Alberta, Ontario and Quebec. This national perspective was critical in the Board's finding the Project would be in the Canadian public interest.

Board-imposed conditions

Trans Mountain formally committed to specific measures to mitigate Project-related risks and, should the GIC approve the Project, the Board would attach 157 conditions to the CPCNs and Instruments that cover a wide range of matters, including:

- safety and integrity of the pipeline;
- emergency preparedness and response;
- protection of the environment;
- ongoing consultation with those affected, including Aboriginal communities;
- socio-economic matters;
- affirmation of commercial support for the Project prior to construction; and
- financial responsibility.

Lifecycle regulation

When Trans Mountain filed its Project application, it commenced an initial phase of the Project's regulatory lifecycle. While the Board made a finding that Trans Mountain's application was complete, the Project application was not at the detailed engineering phase that leads to the final design. This was of concern to a number of participants who felt that the Board lacked critical information on which to found its Recommendation.

At this early stage in the regulatory lifecycle, the Board does not require final information about every technical detail. Rather, the information available to the Board must be sufficient to allow it to make a recommendation to the GIC that the Project is or is not in the public interest, and adequate to allow the Board to craft conditions that would attach to the CPCNs and Instruments should the GIC approve the Project.

If the GIC directs the Board to issue the CPCNs, before Trans Mountain may begin construction, it would first have to satisfy the Board that it has complied with a number of specific conditions and, once constructed, Project operations could not commence until Trans Mountain met a number of additional conditions.

After operations commence, Trans Mountain would be subject to the continuing regulatory oversight of the NEB throughout the lifecycle of the Project. Trans Mountain would be accountable for meeting the Board's requirements that the Project be operated and maintained to ensure safety, and protect people, communities and the environment.

Recommendation

The Board finds that the Project is in Canada's public interest, and recommends the GIC approve the Project and direct the Board to issue the necessary CPCN and amended CPCNs. Should the GIC approve the Project, the associated Instruments issued by the Board would come into effect.



D. Hamilton
Presiding Member

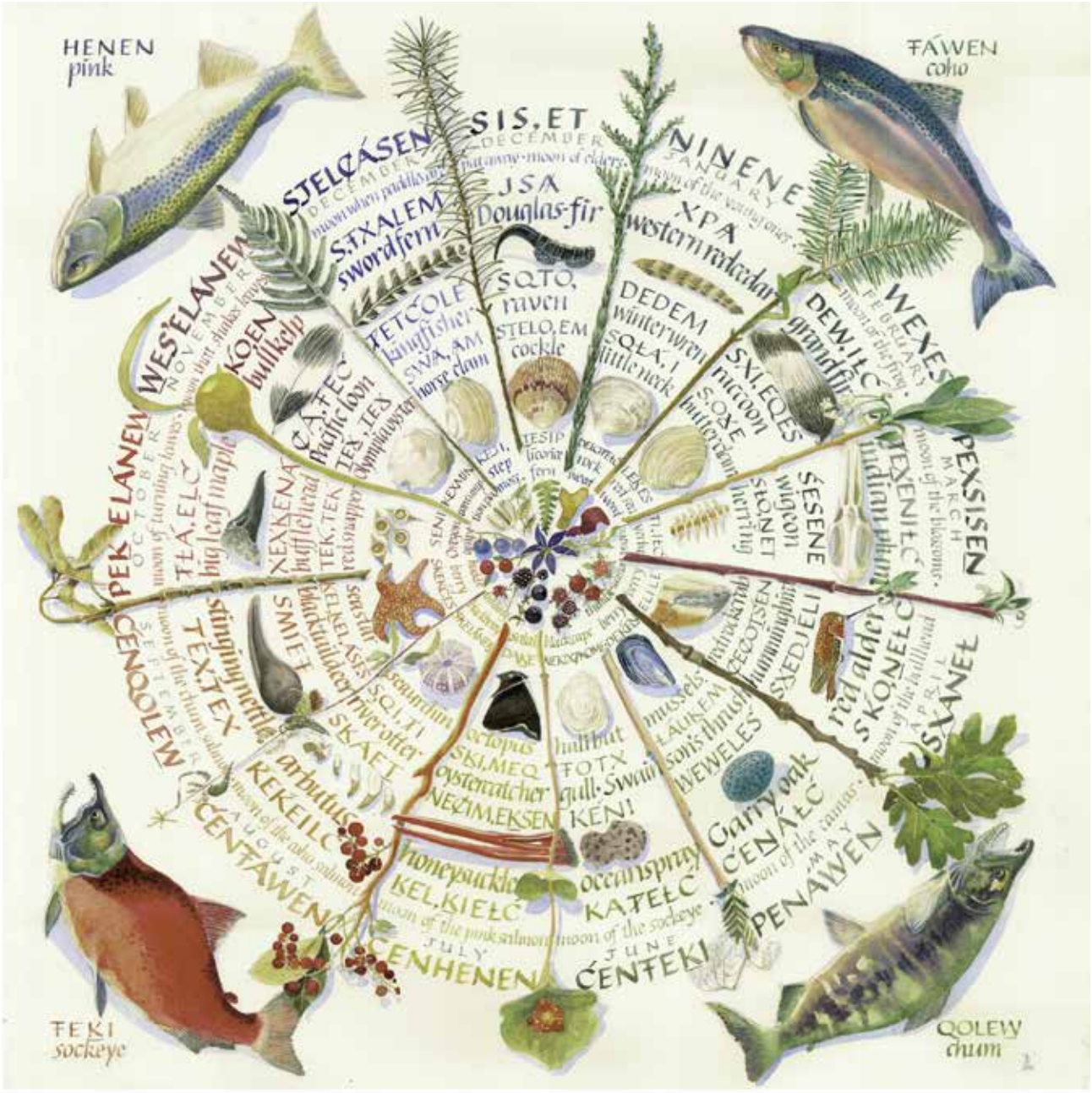


P. Davies
Member



A. Scott
Member

Traditional 13 moon W SÁNEĆ Calendar, artist Briony Penn, copyright Tsawout First Nation.



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The Board's review of the Trans Mountain Expansion Project

1.1 The Application

1.1.1 The Project

On 16 December 2013, Trans Mountain Pipeline ULC (Trans Mountain) submitted an application (Application) to the National Energy Board (NEB or Board) for a Certificate of Public Convenience and Necessity (CPCN) and other requested relief to construct and operate the Trans Mountain Expansion Project (Project).

In its Application, Trans Mountain said that it had received many requests from its shippers over the past few years to increase the capacity of the existing Trans Mountain Pipeline (TMPL) system. This pipeline is currently the only major pipeline route for Western Canadian producers who want to ship oil to the west coast of Canada. The pipeline ships oil from Edmonton, AB to Burnaby, B.C. At that point, oil is loaded onto tankers at the Westridge Marine Terminal (WMT) for Pacific Rim destinations, such as Washington State, California, and Asia.

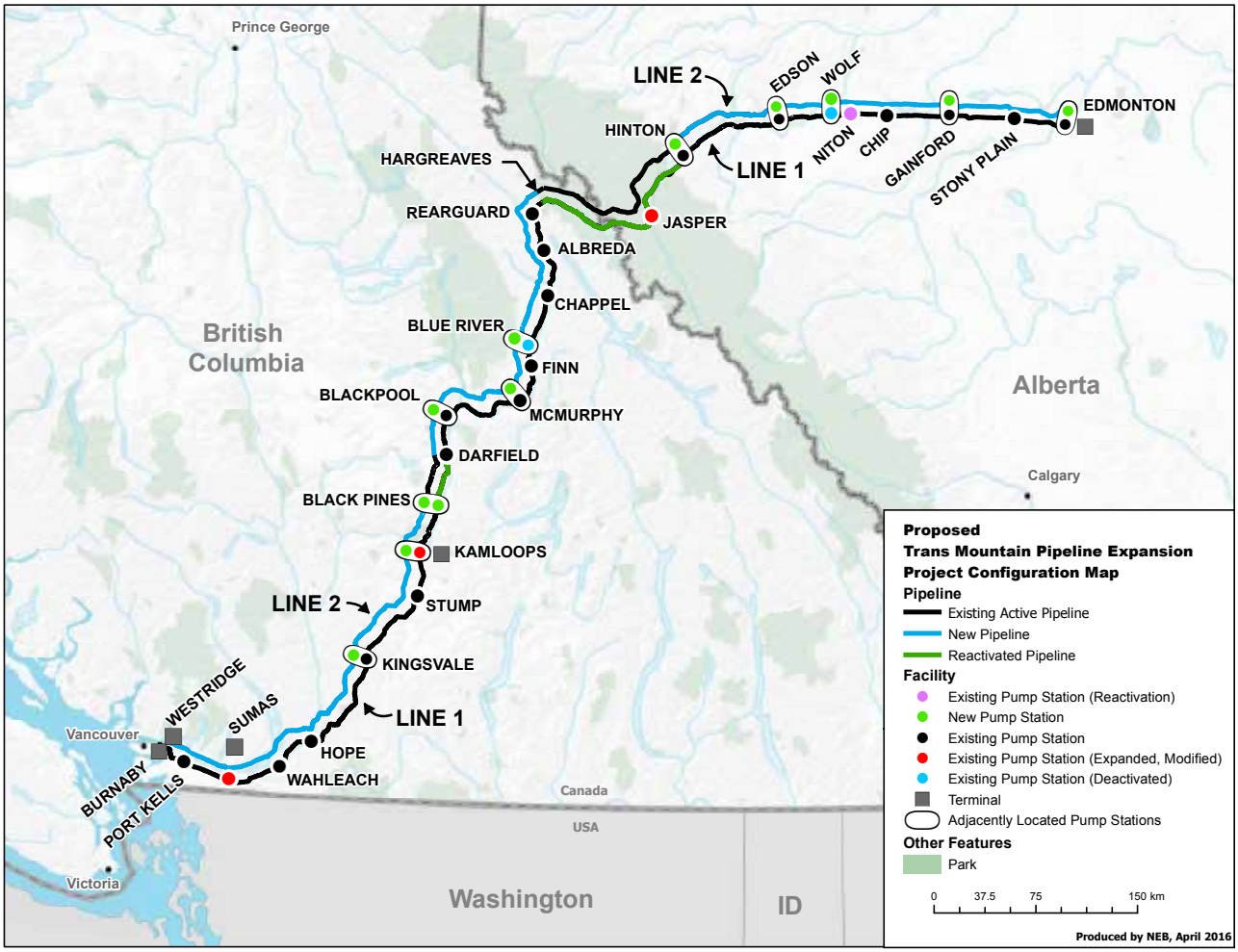
The Project would result in the looping (or twinning) of the existing 1 147 km TMPL system between Edmonton and Burnaby with about 987 km of new buried pipeline. Most of the existing pipeline, along with two reactivated pipeline segments, would become Line 1. The proposed new pipeline segments, along with two currently active pipeline segments, would become Line 2, as shown below in Figure 1.







Figure 1: Project map



The Project would increase the capacity of the existing TMPL system from 47 690 m³/d (300,000 bbl/d) to 141 500 m³/d (890,000 bbl/d) of crude petroleum and refined products.

Currently, Panamax tankers (less than 75,000 metric tonnes deadweight tonnage (DWT)) and Aframax tankers (75,000 to 120,000 metric tonnes DWT) call at the WMT. The existing WMT typically loads five tankers per month. The proposed expanded system associated with the Project would increase the WMT's loads to approximately 34 Aframax class vessels per month, with actual demand driven by market conditions.

Additional technical details about the Project can be found in Appendix 4.

1.1.2 Informing and engaging the public

Participation by those members of the public who are either directly affected or have relevant information or expertise is one means of identifying potential and real impacts of a project. The Board required Trans Mountain to contact anyone who lives, works or uses land and resources along the proposed pipeline route. The Board also took a number of steps, beginning before the Application was received, to ensure that those who could be potentially affected by the Project were aware of it and knew how they could get involved in the review (see Appendix 5). Full details of the application to participate notification are contained in the Board's letter to Trans Mountain, dated 31 December 2013.

It is not unusual for hearing participants to be unfamiliar with how the NEB carries out its reviews. For a major project such as this one, the Board assigns a Process Advisory Team to help participants understand the hearing process and decide how best to participate.

1.1.3 Identifying affected people and experts for involvement in the hearing

The *National Energy Board Act* (NEB Act), section 55.2 states:

> *On an application for a certificate, the Board shall consider the representations of any person who, in the Board's opinion, is directly affected by the granting or refusing of the application, and it may consider the representations of any person who, in its opinion, has relevant information or expertise.*

The Board decides for each hearing whether to grant participation rights to any person and, if granted, the appropriate method of participation. In addition, if it is the Board's opinion that a person has relevant information or expertise about the environmental assessment required under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), the Board must provide that person with an opportunity to participate. Full details of the Board's ruling on participation are found in the Board's ruling of 2 April 2014.

The Board recognizes that good decisions and recommendations consider the thoughts, views and opinions of directly affected people and those with a broad range of relevant information or expertise. Participants for this Project's hearing could apply to:

- write a letter of comment (commenter); or
- become an intervenor.

A letter of comment gives the writer an opportunity to express his/her knowledge, views or concerns about a project. These letters are considered evidence in the proceeding. People who wrote letters of comment in this hearing could not ask questions about other participants' evidence or make final argument, nor were they asked questions about their letters.

Intervenors could file evidence, submit notices of motion, and ask questions of Trans Mountain and other intervenors. They also had the opportunity to provide final written and oral argument. The Board, Trans Mountain and other intervenors could also ask them questions about their evidence.

Full details about participation in the hearing are set out in the Board's Hearing Order OH-001-2014, dated 2 April 2014. Additional rules regarding hearing participation are contained in *National Energy Board Rules of Practice and Procedure, 1995.*

More details about the process and participation are provided in the hearing timeline in Appendix 5.

1.1.4 Providing financial assistance

Public participation is an important element of an open and balanced regulatory process. To facilitate public involvement, the NEB is responsible for a Participant Funding Program (PFP), a transfer payment program independent from the regulatory review process. The objective of the PFP is to provide funding to facilitate the participation of Aboriginal groups, landowners, individuals and groups, associations and not-for-profit organizations.

On 22 July 2013, the NEB announced it would make $1.5 million available to eligible intervenors to participate in the Trans Mountain Expansion Project hearing. Some intervenors raised concerns that the PFP process took too long and given the large number of intervenors requesting funding, the level of funding was not sufficient. While the decisions on who received participant funding, how much, and the timing of those decisions were entirely separate from the regulatory hearing process, the Board notes the funding envelope was increased to $3 million on 16 July 2014. There was also special participant funding offered in September 2015 for up to $10,000 per applicant to cover eligible replacement evidence. In total, the PFP offered funding valued at $3,085,370 to 72 eligible intervenors; 79 per cent of this funding was offered to Aboriginal groups.

Awards are announced in the Participant Funding Report on the NEB website. For more information about the PFP or to see the Participant Funding Report, go to http://www.neb-one.gc.ca/pfp.

1.2 The hearing process

Public hearing processes are designed individually and independently by the Board based on the specific circumstances of the application. Each process is designed to provide for a fair hearing. Through the Board's *Rules of Practice and Procedure, 1995* and the Filing Manual, the Board provides specific details about what information is required to be filed in regard to any application to build and operate a new pipeline.[3] The List of Issues (Appendix 1) provides an outline of the issues that would be considered by the Board during the hearing.

For the Board's review of the Project application, the hearing had significant written processes as well as oral components. With the exception of oral traditional evidence described below, evidence was presented in writing, and testing of that evidence was carried out through written questions, known as Information Requests (IRs). Intervenors submitted over 15,000 questions to Trans Mountain over two major rounds of IRs. Hundreds of other questions were asked in six additional rounds of IRs on specific evidence. If an intervenor believed that Trans Mountain provided inadequate responses to its questions, it could ask the Board to compel Trans Mountain to provide a more complete response. Trans Mountain could do the same in respect of IRs it posed to intervenors on their evidence. There was also written questioning on various additional evidence, including supplemental, replacement, late and Trans Mountain's reply evidence.

The Board decided, in its discretion in determining its hearing procedure, to allow testing of evidence by IRs and determined that there would not be cross examination in this hearing. The Board decided that, in the circumstances of this hearing where there were 400 intervenors and legislated time limits, and taking into consideration the technical nature of the information to be examined, it was appropriate to test the evidence through written processes. In the final analysis, the written evidence submitted was subjected to extensive written questioning by up to 400 participants and the Board.[4] The Board is satisfied that the evidence was appropriately tested in its written process and that its hearing was fair for all parties and met natural justice requirements. Comments about process provided in this hearing will be passed on for the consideration of future Board panels.

With the participation of approximately 400 intervenors and 1,250 commenters, the Board received evidence from those with first-hand knowledge and understanding about the specific circumstances along the corridor. This is why holding the public hearing was so valuable to the Board.

Over 1,600 participants in the hearing, including Aboriginal people, businesses, communities, landowners, individuals and non-government and government organizations, had the opportunity to provide evidence about specific considerations that the Board took into account when coming to its recommendation. While not all those who were granted participation status participated in the hearing, many did participate in some or all hearing steps.

The Board's recommendation is founded upon the evidentiary record built through the oral and written parts of the hearing that formed the basis for the Board's deliberations.

1.2.1 Gathering oral Aboriginal traditional evidence

Aboriginal people in the Project area have a long relationship and connection with the land, water and resources. The Board recognizes that Aboriginal traditional knowledge can help provide relevant information, including historical information, which may otherwise be unavailable. This information can also help identify potential environmental effects, strengthen mitigation measures, and lead to better-informed decision-making.

The Board wants to provide opportunities for Aboriginal people to share their traditional knowledge in a way that is both meaningful to them and valuable for the Board's deliberations. The Board recognizes that Aboriginal people have an oral tradition for sharing stories, lessons and knowledge from generation to generation. This information cannot always be shared adequately in writing.

In this hearing, the Board asked participating Aboriginal groups to let the Board know if they wanted to present oral traditional evidence. The Board received notices of intent from 49 groups and individuals. Originally, the Board intended to hear this oral evidence in August and September 2014. The Board later amended its hearing schedule in response to the input received from a number of Aboriginal groups who expressed concerns that the proposed schedule would interfere with the sockeye salmon harvest. As a

3 The term "pipeline" is defined in section 2 of the NEB Act.

4 The Board's 7 May 2014 Ruling No. 14 dealt with a notice of motion to include oral cross examination of witnesses. (Appendix 7 provides an overview of the notices of motions that were filed.)

result, the Board held sessions in Edmonton, AB, in September; Chilliwack, B.C., in October; Kamloops and Victoria, B.C., in November 2014; and Calgary, AB, in January 2015.

Aboriginal intervenors were able to file written evidence in addition to their oral traditional evidence. Other intervenors, Trans Mountain or the Board could ask questions about the oral traditional evidence. Each Aboriginal group could then decide whether they would respond to any questions orally, in writing, or both.

1.2.2 Responding to participants

As part of the hearing process, the Board provided participants with guidance on how they could ask the Board to do something, such as change or modify a particular deadline. This is known as filing a notice of motion. Depending on the nature of the request and the circumstances surrounding it, the Board had the option of providing an opportunity for Trans Mountain and intervenors to comment on a notice of motion. The Board issued rulings on approximately 291 motions and review applications. The motions focused on, among other things:

- requests to extend deadlines and/or the statutory time limits;
- the release of emergency response plans;
- allegations of apprehension of bias of Panel Members;
- requests to file late evidence;
- calls to include oral cross examination in the hearing process;
- constitutional questions; and
- challenges to the limitations on public access during the oral hearing.

In the case of each of these notices of motion, the Board provided rulings, including reasons. Appendix 7 provides an overview of the notices of motions throughout the hearing.

1.2.3 Other relief requested and Board rulings

As part of closing argument, a number of intervenors made requests for relief other than requests that specifically addressed the intervenors' positions on the recommendation that the Board ought to make to the Governor in Council (GIC).

In some cases, these requests were presented as alternative requests to the intervenor's primary request that the Board recommend denial of the Project application. In other cases, the relief was advanced as the intervenor's primary position. Trans Mountain also made a request for other relief in its reply evidence and in its closing argument.

The Board has addressed other relief requested in Appendix 7.

1.2.4 Issues outside of the Board's regulatory oversight

The Board is an administrative tribunal created by Parliament under the NEB Act. The NEB Act lays out in detail what must be considered, and the extent of the Board's authority is set out in its governing legislation, including the NEB Act and the CEAA, 2012.

When the Board established the List of Issues to be considered in this hearing, it included Issue 5:

> *The potential environmental and socio-economic effects of marine shipping activities that would result from the proposed Project, including the potential effects of accidents or malfunctions that may occur.*

The Board stated that this would be considered under the NEB Act.[5] On 10 September 2013, the Board issued specific filing requirements[6] related to the environmental and socio-economic effects assessment of increased marine shipping that Trans Mountain should consider in its application to the Board.

5 NEB letter of 2 April 2014, Trans Mountain Expansion Project, Factors and Scope of Factors for the Environmental Assessment pursuant to the CEAA 2012 (Scoping Document).

6 This document is titled: Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increased Marine Shipping Activities, Trans Mountain Expansion Project.

In the Board's overall public interest recommendation under the NEB Act, the Board took into consideration its findings on Issue 5.

The Board found that increased marine shipping to and from the WMT was not part of the Project for the purposes of the CEAA 2012. However, the Board indicated that it would consider the potential effects of these shipping activities, and any associated accidents or malfunctions that may occur, under the NEB Act. To the extent that there is potential for the effects of the increased marine shipping to interact with the environmental effects of the Project as defined in the CEAA 2012, the Board indicated it would consider those effects under the cumulative effects portion of its CEAA 2012 environmental assessment.

Regardless of whether the Board's environmental assessment falls under the NEB Act or the CEAA 2012, the Board provides one comprehensive environmental assessment that covers all regulatory requirements.

The Board's regulatory oversight of the Project, as well as the scope of its assessment of the Project under the CEAA 2012, reaches from Edmonton to Burnaby, up to and including the WMT.[7] Marine vessel traffic is regulated by government agencies, such as Transport Canada, Port Metro Vancouver, Pacific Pilotage Authority and the Canadian Coast Guard, under a broad and detailed regulatory framework. All of these agencies participated in the Board's hearing process. As the Board does not have regulatory oversight of marine vessel traffic, any changes to the existing regime would be the responsibility of those competent authorities. However, the Board did consider the potential environmental and socio-economic effects of Project-related tanker traffic, including the potential effects of accidents or malfunctions that may occur in coming to its public interest determination under the NEB Act.[8]

Some participants said that the Board should consider upstream and downstream effects of the Project. However, in the circumstances of this hearing, as explained in detail in Ruling No. 25, the Board did not consider upstream and downstream effects, including those of greenhouse gas emissions. In Ruling No. 25, the Board found that no particular upstream development is dependent on the Project. The Board also found that it did not consider there was a necessary connection between the Project and upstream production or downstream uses.

More information on the exclusion of certain issues from the review process is found in Ruling No. 25, and in Chapter 10, section 10.1, as well as Chapter 14 of this Report.

1.2.5 Modifying the hearing schedule

The NEB Act, section 52(4) sets a 15-month time limit starting when the Board decides an application is complete to when the Board submits its report to the GIC. This may be extended under particular circumstances specified in the Act. On 2 April 2014, the Board found the Trans Mountain Expansion Project application complete and issued the OH-001-2014 Hearing Order.

In June 2014, Trans Mountain advised that its preferred corridor for the delivery lines to the Westridge Marine Terminal would run through Burnaby Mountain instead of around it as described in the original Application.

The new proposed pipeline corridor included two possible construction options through Burnaby Mountain; a horizontal directional drill and a tunnel. Trans Mountain retained the original route around the mountain as an alternative corridor.

In order for the Board and hearing participants to assess the new preferred pipeline corridor, the Board needed more information from the company, and this required more time. The Board, with the approval of the NEB Chair, announced an excluded period that ran from 11 July 2014 until 3 February 2015. The excluded period was not counted in the 15-month time limit that the Board had to make its recommendation to the GIC.

This excluded period provided time for hearing participants and the Board to review the new evidence, once filed, and test it through IRs. The time limit for the Board to issue its Report to the GIC was revised to 25 January 2016, more than six months later than the original date of 2 July 2015.

As Trans Mountain's preferred pipeline corridor through Burnaby had now changed, the Board opened a second "application to participate" process for those who might have been directly affected by,

7 Chapter 9 discusses potential spills from the Westridge Marine Terminal.

8 "Factors and Scope of the Factors for the Environmental Assessment pursuant to the Canadian Environmental Assessment Act, 2012", 2 April 2014.

or might have had relevant information or expertise on, the new preferred corridor. This process ran from 8 to 24 September 2014 (as illustrated in the hearing timeline at Appendix 5).

On 21 August 2015, the Board announced, on its own volition, that it was striking Trans Mountain's filed evidence that was prepared by or under the direction of Mr. Steven J. Kelly. This action was taken to ensure the integrity of the hearing. The stricken evidence addressed, among other things, the issue of oil market supply and demand.

On 18 September 2015, the Board, with the approval of the NEB Chair, announced a second excluded period so that it could acquire information from Trans Mountain and intervenors in relation to the issues previously addressed by the stricken evidence. As a result of this second excluded period, the legislated time limit for the Board to issue its Report to the GIC was extended to 20 May 2016.

The updated hearing timeline is provided in Appendix 5.

1.3 The Project application stage – codes, commitments and conditions

Trans Mountain's Application was filed while the Project was at an initial phase of the regulatory lifecycle, as is typical of applications under section 52 of the NEB Act. As set out in the Board's Filing Manual, the Board requires a broad range of information when a section 52 application is filed. At the end of the hearing, the level of information available to the Board must be sufficient to allow it to make a recommendation to the GIC that the Project is or is not in the public interest. There also must be sufficient information to allow the Board to draft conditions that would attach to any new and amended CPCNs, and other associated regulatory instruments (Instruments), should the Project be approved by the GIC.

The Board does not require final information about every technical detail during the application stage of the regulatory process. For example, much of the information filed with respect to the engineering design would be at the conceptual or preliminary level.[9] Site-specific engineering information would not be filed with the Board until after the detailed routing is confirmed, which would be one of the next steps in the regulatory process should the Project be approved. Completion of the detailed design of the project, as well as subsequent construction and operations, would have to comply with:

- the NEB Act, regulations, including the *National Energy Board Onshore Pipeline Regulations* (OPR), referenced standards and applicable codes;
- the company's conceptual design presented, and commitments made in the Application and hearing proceedings; and
- conditions which the Board considers necessary.

The Board may impose conditions requiring a company to submit detailed information for review (and in some cases, for approval) by the Board before the company is permitted to begin construction. Further information, such as pressure testing results, could be required in future leave to open applications before a company would be permitted to begin pipeline operations. In compliance with the OPR, a company is also required to fully develop an emergency response plan prior to beginning operations. In some cases, the Board has imposed conditions with specific requirements for the development, content and filing of the emergency response plan (see Table 1). This would be filed and fully assessed at a condition compliance stage once detailed routing is known. Because the detailed routing information is necessary to perform this assessment, it would be premature to require a fully detailed emergency response plan to be filed at the time of the project application.

While the project application stage is important, as set out in Chapter 3, there are further detailed plans, studies and specifications that are required before the project can proceed. Some of these are subject to future Board approval, and others are filed with the Board for information, disclosure, and/or future compliance enforcement purposes. The Board's recommendation on the project application is not a final determination of all issues. While some hearing participants requested the final detailed engineering or emergency response plans, the Board does not require further detailed information and final plans at this stage of the regulatory lifecycle.

To set the context for its reasons for recommendation, the Board finds it helpful to identify the fundamental consideration used in reaching any section 52 determination. The overarching consideration for the Board's public

9 Pipeline projects generally follow a three phase design process consisting of a conceptual phase, a preliminary engineering phase, and a detailed engineering phase leading to final design.

interest determination at the application stage is: can this pipeline be constructed, operated and maintained in a safe manner. The Board found this to be the case. While this initial consideration is fundamental, a finding that a pipeline could be constructed, operated and maintained in a safe manner does not mean a pipeline is necessarily in the public interest as there are other considerations that the Board must weigh, as discussed below. However, the analysis would go no further if the answer to this fundamental question were answered in the negative, as an unsafe pipeline can never be in the public interest.

1.3.1 Safety

The Board's regulations focus on results and there are NEB requirements that companies must follow in order to design, construct and operate their pipelines safely. These requirements cover everything from the selection of materials used to build a pipeline to the processes, controls, manuals and programs designed to manage risk and mitigate potential consequences during construction and operation. The Board requires NEB-regulated pipeline companies to consider thoroughly all of the hazards and potential hazards that are associated with their pipeline systems, and demonstrate to the Board that the appropriate safety and risk management plans and measures are in place. The Board provides considerable regulatory oversight throughout the pipeline lifecycle to verify that companies comply with regulatory requirement, and adequately and effectively anticipate, prevent, manage and mitigate risks to people and the environment.

1.3.2 Project-specific commitments and conditions

The Board considered the Project and associated risks in the context of the Board's stringent regulatory requirements, Trans Mountain's Application and the commitments Trans Mountain made during the hearing. The Board also considered the information from participants in the proceeding, including information about community-specific and environment-specific circumstances along the corridor. The Board found that in addition to existing regulations, codes and standards, and Trans Mountain's commitments, Project-specific conditions would be required to mitigate residual effects posed by the Project and to make sure the Project is designed, constructed and operated safely, and in a manner that protects the environment (see conditions in Appendix 3). For example, evidence provided by the Grasslands Conservation Council of British Columbia led to the inclusion of conditions about grassland protection and management, and evidence submitted by municipalities of the lower mainland of B.C. led to the inclusion of conditions for the creation and operation of technical working groups.

The Board issued draft conditions throughout the hearing and gave participants the chance to consider and provide comments on them, and to propose other potential conditions. The Board used these suggestions and its own analysis of the evidence to create a final, comprehensive list of conditions that address a wide range of issues identified through this hearing process.

The Board concluded that the Project could be constructed and operated safely if designed, constructed, and operated in compliance with this list of conditions, which would mitigate risks posed by the Project.

1.3.3 Conditions

Should the GIC approve the Project, the Board would issue the CPCNs and Instruments, and impose 157 conditions to address the identified, outstanding issues.

In addition to conditions addressing specific technical issues, the Board would impose overarching Conditions 1, 2, 3, 4 and 5. The effect would be to make all commitments, plans or programs included, referenced or agreed to on the hearing record, regulatory requirements of the Board. Furthermore, to assist the Board and all stakeholders in tracking construction progress and compliance, and to assist the Board in planning appropriate compliance verification activities, the Board would impose conditions requiring Trans Mountain to file commitments tracking tables, phased filing information, a list of temporary infrastructure sites, construction schedules, construction progress reports, and a signed confirmation of Project completion and compliance (Conditions 6, 10, 61, 62, 106, 139).

The 157 conditions listed in Appendix 3 are arranged in approximate chronological order of the required filings. While the Board encourages those with an interest to review all of the conditions, we are aware it is a long list. In order to assist readers with specific areas of concern, Table 1 is provided, as a guide only. It will be clear that there is overlap between conditions and categories, and a condition may apply to more than one category. For example, air emissions conditions may fall within the *Air quality and greenhouse*

gases category, as well as within the *Terminal* categories. Conditions of interest to Aboriginal people may appear under the *Specific effects on Aboriginal interests* category, as well as various *Environment* and *People* categories. Table 1 also illustrates that conditions would require fulfillment at the appropriate stage of the regulatory lifecycle.

Table 1: Conditions by subject matter and regulatory lifecycle stage

		Pipeline lifecycle stage			
		Overarching	**Prior to construction**	**Prior to operation**	**During operation**
Regulatory oversight		1, 2, 5	6, 10, 61, 62	6, 10, 62, 106	6, 139
Economics and financial responsibility			57	121	121
Emergency preparedness and response			89, 90	117, 118, 119, 120, 123, 124, 125, 126, 127, 136, 138	120, 145, 153
Environment	General	3	7, 60, 72, 78, 81		145, 151
	Air quality and greenhouse gases		52, 53, 54, 55, 79, 85	137	140, 142
	Water quality		35, 39, 47, 71, 87	113, 130	151, 154
	Soil, vegetation and wetlands		40, 41, 42, 45, 46, 47, 71, 76, 92		151, 154, 155, 156, 157
	Wildlife and wildlife habitat		36, 37, 38, 44, 47, 56, 71, 92	128	37, 128, 149, 150, 151, 154
	Fish and fish habitat		43, 47, 71, 75, 92	75, 108, 109, 110	108, 109, 110, 151, 154
	Marine mammals		92	132	151
People, communities and lands	Effects on communities (including Aboriginal)		7, 13, 14, 48, 49, 59, 60, 72, 73, 74, 78, 80, 81, 82, 86, 93, 94, 95, 99, 100, 102, 103	49, 94, 99, 131	94, 99, 141, 145
	Specific effects on Aboriginal interests		7, 39, 77, 96, 97, 98	96	146
	Training, skills and employment		11, 12, 58	58, 107	
	Lands and routing		7, 60		
Engineering and Safety	Project	4	9, 50, 51, 63, 64, 66, 69, 88	63, 66, 105, 111, 112, 114, 116	147, 148
	Line 1 (existing pipeline and reactivated segments)		18, 19	115, 135	152
	Line 2 (new pipeline & segments transferred from Line 1)		15, 16, 17, 65, 67, 68, 70	104, 115, 122, 135	143
	Pump stations		8, 30, 31, 101	30	
Multidisciplinary	Westridge Delivery Pipelines and Burnaby Mountain Tunnel		15, 16, 20, 21, 26, 27, 28, 29, 72, 85, 86, 87	104, 125	143
	Westridge Marine Terminal		8, 21, 30, 33, 34, 35, 52, 53, 80, 81, 82, 83, 84, 97, 101	30, 109, 118, 119, 123, 126, 127, 129, 130, 136, 138	109, 141
	Edmonton, Sumas and Burnaby Terminals		8, 22, 23, 24, 25, 30, 32, 54, 78, 79, 80, 101	30, 118, 123, 125, 127, 129, 130, 136, 137, 138	141, 153
	Watercourses (freshwater)		43, 47, 48, 65, 67, 71, 72, 74, 75, 87, 92, 94	75, 94, 108, 110, 113	94, 108, 110, 151, 154
	Project-related marine shipping		91	131, 132, 133, 134	134, 144

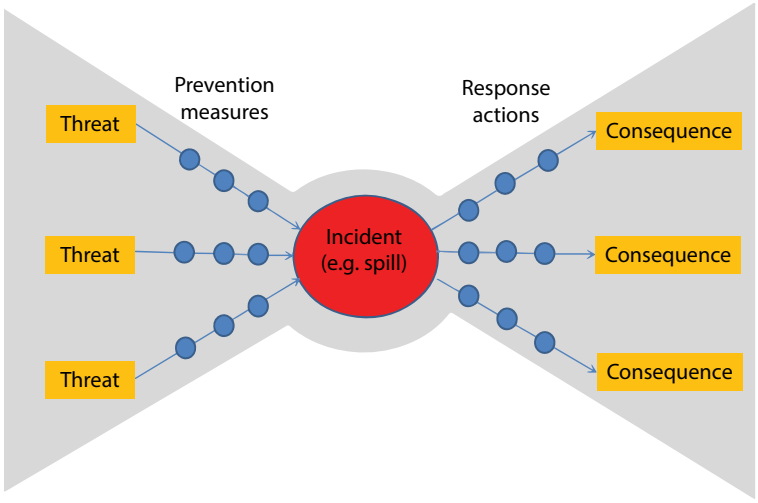
1.4 Risk overview

It is important to carefully analyze the risks created by the Project and Project-related marine shipping. This includes considering the probability of incidents occurring and the severity of the consequences that could result from such incidents, even if such incidents are unlikely to occur. It also includes considering the acceptability of such risks in the context of the benefits and burdens of the proposed Project and Project-related marine shipping as part of the Board's public interest determination.

A bowtie diagram (Figure 2), as exemplified below, is a useful and common aid in illustrating:

- the various threats that could lead to an incident (such as a spill);
- prevention measures that reduce the probability of such threats leading to an incident;
- the various consequences that could result from an incident; and
- response actions that reduce the severity of such consequences.

Figure 2: Bowtie diagram for assessing risk



In addition, risk tables, such as that shown in Figure 3, can be useful to illustrate the combination of the probability (P) of an incident occurring and the anticipated consequences (C) if such an incident does occur, and the magnitude of the resulting risk (R). The Board notes, however, that the labels used for probability, consequences and risk (e.g., Very low to Very high) and the placement of risk labels in such tables can vary widely according to use and author, and can contain considerable subjectivity. Nevertheless, such tables are conceptually useful to illustrate the relationship that R = P x C, that both probability and consequences need to be considered in fully understanding the risk of a spill, and to assist in prioritizing risk mitigation efforts.

Figure 3: Risk as combination of probability and consequence

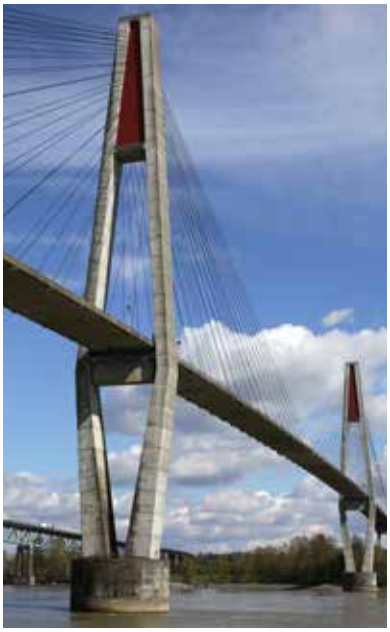
Probability (P)						
	Very high P	Medium R	High R	High R	Very high R	Very high R
	High P	Medium R	Medium R	High R	High R	Very high R
	Medium P	Low R	Medium R	Medium R	High R	High R
	Low P	Very low R	Low R	Medium R	Medium R	High R
	Very low P	Very low R	Very low R	Low R	Medium R	Medium R
		Very low C	Low C	Medium C	High C	Very high C
		Consequences (C)				

1.4.1 Consideration of spill risks

Throughout this Report, the Board has considered the risks associated with spills. For example, Chapter 6 discusses pipeline and facility integrity, which includes the assessment of risk-based design methods proposed by the company to identify, prevent or reduce the frequency of potential releases from the pipelines and terminals, as well as consequence reduction measures, such as leak detection, containment and valve placement. Chapter 8 discusses the environmental behaviour of spilled oil, which is relevant when considering spill response and the consequences of a spill. Chapter 9 discusses prevention, preparedness and response, and considers the likelihood of accidents and malfunctions. Chapter 10 includes a discussion of the potential environmental effects of a spill that might result from such an incident, while Chapter 11 discusses potential socio-economic effects. Chapter 14 discusses spills from Project-related marine shipping.

The Board acknowledges that achieving zero risk is impossible for most developments. The Board finds that there is very low probability of a Project spill (i.e., from the pipelines, tank terminals, pump stations or the WMT) that may result in a significant effect (high consequence). In regard to spills from the Project-related marine shipping, the Board finds that there is a very low probability of a marine spill from a Project-related tanker that may result in a significant effect (high consequence).

Having considered all of the evidence and in light of the spill prevention, preparedness and response measures discussed in Chapter 9, and the regulatory framework for marine oil spill preparedness and response discussed in Chapter 14, the Board finds that the risks associated with potential spills from the Project and Project-related marine vessels are acceptable.





2.0



Benefits, burdens and the National Energy Board Recommendation

This chapter provides the Board's assessment of the overall benefits and burdens of the Trans Mountain Expansion Project (Project) in relation to its recommendation under section 52, Part III of the *National Energy Board Act* (NEB Act). This chapter also summarizes the Board's findings and recommendations in relation to the Project under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), and decisions related to certain Project facilities pursuant to s. 58 of the NEB Act and the *National Energy Board Onshore Pipeline Regulations* (OPR).

2.1 The Board's mandate

Section 52 of the NEB Act requires the Board to make a recommendation to the Governor in Council (GIC) on whether to approve the Project. In making its section 52 recommendation, the Board must have regard to all considerations that appear to be directly related and relevant to that project. The NEB Act provides the Board with flexibility and broad powers, but the Board must interpret and implement the Act in ways that serve the Canadian public interest.

Part III of the NEB Act provides a test for the Board to apply when making its assessment of a project and providing its recommendation to the GIC. When applying the "present and future public convenience and necessity" test under Part III of the NEB Act, the Board makes a recommendation in the overall Canadian "public interest". In its consideration of an application, the Board is required to weigh all relevant evidence on the record and come to a recommendation whether, overall, the project is in the public interest. This is referred to in the NEB Act as the present and future public convenience and necessity.

The Board has described the public interest in the following terms:

> *The public interest is inclusive of all Canadians and refers to a balance of economic, environmental and social interests that change as society's values and preferences evolve over time. As a regulator, the Board must estimate the overall public good a project may create and its potential negative aspects, weigh its various impacts, and make a decision.*[10]

10 NEB Reasons for Decision, Emera Brunswick Pipeline Company Ltd., GH-1-2006.

In section 52 of the NEB Act, Parliament has given direction about the factors relevant to the Board's consideration in reaching its public interest determination.

52(2) In making its recommendation, the Board shall have regard to all considerations that appear to it to be directly related to the pipeline and to be relevant, and may have regard to the following:

a) the availability of oil, gas or any other commodity to the pipeline;

b) the existence of markets, actual or potential;

c) the economic feasibility of the pipeline;

d) the financial responsibility and financial structure of the applicant, the methods of financing the pipeline and the extent to which Canadians will have an opportunity to participate in the financing, engineering and construction of the pipeline; and

e) any public interest that in the Board's opinion may be affected by the issuance of the certificate or the dismissal of the application.

52(3) If the application relates to a designated project within the meaning of section 2 of the CEAA 2012, the report must also set out the Board's environmental assessment prepared under that Act in respect of that project.

52(4) The report must be submitted to the Minister within the time limit specified by the Chairperson. The specified time limit must be no longer than 15 months after the day on which the applicant has provided, in the Board's opinion, a complete application. The Board shall make the time limit public.

With respect to the Project application, the Board's role is to determine if the Project is in the public interest, pursuant to section 52 of the NEB Act.

The Board also has a mandate to conduct an environmental assessment of the Project under the CEAA 2012. As a responsible authority under the CEAA 2012, the Board must, in its report to the GIC, set out its recommendation regarding the environmental effects of the Project. Specifically, the Board must provide a recommendation that the Project is likely, or is not likely, to cause significant adverse environmental effects after taking into account the implementation of mitigation measures, including the Board's recommended conditions. The Board's environmental assessment of the Project can be found in Chapter 10, with the socio-economic components assessed in Chapter 11.

2.2 Benefits and burdens of the Project

Table 2 and Table 3 summarize the key benefits and key residual burdens, respectively, of the Project and Project-related marine shipping that were determined by the Board and outlined in the chapters of this Report. Both tables indicate whether the benefits or burdens would apply locally (e.g., within the immediate vicinity of the Project, such as the specific municipalities along the route), regionally (i.e., Alberta and British Columbia) or nationally.

These tables are not intended to be a comprehensive list of all benefits and burdens mentioned during the hearing by participants and considered by the Board. Rather, it is a summary of the key benefits and key residual burdens that the Board identified during its analysis of the evidence. A description of how the Board considered the balance of benefits versus residual burdens is found in Section 2.3 and a more in-depth assessment of the evidence is provided in the chapters of the Report that follow.

2.2.1 Benefits

The Board finds that the benefits associated with the Trans Mountain Expansion Project, taken as a whole, are **considerable**.[11]

11 Definitions for the terms considerable and modest are not provided. Rather, the terms are meant to illustrate weight the Board attributed to the benefits and burdens relative to each other.

Table 2: Summary of key benefits

Benefits associated with:	Brief description	Type of impact	Report chapter(s)
Market diversification	The Board finds there would be a **considerable** benefit gained by providing Canadian shippers with more flexible and diverse markets, the ability to manage risk associated with competing in multiple markets, the ability to manage development and operational risk, and a likely reduction of discounts to Canadian crude.	Regional National	12
Jobs	The Board finds a **considerable** benefit in the form of jobs created across Canada: • Pipeline construction - 400-600 workers per spread • Tank construction - between 60 and 370 workers • Westridge Marine Terminal construction - 95 workers • Over the first 20 years of operation – 443 jobs/year (313 in B.C., with remainder in AB)	Local Regional National	11
Competition among pipelines	The Board finds a **considerable** benefit would be gained from the increase in flexibility and optionality for those producers looking to get their product to markets, and that all western Canadian producers are likely to benefit from the Project in the longer term, through greater customer choice and efficiencies gained through competition among pipelines.	Regional National	12
Spending on pipeline materials	The Board finds there would be a **considerable** benefit to local and regional economies from the direct spending on pipeline materials in Canada and spending within the regions where the Project is located.	Local Regional	11
Community Benefit Program	The Board finds a **modest** benefit to local communities and the environment along the Project from the establishment of a Community Benefit Program, including: • local emergency management capacity enhancements; • improvements to community parks and infrastructure; • support for events and educational programs; and • Environment Stewardship Program.	Local Regional	10 11
Enhanced marine spill response	The Board finds there would be a **modest** benefit from the enhanced marine spill response planning for and capacity to respond to spills from vessels not associated with the Project (e.g., fuel spills from container ships and cruise ships).	Local Regional	14
Capacity development	The Board finds that a **modest** benefit from local economic and educational opportunities, and the development of capacity of local and Aboriginal individuals, communities and businesses.	Local Regional	11
Government revenues	The Board finds that direct Project expenditures will likely result in **considerable** revenues to various levels of government.	Local Regional National	11

2.2.2 Burdens

A number of concerns are identified in this Report. Many of the issues underlying these concerns can be mitigated, and the Board assessed and weighed the likely success of potential mitigative options in reaching its recommendation. For example, one of the most significant mitigating factors is that most of the pipeline route for the Project parallels existing disturbance, including the right-of-way for Trans Mountain's existing pipeline. The Board finds this appropriate, as this reduces the requirements for new right-of-way disturbance, minimizes the potential impacts of construction, and reduces effects on nearby residents and communities.

Other mitigation would be found in the commitments from Trans Mountain and through conditions that the Board would attach to the new Certificate of Public Convenience and Necessity (CPCN), amended CPCNs, and other associated regulatory instruments (Instruments) should the GIC approve the Project, and which cover a wide range of matters including:

- emergency response and emergency management;
- protection of the environment;
- consultation with those affected;
- socio-economic matters;
- safety and integrity of the pipeline;
- commercial support for the project prior to construction; and
- financial responsibility.

Nevertheless, some impacts or residual burdens remain, and they must be considered and weighed in the Board's recommendation under Part III of the NEB Act.

Table 3: Summary of key residual burdens

Burdens associated with:	Brief description	Type of impact	Report chapter(s)
Southern resident killer whales	The Board finds that the operation of Project-related marine vessels would likely result in **significant**[12] adverse effects to the Southern resident killer whale. Although the effects from Project-related marine vessels on the Southern resident killer whale would be a small fraction of the total cumulative effects, the Board recognizes that the increase in Project related marine vessels would further contribute to cumulative effects that are already jeopardizing the recovery of the Southern resident killer whale.	Local Regional National	14
Aboriginal cultural use associated with Southern resident killer whales	The Board finds that that the operation of Project-related marine vessels would likely result in **significant** adverse effects on Aboriginal cultural use associated with Southern resident killer whales. The Board acknowledges concerns raised by a number of Aboriginal groups about the social and cultural effects that would result from impacts of Project-related marine shipping on the Southern resident killer whale.	Local Regional	14
Marine greenhouse gas emissions	The Board finds that greenhouse gas emissions from Project-related marine vessels would likely be **significant**. Given that there are no regulatory reporting thresholds or specific requirements for marine greenhouse gas emissions in Canada, and that the modelled emissions would result in measurable per cent increases, the magnitude of these emissions is high. While the Board understands that emissions from Project-related marine vessels would be a small percentage relative to Canadian greenhouse gas emissions, the Board finds the greenhouse gas emissions from Project-related marine vessels are likely to be significant.	Regional National	14

12 Although the effects of Project-related marine vessels are not assessed under the CEAA 2012 (as they are not part of the Project), the Board undertook an environmental and socio-economic effects assessment under the NEB Act and has made significance determinations.

Burdens associated with:	Brief description	Type of impact	Report chapter(s)
Municipal development plans	The Board finds that the Project may pose a **modest** burden on municipalities with respect to potentially constraining future plans for municipal development. There is the potential for reduced flexibility and/or additional municipal time constraints with respect to planned or possible future municipal projects that may be impacted by the Project.	Local	11
Aboriginal groups' ability to use the land and water during construction and operation	The Board finds that there would be **modest** burdens sustained by Aboriginal groups as their ability to use the lands, waters and resources for traditional purposes would be temporarily impacted by construction and routine maintenance activities, and that some opportunities for certain activities such as harvesting or accessing sites or areas of traditional use would be temporarily interrupted. For activities directly affected by the WMT, the Board finds that these effects would persist for the operational life of the Project, as traditional activities would not occur within the expanded water lease boundaries. The Board finds that while the effects would be long term in duration, they would be reversible in the long term and would be confined to the water lease boundary for the WMT.	Local	11
Landowners' and land users' ability to use the land and water during construction and operation	The Board finds that there would be **modest** burdens sustained by Landowners and land users as their ability to use the land and water would be affected by construction and routine maintenance activities during operations. Construction and routine maintenance activities will cause temporary, limited effects on recreational and commercial hunting, fishing, agricultural practices and access to property, and will cause nuisance disturbance such as noise.	Local	11
Project spill (i.e., from pipeline, tank terminals, pump stations, or Westridge Marine Terminal)	The Board finds that there is a very low probability of a Project spill (i.e., from pipeline, tank terminals, pump stations, or WMT) that may result in a significant effect (high consequence). The Board finds this level of risk to be **acceptable**.	Local Regional	2 9 10 11
Spill from a Project-related tanker	The Board finds that there is a very low probability of a marine spill from a Project-related tanker that may result in a significant effect (high consequence). The Board finds this level of risk to be **acceptable**.	Local Regional	2 14

2.3 Balancing of benefits and burdens

Having weighed the benefits and residual burdens (summary in section 2.2 and details throughout the Report), the Board must balance the benefits against the residual burdens to come to its final determination under section 52 of the NEB Act as to whether the Project is in the public interest. This task of balancing the benefits versus the burdens of the Project was a difficult one. Many of the benefits, as can be seen from the foregoing analysis and the Report chapters, are national or regional in scope; fewer are strictly local. With respect to the burdens, the reverse is true; the majority of the burdens of the Project and Project-related marine shipping would be shouldered by local and regional communities.

In balancing the benefits and burdens, the Board placed significant weight on the economic benefits from the Project. There would be considerable local, regional and national benefits from market diversification. These include enabling increased capacity to access Pacific Rim markets. There will also be considerable spending on pipeline materials in Canada, as well as considerable jobs that would be created for Canadians, including jobs and opportunities for Aboriginal communities. Many of the benefits would be realized throughout Canada, particularly in British Columbia, Alberta, Ontario and Quebec. The national nature of the benefits was important to the Board.

The Board notes that its conclusion and recommendation under the CEAA 2012 that with the implementation of mitigation and conditions, the Project is not likely to cause significant adverse environmental effects, does not imply that there would be no adverse environmental or socio-economic effects associated with the Project.

The Board recognizes that there are burdens associated with this Project that cannot be completely mitigated and that these residual burdens rest primarily within the local and regional communities. This includes Aboriginal communities.

As stated throughout this hearing process and explained in Chapter 14, Project-related marine shipping does not constitute part of the Project and the Board did not assess the effects of Project-related marine shipping under the CEAA 2012. Rather, the Board assessed the effects of Project-related marine shipping under section 52 of the NEB Act, under which, in Chapter 14, the Board found Project-related marine shipping to have significant effects on the Southern resident killer whale, and on Aboriginal cultural and spiritual use of the Southern resident killer whale. The Board also found that greenhouse gas emissions from Project-related marine vessels are likely to be significant. The Board has considered these significance findings along with all of the environmental, social and economic benefits and burdens to come to its NEB Act Recommendation.

The Board must balance the totality of benefits against the totality of residual burdens to come to its final determination under section 52 of the NEB Act as to whether the Project is in the present and future public interest and necessity.

In making its recommendation, the Board must focus on the overall Canadian public interest. On the whole, taking into account all of the evidence in this hearing, considering all relevant factors, and given that there are considerable benefits nationally, regionally and, to some degree, locally, the Board finds that the benefits of this Project outweigh the residual burdens. Accordingly, the Board concludes that the Project is in the present and future public convenience and necessity, and in the Canadian public interest.

2.4 Recommendation and decisions

In the OH-001-2014 proceeding, the Board conducted an environmental assessment of the Project (as stated above, the Board does not regulate marine shipping and the increased Project-related marine shipping is not part of the Project). The Board considers environmental protection as part of its public interest mandate under the NEB Act. The Board also has a mandate to conduct environmental assessments under the CEAA 2012. The Board's environmental assessment fulfils all of the requirements for both the NEB Act and the CEAA 2012, as applicable.

The Board is of the view that with the implementation of Trans Mountain's environmental protection procedures and mitigation, and the Board's recommended conditions, the Project is not likely to cause significant adverse environmental effects. Therefore, pursuant to the CEAA 2012, the Board recommends that the GIC decide that the designated Project is not likely to cause significant adverse environmental effects.

The Board conducted its public interest assessment, including environmental and socio-economic assessment of the Project and Project-related marine shipping, under the NEB Act.

The Board recommends that a CPCN be issued under section 52 of the NEB Act, and that CPCNs OC-2 and OC-49 be amended to permit the construction and operation of the Project, including the complete looping (or twinning) of the existing Trans Mountain Pipeline system between Edmonton, AB, and Burnaby, B.C., and the construction and operation of associated facilities. The details of the work/activities to be undertaken pursuant to each of the CPCNs the Board would issue, should the Project be approved by GIC, are provided in Appendix 2. In Appendix 3, the Board has set out the terms and conditions that it considers necessary and desirable in the public interest, and to which the new and amended CPCNs would be subject if the GIC were to direct their issuance.

Additional Instruments would be required for the construction and operation of the Project as proposed by Trans Mountain, and these are also subject to terms and conditions as outlined in Appendix 3. Details of the work/activities to be undertaken pursuant to each Instrument are provided in Appendix 2. These would include four NEB Act section 58 orders approving temporary infrastructure and the construction, operation, and/or modification of pump stations and tanks; and an order, pursuant to section 44 of the OPR, for the deactivation of one pump station.

While the Board is normally the final decision maker on orders such as those summarized in the previous paragraph, since this Project overall is subject to the GIC approval, all of these additional orders contain a precondition that makes them ineffective unless and until the GIC approves issuance of new and amended CPCNs approving the Project.





3.0



Regulating through the Project lifecycle

The approval of a project, through issuance of one or more Certificate of Public Convenience and Necessity (CPCN) and/or orders incorporating applicable conditions, forms just one phase in the Board's lifecycle regulation. The Board's public interest determination relies upon the subsequent execution of detailed design, construction, operation, maintenance and, ultimately, abandonment of a project in compliance with applicable codes, commitments and conditions, such as those discussed in Chapter 1. Throughout the lifecycle of an approved project, as illustrated in Figure 4, the Board holds the pipeline company accountable for meeting its regulatory requirements in order to keep its pipelines and facilities safe and secure, and protect people, property and the environment. To accomplish this, the Board reviews or assesses condition filings, tracks condition compliance, verifies compliance with regulatory requirements, and employs appropriate enforcement measures where necessary to quickly and effectively obtain compliance, prevent harm, and deter future non-compliance.

After a project application is assessed and the Board makes its section 52 recommendation (as described in Chapter 2, section 2.1), the project cannot proceed until and unless the Governor in Council approves the project and directs the Board to issue the necessary CPCN. If approved, the company would then prepare plans showing the proposed detailed route of the pipeline and notify landowners. A detailed route hearing may be required, subject to section 35 of the *National Energy Board Act* (NEB Act). The company would also proceed with the detailed design of the project and could be required to undertake additional studies, prepare plans or meet other requirements pursuant to NEB conditions on any CPCN or related NEB order. The company would be required to comply with all conditions to move forward with its project, prior to and during construction, and before commencing operations. While NEB specialists would review all condition filings, those requiring approval of the Board would require this approval before the project could proceed.

Once construction is complete, the company would need to apply for the Board's permission (or "leave") to open the project and begin operations. While some conditions may apply for the life of a pipeline, typically the majority must be satisfied prior to beginning operations or within the first few months or years of operation. However, the company



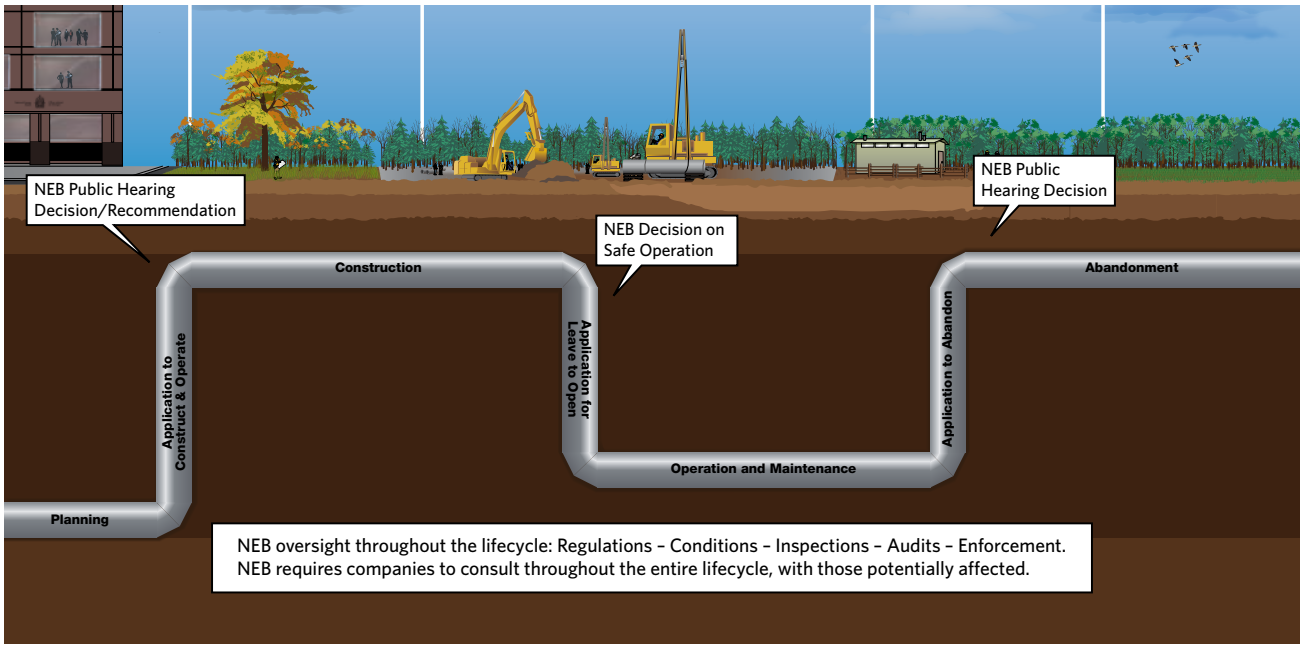




must continue to comply with the *National Energy Board Onshore Pipeline Regulations* (OPR) and other regulatory requirements to operate the pipeline safely and protect the environment.

The Board's regulatory requirements focus on preventing incidents and emergencies, and the Board promotes development of pipeline company safety culture as an important element in meeting this goal. It is a company's responsibility to keep its pipelines safe through implementation and continuous improvement of a comprehensive management system, and effective pipeline integrity, safety, security, environmental protection, and crossing and public awareness programs, with a target of zero spills. While the prevention of incidents is the Board's top priority, the Board also believes that being prepared for any situation is a critical part of energy safety. NEB-regulated companies must have robust emergency management programs to manage conditions and reduce consequences during an emergency. Should an incident occur, the NEB investigates the incident and holds the company accountable for corrective actions and clean up.

Figure 4: Lifecycle regulation



If the Project is approved, the Board would employ its established lifecycle compliance verification and enforcement approach to hold Trans Mountain accountable for implementing the proposed conditions and other regulatory requirements during construction, and the subsequent operation and maintenance of the Project.

3.1 Condition compliance

If the Project is approved and Trans Mountain decides to proceed, it would be required to comply with all conditions that are included in the CPCNs and associated regulatory instruments (Instruments). The types of filings that would be required to fulfill the conditions imposed on the Project, if approved, are summarized in Table 4.

Table 4: Conditions by filing type

Filing type	Number of conditions requiring one or more of this type of filing
Supplementary study, assessment or survey that contributes to Project planning	17
Engineering/risk assessments, detailed design and/or related information or confirmation	33
Plan or program (such as management, monitoring, financial or habitat offset plans)	67
Report on outcomes of activities	27
Other compliance filings	31

If the Project is approved, the Board would oversee condition compliance, make any necessary decisions respecting such conditions, and eventually determine, based on filed results of field testing, whether the Project could safely be granted leave to open.

Documents filed by Trans Mountain on condition compliance and related Board correspondence would be available to the public on the NEB website. All condition filings, whether or not they are for approval, would be reviewed and assessed to determine whether the company has complied with the condition, and whether the filed information is acceptable within the context of regulatory requirements and standards, best practices, professional judgement and the goals the condition sought to achieve. If a condition is "for approval," the company must receive formal approval, by way of a Board letter, for the condition to be fulfilled.

If a filing fails to fulfill the condition requirements or is determined to be inadequate, the Board would request further information or revisions from the company by a specified deadline, or may direct the company to undertake additional steps to meet the goals that the condition was set out to achieve.

3.2 Construction phase

During construction, the Board would require Trans Mountain to have qualified inspectors onsite to oversee construction activities. The Board would also conduct field inspections and other compliance verification activities (as described in section 3.5) to confirm that construction activities meet the conditions of the Project approval and other regulatory requirements, to observe whether the company is implementing its own commitments and to monitor the effectiveness of the measures taken to meet the condition goals, and ensure worker and public safety and protection of the environment.

3.3 Leave to open

If the Project is approved and constructed, the Board will require Trans Mountain to also apply, under section 47 of the NEB Act, for leave to open the pipelines and most related facilities. This is a further step that occurs after conditions applicable to date have been met and the company wishes to begin operating its pipeline and facilities. The Board reviews the company's submissions for leave to open, including the results of field pressure testing, and may seek additional information from the company. Before granting leave to open, the Board must be satisfied that the pipeline or facility has been constructed in compliance with requirements and that it can be operated safely. The Board can impose further terms and conditions on a leave to open order, if needed.

3.4 Operations phase

If the Project is approved and constructed, once the Project is in operation, Trans Mountain would be required to restore the right-of-way (RoW) and temporary work areas to a condition similar to the surrounding environment and consistent with the current land use. The NEB would require Trans Mountain to monitor the RoW and file post-construction monitoring reports that identify any environmental issues caused by construction activities and what the company plans to do about unresolved issues. The NEB would also conduct post-construction inspections to verify compliance with regulatory requirements, including conditions and commitments, and to monitor the company's mitigation measures for success in restoring the land.

During the operational phase, as for its existing pipeline system, Trans Mountain would be required to conduct monitoring and maintenance of its pipelines and facilities, including running measurement tools through the pipelines and conducting investigative digs at the locations of any anomalies, to ensure the ongoing integrity of the pipelines. Trans Mountain would also be required to regularly monitor the RoW for signs of pipeline leaks or impacts to the land (such as slope movement, erosion, compaction, or invasive plants), as well as infringements on the RoW by third parties. When issues are identified, the Board can require further action to correct the situation. The Board also assists in addressing and resolving landowner complaints.

The Board would monitor compliance with the remaining CPCN and Instrument conditions and other regulatory requirements throughout the operating life of the Project. To evaluate Trans Mountain's performance and compliance, the Board would, where appropriate, conduct compliance meetings, audit Trans Mountain's management systems and protection programs, and/or inspect its facilities, operations and maintenance activities.

3.5 Compliance verification and enforcement

The Board recognizes that properly constructed and well-managed pipelines are not entirely free of risk. That is why the Board's compliance and enforcement programs are designed to make sure companies are effective in managing safety and environmental protection throughout the lifecycle of a pipeline, from design to construction to operation and through to abandonment. In addition to conditions of NEB orders and CPCNs, companies must comply with applicable acts and regulations, including the NEB Act and the OPR, applicable codes and standards, and companies' own policies, plans, programs, systems and commitments.

In order to hold companies accountable to these requirements, the Board evaluates their facilities, activities, and condition filings on an ongoing basis, including before, during, and after construction. Once construction is complete, the Board continues to evaluate compliance throughout the operation of a project until it is eventually abandoned. Compliance verification activities include field inspections, management system audits, various compliance meetings, review of company programs, manuals and reports (including regularly updated Emergency Response Plans), and evaluation of emergency response exercises. This proactive approach allows the Board to identify potential problems and address them with the appropriate enforcement tool or tools before they become an issue.

The Board uses a risk-informed approach when planning compliance verification activities. This means that the Board evaluates regulated companies and their facilities on an ongoing basis to determine the appropriate compliance verification activities. The Board then focuses its oversight according to the level of risk to public and worker safety and the environment.

The Board looks at the potential consequences a facility could pose to people and the environment based on a number of criteria, including the facility's location and the type of product carried. The Board also looks at the probability of effects on people and the environment based on a company's operating history and performance.

While all companies are subject to regulatory oversight, some companies receive more than others. In other words, high consequence facilities, challenging projects and those companies who are not meeting the Board's regulatory expectations and goals can expect to see the Board more often than those companies and projects with routine operations.

Board Inspection Officers have the authority to take immediate action if they have reasonable grounds to believe that a hazard to the safety or security of the public or employees of a company, or a detriment to property or the environment, will be caused by the construction, operation, maintenance or abandonment of a pipeline. The Board's goal is to obtain regulatory compliance as quickly and as effectively as possible in order to prevent harm to people, property or the environment, and the Board has a number of tools to make this happen, as well as to deter future non-compliance. These tools include suspending construction or operations, and revoking the CPCN or order that allows a company to continue operating a pipeline or facility. In addition, every person that contravenes certain provisions of the NEB Act or regulations may be subject to criminal prosecution and sentencing in criminal court, including fines up to $1,000,000 or imprisonment for up to five years, or both. For contraventions of Board decisions or orders (including conditions and referenced company commitments), the NEB Act or regulations, the Board also has the ability to issue Administrative Monetary Penalties of up to $100,000 per day. Furthermore, most of the Board's enforcement tools are not mutually exclusive and more than a single measure may be used concurrently, depending on the situation.

The Board is committed to providing information to the public on the safety of NEB-regulated pipelines and facilities by posting compliance and enforcement documents on its website. Condition filings are publicly posted on the NEB's Regulatory Document Index and condition compliance status, inspection reports, audit reports, Inspection Officer Orders, Board Orders, and Administrative Monetary Penalty Notices of Violation are all publicly posted on the NEB's Compliance and Enforcement webpage.

3.6 Regulating emergency response

One of the key goals of the Board's compliance and enforcement program is to prevent pipeline incidents from happening in the first place. However, should an incident occur, the Board is ready to respond, as and when required.

In addition to reporting all incidents through the Board's Online Event Reporting System, companies are responsible for reporting significant incidents, including ruptures or larger spills which leave company property or the RoW, to the Transportation Safety Board which then notifies the Board. Each company is expected to implement its emergency response plan immediately, which must be on file with the Board prior to beginning operation and which must be kept up to date. An emergency response plan outlines the emergency management procedures that the

company will follow during an incident. The procedures must address emergency management, environmental protection, and worker and public safety. The Board also requires a regulated company to develop a training program and conduct emergency exercises. The Board often independently observes these exercises to verify the company's capabilities in responding to incidents.

When the Board is notified of an incident, its top priorities are the safety and security of people, and the protection of property and the environment. The Board holds the company fully responsible and accountable for clean up and site remediation, regardless of the size of the release.

When an incident is reported, the Board initiates its emergency response procedures and, if appropriate, activates its Emergency Operations Centre (EOC) or deploys field personnel. The Board coordinates, from the EOC, field staff at the incident site and provides situation reports to the Government of Canada's EOC. The Board also has working agreements with other government departments and agencies to coordinate responses and communicate effectively during emergencies.

In the case of a spill, once Board staff arrives at the incident site, they make sure that the company is properly cleaning up the spill and remediating any environmental effects caused by the incident. The Board's long-term goal with any incident is the full restoration of the site, including mitigating any potential sub-surface effects on groundwater. Companies are required to meet the most stringent applicable remediation criteria for all contaminants of concern.

3.7 Developing a safety culture

The Board believes that one of the best ways to prevent an accident from happening in the first place is to promote a workplace culture where safety is a way of life. This means that safety, not production or deadlines, must be a company's very first priority.

In some of the worst tragedies in the energy industry,[13] there was often an observable disconnect between the company's vision and policies, and the planning, implementation, monitoring and review of these policies. While the direct causes of these incidents varied, investigators found the lack of a strong safety culture was a factor in all of the incidents.

To achieve a strong safety culture, companies set the tone, beginning at the very top of the organizational chart. It is the senior executives who shape and reinforce a robust safety culture in which the company demonstrates a continual respect for threats to its defenses. The required investment of time, energy and resources means it cannot simply be an intellectual exercise to meet a prescribed minimum standard. It has to be a personal mission for the person at the top. It is their duty to drive the culture and values down and across the organization.

When committed safety leadership exists, safety performance and oversight are considered part of the organization's governance model in the same way as financial performance. This means that leaders stand up for safety even when production may be impacted.

The OPR requires senior company leadership to be accountable for building a safety culture and supporting management systems. Companies must appoint a senior officer who is accountable to ensure that the company's management system and programs are in compliance with the OPR.

13 Det Norske Veritas. (2011). Major Hazard Incidents. Prepared for the National Energy Board's Arctic Offshore Drilling Review. Report No.: NEB 2010-04/DNV Reg. No.: ANECA 851





4.0



Public Consultation

The Board's expectations of an applicant regarding public consultation are set out in the Board's Filing Manual. Applicants are expected to undertake a level of public consultation commensurate with the setting, nature, and magnitude of their project. The Board uses the information gained through the company's consultation process, and filed on the hearing record, to contribute to its understanding of the concerns and interests of those who are potentially affected by the project, and to help inform its public interest determination. The Board requires companies to involve the public during each phase in the lifecycle of a project (that is, project design, construction, operation and maintenance, and decommissioning or abandonment) in order to address potential impacts of that project.

This chapter addresses Trans Mountain's public consultation program. Trans Mountain's engagement and consultation with potentially affected Aboriginal groups are discussed in Chapter 5.

4.1 Trans Mountain's Stakeholder Engagement Program

4.1.1 Principles and goals of Trans Mountain's Stakeholder Engagement Program

Trans Mountain said that its Stakeholder Engagement Program is designed to foster participation from the public who have an interest in the scope, activities and routing of the Project. The program seeks input from stakeholders regarding the proposed pipeline corridor, environmental effects, and socio-economic effects and benefits. The program also shares information with stakeholders to keep them informed throughout the process.

Prior to launching its Stakeholder Engagement Program in 2011, Trans Mountain said that it consulted with local governments and community leaders to seek input on the program. These early conversations with local governments and community leaders provided Trans Mountain with direction on areas of greatest interest to local communities, appropriate means of engagement for different communities and local stakeholders who should be engaged in the process.







Trans Mountain identified a number of stakeholder groups that could have an interest in the Project, including: private and public landowners and occupants, government authorities, industry and business development agencies, environmental non-governmental organizations, special interest groups and the general public. Trans Mountain said that its Stakeholder Engagement Program allows for the identification of new information and additional stakeholders as Trans Mountain proceeds through the life of the Project.

In consideration of the potential impacts to the marine environment from an increase in Project-related marine vessel traffic, Trans Mountain said that it extended stakeholder engagement to include coastal communities beyond the pipeline terminus at the Westridge Marine Terminal (WMT) in Burnaby, B.C. In recognition of this and the high level of stakeholder interest in marine shipments of petroleum products, Trans Mountain engaged communities on Vancouver Island and the Gulf Islands along established marine shipping corridors transited by oil tanker traffic, as well as communities in and around Port Metro Vancouver.

Trans Mountain described the principles it used to guide the development and execution of the Stakeholder Engagement Program. These included principles regarding accountability, communication, local focus, mutual benefit, relationship building, respect, responsiveness, shared process, sustainability, timeliness and transparency.

Trans Mountain said it is committed to ongoing engagement throughout the life of the Project, including the continuation of engagement opportunities through hosting facility open houses, providing newsletters and Project updates, making safety and public awareness presentations; and participating in community events, regulatory processes and ongoing informal meetings with stakeholders.

4.1.2 Public consultation activities

Trans Mountain said that its engagement activities were designed to reflect the diverse and varied interests of the various communities and areas along the proposed pipeline route, and provided various engagement opportunities, including public open houses, community workshops, and online discussion activities. Trans Mountain said that since 2012, there were tens of thousands of exchanges with stakeholders through face-to-face meetings, presentations, public forums, technical meetings, community meetings, social media sites, community investment events, emails, telephone calls, letters, advertisements and website postings. It noted that some of these exchanges included:

- providing 159 open houses or workshops along the pipeline and marine corridors, including topics focused on routing, emergency management, economic benefits, regional environmental and socio-economic assessment (ESA), and terminal information;
- organizing more than 1,700 meetings between Project team members and stakeholder groups;
- responding to approximately 550 phone inquiries and 1,500 emails received from the public; and
- providing responses to approximately 950 media inquiries and giving 430 media interviews.

Trans Mountain translated various documents, such as news releases, newspaper advertisements and information material, into French, Chinese, Punjabi and Korean with the goal to provide Project information in other languages that would help inform and serve public audiences and media in communities along the proposed pipeline and marine corridor. Trans Mountain said that community and technical workshops, and public open houses were advertised in numerous newspaper and online advertisements and direct mail postcard drops.

Trans Mountain said that feedback received from the stakeholder engagement initiatives helped shape various aspects of the Project, including topics and issues related to construction, routing, economic benefits and impacts, employment and training, environment, liability and safety. Examples of how Trans Mountain said that it incorporated stakeholder feedback into the design of the Project included:

- exploring alternative methods of construction in order to avoid the use of temporary workspace in Colony Farm Regional Park;
- establishing access plans, construction schedules, pipeline alignments and compensation plans to minimize impacts to Ledgeview Golf Course;
- having horizontal directional drilling entry and exit points more than 30 metres away from the watercourse in order to avoid routing the proposed pipeline through riparian zones; and

- assigning community construction liaison roles as part of its construction team as a key point of contact, in response to concerns raised by the Wembley Estates Strata Council.

4.1.3 Landowner Relations Program

Trans Mountain said that the primary objectives of its Landowner Relations Program were to:

- introduce the Project to landowners and occupants;
- obtain approval for land access on a timely basis to support engineering and environmental surveys;
- obtain landowner understanding, acceptance, and land rights for survey, construction, restoration, and transition to operations; and
- preserve good relationships that currently exist and reinforce positive relations into operations.

Trans Mountain identified a study corridor of, generally, 150 metres width along the entire length of the Project. Since the commencement of the Landowner Relations Program, Trans Mountain's Project representatives identified and contacted more than 4,400 owners and occupants of properties located in part or in whole within the proposed pipeline corridor and alternative corridors in Alberta and B.C. A standard information package was provided that included information regarding the Project, NEB publications and a copy of the original easement. As route refinements were made, some landowners and occupants were no longer within the 150 metre-wide pipeline corridors. Those who no longer fell within the consultation areas were notified and no longer engaged. Those landowners or occupants that were identified as being within these areas were contacted.

Trans Mountain said that it continued to engage with landowners into 2014 to obtain permission for environmental and engineering surveys, discuss changes in potentially affected lands resulting from routing modifications, and provide Project notification and details to any new landowners or occupants potentially affected by these changes. In addition to commencing discussions on land rights acquisition, land agents continued efforts to obtain survey consent for those lands where landowners had not yet provided their consent, to collect issues and concerns, and to provide information to landowners in response to any questions and concerns. Trans Mountain said that the questions, issues or concerns raised by landowners commonly included topics such as land access, compensation, environmental and land impact, land value, legacy concerns, opposition to the Project, and construction and routing.

Some of the evidence filed and concerns raised by intervenors related to issues that occurred respecting the existing Trans Mountain Pipeline (TMPL) system. Trans Mountain said that although these specific issues related to the existing TMPL system and are therefore not within the scope of this hearing, Trans Mountain representatives attempted to meet with landowners and address the concerns identified.

Trans Mountain said that its Landowner Relations Program continues to be an ongoing process, and questions or concerns will continue to be addressed throughout the life of the Project.

4.2 Trans Mountain's consultation with governments

Trans Mountain said that it incorporated consultation with municipal, provincial and federal governments into its consultation activities for the Project, as it anticipated that they would have an interest in shaping project planning. The company said that local government officials from relevant jurisdictions in Alberta and B.C. were invited to, and participated in, stakeholder and issues identification, public information and input gathering, community conversations and continuing engagement. In June and July 2012, a Project information package was mailed to municipal governments, members of the legislative assemblies, and members of parliament along the proposed pipeline corridor and in marine communities.

Trans Mountain said that it held more than 250 government meetings to provide information on the Project and respond to questions on a wide range of topics, including routing, Aboriginal and stakeholder engagement, marine ESA, Transport Canada's Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL) marine risk studies, and economic benefits.

Several government authorities requested further information from Trans Mountain on aspects of its consultation with various stakeholders, landowners and other government authorities. They also requested further information from Trans Mountain on aspects of its on-going engagement program with regard to concerns

about the impact of the Project on emergency services, transportation rights-of-way, infrastructure, permits and further route refinements.

In the joint final argument of the City of Abbotsford, Township of Langley, Fraser Valley Regional District, Fraser-Fort George Regional District & Village of Valemount, the intervenors expressed concerns regarding Trans Mountain's overall consultation methods and its failure to communicate with them or incorporate their feedback on important matters that would impact them, specifically during the design and construction phase of the Project. These intervenors said that Trans Mountain had not fully recorded all of the commitments it made to them, and it had failed to identify and adequately mitigate the risk and impacts to the local governments.

The City of Burnaby said that it had not made formal or informal arrangements with Trans Mountain for many of the necessary services, resources, and planning initiatives that Trans Mountain contemplates will be available. It said that Trans Mountain made many assumptions concerning emergency services, emergency planning, evacuation, availability of external resources, fire services, police services, traffic management, planning and development, land use, access to water, noise and compensation that were either incorrect or unsupported by commitments from the City of Burnaby.

Trans Mountain said that the City of Burnaby declined several attempts by Trans Mountain to engage with the city about its concerns.

Trans Mountain said that it maintained regular engagement with the governments of Alberta and B.C., facilitating effective participation in the assessment process by provincial authorities. Trans Mountain said that it will continue ongoing municipal and regional government engagement, including undertaking a number of specific engagement commitments it has made during the hearing process that extend from approval through the entire lifecycle of the Project. It also committed to work jointly with municipalities to identify and address specific municipal issues and concerns through joint technical working groups. Trans Mountain said that it would review intervenor submissions and incorporate all applicable commitments into the commitment tracking table to ensure no commitments are missed.

Views of the Board

The Board regards engaging the public as an essential and ongoing activity throughout the Project's entire lifespan. Thorough and effective consultation requires a process that must provide timely, appropriate and effective opportunities for all potentially affected parties to learn about the Project, provide their comments and concerns, and to discuss how Trans Mountain could address them.

The Board is of the view that Trans Mountain has developed and implemented a broadly based public consultation program, offering numerous venues and opportunities for the public, landowners, governments and other stakeholders to learn about the Project, and to provide their views and concerns to the company.

Since a company's relationship with directly affected stakeholders will continue for several decades throughout the lifecycle of a project, it is critical for all parties to recognize and understand their respective roles and responsibilities for achieving effective dialogue during consultation, including those offered outside of the NEB hearing process. The Board expects affected parties, including municipalities, to engage with Trans Mountain by communicating their concerns to the company and making themselves available to discuss potential solutions. The Board observes with regret that not all municipalities accepted the opportunity to engage with the Trans Mountain effectively. In particular, the City of Burnaby declined a number of opportunities to engage with Trans Mountain. The Board is of the view that when municipalities decline opportunities to engage, this diminishes the quality of information available to both the company and the Board, and creates the potential that less than satisfactory solutions to municipal concerns may be the result.

The Board acknowledges the concerns raised by municipalities regarding ongoing consultation, particularly during the design and construction phase of the Project. Trans Mountain has committed to offer continued engagement opportunities to affected municipalities through the formation of technical working groups, with the stated goal to build trust and good relationships where the company operates. The Board views such working groups as useful opportunities to explore collaborative approaches through the design and construction phases of the Project, and to pursue ongoing dialogue. To facilitate the establishment and development of the technical working groups,

the Board would impose Condition 14 requiring Trans Mountain to file with the Board, prior to commencing construction, the terms of reference for the technical working groups, to be developed in collaboration with participating affected municipalities, and facility owners and operators.

Although consultation with government authorities was initiated early in the process, the Board expects Trans Mountain to continue to offer opportunities for effective and timely consultation with government stakeholders, as appropriate, through the lifecycle of the Project in order to further identify and adequately address concerns regarding the Project's potential effects on governments, including municipalities. To facilitate Trans Mountain's ongoing consultation with government stakeholders, and to apprise the Board and all parties of the outcomes of this ongoing consultation, the Board would impose Condition 49 requiring Trans Mountain to file with the Board, reports of the meetings of the technical working groups. In the Board's view, this reporting would allow the Board and all parties to understand the outcomes achieved by the technical working groups, and provide for the transparent reporting to the Board of any potential issues regarding the design and construction of the Project. The reporting would also allow the Board and all parties understand how these issues have been addressed, to the extent possible, by Trans Mountain and the members of the technical working groups.

As discussed in Chapter 7, the Board would impose a condition requiring Trans Mountain to file with the Board an updated commitment tracking table prior to the start of construction (Condition 6). This update should include all commitments made to landowners and government stakeholders. The Board reminds Trans Mountain that even where commitments may not be specifically included in Trans Mountain's filings submitted pursuant to Condition 6, Trans Mountain would still be required to implement all commitments made in its Project application, or as otherwise agreed to in the evidence it filed during the hearing, or in its related submissions (Condition 2).

Trans Mountain has committed to continue consulting with and addressing issues raised by affected landowners, both before and after pipeline construction. The Board is of the view that an effective and responsive process for responding to issues that may be raised by affected landowners is an important part of the company's ongoing engagement with landowners. To that end, the Board would impose Condition 102 requiring Trans Mountain to confirm that it has created, and will maintain, a process/system that tracks Project-related landowner and tenant complaints or concerns and how Trans Mountain has addressed them, up until the Project is abandoned or decommissioned pursuant to the NEB Act. The Board would also impose Condition 99. Some groups were critical of the approach requiring Trans Mountain to maintain and file with the Board, records of its landowner and tenant consultations, and provide confirmation that it will make available to a landowner or tenant, upon request, a copy of the consultation records related to that landowner or tenant. The Board is of the view that these requirements would facilitate an effective and responsive process for responding to issues raised by landowners and tenants in order that potential concerns can be appropriately addressed, to the extent possible.

The Board is of the view that with Trans Mountain's commitments and the Board's recommended conditions, Trans Mountain can continue to effectively engage the public, landowners and other stakeholders, and address issues raised throughout the Project's operational life.





5.0





Aboriginal matters

5.1 Overview

The Board's process was designed to obtain as much relevant evidence as possible on Aboriginal concerns about the Project, the potential impacts on Aboriginal interests, and possible mitigation measures to minimize adverse impacts on Aboriginal interests. The Board was provided with and considered extensive information about concerns related to the Project, and the measures that would be required to address those concerns, as brought forward through consultation undertaken by the applicant and through the participation of potentially affected Aboriginal groups and others in the hearing process. In assessing the potential impacts on Aboriginal interests, the Board considered all of the evidence provided.

This chapter includes summaries of evidence provided directly by Aboriginal groups through their participation in the hearing, as well as summaries of Aboriginal concerns and interests as recorded by Trans Mountain in its evidence. Appendix 8 refers to information and evidence sources provided by Aboriginal groups who participated in the hearing. The Board notes that identifying and referring to specific passages within the record can lead to other direct and indirect references being overlooked. Therefore, anyone wishing to fully understand the context of the information and evidence provided by Aboriginal groups should familiarize themselves with the entire record of the hearing.[14] In addition, evidence provided by Aboriginal groups and evidence of Aboriginal concerns and interests recorded by Trans Mountain in its evidence is summarized in chapters throughout this Report, including matters relating to the use of lands, waters and resources for traditional purposes by Aboriginal groups as described in Chapter 11 and Chapter 14.







14 Aboriginal groups provided evidence and made argument addressing all the chapters contained in this Report. Their evidence and views were fully considered as is reflected throughout the Report. As noted above, this chapter of the Report cannot be considered in isolation from the Report as a whole.

5.2 Trans Mountain's consultation with Aboriginal Groups

Trans Mountain said it views working with Aboriginal communities along the Project route as part of its commitment to promote open and transparent consultation and communication with Aboriginal communities, and to build lasting and mutually beneficial relationships with these communities and Aboriginal businesses.

Trans Mountain said it embarked on an extensive consultation program commencing in 2012 to engage with Aboriginal communities about the Project. To ensure meaningful engagement continues to occur, the company committed to continue its engagement with Aboriginal communities, groups, associations, councils and tribes throughout the life of the Project.

5.2.1 Trans Mountain's Aboriginal Engagement Program Design

Trans Mountain said it worked in collaboration with the Government of Canada and provincial ministries to identify Aboriginal groups in Alberta and B.C. that might have an interest in the Project, or have Aboriginal interests potentially affected by the Project.

Trans Mountain said that its final engagement list for Aboriginal communities and groups with traditional territories in the Project area was developed in collaboration with federal departments, provincial ministries, the Major Projects Management Office (MPMO), NEB, and the B.C. Oil and Gas Commission. The company said it followed the recommendation of Indigenous and Northern Affairs Canada (INAC) and used a 10-kilometer buffer area around the proposed pipeline corridor in B.C. to identify Aboriginal groups with traditional territory in the Project area. Trans Mountain said given the lower degree of certainty regarding traditional territories in Alberta, a 100-kilometer buffer was used. In Alberta, the pipeline would cross Treaty 6 territory, Treaty 8 territory, and the Métis Nation of Alberta Region 4, but would not cross any Indian Reserves. In B.C., the Project would cross both Crown lands and privately held lands, and is proposed to cross seven Indian Reserves utilized by five Aboriginal communities:

- Zoht #4 – Lower Nicola Indian Band
- Zoht # 5 – Lower Nicola Indian Band
- Joeyaska # 2 – Lower Nicola Indian Band
- Ohamil # 1 – Shxw'ow'hamel First Nation
- Popkum # 1 – Popkum First Nation
- Tzeachten #13 – Tzeachten First Nation
- Matsqui Main # 2 – Matsqui First Nation

Trans Mountain said that it extended its Aboriginal engagement program to include coastal communities, beyond the pipeline terminus at the Westridge Marine Terminal (WMT). Trans Mountain said it engaged with communities on Vancouver Island and the Gulf Islands along established marine shipping corridors transited by tanker traffic, as well as communities in and around Port Metro Vancouver. At the recommendation of Transport Canada, for the Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL) review process, Trans Mountain also engaged with Aboriginal groups located in the Burrard Inlet Region and Marine Corridor.

Trans Mountain said it added Aboriginal groups to its engagement when groups expressed an interest in the Project. Trans Mountain's final list included 120 Aboriginal groups, two non-land based B.C. Métis groups, and 11 Aboriginal associations, councils and tribes. The list of Aboriginal groups engaged by Trans Mountain can be found in Appendix 9.

Trans Mountain said its Aboriginal Engagement Program for the Project was guided by the Kinder Morgan Canada Aboriginal Relations Policy and focused on:

- enhancing trusting and respectful relationships;
- sharing Project information such as the Project scope, routing options, safety and emergency response, scheduling and environmental field study components;
- negotiating group and community-specific protocols, capacity agreements, Letters of Understanding (LOUs) and Mutual Benefit Agreements (MBAs);

- facilitating traditional land use (TLU) and traditional marine resource use (TMRU) studies, including traditional ecological knowledge (TEK) and socio-economic research;
- identifying potential impacts and addressing concerns;
- discussing the adequacy of planned impact mitigation and opportunities; and
- identifying education, training, employment, and procurement opportunities.

Trans Mountain said it considered Aboriginal Traditional Knowledge (ATK) according to Section 19(3) of the *Canadian Environmental Assessment Act, 2012*, the filing requirements and guidance provided in the Board's *Filing Manual*, as well as pertinent issues and concerns identified through Aboriginal engagement for the Project. Trans Mountain said that ATK was typically collected from Aboriginal communities through the participation of their members in biophysical field studies for the Project, and that their knowledge about the land formed part of the documented studies.

5.2.2 Trans Mountain's consultation activities with Aboriginal groups

Trans Mountain said it made substantial efforts to provide Aboriginal groups with opportunities to participate in planning the Project. It said that it used a number of methods to inform Aboriginal communities, obtain feedback and identify issues about the Project. Activities began in 2012, including sending out Project letters, holding open houses during 2012 and 2013, maintaining a project website, providing Project update letters, and holding a number of Project meetings. Trans Mountain said more than 24,000 engagement activities were completed with Aboriginal groups based on the following framework of activities:

- project announcement;
- initial contact with Aboriginal community or Aboriginal group;
- negotiation and execution of confidential LOUs or capacity agreements;
- host community information session(s);
- conduct TLU, TMRU and TEK studies;
- identify interests and concerns;
- review key mitigation options;
- provide additional capacity funding, if required; and
- negotiate and execute confidential MBA.

Trans Mountain said the communications materials that it sent to communities included:

- advanced notice of field study work and a field study process brochure;
- Project update letters and newsletters including updates to the Project website content, regulatory filings and participation funding; and
- invitations to meet to discuss routing options for those communities where the existing Trans Mountain Pipeline system encounters Indian Reserve lands.

Trans Mountain said its process for engagement allowed each community and group to engage in meaningful dialogue in the manner they chose, and in a way that met its objectives and values. Trans Mountain said many communities worked cooperatively with Trans Mountain in relation to the Project, some openly and others on a strictly confidential basis at their request.

Trans Mountain said that in March 2013, it provided a copy of the environment and socio-economic assessment (ESA) approach summary to Aboriginal groups. Trans Mountain requested feedback on the methodology for field studies that would be undertaken starting in May 2013.

Trans Mountain said that potential environmental elements interacting with the Project were identified through consultation with Aboriginal groups. These elements included air and water quality, fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat, and species at risk. Effects from potential accidents and malfunctions were also identified. Issues raised through consultation were included in the assessment of potential Project effects. Trans Mountain said the feedback it received informed its Project planning in a number of areas including routing, the scope of ESA, the identification of mitigation

measures to reduce environmental and socio-economic impacts, emergency management, construction planning, Project-related benefits and routing alternatives.

Trans Mountain said that engagement with participating Aboriginal communities about socio-economic issues occurred in parallel with its Aboriginal Engagement Program. Activities included one-on-one meetings with leaders and staff members, and meetings, interviews and discussions with people living in the area. Trans Mountain said that information related to socio-economic elements (e.g., cabin locations, resource use and employment and economy concerns) is often provided during meetings and discussion associated with TLU and TEK. As a result, information made available from the non-confidential TLU study reports and TEK discussions as it relates to the socio-economic elements was incorporated into the socio-economic assessment.

Trans Mountain said TLRU and TMRU studies were initiated for the Project in 2012 and were consultant-facilitated or independently directed by the group. Trans Mountain said the aim of the TLRU and TMRU studies was to identify and mitigate effects of the Project on current use of traditional land and marine resources. At the time of the submission of its evidence, Trans Mountain said a total of 52 communities participated in TLRU studies, 15 communities participated in TMRU studies and 57 communities provided TEK.

Trans Mountain said that the remainder of the Aboriginal groups consulted on the Project either did not request to participate in a TLRU study or, in other cases, funding for a TLRU study had been discussed but the parties were unable to reach agreement.

Trans Mountain said it executed 94 agreements, including LOUs (which include components for TEK, TLRU and TMRU studies), capacity funding, and integrated cultural assessments with an aggregate value of $36 million.

Trans Mountain said it received 30 letters of support from Aboriginal groups.

Trans Mountain said it is committed to working with Aboriginal groups to address Project-related interests and concerns. The company said this is an ongoing and iterative process that is part of the ongoing dialogue with Aboriginal groups. Trans Mountain said its ongoing consultation process is designed to refine and optimize the work based on knowledge of the mitigation measures to be implemented in the field. Trans Mountain said this would include regional workshops with Aboriginal groups to discuss Environmental Protection Plans (EPPs) and Emergency Management, including mitigation measures to minimize Project-related effects.

Trans Mountain said that through its Environmental Education Program, all personnel working on the construction of the Project would be informed of the location of known TLRU sites.

Trans Mountain said that it is committed to the continuation of an effective Aboriginal Engagement Program that satisfies all parties, and that it will continue engagement into Project development and through operations.

5.2.3 Concerns raised about Trans Mountain's consultation with Aboriginal groups

A number of Aboriginal groups raised concerns in their written evidence and submissions filed with the Board about Trans Mountain's consultations, including Adams Lake Indian Band, Asini Wachi Nehiyawak Traditional Band, Cheam First Nation, Chawathil First Nation, Coldwater Indian Band, Cowichan Tribes, Katzie First Nation, Lyackson First Nation, Métis Nation of Alberta Gunn Métis Local 55, Métis Nation of British Columbia, Matsqui First Nation, Michel First Nation, Musqueam Indian Band, Nooaitch Indian Band, Pacheedaht First Nation, Stk'emlupsemc Te Secwépemc, Stó:lō Collective, Snuneymuxw First Nation, Squamish Nation, Tsartlip First Nation, Tsawout First Nation, Tsawwassen First Nation, Tsleil-Waututh Nation, and Upper Nicola Band. The concerns raised in relation to Trans Mountain's consultation for the Project included:

- the engagement process and/or timing;
- Project benefits;
- emergency response management and planning;
- capacity funding;

- the opportunity to provide input; and
- the potential Project-related effects on the assertion of Aboriginal rights and title governing traditional and cultural use of the land and/or marine environment.

Cheam First Nation and Chawathil First Nation said that Trans Mountain has not engaged in any consultation with respect to emergency response, and did not give consideration to their Aboriginal rights and title.

Adams Lake Indian Band said that Trans Mountain's engagement has been impersonal, inaccurate, and lacking sincerity. It also said that Trans Mountain offered to engage on its Aquatics Offset Plans. However, when Adams Lake Indian Band expressed interest and proposed engagement, Trans Mountain retreated from its offer of engagement.

Cowichan Tribes said that Trans Mountain's approach to consultation limited the measures available to mitigate impacts, and that to properly account for the Project's potential impacts on the Cowichan Tribes' Aboriginal rights and title, Trans Mountain must have understood Cowichan Tribes' strength of claim at a stage where Trans Mountain could have fundamentally altered the Project design and been open to all options for mitigation measures. Cowichan Tribes said that did not occur.

Coldwater Indian Band said targeted and specific consultation with Coldwater is required to develop appropriate avoidance, mitigation and accommodation of impacts, and this has not occurred. Coldwater Indian Band also said that meaningful consultation on the Project, including routing, has not occurred.

Katzie First Nation said they had difficulties in reaching agreement with Trans Mountain on capacity funding or Mutual Benefit Agreements, and therefore could not provide all of the information Trans Mountain needed to understand the potential impacts to traditional sites and uses.

Kwantlen First Nation expressed concerns with Trans Mountain's lack of consultation and consideration of Aboriginal rights and title for emergency response in Trans Mountain's identification of "High Consequence Areas" for emergency response.

Lyackson First Nation said that Trans Mountain did not discuss mitigation measures and without further consultation, issues remain unresolved.

Métis Nation of Alberta Gunn Métis Local 55 said that it wishes for meaningful consultation beyond the hearing and construction phase. It said this should include operation of the pipeline, since a spill could impact water bodies downstream of the Project, as well as lands holding burial, archaeological and heritage sites, and lands used for harvesting. It also said it has been excluded from discussions on developing a fish and fish habitat offset program.

Michel First Nation said Trans Mountain only initiated consultation with Michel First Nation on the proposed Project once Michel First Nation made Trans Mountain aware of the need to consult with them, and that the late start to the consultation process and collection of TLU information has resulted in a failure to include Michel First Nation in the overall development of the assessment, failure to assess effects on Michel First Nation rights and interests, and failure to include Michel First Nation in discussions of mitigation and accommodation.

The Stó:lō Collective raised a number of concerns regarding its consultation with Trans Mountain. The Stó:lō Collective expressed concern about Trans Mountain's reluctance to formalize commitments to the Stó:lō Collective outside of a Mutual Benefit Agreement, to directly involve Stó:lō technical and cultural experts in Project mitigation and Environmental Protection Planning (EPP development), emergency response planning, or environmental survey work in order to mitigate concerns pertaining to traditional fisheries, spiritual and cultural sites, wetlands, old growth forests, communication protocols, capacity development, economic development or emergency response procedures. The Sto:lo Collective also raised concerns with the engagement process, in that communication has been on a proponent to Band level, when Trans Mountain was asked to have communication sent through the Stó:lō Collective as the process for engagement established by the Collective, leading to negative impacts on the engagement process.

Stk'emlupsemc Te Secwépemc said that there had been no discussion with Trans Mountain on the proposed routing of the pipeline.

Tsawwassen First Nation said in their written evidence that Trans Mountain mischaracterized its engagement with Tsawwassen First Nation through the Aboriginal Engagement Logs filed by Trans Mountain. Trans Mountain acknowledged errors and omissions, and accepted the updated information on consultation filed by Tsawwassen First Nation.

Simpcw First Nation, First Nations of Maa-nulth Treaty Society, and Adam Olson said they were not meaningfully consulted by Trans Mountain about the Project and its potential impacts to their Aboriginal rights, title and interests.

In response to the concerns expressed, Trans Mountain said it made every effort to provide Aboriginal groups with opportunities to engage in meaningful dialogue in the manner they chose, and in a way that met their objectives and values. Trans Mountain said it tailored its engagement approach to accommodate the myriad of diverse objectives and values it encountered. The sharing of information was integral to this process. As a result of the information it received, Trans Mountain said it made modifications to the Project in order to reduce impacts on the land and marine environment, address concerns regarding routing and construction, address socio-economic considerations, and enhance Aboriginal involvement and engagement.

Trans Mountain said during engagement activities, Aboriginal groups expressed an interest in participation in emergency response planning and programs (ERP). Trans Mountain said the integration of Aboriginal groups into ERP provides opportunities for reduced response time in some locations and additional workforce to respond to a spill and participation of Aboriginal communities in emergency planning and response also aligns with the principles outlined in the B.C. land based spill initiative. Trans Mountain said ERPs will be developed with the participating Aboriginal group(s) and Aboriginal groups will be invited to participate in regional workshops regarding emergency response planning. Finally, Trans Mountain committed to file a consultation plan related to their Emergency Management Program (EMP), including its ERPs.

Trans Mountain said the company and the Stó:lō Collective have had multiple engagements throughout the hearing process. Trans Mountain said it has proactively engaged with the communities represented by the Stó:lō Collective, with the Stó:lō Collective, and with Ts'elxweyeqw Tribe Management Limited (TTML) to ensure Stó:lō interests are heard, and potential issues and concerns can be avoided or mitigated. Trans Mountain's evidence of the engagement activities, completion of land use studies, and the provision of funding to support engagement is outlined in its evidence filed throughout the hearing process.

Trans Mountain also said it has continued to share information with Stó:lō, in response to the information received through the Integrated Cultural Assessment Report.

Trans Mountain said it has made multiple efforts to share information regarding procurement, employment, and training for the Project, including with Tsarlip First Nation, and has requested that Tsartlip share information regarding the abilities of the Nation and its membership to participate in the business and employment-related opportunities that would arise as a result of the Project.

In response to Tsawwassen First Nation, Trans Mountain said that starting in 2012, Trans Mountain has been engaging Tsawwassen First Nation on the Project to provide comprehensive information to them, to seek feedback from them, and to identify anticipated impacts of the Project on the assertion of Aboriginal rights and title governing traditional and cultural use of the environment. Trans Mountain stated it is aware of the Tsawwassen First Nation Final Agreement, and the resulting rights and obligations. Trans Mountain said its understanding of the Final Agreement is based on both reviewing the agreement and on discussions with Tsawwassen First Nation. Trans Mountain confirmed that, in engaging with Tsawwassen First Nation regarding the Trans Mountain Expansion Project, it took the Final Agreement into consideration.

Trans Mountain said it is committed to continued engagement to discuss the Project, mitigation measures, Project-related issues and the potential Project-related effects on Aboriginal groups.

5.3 The Government of Canada's consultation process with Aboriginal groups

The Government of Canada said it would rely on the Board's review process, to the extent possible, to identify, consider and address any adverse impacts on potential or established Aboriginal and treaty rights resulting from the Project. The Government of Canada said federal authorities work together to ensure the legal duty to consult Aboriginal groups is fulfilled and performed in a coordinated manner that is integrated with the

environmental assessment and regulatory review process for the Project. In the Government's correspondence to Aboriginal groups, Aboriginal groups were informed of the Crown's reliance on the Board's process, to the extent possible, to meet the Crown's duty to consult and encouraged to participate in the Board's process to express Project-related concerns.

The Government of Canada outlined its approach to consultation with Aboriginal groups for the Project, which occurs in four phases:

- Phase I: Initial engagement, from submission of project description to the start of NEB review process;
- Phase II: NEB hearings, from the start of the NEB review process to the close of the hearing record;
- Phase III: Post-NEB hearings, from the close of the hearing record to a the Governor in Council (GIC) decision on the project; and,
- Phase IV: Regulatory permitting, from the GIC decision on the project to issuance of departmental regulatory approvals (if required).

The Government of Canada said that commencing at the close of the NEB hearing record and ending with a GIC decision on the Project, the Major Projects Management Office (MPMO) will coordinate consultation meetings between the Government and Aboriginal groups for which the depth of consultation has been determined to be moderate or high. The purpose of these consultations is to conduct a meaningful two-way dialogue to determine if there are any concerns related to the Project that have not been fully addressed by the NEB's draft conditions or the proponent's commitments to that point in the process, and to consider proposals from Aboriginal groups for accommodation measures to further address outstanding issues or concerns that could be considered by the Crown.

A number of Aboriginal groups expressed concerns about the limitations of the Government of Canada's approach to discharging its duty to consult with Aboriginal groups, including its reliance on the NEB process. Some said that direct government-to-government consultation with the federal government is required to address their concerns, or as part of their decision-making about whether the Project may proceed in their territory.

5.4 Participation of Aboriginal groups in the Board's hearing process

The Board's Enhanced Aboriginal Engagement (EAE) initiative aims to provide proactive contact with Aboriginal groups that may be affected by a proposed project, and to help Aboriginal groups understand the Board's regulatory process and how to participate in that process. The Board reviews the completeness of the list of potentially affected Aboriginal groups identified in the proponent's Project Description filed with the MPMO and the Board. The Board may suggest to the applicant any necessary revisions. The Board then sends letters to each potentially impacted Aboriginal group on the revised list, informing them of the project as well as the Board's regulatory role in respect of the project, and offers to provide further information on the hearing process. Following issuance of these letters, Board staff follow up, respond to questions or conduct information meetings, where requested.

As committed to in the Project Agreement with the MPMO for the Project, the Board carried out its EAE activities for the Project from the time the Project Description was received on 23 May 2013 until February 2014. In August 2013, the Board sent a letter to 131 potentially affected Aboriginal groups and organizations. The letter discussed the Board's hearing process and its Participant Funding Program. It also included a summary of the Project, information on how to obtain further information and an offer for NEB staff to attend a community meeting. Between November 2013 and February 2014, NEB staff presented information in person at nine community meetings attended by 22 different Aboriginal groups and organizations.

Seventy-three Aboriginal groups participated as intervenors in the OH-001-2014 hearing and provided their comments, views and evidence through written submissions and oral evidence to the Panel. Appendix 8 refers to information sources provided by Aboriginal groups who participated in the review process and where this information can be located on the public record.

A total of 35 Aboriginal groups and individuals provided oral traditional evidence (OTE) to the Board during the hearing. The Board received OTE at five locations (Edmonton, Chilliwack, Kamloops, Victoria, and Calgary). The Board received traditional evidence from the Horse Lake First Nation by telephone. The Board also made the audio recordings of OTE sessions available free of charge from the audio recording service provider.

5.5 Potential impacts on Aboriginal groups

5.5.1 Trans Mountain's assessment of impacts on Aboriginal groups

Trans Mountain said that through its Aboriginal Engagement Program, it worked with Aboriginal groups to identify anticipated impacts of the Project on the assertion of Aboriginal rights and title governing traditional and cultural use of the land and marine environment. Trans Mountain said it endeavored to gather Aboriginal perspectives on rights and asserted rights, identify issues and concerns relating to those rights and the Project, and reach understandings or agreements that address potential infringement of Aboriginal rights affected by the Project.

Trans Mountain said its understanding that existing Aboriginal and treaty rights of the Aboriginal peoples of Canada are recognized and affirmed through section 35 of the *Constitution Act, 1982*.

Trans Mountain said it acknowledges the importance of the environment and the resources within it to Aboriginal communities, and understands that the ability to participate in traditional land use activities is an important component of the exercise of their rights. Trans Mountain said its assessment of potential adverse effects of the Project considered the following value components that support Aboriginal rights and interests:

- economy;
- employment;
- community services and infrastructure;
- individual, family and community well-being;
- human health;
- traditional culture;
- section 35 rights to fish, hunt and gather;
- Governance;
- visual and aesthetic resources; and
- species and habitats required to maintain a traditional lifestyle.

Trans Mountain said the methodology used to assess potential adverse effects of the Project on valued components supporting the exercise of Aboriginal rights and interests considers: the potential environmental and socio-economic effects of the Project; ways in which these effects can be minimized or avoided altogether; and key mitigation strategies in place that would further reduce these effects. Trans Mountain said that it included Aboriginal participation in its environmental field program to incorporate Aboriginal views and additional traditional knowledge of the land into the consideration of potential Project-related environmental effects, and to provide Aboriginal community members with the opportunity to provide TEK information to the ESA. Trans Mountain said its approach for collecting TEK tried to ensure a free, informed and ongoing process that meets Canadian ethical research standards. Translators were made available in the field upon the request of a given community, as warranted. Trans Mountain said that during field surveys, over 200 participants reviewed, collected and discussed TEK and potential Project-related effects and mitigation strategies.

Trans Mountain said it considered the potential effects of spills on elements of the environment that support Aboriginal rights and interests. It said it acknowledges that salmon are vital to First Nations people in B.C.

Trans Mountain said TLU studies were completed on Crown land to obtain information regarding the TLU activities that participating Aboriginal communities engage in on the land. The aim of the TLU studies was to assess and mitigate effects of the Project on current use of Crown lands for traditional activities and on identified TLU sites. Trans Mountain said this is achieved by meeting the following objectives:

- determine the extent and general nature of each community's current use of lands for traditional activities relative to the Project;
- identify existing concerns and potential effects of the Project on traditional land and resource use for baseline scoping and selection of social or environmental indicators for the effects assessment;

- provide traditional knowledge information, where appropriate, for the assessment of potential Project-related effects on traditional land and resource use; and
- establish appropriate site-specific mitigation measures to address traditional land and resource use concerns raised relative to the Project.

As discussed in detail in Chapters 11 and 14 of this report, Trans Mountain said it based the assessment of effects on TLRU and TMRU on biophysical and human environments.

For the pipeline and associated facilities, Trans Mountain said that subsistence activities may be temporarily disrupted by construction or operations of the Project and the disruptions could mean that the traditional resource users miss the opportunity to harvest wild foods (e.g., wildlife, fish, plants) or that their participation is curtailed. Trans Mountain said that, despite these disruptions, the construction and routine operations would not result in significant adverse effects on the ability of Aboriginal communities to continue to use land, waters or resources for traditional purposes, and thus the Project's contribution to potential broader cultural impacts related to access and use of natural resources is also considered not significant.

For the WMT, Trans Mountain said the expanded dock complex would become a permanent feature of the inlet and long-term traditional resource use patterns will likely adapt over time. Trans Mountain concluded there are no situations for TLRU that would result in a significant residual socio-economic effect, and that residual socio-economic effects of construction and operations activities of the WMT on TLRU indicators would be not significant.

With respect to the effects of Project-related marine vessel traffic, Trans Mountain said that a disruption of subsistence activities may occur due to increased transit of Project-related marine vessel traffic by restricting access to traditional use areas particularly if the resource users' travel occurs at the same time and in the same location as the Project vessel's transit. The company said that this could result in limiting the ability to harvest in certain areas, missed harvesting opportunities, or an increase in travel time to reach a destination. Trans Mountain said the Project-related disruption would only be temporary and activities are likely to be resumed in most cases once the vessel has passed. Trans Mountain said the effects associated with Project-related marine vessel traffic on TMRU are considered not significant, with the exception of the expected residual effects on the traditional use associated with Southern resident killer whale population, which are considered to be significant.

Trans Mountain also said that its assessment of total cumulative effects for the Project concluded that that there would be no significant Project contribution to adverse cumulative effects to the biophysical resources in the environment used for TLRU or TMRU by Aboriginal groups. Trans Mountain concluded that overall there would be no significant adverse effects on the biophysical resources or the ecosystems that support TLU activities, with the exception of the Project's effects on the Southern resident killer whale.

With respect to human environment considerations, Trans Mountain concluded that there are no situations where social and cultural well-being, infrastructure and services, and community health indicators would result in a significant residual socio-economic effect with respect to Aboriginal groups, including with respect to increased stress and anxiety related to perceived contamination that Aboriginal groups may feel could result from the Project. Trans Mountain said that the assessment of effects on TLU patterns is based on alterations to the biophysical resources that TLU practices are based on and on consideration of the human environment, and concluded that the effects of the Project on TLU are not significant. Therefore, according to Trans Mountain, the residual socio-economic effects of Project construction and operations would be not significant.

5.5.2 Impacts raised by Aboriginal groups

Aboriginal groups have raised concerns throughout their written and oral evidence in this proceeding, and information about their concerns and interests has also been provided directly to Trans Mountain, which has filed evidence summarizing the concerns presented to them. Aboriginal groups have characterized their concerns and interests in ways specific to each of them and while information regarding key concerns and interests are summarized here, anyone wanting to understand the full context of the concerns and interests expressed by Aboriginal groups should familiarize themselves with all of the relevant evidence on the record.

Aboriginal groups provided information on impacts through their consultation activities with Trans Mountain as well as through their participation in the NEB hearing process. This evidence included completed TLRU and TMRU studies, OTE, responses to information requests, written evidence and final argument.

A number of Aboriginal groups raised overarching concerns about impacts on their Aboriginal and treaty rights. Within both written and oral evidence, Aboriginal groups provided information on how, where, and when they exercise their asserted and established Aboriginal and treaty rights, and they expressed their concerns as to how these rights might be impacted.

Groups described their established rights in the Project area, including those established through Treaty No. 6, Treaty No. 8, the Douglas Treaties, the Tsawwassen First Nation Final Agreement and court cases, including *R. v. Sparrow* and *R. v. Van der Peet*. Groups also described their rights in areas that would be traversed by Project-related marine vessel traffic. Aboriginal groups referred to, and provided evidence on, their rights to hunt, trap, fish and gather and noted their rights related to the establishment of reserves.

In addition, a number of Aboriginal groups provided information about their asserted rights. Details were provided as to claims to Aboriginal title in areas potentially impacted. Descriptions were provided of stewardship and governance rights. Aboriginal groups described their rights to fish for food, social, ceremonial and commercial purposes, and specific reference was made to fishing and harvesting sites, including those for salmon, crabs, prawns, shellfish and waterfowl. A number of Aboriginal groups noted the importance of the Fraser River for the exercise of rights. Aboriginal groups also noted the importance of marine areas for exercising their rights, including Burrard Inlet, Howe Sound, Swiftsure Bank and the Strait of Georgia. Details were provided regarding rights to gather plants for food and medicine as well as rights to engage in hunting and trapping activities, including harvesting of ungulates, waterfowl, fish, and shellfish. Travel and access was often referred to in the descriptions of their Aboriginal rights. Many Aboriginal groups noted rights related to ceremonial and spiritual practices and places. Rights related to archaeological and cultural heritage sites were also described. Much emphasis was placed on the importance of the exercise of their Aboriginal rights to their culture.

Aboriginal groups expressed significant concern as to how the exercise of these rights would be impacted. A number of Aboriginal groups noted the importance of protecting the land and water for future generations, and indicated that the Project would introduce too much risk and additional impacts to their territories, rights, and identities. Aboriginal groups also said that they must be part of all part decisions regarding access to their lands, waters and resources.

Indigenous and Northern Affairs Canada (INAC) said First Nations involved in the review of the proposed Project are at various stages of the British Columbia treaty process. INAC described in its evidence the ongoing status of negotiations within the British Columbia treaty process.

In addition to these overarching concerns related to their asserted and established Aboriginal rights and title, key concerns raised by Aboriginal groups about the Project relate to its potential impacts on:

- traditional land and marine resource uses, practices and activities;
- cultural heritage resources;
- community health;
- cultural practices;
- effects of cumulative development; and
- employment.

Many of the topics of concern raised by Aboriginal groups are addressed in the chapters throughout this Report. The potential impacts on biophysical components, including fish and fish habitat, wildlife, vegetation, soils, and water quality and quantity, are discussed in Chapters 10 and 14. The potential effects on traditional land and resource use (TLRU) and traditional marine resource use (TMRU) are addressed in Chapters 11 and 14 respectively. Navigation, navigation safety and potential effects on recreational and commercial fishing are discussed in Chapter 11. Potential effects on human health, including the health of Aboriginal people, are discussed in Chapters 11 and 14. Emergency management and spill response is discussed in Chapter 9. The concerns raised by Aboriginal groups that relate specifically to these elements are discussed in detail in each of these respective chapters.

Impacts on traditional land and marine resource uses, practices and activities

Aboriginal groups said that their people have lived, hunted, gathered and fished within their traditional territories since time immemorial, and their uses of the lands, waters and resources within their territories are the backbone of their cultures. Many groups said they felt that the construction and operation of the Project would adversely impact their uses and activities within their traditional territories.

Aboriginal groups raised concerns about how the Project could negatively impact their ability to continue their traditional uses, practices and activities such as hunting, fishing, trapping, the gathering of plants for subsistence and medicinal purposes, as well as their ability to access the land and specific sites for these purposes. Groups expressed concerns about their ability to harvest traditional food resources, including fish, shellfish, birds, and wild game as well as the impacts any reductions in their ability to harvest these resources would have on cultural and ceremonial activities as well as cultural transmission. Groups said that the harvesting and preparing of food is the primary context for many aspects of cultural transmission.

Many groups were concerned about their ability to continue to harvest plants for traditional uses, including medicinal plants. Some Aboriginal groups said that they had concerns with the clearing of vegetation and with contamination of plants and loss or alteration of traditional use subsistence sites for plant gathering.

With respect to the WMT and marine shipping, a number of groups expressed concern these would negatively impact fish and fish habitat and would impact the reliance on fish for food and sustenance, and for economic purposes and spiritual practices and ceremonies, including harvesting at and around the WMT.

Concerns about specific marine resource harvesting locations, such as Swiftsure Bank, were also raised.

Several Aboriginal groups expressed concern that accessing marine harvesting sites will be further restricted as a result of increased Project-related marine traffic.

Aboriginal groups contend that a spill would have a catastrophic effect on the resources that they traditionally harvest and that the fact that the probability of a spill is small is not sufficient reason to determine the effects of a spill are not significant. They fear that a substantial spill or series of smaller spills could push resources past the tipping point and dramatically pollute and reduce stocks and habitat for many years.

Impacts on cultural heritage resources

A number of Aboriginal groups raised concerns about the potential effects on their cultural heritage resources, including potential impacts to specific sites as well as effects on their continued ability to access sites in areas of cultural significance such as spiritual sites and gathering places. Groups said the Project would have impacts on their lands, resources and cultural practices including potential contamination of ancient village sites and cemeteries. Groups said their cultural rights and interests include sacred sites like villages, cemeteries, burning and ritual bathing sites, pit houses, and travel routes. Some groups expressed concern about their most sacred sites, including house pits and burial grounds.

Some groups expressed concern that specific information relating to their particular cultural heritage and spiritual sites were not fully accounted for in Trans Mountain's assessment of the project or its mitigation measures. The Stó:lō Collective raised specific concerns about potential impacts of the Project on the Lightening Rock site.

Impacts on community health

Several Aboriginal groups expressed concerns about potential direct or indirect effects on community health, particularly in the event of a spill, through impacts on cultural activities, traditional food resources, or through increased anxiety and perception of contamination. Groups raised concerns about how the ability to continue traditional land use activities has resulting effects on the physical and psychological health of community members.

Some Aboriginal group expressed concern about predicted impacts on physical and community health including stress, and reduced pre-natal health and youth development.

Impacts on cultural practices

Many Aboriginal groups expressed concerns that the Project would impact opportunities to transmit knowledge from one generation to the next. Aboriginal groups said that being on the land connects the present to the past, and traditional and cultural activities, such as harvesting, fishing and ceremonies bind families together. A number of groups were concerned that the Project would accelerate the process of loss of the spiritual connection to the land being experienced by youth and successive generations.

Aboriginal groups said that their sense of place, privacy and quiet enjoyment are all-essential to their cultural and sacred practices, and that they will suffer sensory disturbance to these from tanker noise, light and vibration. Groups noted specific cultural practices they undertake, such as bathing in the waters of Burrard Inlet and associated creeks. Groups said continuing to engage in their ceremonial practices is a very important part of their culture.

Many Aboriginal groups described how a disruption or reduction to traditional travelways would represent a loss of cultural expression and identity, as well as a loss of teaching opportunities for youth.

Effects of cumulative development

Many Aboriginal groups discussed cumulative effects in their written and oral evidence. Aboriginal groups said that their traditional territories have already been subject to change and continued encroachment. Groups said that the cumulative effects of development activities, including large-scale residential, industrial and commercial development, highways, railways and other infrastructure, and agricultural development have severely impacted their ability to exercise their Aboriginal and treaty rights. Aboriginal groups are concerned about the effects of existing development on the health of the ecosystems and resources harvested, and on their cultural and spiritual well-being, and the potential effects of the Project in addition to these existing effects.

Groups said that hunting activities continue to be impacted by development, and expressed concerns about the fragmentation of lands, loss of access to hunting and trapping areas, encroachment of developments, and loss of natural habitat.

A number of Aboriginal groups had concerns with increased access to traditional areas. They were concerned that this would threaten wildlife, increase fishing pressure, and increase competition for resources used for traditional purposes.

A number of groups expressed concerns about Tran Mountain's cumulative effects assessment. Some groups said it did not accurately characterize or reflect the implications of incremental impacts on their use and occupancy of their territory, their interests, or their Aboriginal rights and title.

Employment

In addition to the concerns noted above, numerous Aboriginal groups also expressed an interest in employment and procurement opportunities as well as assistance with training to provide required skills. Many Aboriginal groups said they wanted to participate in monitoring activities, and that community members or Elders should be present during construction and involved in reclamation work to ensure mitigation measures are completed. Samson Cree First Nation expressed concerns with monitoring by third parties and said ongoing Traditional Land Use and Environmental monitoring should be part of prevention and protection mechanisms.

Mitigation for potential impacts on Aboriginal groups

Trans Mountain said it developed mitigation measures in accordance with Trans Mountain standards, industry and provincial regulatory guidelines, current industry-accepted best practices, engagement with Aboriginal communities, experience gained from other pipeline projects with similar environmental and socio-economic conditions, and professional judgment. Mitigation measures, Management Plans and Contingency Plans are included in the Pipeline, Facilities and Westridge Marine Terminal EPPs. Trans Mountain said the EPPs and Environmental Alignment sheet would be used to guide inspection and monitoring of the Project during construction. Details of the mitigation measures Trans Mountain committed to for specific impacts are outlined throughout this Report.

Trans Mountain said that, in response to concerns and requests from Aboriginal groups, it made a number of changes to the Project, including:

- reconfiguring the pipeline design in the Upper Fraser River and Upper North Thompson River Valley as a result of concerns raised during Aboriginal engagement activities;
- revising a proposed route as a result of engagement with Peters First Nation on routing options across the Peters Indian Reserve No. 1A;
- implementing mitigation to ensure Project personnel are prohibited from fishing on Jacko Lake during construction activities, and working to provide continuous access to Jacko Lake for Stk'emlupsemc te Secwepemc members; and
- in response to concerns from the Katzie First Nation about Surrey Bend Regional Park, confirming that no land would be taken or removed from Surrey Bend Regional Park, and acquiring an easement for the pipeline that ensures ownership of the land will remain with the Park authority.

To mitigate the effects and concerns regarding traditional marine harvesting and cultural activities, Trans Mountain committed to, among other measures, provide regular updated information on Project-related marine vessel traffic to Aboriginal communities. It also committed to initiate a public outreach program prior to the Project operations phase to communicate information on Project-related timing and scheduling with Transport Canada, the Canadian Coast Guard, the Chamber of Shipping for British Columbia, commercial and tourism associations, and potentially affected Aboriginal groups.

Trans Mountain said that Project-related marine vessels would be fully compliant with all applicable navigational, communications and safety regulations, including those of Transport Canada, the Canadian Coast Guard, the PPA and PMV.

Trans Mountain said that, during engagement activities, Aboriginal groups expressed an interest in participation in emergency response planning and programs (ERP). Trans Mountain said that ERPs will be developed with the participating Aboriginal group(s) and Aboriginal groups will be invited to participate in regional workshops regarding emergency response planning. Trans Mountain committed to file a consultation plan related to its Emergency Management Program (EMP) including its ERPs.

In response to the high level of interest in monitoring activities, Trans Mountain said Aboriginal Monitors would be part of the onsite Environmental Inspection Teams to provide traditional knowledge to the construction program to ensure protection of the environment, and to ensure the successful protection, mitigation and monitoring requirements set out in the EPPs. Trans Mountain also committed to manage access along portions of its right-of-way by implementing mitigation measures during the pre-construction, construction and post-construction phases.

Trans Mountain said it is committed to continued engagement with Aboriginal groups when reclamation management plans are being finalized.

Trans Mountain said that site-specific mitigation and enhancement measures will be implemented to ensure that the potential adverse social effects are eliminated or reduced and potential positive effects are enhanced during Project activities.

Trans Mountain said it will support employment and economic opportunities for Aboriginal groups for the Project and that it has developed a Training Policy for Aboriginal Peoples to create initiatives that increase the long-term capability for Aboriginal people to participate in the economy and to share in the success of the Project. Trans Mountain also said it will work with Aboriginal communities to promote economic development through the identification of opportunities that offer Aboriginal communities and businesses the ability to participate in the procurement of goods and services in support of the Project.

5.6 Submissions related to section 35, *Constitution Act, 1982*

Aboriginal groups noted that the Board is required to act in a manner that is consistent with the *Constitution Act, 1982*. They said that federal action cannot unjustifiably infringe treaty and Aboriginal rights and that the Crown is always subject to the limits imposed by the honour of the Crown, including the obligation to engage in proper consultation.

Aboriginal groups argued that, in accordance with the Supreme Court of Canada's decision in *Rio Tinto Alcan Inc*. v. *Carrier Sekani Tribal Council*, 2010 SCC 43 ("*Carrier Sekani*"), the Board must assess the adequacy of Crown

consultation as it has the power to decide questions of law, and Parliament has not excluded the ability to decide constitutional questions from the Board's jurisdiction under either the NEB Act or CEAA. They argued that if the Board is to exercise its jurisdiction under section 52, it must first address and decide all necessary questions of fact and law, including whether the Crown has discharged the duty to consult and accommodate. They said that the Board cannot make a recommendation in the public interest until it is satisfied that the duty to consult has been discharged. Groups argued that, because the Crown participated in the process, this case was different from the facts considered in *Chippewas of the Thames First Nation v. Enbridge Pipelines Inc.*, 2015 FCA 222. It was argued that the Board's recommendation was not simply one of many decisions in relation to the Project but rather was the key regulatory decision to be made in relation to the Project. Aboriginal groups characterized the Board's recommendation as a strategic higher-level decision or recommendation.

Aboriginal groups said that the controlling question in all situations is what is required to maintain the honour of the Crown and to effect reconciliation between the Crown and the Aboriginal peoples with respect to the interests at stake. Reference was made to what was described as the two primary purposes of the duty to consult and accommodate: balancing interests and preserving the honour of the Crown. Aboriginal groups noted that the duty to consult is intended to advance reconciliation between Aboriginal people and the Crown by ensuring Aboriginal concerns are heard and considered and that Aboriginal rights are accounted for in decision-making, protected and accommodated. Consultation must involve a dialogue with a genuine intention of understanding the rights and concerns of Aboriginal groups, and with an openness towards changing course if required. They noted that there must be an intention to substantially address Aboriginal concerns.

Aboriginal groups argued that the Crown has not discharged its duty to consult and accommodate and therefore the Board must recommend that the Project not be approved. Some Aboriginal groups argued that there had been no Crown consultation to date and that a decision-maker who proceeds on the basis of inadequate consultation errs in law. Aboriginal groups argued that while the Board does not have an independent duty to consult and accommodate, it does have an obligation to exercise its decision making function in accordance with section 35 but that because of procedural flaws in the hearing process, the Board did not have sufficient evidence to recommend the Project. Several groups argued that the Board's process was inadequate and that their participation in that process was hampered by a variety of issues, including funding. Some argued that they were not provided with complete information, that their rights were not appropriately scoped and that the Project impacts on their rights were not appropriately assessed, as there was too much reliance on biophysical indicators as proxies for Aboriginal rights rather than on evidence dealing directly with impacts to Aboriginal rights A number of Aboriginal groups noted that consultation must occur early in the process and cannot be put off to later stages; they argued that such early consultation had not occurred in this case. Several groups argued that the Board's process was ill-suited for the intended purpose of consultation.

Aboriginal groups argued that the Government of Canada's commitment to consultation after the Board has issued its decision cannot have any bearing on the Board's determination of whether the duty to consult and accommodate has been discharged as it is impossible to know whether it would be meaningful or effective. They argued that consultation that occurs after the Board issues its Report cannot be meaningful as the conditions of approval will have already been set. Aboriginal groups pointed to NRCan's list of potentially outstanding issues as evidence that the Crown is of the view that Crown consultation has not been adequate. Aboriginal groups suggested that the Crown does not rely on Trans Mountain to discharge its duty to consult and, therefore, Trans Mountain's regulatory filings regarding engagement with Aboriginal groups are not relevant. Some Aboriginal groups argued that the Crown has not put any evidence before the NEB that would allow the Board to find that consultation has been fulfilled.

While most Aboriginal groups were of the view that the Board had to make a finding on Crown consultation, the Stó:lō Collective said during oral argument that the Board did not have a role as far as commenting on the Crown's consultation because Crown consultation was not complete. The Stó:lō Collective said the Board should make a finding on whether Trans Mountain has done an adequate job of consultation such that the Crown could rely on it in some way. Additionally, the Stó:lō Collective submitted that since the Crown has made filings with the Board, the Board could comment on them. However, in the Stó:lō Collective's view, the final determination about adequacy of Crown consultation rests with the GIC.

Several groups argued that the Board's constitutional role includes determining whether they had proven their Aboriginal rights for the purposes of the application and whether issuing the Certificate would infringe those rights. Groups also argued that a justification analysis must be performed to determine whether, absent consent of the

Aboriginal groups, infringements of proven rights are justified such that the government action is consistent with section 35(1). A number of Aboriginal groups argued that the infringements to its rights could not be justified, with one group noting that a "public interest" justification was too vague to be a valid legislative objective. Aboriginal groups argued that the Crown must fully discharge its constitutional obligation to justify the infringement prior to permitting the Project to proceed and that the NEB regulatory process was not designed to justify the infringement. They argued that the Board should recommend dismissal of the application on the grounds that the Crown has to date failed to justify the infringement of proven Aboriginal rights.

Trans Mountain said that the Board must exercise its decision-making function in accordance with both the NEB Act and section 35(1) of the *Constitution Act, 1982*. It said the Board does this through broad consultation requirements it imposed on the proponent and by providing Aboriginal groups with an opportunity to participate in a robust and accessible regulatory process in a meaningful way.

Trans Mountain said the Federal Court of Appeal was clear in *Standing Buffalo First Nation v. Enbridge Pipelines Inc.*, 2009 FCA 308 that the Board is not the Crown nor its agent when considering a section 52 application. This case was said to be directly analogous to the current Project because here the NEB process also ensures that the proponent has due regard for Aboriginal rights. Trans Mountain argued that the Board's process also provides a practical and efficient framework within which the Aboriginal group can request assurances regarding project impacts.

Trans Mountain said that the Crown has indicated that the feedback it receives in the NEB's Report will refine the Crown's understanding of potential Project impacts on Aboriginal interests. While acknowledging that the NEB Act gives the Board full jurisdiction to hear and determine all matters, whether of law or of fact, Trans Mountain submitted that in *Carrier Sekani*, the Court rejected the argument that every tribunal with jurisdiction to consider questions of law has a constitutional duty to consider whether adequate consultation has occurred and if not to fulfill that requirement itself. In Trans Mountain's view, given the evidence on the Board's record that the Crown consultation process with Aboriginal groups is not over, an adequacy determination by the Board at the NEB recommendation stage would effectively usurp the Crown's role in the consultation process that will follow the NEB's regulatory process. Phase III and Phase IV of the Crown's consultation will occur after the close of the public record. Therefore, according to Trans Mountain, it would be premature for the NEB to assess the adequacy of Crown consultation prior to issuing this report. In any event, the Crown is the final decision maker of whether a Project certificate will be issued.

Regarding requested justification for infringement by Aboriginal intervenors, Trans Mountain was of the view that there is no legal basis for a justification test to be applied by the Board at this stage of the process when the GIC will be considering the process and its own consultation with Aboriginal groups in entirety.

Views of the Board

The Board interprets its responsibilities in a manner consistent with the Constitution Act, 1982, including section 35(1), which recognizes and affirms the existing Aboriginal and treaty rights of Aboriginal peoples. In order to ensure that its recommendations and decisions with respect to this application are consistent with both section 35(1) and procedural fairness requirements, the Board has adopted the following assessment process. The Board is of the view that this process is appropriate, recognizing the complexity of this application, the importance of the constitutionally protected rights of Aboriginal peoples, and the many and varied societal interests that must be considered in its assessment.

The Government of Canada and the NEB hearing process

The Board notes that the Government of Canada indicated in letters to potentially affected Aboriginal groups that it is relying on the NEB process to the extent possible to meet the Crown's duty to consult Aboriginal groups. While the Board itself does not owe the duty to consult, the Board is of the view that this reliance is appropriate given the Board's robust and inclusive process, its technical expertise, and broad remedial powers with respect to Project-related matters. The Board notes that a number of judicial decisions, including Taku River Tlignit First Nation v. British Columbia (Project Assessment Director) 2004 SCC 74, have acknowledged the Crown's ability to rely on opportunities for Aboriginal consultation that are available within existing processes for regulatory or environmental review. This is a means by which the Crown may be satisfied that Aboriginal

concerns have been heard and, where appropriate, accommodated. The evidence of the Government of Canada also indicates that following the issuance of this Report, the Government of Canada will continue consulting with certain Aboriginal groups.

Requirements of Trans Mountain

The Board's process was designed to obtain as much relevant evidence as possible on Aboriginal concerns about the Project, potential impacts on Aboriginal interests and possible mitigation measures to minimize adverse impacts on Aboriginal interests. In addition to providing technical information addressing Project-related impacts on, among other things, fisheries, wildlife, vegetation, and heritage resources, Trans Mountain was required to make all reasonable efforts to consult with potentially affected Aboriginal groups and to provide information about those consultations to the Board. This included evidence on the nature of the interests potentially affected, the concerns that were raised and the manner and degree to which those concerns have been addressed. Trans Mountain was expected to report to the Board on all Aboriginal concerns that were expressed to it, even if it was unable or unwilling to address those concerns. Therefore, even if an Aboriginal group chose not to participate in the subsequent hearing process, any concerns could be brought to the attention of the Board through the applicant's evidence.

This early consultation was guided by the Board's Filing Manual Requirements, direction given by the Board during the Project Description phase, as well as information the applicant received from other government departments and agencies that it consulted in relation to the Project. The requirements reflect the fact that an applicant is often in the best position to respond to Aboriginal concerns about a project before an application is filed and while a project is still in the early stages of development.

The Board expects an applicant to design and implement its consultation activities with regard to the nature and magnitude of a project's potential impacts. Where there is a greater risk of more serious impacts on Aboriginal interests (which would, in part, depend on the nature of that interest), the Board has greater expectations in terms of the applicant's consultation with the potentially impacted Aboriginal group. In contrast, where there is a remote possibility of an impact on Aboriginal interests, or the impacts are minor in nature, the applicant's consultation will generally not be expected to be as extensive. An evaluation of Trans Mountain's consultation is outlined below.

Aboriginal groups and the NEB hearing process

In addition to the mandated one-on-one consultation that is to occur between an applicant and potentially impacted Aboriginal groups, it should also be understood that the Board's hearing process itself, including this report, is part of the overall consultative process. While much of the early consultation was performed by Trans Mountain, the Board process acted as a necessary and important check on that consultation and gave Aboriginal groups an additional avenue to explain their concerns about the Project and have those concerns carefully considered by the Board.

Aboriginal groups who are concerned with potential Project-related impacts on their interests had opportunities to present their views directly to the Board. While the Board required the applicant to implement a consultation program and perform an impact assessment, the Board also took steps to facilitate the direct participation of Aboriginal groups in its proceedings. The Board entered into a Project Agreement with the MPMO for the Project, which described the Board's commitments related to its Enhanced Aboriginal Engagement activities. The Board sent letters to each potentially impacted Aboriginal group informing them of the Project, as well as the Board's role in respect of the Project. The letters provided information regarding the Board's participant funding program and offered to provide further information on the hearing process. Board staff followed up on these letters, responded to questions regarding the Board's process and conducted information meetings where requested.

Independent of the Panel and regulatory process, the Board administered a participant funding program, which allotted funding to assist intervenors with their participation. A total of approximately $3 million was made available for participant funding for this hearing. This amount was offered to 72 eligible intervenors, with 79 per cent of the funding offered to Aboriginal groups.

In addition, potentially affected Aboriginal groups were provided with a choice of a number of methods of participating in the hearing. Aboriginal intervenors had the option of participating in the

Board's proceeding in writing or orally, remotely or in person. The Board understands that Aboriginal peoples have an oral tradition for sharing information and knowledge from generation to generation. Since this information cannot always be shared adequately in writing, the Board provided Aboriginal groups with the opportunity to present oral traditional evidence (OTE). The Board finds OTE provided by Aboriginal groups valuable for the Board's consideration of a project. The opportunity to provide OTE was unique to Aboriginal participants. A total of 35 Aboriginal groups and individuals provided OTE to the Board during the hearing.

Given the sensitivity of some of the information that was provided by Aboriginal groups in their evidence, the Board also ordered that certain information be treated confidentially.

To further facilitate Aboriginal groups' participation, the Board generally held oral portions of its hearing in locations near those interested in the Project, and accommodated requests to incorporate traditional ceremonies into its proceeding. When advised of a potential conflict with certain traditional activities, the Board revised, to the extent practical, its schedule to accommodate those timing concerns. The Board also provided both audio and video online broadcasts, as well as transcripts of its proceedings and audio recordings of OTE sessions, so that interested parties who were not in attendance could be aware of what was occurring during the hearing.

Many Aboriginal groups took the opportunity to participate in the Board's hearing process and make submissions directly to the Board. Many of those submissions are reflected throughout this Report. Such submissions by Aboriginal groups included, among other things, descriptions of the nature and extent of their interests in the Project area, views on the potential Project-related impacts, and discussion of appropriate mitigation measures, including their views on the draft conditions the NEB released for comment. The Board thanks each community for providing their traditional and cultural knowledge at the oral traditional evidence hearings

Government departments and the NEB hearing process

Given the comprehensiveness of the Board's process, the Board's technical expertise and its broad remedial powers that are generally not within the purview of other government departments, it was important that concerns related to the Project be brought to the Board's attention through consultation with the applicant and participation in the hearing process. To the extent that other government departments had information to provide to the Board, they had the opportunity to participate in the Board's process and file relevant information on the Board's record. Several government departments participated in the Board's proceeding, including Natural Resources Canada (NRCan), Transport Canada, Environment and Climate Change Canada, Port Metro Vancouver, and the Department of Fisheries and Oceans and Canadian Coast Guard. These government participants filed expert information on the Board's hearing record and were available (and required) to answer questions asked by both the Board and intervenors, including Aboriginal groups. These authorities also had the opportunity to comment and provide information on appropriate mitigation measures.

There were concerns identified by Aboriginal groups during the Board proceeding that are generally unrelated to the application under consideration. The Board recognizes that Aboriginal people have a broad range of matters and concerns that they wish to raise, discuss and resolve with the Government of Canada. While the Board recognizes the importance of these issues, the Board does not have the ability within its proceedings, to properly address issues that are unrelated to the application. Nevertheless, the Board carefully considered all of the submissions of Aboriginal groups so that it could have a greater understanding of the context for Aboriginal concerns with the Project.

Consideration of potential impacts and mitigation

Before making its decisions and recommendation on the Project, the Board considered all of the relevant information before it, including information regarding the consultation undertaken with Aboriginal groups, the views of Aboriginal groups, the potential impacts on Aboriginal interests, and proposed mitigation measures. While the Board considered the nature of the interests potentially impacted, its consideration of claimed interests is not tantamount to the process undertaken to determine the definitive scope of a right through a claims process or a court proceeding aimed at confirming the existence and parameters of an asserted Aboriginal right. In the Board's view, the Board is not required to make a declaration that a claimed right has or has not been proven.

The Board looked at the claimed or established interest in the context of how it may be impacted, what measures can be employed to mitigate that impact and how any impact should be considered in light of other interests related to the Project. The Board then considered all of the benefits and burdens associated with the Project, balancing Aboriginal concerns with other interests and factors (such as the need for the Project), before determining whether, in its opinion, the Project is in the public interest.

In carrying out this part of its mandate, the Board's objective was to reconcile Aboriginal interests and concerns with other public interest considerations. The Board's process is designed to be thorough and accessible to Aboriginal groups so that they may make their concerns known to the Board and have those concerns considered and addressed as appropriate. Further, the open nature of the Board's process allowed all participants interested in the application to be fully aware of the evidence that the Board considered in making its recommendations and decisions on the Project, which is consistent with principles of procedural fairness.

Consultation through the Project lifecycle

It is important to understand that there is a need for consultation to occur early in the planning stages of a project. However, information about a project is necessarily refined as project planning progresses, including in response to information provided by Aboriginal groups through consultation, and therefore, it is important that consultation is ongoing. The Board has set out broad expectations for all regulated companies that consultation will continue throughout the life of a project and the Board routinely imposes binding obligations on the applicant to ensure that such consultation is occurring in an appropriate manner throughout the lifecycle of a pipeline. As the regulator of a project throughout its lifecycle, the Board also has a number of processes and tools at its disposal to execute its oversight of a project, including ensuring compliance with any conditions imposed by the Board.

If a certificate is issued for this Project, consultation will be ongoing throughout the life of the Project as conditions are met and additional permits are obtained. Notwithstanding this additional consultation, the Board is satisfied that the initial certificate process described above serves an important role in reconciling the various interests involved in such applications and ensuring that Constitution Act, 1982, section 35(1) obligations associated with the Project are met.

Trans Mountain's consultation

In assessing the consultation undertaken by Trans Mountain with Aboriginal groups, the Board evaluated the design and implementation of Trans Mountain's consultation activities. The Board considered the company's activities to engage Aboriginal groups and to learn about their concerns and interests. It also considered how Aboriginal groups responded to opportunities for consultation and how Trans Mountain sought to understand, consider and address the concerns of potentially affected groups. The Board considered how this input influenced the Project's proposed design and operation. The Board also considered the concerns and views expressed by Aboriginal groups.

A company's early consultation with Aboriginal groups is a critical part of the development of proposed project, and a key matter for consideration within the regulatory review process. Timely, accessible and inclusive consultation facilitates the effective exchange of information, and provides opportunities for the company to learn about the concerns of potentially affected Aboriginal groups, to discuss how those concerns can be addressed through project design and operational considerations, and to develop and discuss measures to reduce and mitigate the effects a project may have on the interests of Aboriginal groups. Timely and effective consultation can help establish productive relationships that can carry on throughout the life of the project. It also informs the Board of the concerns Aboriginal groups may have about a project's impacts.

With respect to Trans Mountain's consultation with Aboriginal groups, the Board finds that Trans Mountain met the expectations of the National Energy Board, including those set out in the Board's Filing Manual. Since 2012, as part of the initial phases of the consultation process, the company provided Project information to Aboriginal groups. This included information about the Project's design, operations, as well as its potential environmental, social and economic effects, including potential economic benefits through employment and training opportunities. The Board notes that Trans Mountain continued to provide opportunities to raise and discuss concerns with the company to those Aboriginal groups that were identified as being potentially affected, and those that identified

themselves to Trans Mountain as wishing to be engaged in consultation, throughout the early Project design phase and the regulatory review process.

The Board finds that the criteria used by Trans Mountain to identify potentially affected Aboriginal groups were appropriate. The Board notes that Trans Mountain's consultation with Aboriginal groups took into consideration the Project's proximity to areas of traditional use along the proposed right-of-way, and in proximity to the WMT. Trans Mountain also considered input from relevant federal and provincial departments and ministries. Once groups identified to Trans Mountain their interest in engaging in consultation, Trans Mountain was responsive to these requests, including Michel First Nation. The Board also notes that Trans Mountain included Aboriginal groups along the shipping route that would be used by tankers associated with marine transportation activities. This included Aboriginal groups on Vancouver Island and the Gulf Islands along established marine shipping corridors transited by tanker traffic, as well as communities in and around Port Metro Vancouver. The Board finds these aspects of Trans Mountain's consultation program design and implementation to be inclusive and appropriate for the Project's location and scope.

The Board finds that Trans Mountain offered all potentially affected Aboriginal groups adequate opportunities to raise any concerns they had with the company, and to provide information about their concerns and interests in the Project area and within their traditional territories. The Board notes that this included the opportunity for each potentially affected Aboriginal group: to complete or participate in traditional land and resource use (TLRU) studies and traditional marine use (TMRU) studies; to provide traditional ecological knowledge (TEK); and to identify potential effects on the current use of lands and waters and resources for traditional purposes. The Board also finds Trans Mountain provided appropriate opportunities to identify and discuss measures to reduce or avoid potential adverse effects. The Board notes the variety of information provided by Trans Mountain to Aboriginal groups, as well as the numerous opportunities and offers to engage in consultation. These included providing Aboriginal groups with notices of field study work, Project updates, and invitations to meet with the company to discuss concerns. The Board also notes Trans Mountain's offers to provide capacity funding to Aboriginal groups, which Trans Mountain said *were facilitated through the signing of 94 agreements for capacity funding and assessment studies with an aggregate value of $36 million.*

The Board notes that some Aboriginal groups were critical of Trans Mountain's approach to consultation. A number of Aboriginal groups raised concerns about the adequacy of Trans Mountain's consultation activities and efforts. Some groups said they were not provided adequate opportunities to raise their concerns with the company, or to discuss or participate in the development of mitigation measures for the Project. Other groups felt that the time allowed to review Project information was inadequate. The Stó:lō Collective felt some of its information was not fully considered by Trans Mountain.

The Board finds that Trans Mountain provided numerous opportunities and venues for Aboriginal groups to provide information about their interests to the company, and that Trans Mountain considered the information that it received from those Aboriginal groups that chose to provide it. The Board notes that many Aboriginal groups chose not to participate in TLRU and TMRU studies for the Project.

The Board is of the view that Trans Mountain considered the information that was provided by Aboriginal groups about their use of the lands, waters, and resources, and made a number of changes to the design and planned operation of the Project as a result of this information. These changes include reconfiguring the pipeline design in the Upper Fraser River and Upper North Thompson River Valley, and revising a proposed route across the Peters IR No. 1A. As the Board discusses in Chapter 11, the majority of the pipeline route for the Project parallels existing disturbance, including the right-of-way for Trans Mountain's existing pipeline. The Board finds this appropriate, as this reduces the requirements for new right-of-way disturbance, minimizes the potential impacts of construction, and reduces effects on nearby residents and communities. The Board is of the view that Trans Mountain appropriately responded in its design and routing to the concerns and recommendations made by Aboriginal groups, to the extent that was possible while maintaining minimal disturbance by paralleling existing disturbance.

Trans Mountain committed to ongoing consultation with affected Aboriginal groups throughout the life of the Project. The Board views consultation as an iterative and ongoing process of discussion and dialogue. The Board expects companies to continue to learn about the concerns that groups may have about a project, and to discuss ways to address those concerns to the extent possible. Trans Mountain's approach to its ongoing consultation with potentially affected Aboriginal groups meets the Board's expectations. Trans Mountain has committed to implement its ongoing consultation efforts in order to further develop and finalize those measures that will be used to mitigate and reduce the potential effects on the Aboriginal groups in the Project area. The Board finds this approach acceptable, and encourages Aboriginal groups to continue to engage with Trans Mountain in order to provide input into the final plans and mitigation measures for the Project. In order to apprise the Board and all potentially affected Aboriginal groups about Trans Mountain's ongoing consultation efforts, including how it has addressed any concerns raised by Aboriginal groups, the Board would impose Condition 96 requiring Trans Mountain to file with the Board reports on its ongoing consultation with potentially affected Aboriginal groups during construction, and through the first five years of operations (Condition 146).

Some groups were critical of this approach to ongoing consultation, and felt that Trans Mountain had not yet adequately completed or fulfilled its consultation with Aboriginal groups. For example, Kwantlen First Nation, Cheam First Nation and Chawathil First Nation felt that Trans Mountain did not adequately provide opportunities to discuss or finalize emergency response plans for the Project. The Board finds that, for this phase of the Project, Trans Mountain provided appropriate and adequate opportunities to discuss elements of the Project such as emergency response plans. Trans Mountain has committed to engaging directly with potentially affected groups on the development of emergency response plans. The Board finds this appropriate. In order to apprise the Board and potentially affected Aboriginal groups about its consultations, and to ensure that Aboriginal groups are provided with opportunities to provide input into the final plans and measures, the Board would require Trans Mountain to file with the Board its plan for consultation on the development of its Emergency Management Program (Condition 90). Trans Mountain would also be required to incorporate the results of consultation into its Emergency Management Program, including tactical plans for high consequence areas (Condition 124). The Board finds that Trans Mountain provided Aboriginal groups appropriate and adequate opportunities to discuss the measures and plans that would protect communities and the environment, and that these opportunities will continue as part of ongoing planning for the Project.

The Board acknowledges that Trans Mountain and a number of Aboriginal groups entered into agreements and letters of understanding for the Project. The Board also notes the letters from certain Aboriginal groups expressing their support for the Project, some of which note they do not object to the Project, or are satisfied by the mitigation measures and consultation provided with respect to the Project. Several of the letters from Aboriginal groups also expressed their opinion that the Project would result in positive economic effects. The Board is supportive of the aims of such agreements, which clarify the nature of the relationship between the parties, outline any support necessary to aid in discussion about the Project, and facilitate cooperation. The Board views the expressions of support offered by Aboriginal groups to reflect the outcomes of effective consultations and discussions between the company and those Aboriginal groups that have chosen to enter into arrangements with Trans Mountain. The Board also notes the concerns expressed by Aboriginal groups regarding opportunities to participate in the Project through employment, training, and contracting or procurement. As discussed in Chapter 11, in order to facilitate the economic participation of Aboriginal groups in the Project, the Board would impose Condition 12 requiring Trans Mountain to file with the Board a plan for monitoring the implementation of training and education opportunities, and to file a local, regional and Aboriginal skills and business inventory (Condition 11).

The Board finds that Trans Mountain has designed and implemented an appropriate and effective consultation program, that meets the requirements and expectations set out in the Board's Filing Manual. The Board also finds that, with Trans Mountain's commitments and the Board's recommended conditions, Trans Mountain can effectively continue to consult with Aboriginal groups, to learn more about their interests and concerns, and address issues raised by Aboriginal groups throughout the Project's operational life.

Project-related impacts

In assessing potential impacts on Aboriginal interests, the Board considered all of the evidence provided. The Board assessed how Trans Mountain identified and evaluated the potential impacts, the concerns raised by Aboriginal groups, and the measures Trans Mountain has proposed to minimize or eliminate the Project's potential impacts on the interests of Aboriginal groups.

Through the review process, Aboriginal groups had the opportunity to make their views and concerns about the Project, including what effects it might have on their potential or established interests, known to both Trans Mountain and the Board. Aboriginal groups expressed their views and concerns about how the Project might affect their Aboriginal and treaty rights relating to hunting, fishing, trapping, the gathering of plant resources for subsistence and medicinal purposes, and the continued cultural and ceremonial practices and activities that are intimately interwoven with and dependent on their access to lands, waters, and resources within their traditional territories. The Board acknowledges the importance that Aboriginal groups place on being able to exercise their Aboriginal and treaty rights, and continue their traditional activities, uses and practices within the entire area of their traditional territories, including access to resources and areas and sites of cultural importance and significance.

Trans Mountain outlined its approach for assessing the potential impacts on the rights and interests of Aboriginal groups. Its approach relied on an assessment of the effects on biophysical and human environments. This incorporated information provided by Aboriginal groups through consultation, traditional land and marine use studies, and their participation in biophysical field studies.

The Board considered the evidence provided by Trans Mountain, Aboriginal groups, and other participants about the nature and extent of the activities, uses, and practices that are carried out by Aboriginal groups in the Project area, and the concerns expressed regarding the impacts of spills on traditional use and activities. The Board considered the potential impacts on those activities, uses, and practices. The Board also considered all the measures committed to by Trans Mountain to minimize or avoid such impacts.

As described in detail in Chapters 10, 11, and 14, Trans Mountain has described its specific and broad mitigation measures that would be implemented to address potential effects on biophysical elements, including fish and fish habitat, wildlife, vegetation, and water quality and quantity, as well as measures to address specifically the potential effects on TLRU, TMRU and socio-economic components, including cultural heritage resources. Trans Mountain concluded that with the application of its mitigation measures, adverse effects on TLRU, TMRU and the biophysical elements that support such use, as well as on socio-economic components, including cultural heritage resources, are not likely to be significant, with the exception of effects on the Southern resident killer whale, including traditional uses associated with the Southern resident killer whale.

Some Aboriginal groups did not agree with the approach taken by Trans Mountain. Some groups expressed concern that Trans Mountain did not undertake group-specific assessments of the potential effects, or did not assess the potential impacts to established or asserted rights. The Board finds Trans Mountain's approach to assessing the potential effects on Aboriginal interests is acceptable. Trans Mountain has assessed the effects related to construction, operations, and potential accidents and malfunctions including spills that may impact biophysical resources and socio-economic components within the Project area, and the Aboriginal uses, practices and activities associated with those resources.

The Board recognizes that there would be impacts associated with this Project, and that these would be experienced by some Aboriginal groups. Reduced or interrupted access to lands, waters, or resources used by Aboriginal groups, including for traditional land and marine uses, and for cultural and ceremonial purposes, may result in disruptions in the ability of Aboriginal groups to practice their traditional activities. The Board has fully considered all the evidence in relation to these matters, which are described in detail in chapters 11 and 14, and the Board finds that, during construction and routine operations, these impacts would be temporary and are not likely to be significant. With respect to TMRU activities directly affected by the WMT, the Board finds that these effects would persist for the operational life of the Project, as TMRU activities would not occur within the expanded water lease boundaries for the WMT. The Board finds that while the effects would be long-term in duration, these would be reversible in the long term, and that adverse effects are not likely to be significant.

With respect to the potential effects of Project-related vessel traffic on Aboriginal marine vessels and users, the Board finds, as described in Chapter 14, that these effects would be limited to the time during which the Project-related vessels are in transit and therefore, these effects would be temporary and Aboriginal marine vessels will be able to continue their movements and to access areas outside of those brief periods of interruption. As outlined in Chapter 14 of this Report, the Board finds that with the exception of effects on the traditional uses associated with the Southern resident killer whale, adverse effects of Project-related marine vessel traffic on traditional marine resource uses, activities and sites are not likely to be significant.

With respect to the potential impacts of a worst-case spill from the pipeline or from Project-related vessels on the ability of Aboriginal groups to continue their traditional uses, practices and activities, the Board finds, as described in Chapters 11 and 14, that depending on the size, location and conditions of a spill and the effectiveness of response measures, there could be significant adverse effects on these traditional uses, practices and activities. As noted in its views on these matters in the respective chapters, the Board finds that the probability of such events is very low. The Board has incorporated the potential consequences of a spill outlined above into its discussion on Spill Risks in Chapter 1 and considered them in its overall weighing of the benefits and burdens of the Project in Chapter 2.

The review and final design of a proposed project is, in the Board's view, an iterative process. Should the Project proceed, Trans Mountain would be required to continue its consultation with potentially affected Aboriginal groups, and to finalize the development of its plans and measures to reduce and mitigate the potential effects and to protect the environment and the resources that are of importance to and utilized by Aboriginal groups. The Board would impose a number of conditions requiring Trans Mountain to report to the Board on its consultation with Aboriginal groups during construction, through the first five years of operations, and to report to the Board on its consultations regarding the development of a number of its plans related to, among other things, environmental protection and emergency response programs.

Viewing all of these factors together, and as the Board has concluded within Chapters 10, 11, and 14, the Board is satisfied that with Trans Mountain's commitments, its proposed mitigation measures, and with the Board's proposed conditions, that the effects on the interests of potentially affected Aboriginal groups can be effectively minimized, and that there would not be significant adverse effects on the ability of Aboriginal people to continue to use lands, waters and resources for traditional purposes, with the noted exception of traditional uses associated with the Southern resident killer whale.

Summary of views on section 35(1), Constitution Act, 1982

The Board heard a number of arguments regarding requirements related to section 35(1) of the Constitution Act, 1982, including the need for the Board to assess the adequacy of Crown consultation. The Board recognizes that the law with respect to such matters is regularly being clarified. Nevertheless, the Board understands that the duty to consult with Aboriginal groups, triggered when government decisions have the potential to adversely affect Aboriginal and treaty rights, is a constitutional duty invoking the honour of the Crown and it must be met. While the Board does not itself owe the duty, its process is relied upon, to the extent possible, to discharge the duty to consult.

Having considered all the evidence submitted in this proceeding, the consultation undertaken with Aboriginal groups, the impacts on Aboriginal interests, the proposed mitigation measures, including conditions, to minimize adverse impacts on Aboriginal interests and the commitments to and Board imposed requirements for ongoing consultation, the Board is satisfied that the Board's recommendation and decisions with respect to the Project are consistent with section 35(1) of the Constitution Act, 1982. The Board is of the view that this assessment is consistent with what is required for the purposes of the Board's Report.

The Government of Canada has stated that there will be additional consultation following the issuance of this Report, and the GIC will be making a determination as to whether it will direct the Board to issue a certificate for the Project pursuant to section 54 of the NEB Act.



6.0



Pipeline and Facility Integrity

The Board makes and implements regulations and guidelines to promote the safety, security, and protection of people, the environment, and property throughout a pipeline project's lifecycle. Pipelines regulated under the *National Energy Board Act* (NEB Act) must be designed, constructed, and operated in accordance with the *National Energy Board Onshore Pipeline Regulations* (OPR) and the latest versions of relevant design codes, including Canadian Standards Association Z662 – Oil and Gas Pipeline Systems (CSA Z662).

In making its public interest determination, the Board is mindful of the direction provided by Parliament in section 52 of the NEB Act. It says in part that the Board must have regard to all considerations that appear to it to be directly related to the pipeline and to be relevant.

The Board may make its recommendation in the public interest before a company completes the final design for a project in cases where the company's preliminary design approach and methodology are found to be acceptable. The Board typically makes its recommendation subject to the fulfillment by the company of various certificate conditions and commitments prior to construction, operation, or other appropriate project milestone. The Board then verifies compliance with conditions and commitments through assessment of the information filed, inspections, and audits. Upon the completion of construction and when all relevant conditions and commitments have been fulfilled, the company may then apply to the Board for Leave to Open the subject pipeline sections and facilities. In accordance with the NEB Act, a company requires permission from the Board, by applying for Leave to Open, before opening a pipeline or a section of pipeline for the transmission of hydrocarbons or any other commodity. The Board may grant leave under section 47 of the NEB Act if satisfied that the pipeline can be safely opened for transmission.

6.1 New pipeline segments in Line 2

6.1.1 Design approach

Trans Mountain proposed to construct the following pipeline segments that will be part of the 1 180[15] km long Line 2 pipeline:

- approximately 339 km of new 914 mm (NPS 36) pipeline from Edmonton to Hinton, AB;
- approximately 121 km of new 1067 mm (NPS 42) outside diameter pipeline from Hargreaves to Blue River B.C.;

15 Line 2 will also include approximately 193 km of active pipeline segments transferring to Line 2 service.

- approximately 158 km of new 914 mm (NPS 36) pipeline from Blue River to Darfield B.C.; and
- approximately 368 km of new 914 mm (NPS 36) pipeline from Black Pines to the Burnaby Terminal.

Trans Mountain said that the new pipeline will be designed, constructed, operated, maintained, and abandoned in accordance with the OPR and the latest version of CSA Z662. Trans Mountain submitted its application for the Project when the CSA Z662-11 standard was in effect. Trans Mountain subsequently committed to complying with CSA Z662-15 requirements when this standard came in to effect. In addition, Trans Mountain committed to complying with the requirements of the latest versions of various industry codes, standards, specifications, and recommended practices. Kinder Morgan Canada (KMC) standards, specifications, manuals, and recommended practices will be incorporated into the design, construction, operation, and maintenance of the expanded Trans Mountain Pipeline system, where applicable.

According to Trans Mountain, the engineering design information provided in its application was at a conceptual or preliminary engineering level. Detailed design for the Project is ongoing and will continue through the fall of 2017. Trans Mountain said that it is employing an iterative risk-based design approach as the basis of identifying optimal risk-mitigation measures and is incorporating these measures into the final design. See section 6.1.3 for more information on the risk-based design process.

Trans Mountain said that there would be locations along the pipeline route where conditions or circumstances are not adequately addressed in CSA Z662 or the OPR, such as potential slope instability, scour, and erosion. Trans Mountain said that qualified engineering specialists will evaluate and prepare detailed engineered designs to meet the safety and integrity requirements of CSA Z662 and the OPR for those conditions or circumstances. Trans Mountain committed to using the best available technologies with respect to the engineering design, materials, and construction of the Project.

Views of the Board

The role of the Board in assessing the design of pipelines and facilities under its jurisdiction is primarily to ensure public safety and the integrity of the pipelines and facilities. The Board notes the concern of many participants that the information provided by Trans Mountain was at the preliminary design level, and that detailed engineering and design information was not available for them to examine during the hearing.

As discussed in Chapter 1, section 1.3, pipeline projects generally follow a three-phase design process consisting of a conceptual phase, a preliminary engineering phase and a detailed engineering phase which would lead to the final design. Applications submitted to the Board for a Certificate of Public Convenience and Necessity (CPCN) typically contain information based on conceptual and preliminary engineering data. The detailed route for a project has typically not been determined at the application stage and, therefore, detailed designs cannot be completed for all aspects of the project.

The Board has examined the evidence and tested the assertions made by Trans Mountain and other hearing participants. Having done so, the Board has determined that the proposed design approach, in the form before the Board in this application, demonstrates that the conceptual and preliminary design of the Project complies with current and applicable regulations and standards. The Board proposes conditions to ensure that critical components of the final design and the Project once it is constructed will also comply with regulatory requirements.

6.1.2 Pipeline design

Hydraulic analyses

Trans Mountain said that single-phase steady state pipeline hydraulic analyses were undertaken to evaluate the hydraulic characteristics of the Project's pipelines. These analyses considered a wide range of pipeline diameters and design pressures to achieve the lowest combination of capital and operating costs per barrel of crude oil transported by optimizing the size of the pipeline segments, and the number, capacity and location of pump stations. Trans Mountain said that transient analyses will be performed during the detailed engineering phase to further evaluate the specific anticipated operational conditions.

Trans Mountain said that Line 2 has been designed to have a sustainable annual average pipeline capacity of approximately 85 850 m^3/d (540,000 bbl/day), based on an assumed slate of heavy crude oil batches, using a design flow rate of 90 370 m^3/d (568,400 bbl/day). Trans Mountain assumed an availability factor of 0.95 to establish the sustainable annual average capacity. The availability factor reflects the need for planned shutdowns for maintenance as well as unplanned shutdowns, operational flexibility, and hydraulic calculation uncertainties. Trans Mountain said that the capacities of the pipelines were governed by the viscosities of the crude oil. For Line 2, Trans Mountain's hydraulic analyses assumed that the crude shipped would be batches of diluted bitumen.

According to Trans Mountain, the hydraulic analyses indicated that 11 new pump stations will be required on Line 2 to achieve the necessary pumping capacity. Trans Mountain said that the availability factor of 0.95 for Line 2 has been selected for preliminary design purposes but may be revised during the detailed engineering phase, after considering a number of reliability and operating parameters.

During the hearing, Trans Mountain continued to refine its design and proposed several modifications to the initial design that would serve to reduce environmental impacts and reduce the scope of upgrades to the utility power infrastructure in the lower North Thompson River valley. This was achieved by changing the location of some pumping units and increasing the diameter of the pipeline from NPS 36 to NPS 42 for a distance of 121 km between Hargreaves, B.C., and the Blue River Pump Station. The proposed increase in diameter will result in reduced fluid friction losses in the pipeline, eliminating the need for the proposed Rearguard Pump Station and the associated B.C. Hydro upgrades to supply utility power. Trans Mountain said that one of the most significant results of the change was the elimination of two pipeline crossings of the Fraser River near the previously proposed Rearguard Pump Station. Trans Mountain said that the proposed reconfiguration resulted in a slight reduction in overall risk when compared to the same segment using an NPS 36 diameter pipeline.

As part of its hydraulic design, Trans Mountain said that it considered a theoretical future expansion scenario of 124 010 m^3/day (780,000 bbl/day) average annual sustainable capacity on Line 2. However, the expansion scenario will require installation of new pipeline segments, the addition of pumping units to several pump stations, and changes to the pump station design temperatures. Trans Mountain said that the purpose of considering a future expansion is to ensure that the pump station piping sizes and pump configurations selected for the current proposed expansion are appropriate for a higher capacity, and that physical space is available for additional pump units and other elements at the proposed pump stations. Trans Mountain said that there are many obstacles to the feasibility of this future expansion scenario, including the availability of power supply, the space available for tanks and terminal infrastructure at Edmonton, Sumas, and Burnaby, the capacity of the Puget Sound pipeline, and the capacity for increased vessel traffic through the Second Narrows in Burrard Inlet.

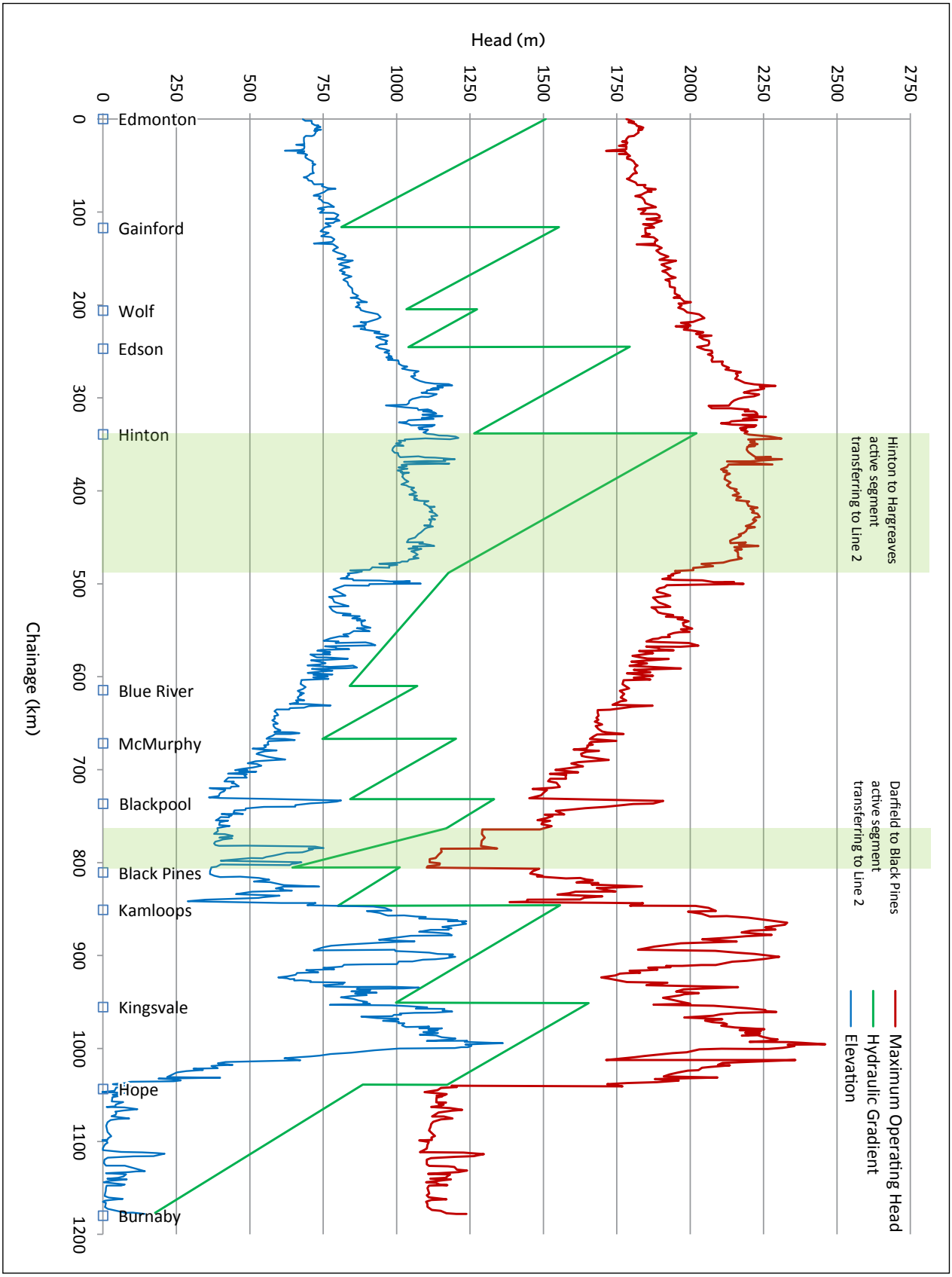
Design and operating pressure

Trans Mountain said that the new pipeline segments will be hydrostatically tested in accordance with CSA Z662 to provide a point-specific maximum operating pressure (MOP)[16] with the exception of some sections that would have a flat MOP. The point-specific MOP is expected to vary between 6,000 and 10,000 kPa. Trans Mountain said that it has extensive experience operating pipelines with point-specific MOPs and does not anticipate operational challenges as point- specific MOPs have been effectively applied on the existing Trans Mountain Pipeline (TMPL) system for many years. Trans Mountain said it is carrying out comprehensive hydraulic studies to identify safe limits for operating the pipeline and protective device settings to ensure the pipeline does not exceed allowable limits for transient pressures during abnormal operations. In addition, point-specific MOPs will be configured into the supervisory control and data acquisition (SCADA) system, which will provide a real-time pressure and point-specific MOP display to the Control Centre Operator (CCO) with MOP warning alarms. Figure 5 illustrates the anticipated maximum operating head profile[17] along the Line 2 pipeline.

16 A point-specific MOP will have a different MOP at each location of a pipeline segment. A flat MOP will have the same MOP for the entire segment of the pipeline.

17 Maximum operating head expressed in units of metres or feet of crude compared to maximum operating pressure expressed in units of kilopascals or pounds per square inch.

Figure 5: Anticipated maximum operating head profile



Line pipe specifications

Trans Mountain said that line pipe will be made of low carbon, high strength, low alloy, Grade 483 steel with a minimum temperature rating of -5°C for below grade pipe and -45°C for above grade pipe. The maximum design temperature is 50°C. Trans Mountain also said that it will specify Category II pipe for the below ground pipe and Category III for the above ground pipe to maximize fracture initiation resistance and ensure premium product quality.

Trans Mountain said that the line pipe minimum wall thickness would be selected in accordance with CSA Z662. In addition, a risk assessment would be undertaken to identify the specific locations that require heavier wall pipes. In general, new 762 mm (NPS 30), 914 mm (NPS 36) and 1067 mm (NPS 42) line pipe will have a minimum pipe wall thickness of 9.8 mm, 11.8 mm, and 13.8 mm respectively.

Slack line flow

Trans Mountain said that slack line flow[18] can have negative impacts on leak detection systems causing decreases in sensitivity, reliability and accuracy.

With regard to Line 2, Trans Mountain said that there was the potential for slack line flow downstream of the Coquihalla summit at the design flow rate and that back pressure control would be appropriate. As a result, the design would include increased pipe wall thickness for several kilometres upstream (the exact length to be determined), and for approximately two kilometres downstream of the relief station at Hope, as well as back pressure control valve(s) at the relief station. A pressure relief valve would be installed upstream of the back pressure control valve(s).

According to Trans Mountain, slack line flow will not occur at the design flow rates at other locations on Line 2. Trans Mountain said further study is required to assess atypical flow rate scenarios and shut-down and start-up conditions for Line 2. It may be necessary and/or desirable to allow slack line flow to develop in these transitional flow scenarios. Where it is possible and/or desirable to avoid slack line flow during pipeline shut down scenarios, mainline valves will be selectively closed to maintain line pack.

Edward Farquhar asked about specific control centre operating procedures for identifying slack line flow conditions. Trans Mountain said that KMC CCOs currently follow established procedures for considering deviations of pressure and flow when assessing slack line flow conditions. However, Trans Mountain was of the view that adding additional procedures to more specifically address slack line flow conditions would be a useful enhancement to the existing KMC procedures. Trans Mountain said this initiative was currently under development and that KMC will have these procedures completed and in use prior to the operation of the expanded pipeline system.

Views of the Board

The Board finds that Trans Mountain has followed accepted engineering practices during the conceptual and preliminary design stage, and that the proposed pipeline design meets or exceeds minimum requirements of the Onshore Pipeline Regulations and Canadian Standards Association Z662 (CSA Z662). Trans Mountain has considered a future capacity expansion scenario, which is reasonable for companies to consider during the project design stage. However, Trans Mountain would be required to file a separate application with the Board for the Board's consideration and approval, should it wish to increase the pipeline's design capacity in the future.

The Board notes that Trans Mountain is proposing to use point-specific Maximum Operating Pressure (MOPs) for the new pipeline segments in mountainous areas, which is also permitted by CSA Z662. It is advantageous, or in some cases necessary, for liquid pipelines to operate with point-specific MOPs to account for variations in pressure due to elevation changes in such areas. Trans Mountain is required by CSA Z662 to install the necessary protective devices to ensure the pipeline does not exceed point-specific MOPs during normal or abnormal operating conditions.

The Board is satisfied with the proposed pipeline specifications for the new pipeline segments. In addition to minimum wall thickness requirements provided in CSA Z662, Trans Mountain will

18 Slack line flow refers to a condition where a pipeline transporting a liquid product, such as oil, develops vapour bubbles at locations where the pipeline pressure falls below the vapour pressure of that liquid.

undertake a risk assessment to identify the locations where heavier walled pipe is required. Stress analyses will be carried out to calculate the stresses that would be experienced by the pipe to determine the required pipe wall thicknesses at proposed horizontal directional drilled crossings. The Board is of the view that these approaches will help in enhancing the integrity of the pipeline by reducing risk.

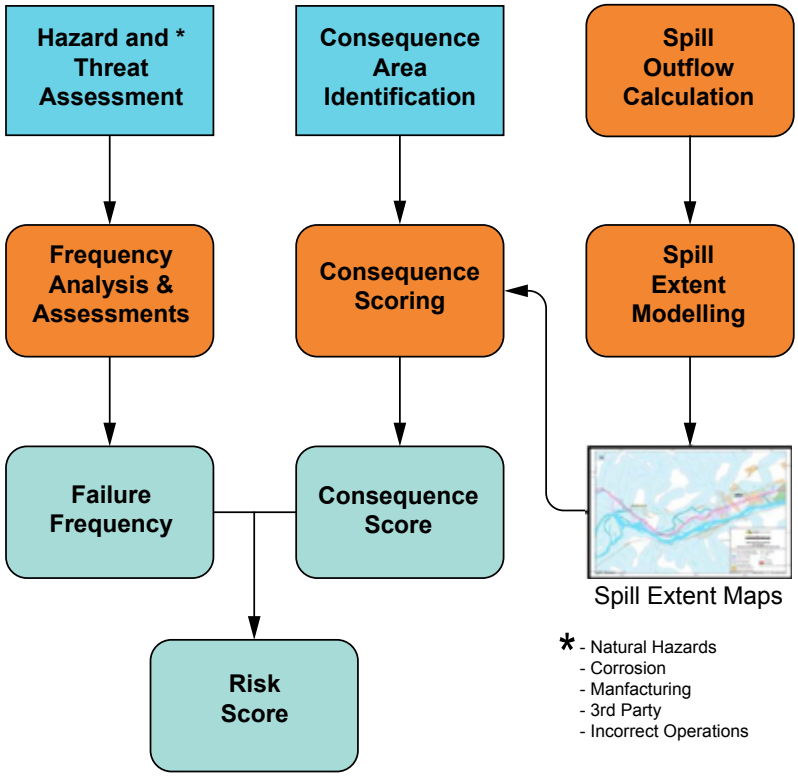
Slack line flow conditions can negatively affect the capabilities of the leak detection system and the Board is of the view that, where possible, slack line flow should be addressed during the detailed design stage of the pipeline. Therefore, the Board would impose Condition 135 requiring Trans Mountain to provide the design and operation measures it will implement for the detection and prevention of slack line flow conditions.

6.1.3 Risk-based design

Trans Mountain said that it was undertaking a risk-based design process that enables the pipeline design team to minimize risk in a cost effective manner and to demonstrate safe operations. The risk-based design would be primarily used to develop a basis for identifying and mitigating principal threats, such as natural hazards (e.g., geotechnical, hydrological and seismic) and external threats (e.g., third-party damage). It would also be used to develop strategies at the design stage to reduce risk resulting from identified threats and associated consequences. Trans Mountain said that risk-based design is a rigorous design approach that goes beyond the minimum requirements of CSA Z662. For the purposes of risk-based design, Trans Mountain considered the probability of full-bore ruptures and their potential consequences as representing the most credible worst-case hazard scenario.

Trans Mountain characterized its risk assessment method for the pipeline as being semi quantitative, resulting in a relative ranking of risk for all segments along the pipeline. Trans Mountain said that its risk-based design process is iterative and that, based on the results, additional measures could be implemented in the design to either reduce the probability (i.e., frequency) of failure or to reduce the consequences for areas of higher risk. The risk-based design is informed by risk scores derived by multiplying quantitative estimates of failure frequency and qualitative consequence score. Figure 6 provides an overview of Trans Mountain's Spill Risk Assessment Process.

Figure 6: Risk assessment process



In the risk-based design process, Trans Mountain segmented the proposed pipelines into individual similar segments called dynamic segments. A dynamic segment is a contiguous length of pipeline which has the same wall thickness, internal pressure, land use and depth of cover. Trans Mountain said this approach enabled the establishment of a failure frequency, consequence score and risk score for each segment. Line 2 has over 91,000 dynamic segments between Edmonton and Burnaby. Trans Mountain said this approach would enable pipeline designers to identify principal risk drivers and prioritize and select the most effective risk mitigation measures to arrive at a risk-optimized design.

Establishing the failure frequencies

Trans Mountain said that industry failure statistics are not directly applicable to new pipelines because they do not take into consideration modern pipeline designs, materials and operating practices that benefit new pipelines. Trans Mountain cited 20 technological advances that have addressed many of the issues affecting the older pipelines.

For some failure threats, Trans Mountain used reliability models that employ limit state functions[19] for the specific damage mechanism of interest. Trans Mountain said that these limit state functions exist for some of the most significant threats, such as third-party damage and corrosion (both internal and external). Trans Mountain said that reliability methods are not feasible for all threats, and that industry failure statistics must be relied upon in order to provide estimates of failure frequency for failure threats such as human error during operation, material defects and construction defects. The historical failure frequency estimates were evaluated by Trans Mountain and modified to account for the era of installation, use of current materials, design and operations technologies.

Trans Mountain said that geohazards could be evaluated by an expert assessment at discrete locations of potential susceptibility in order to characterize the magnitude and associated frequency of occurrence. Trans Mountain said that it evaluated the potential frequency of loss of containment (FLoC) for each type of geohazard at every location along the proposed pipeline. Trans Mountain evaluated 14 categories of geohazards under the broader categories of hydrotechnical hazards, rock slope geohazards, soil slope geohazards, seismic geohazards, and snow slope geohazards. It provided examples of potential mitigation measures that could be applied to reduce the FLoC values, including the use of horizontal directional drilling (HDD) at a watercourse crossing to eliminate potential exposure due to scour, or relocating a valve outside of an avalanche path to remove the potential for impact. Trans Mountain said that such mitigation would be implemented as part of detailed design and engineering. Section 6.1.4 provides more information on geohazard assessment. The results of the Quantitative Geohazard Frequency Assessment, along with other hazards, were included in Trans Mountain's overall risk assessment in order to identify sites where additional investigation or mitigation may be required as part of Trans Mountain's risk-based design.

Qualitative consequence assessment

Trans Mountain said that the environmental and socio-economic consequences that are associated with a crude oil pipeline spill do not lend themselves to absolute quantification and expression in terms of a universally recognized unit of measure. Trans Mountain outlined a qualitative consequence methodology that it had developed to evaluate the environmental impacts associated with a low vapour pressure liquid spill on its new pipeline sections. This is an indexing method in which factors that influence consequence severity are assigned weighting factors and are then combined into a qualitative score. Trans Mountain said that since there are often no publications or other reference material available to support the relative weightings of these factors, the factors themselves were assigned on the basis of expert judgment, considering known effects from past incidents and known relative environmental sensitivities. Trans Mountain said that the qualitative estimates of consequence were based on the following assumptions:

- a maximum design throughput of 90 370 m^3/day (568,420 bbl/d) between Edmonton and Burnaby, and for Burnaby to Westridge, volumes of 111 290 m^3/day (700,000 bbl/day);
- a full-bore release as a most-credible worst-case scenario;
- the product was released through an opening in the bottom of the pipe equivalent to the internal diameter; and

19 A mathematical expression that determines whether the pipeline satisfies a design requirement (e.g., fails or does not fail during the period of time specified).

- there was a time interval of ten minutes between release and pump shut-down.

In order to provide environmental consequence scores for its semi-quantitative risk analysis, Trans Mountain used two separate consequence scoring approaches; one for watercourse intersects (i.e., segments where the spill plume intersects watercourses) and the other for non watercourse intersects (i.e., all other segments). Scoring tables were provided which gave input values associated with different outflow volumes, various watercourse sensitivities, the presence of drinking water sources and potential land use impacts.

Risk scores and acceptance

Trans Mountain provided tabulated risk results for the proposed Line 2 pipeline that contain unmitigated risk results reported for one-kilometre segments of the route. Unmitigated risks are the risk values prior to implementation of all risk mitigation measures. In ranking the unmitigated risk results from highest to lowest, Trans Mountain observed that natural hazards (geohazards) represent the largest contributor to failure frequency. The lowest threat contributors to total failure frequency were internal and external corrosion.

Trans Mountain said that all risk mitigation measures would be incorporated into the final design through the implementation of the risk-based design process. Once incorporated into the final design, these mitigation measures would reduce failure likelihood and/or consequence (and hence risk) by targeting risk mitigation strategies directed at the principal drivers of risk identified in the risk assessment.

With regard to risk acceptance criteria, Trans Mountain said that no environmental risk evaluation criteria have been established for pipelines in any jurisdiction, and those risk criteria that do exist relate to human life. Therefore, the types of risk mitigation measures that are being considered by Trans Mountain include both failure prevention and spill mitigation measures to ensure that risk is managed to levels that are As Low As Reasonably Practicable (ALARP). Trans Mountain said that the ALARP principle dictates that risk mitigation should be considered until a point of diminishing returns has been reached with respect to the expenditure of further resources. Once it has been established that risk reduction in one area is not sensitive to further implementation of risk-mitigation measures, resources are more appropriately directed at reducing risk in other areas. Trans Mountain is of the view that the risk mitigation decisions that are based on ALARP promote safe and reliable operation because the presumption is that an operator is bound by duty to implement the risk reduction measure. To avoid having to implement risk-mitigation measures, the operator, as duty-holder, must be able to show that it would be grossly disproportionate to the benefits of the risk reduction that would be achieved. Thus, according to Trans Mountain, the process is not one of balancing the costs and benefits of measures, but rather of adopting measures except where they are ruled out because they involve resource allocations that are grossly disproportionate to the benefits achieved.

Trans Mountains said in its reply evidence that the misperception and mischaracterization of the purpose of the pipeline risk assessment was common in the evidence submitted by intervenors. According to Trans Mountain, many intervenors were of the opinion that the risk assessment described in Trans Mountain's pipeline risk assessment represented the risk associated with the final design of Line 2 and the new delivery lines, and that furthermore, it should serve as the basis for some form of evaluation of risk acceptability. Trans Mountain said that many intervenors also asserted that the expected frequency of full-bore ruptures along the entire length of the pipeline should be reported as a "return period." Trans Mountain said that reporting failure frequencies in this manner would not be meaningful since the results of the risk assessment are preliminary, and therefore would not be representative of the final design of Line 2 and the new delivery lines.

Tsleil Waututh Nation, Tsawout First Nation, and Upper Nicola Indian Band submitted a report by Dr. Thomas Gunton and Dr. Sean Broadbent, dated May 2015, entitled "An Assessment of Oil Spill Risks for the Trans Mountain Expansion Project" (the Gunton Report). This Report evaluated, in part, the evidence of Trans Mountain respecting the risk of pipeline spills used in the risk-based design approach for the Project.

The Gunton Report estimated pipeline spill risks based on recent historical spill frequency data from the National Energy Board, Enbridge liquids pipeline system, and Pipeline and Hazardous Materials Safety Administration (PHMSA). The Gunton Report said that spill risk estimates based on these data sources, as well as Trans Mountain's own analysis, show that spill likelihood is high, with the number of spills for the new Line 2 ranging from one to three spills every two years. The Gunton Report observed that a comparison

of pipeline spill risk for the Project shows Trans Mountain's unmitigated pipeline spill frequency estimate is similar to an estimate based on data from the National Energy Board, but much lower than spill risk frequencies based on data they obtained from Enbridge and the PHMSA incident statistics. The Gunton Report stated that Enbridge and PHMSA data are based on pipelines that use mitigation measures similar to those proposed by Trans Mountain for the Project. The Gunton Report highlighted that in comparison to these actual spill rates, Trans Mountain's much lower forecasted spill frequency rates raise doubts about the reliability of the Project forecasts.

In Trans Mountain's reply evidence, it was noted that the Gunton Report stated that its assessment examined whether risk assessments for tanker, terminal, and pipeline spills adequately assess the likelihood of significant adverse environmental effects, as required in the CEAA 2012. Trans Mountain said that the Gunton Report confused Trans Mountain's pipeline risk assessment, which serves as the basis for the company's risk-based design, with an environmental assessment. Trans Mountain indicated that the pipeline risk assessment was completed for a different purpose and therefore, the analysis and findings in the Gunton Report were misdirected. Trans Mountain reiterated that it was its intention to identify potential risks along Line 2 and the new delivery lines, and to adopt mitigation measures to address those risks at the design phase pre-emptively. Once incorporated into the final design, Trans Mountain asserted that the mitigation measures would reduce failure likelihood and/or consequence.

Trans Mountain took issue with the incident data used in the Gunton Report to demonstrate a lack of conservativeness in Trans Mountain's full-bore rupture frequency estimates. Trans Mountain noted that the Gunton Report incident rates include both leaks and ruptures, and therefore, were not representative of the worst-case, full-bore rupture scenario considered in Trans Mountain's risk assessment. Consequently, Trans Mountain said that the authors overstated the incident rates relative to that hazard scenario.

Views of the Board

The Board is of the view that a risk-based methodology is a rational approach to the design of the proposed new pipeline segments. The Board finds that the nature and purpose of the failure statistics provided by Trans Mountain is to support the risk-based design of Line 2, and is not meant to establish a spill return period for the entire pipeline length. The evidence provided in the Gunton Report in relation to the probabilities of failure does not add value, and is not a basis for designing or assessing the design of a pipeline. Using historical pipeline failure statistics from other jurisdictions or other companies is relevant only if it can be determined that their design, construction, and operation are comparable. The type of product shipped, the specific regulatory requirements and oversight, the internal company inspection procedures and design standards, and the period of construction can all impact the failure frequencies observed. Extensive expertise in pipeline design, construction, operation, and an understanding of codes and regulations is required to assess these factors. Trans Mountain's limited use of historical data for construction and material defects is appropriate for risk-based design; however, there is no evidence that the mitigation proposed by Trans Mountain exceeds the mitigations applied in other similar projects. The Board has proposed conditions to address this issue by identifying, addressing and mitigating potential hazards (Conditions 9, 66, 111, 114, and 143).

There currently appears to be a lack of established quantifiable environmental risk evaluation criteria for pipelines. The Board notes Trans Mountain's commitment to implement both failure prevention and spill mitigation measures to ensure that risk is managed to levels that are As Low As Reasonably Practicable (ALARP). However, Trans Mountain has not provided the Environmental Risk Score limits within which the ALARP criteria would apply, nor has Trans Mountain provided the methodology employed in establishing these limits. In addition, Trans Mountain has not provided its final Environmental Risk Score targets following the implementation of failure prevention and spill mitigation measures. The Board reminds Trans Mountain that section 9[20] of the OPR requires that pipeline designs provide for adequate and effective protection of property and the environment, security of the pipeline, and the safety of all persons. As a result, risk mitigation decisions based on ALARP criteria must fulfill the intent of the OPR as a priority over commercial considerations.

20 Section 9 of the OPR requires companies to develop detailed designs of the pipeline and submit them to the Board when required to do so.

The Board notes that the detailed engineering and design will include finalization of the risk-based design process. Consequently, final risk mitigation methods, mitigated Environmental Risk Scores, and expected outflow volumes following mitigation will not be available prior to the completion of detailed engineering and design. The Board would impose Condition 15 requiring Trans Mountain to file with the Board results of the updated risk assessment for Line 2 and the new delivery pipelines, including mitigated Environmental Risk Scores, Environmental Risk Score acceptance criteria, and the rationale for criteria selection.

6.1.4 Geotechnical design considerations

Terrain mapping and geohazard inventory

Trans Mountain delineated areas referred to as terrain polygons along the route with similar features and characteristics in its Terrain Mapping and Geohazard[21] Inventory report. The terrain polygons were assigned geohazard stability ratings ranging from Class I (stable) to Class V (unstable) based on factors including slope angle, surficial material type, and evidence of ground movement. Natural hazards were identified for each polygon and assigned ratings of low, medium, or high depending on their likelihood of occurrence within the life of the Project.

Trans Mountain said that the geohazard inventory was developed using engineering judgment and experience, an understanding of the geology, landform and hazard types, and potential natural hazard triggers. Input to the geohazard inventory was from various sources including features identified from the terrain mapping, a review of aerial imagery, and observations undertaken during field verification of the terrain mapping.

Geohazard assessment

Trans Mountain assessed 14 different types of geohazards in the design of the Project, under the broader categories of hydrotechnical hazards, rock slope geohazards, soil slope geohazards, seismic geohazards, and snow slope geohazards. The results were presented in a report entitled Quantitative Geohazard Frequency Assessment – Final. Trans Mountain also assessed karst, acid rock drainage and metal leaching, and tsunamis.

Trans Mountain said that it had initially identified 4,281 potential geohazards along the alignment and that although many geohazards would have an effect on the right-of-way, only a small subset of these would have the potential to result in a loss of containment. Trans Mountain identified 628 potential geohazards with unmitigated frequency of loss of containment (FLoC) values greater than $1x10^{-5}$ events per year and committed to review all of these regardless of the ultimate risk ranking. Trans Mountain said it would prioritize, manage and mitigate these geohazards to reduce the overall risk to levels that are As Low As Reasonably Practicable (ALARP) (refer to section 6.1.3).

Trans Mountain provided potential mitigation options to reduce the frequency of occurrence, the spatial impact and the vulnerability for each geohazard type where applicable. Trans Mountain also provided a table of the ten highest-ranked individual discrete geohazards to demonstrate how the unmitigated risk score could be reduced by potential mitigation measures, including relocation of pipelines or valve sites, horizontal directional drilling (HDD), deep burial, use of heavy walled pipe and implementing surface water control.

Trans Mountain said that site-specific field assessments at geohazard sites along the proposed pipeline route would be initiated in 2015 and would continue through to construction. The results from the field assessments would be used to refine the estimated FLoC values for each potential geohazard presented in its Quantitative Geohazard Frequency Assessment. The results of the Quantitative Geohazard Frequency Assessment would be incorporated into the overall risk assessment, along with the other identified threats that could result in a loss of containment.

21 A geohazard, as defined by Trans Mountain, is an event caused by geological features and processes that present severe threats to humans, property, and natural and built environments. Geohazards are a subset of natural hazards. Trans Mountain said that geohazards were reviewed with respect to their ability to impact the pipeline.

The Upper Nicola Band raised concerns regarding metal leaching and acid rock drainage. In response, Trans Mountain said that it has carried out a desktop[22] and field assessment of the proposed pipeline route to identify and characterize geologic units with an increased potential to leach metals or produce acidic drainage. Trans Mountain said that it would develop a metal leaching and acid rock drainage Mitigation Toolbox which would describe additional sampling and monitoring programs to assess site-specific geochemical characteristics, develop appropriate management strategies to be applied during construction, and confirm the effectiveness of the management strategies in minimizing the long-term potential for acidic and/or metal-rich runoff.

The Stó:lō Collective raised concerns about natural hazards, such as flooding, debris flows, mudslides and rock slides in the Fraser Valley, saying that these are regular occurrences, have been large in scale, and have caused massive damage. The Stó:lō Collective provided photographs of large-scale natural hazards, including the Hope Slide in 1965 and flooding of the Fraser River in 1972, 1977, and 2012. The Stó:lō Collective said that local knowledge holders feel there is a high likelihood that large scale events will occur in the future, creating concern regarding the ability of the pipeline to withstand such impacts. In response, Trans Mountain said the Project would be designed to avoid these hazards and that it would implement mitigation measures where avoidance was not possible.

The City of Surrey submitted a geotechnical review of the Thornton Yards and Fraserview Area in Surrey, B.C. which, it noted, Trans Mountain had identified as having high natural hazard potential. The report identified specific locations of concern and recommended that Trans Mountain conduct a further review of the proposed pipeline route due to high liquefaction susceptibility ratings at some locations and the potential for landslides that could impact the pipeline at other locations. The City of Surrey provided two alternate routing options that avoided Surrey Bend Region Park. In response, Trans Mountain committed to pursue and investigate options with the Ministry of Transport regarding sharing its right of way, as proposed by the City of Surrey.

Letters of Comment were filed that said:

- Trans Mountain should demonstrate that the design will account for landslide risks under future climate conditions, noting that slopes could become increasingly unstable with weather extremes due to climate change; and
- Trans Mountain should consider the risk of spills due to multiple incidents happening at the same time, for example, weather conditions combined with associated floods and erosion.

Views of the Board

The Board is of the view that Trans Mountain's Quantitative Geohazard Frequency Assessment approach and methodology are acceptable for identifying and quantifying geohazards along the pipeline route. Trans Mountain has identified the location of specific geohazards, and geotechnical investigations in support of detailed engineering and design are ongoing.

Regarding Trans Mountain's commitment to reducing overall risk to As Low As Reasonably Practicable (ALARP), the Board seeks to verify that the most accurate values of frequency of loss of containment (FLoC) are input into the pipeline risk assessment, and any required mitigation takes place to reduce FLoC values to acceptable levels. Accordingly, the Board would impose Condition 16 requiring Trans Mountain to file an updated Quantitative Geohazard Frequency Assessment for the new Line 2 and delivery pipeline segments, containing a reassessment of the FLoC values based on site-specific field assessments and any required mitigation. The assessment must include a detailed explanation of how the ALARP level has been met for any location where the FLoC value is greater than 10-5 events per year.

Regarding the letters of comments received about the design for geohazards, the Board is of the view that Trans Mountain has demonstrated that the concerns expressed have been or will be adequately addressed in Trans Mountain's Quantitative Geohazard Frequency Assessment, pipeline risk assessment (Condition 15), and Natural Hazards Management Program (Condition 147)

22 A desktop assessment is carried out using available information such as airphotos, LiDAR survey results, and existing geological and geotechnical data, whereas a field assessment would involve the acquisition of new data through field programs such as geotechnical drilling and sampling, geophysical surveys, and site reconnaissance.

(Refer to section 6.10.2). This includes allowance for the effects of possible increased climatic variation (e.g., rainfall distribution and intensity, Mountain Pine Beetle migration), and consideration of multiple geohazards occurring simultaneously.

The Board notes that Trans Mountain has committed to implementing an Acid Rock Drainage Management Plan as part of the Pipeline Environmental Protection Plan. The Board would impose Condition 72 that would require Trans Mountain to provide finalized management plans as part of its Pipeline Environmental Protection Plan. The Board would require Trans Mountain to provide a summary of its consultation with affected Aboriginal groups, which would include Upper Nicola Band, and demonstrate how it has incorporated the results of its consultation into the plan.

6.1.5 Seismic design considerations

Trans Mountain said that the Project would traverse seismically active terrain in which there are three types of earthquakes: subduction-interface, in-slab, and crustal. Great earthquakes, up to magnitude 9[23], occur along the Cascadia subduction zone off the west coast of Vancouver Island every 500 years on average. Major in-slab earthquakes of up to magnitude 7.5 occur deep beneath southwestern B.C. and northwestern Washington. Crustal earthquakes of up to magnitude 7.5 may occur within, and west of the Coast and Cascade Mountains. There is some potential for moderate to strong earthquakes up to magnitude 6 around the Rocky Mountain Trench. Weak to moderate earthquakes of magnitude 5 or less have occurred across the central and southern interior of B.C. and in Alberta.

Trans Mountain said that there are currently no guidelines in Canada that prescribe a performance standard for the seismic design of pipelines and that it would develop performance standards for the new pipeline and related facilities during the detailed design phase. Seismic design of earthen, concrete and steel structures would be in accordance with the latest editions of the National Building Code of Canada (NBCC)[24], the Alberta Building Code, the British Columbia Building Code, and other recognized standards and practices, as applicable. The new pipeline and facilities would be designed for seismic loading corresponding to a 2 per cent probability of exceedance in 50 years, which is equivalent to a 1:2,475 annual probability of exceedance (APE). According to Trans Mountain, this means that the Line 2 pipeline and facilities would be designed to not lose containment for crustal and in-slab seismic events of magnitude 7.1 and Cascadia subduction-interface seismic events of approximate magnitude 9. Trans Mountain said that this is consistent with the design criteria in current provincial and national building code guidelines, and other utility agencies operating in B.C.

Trans Mountain said that detailed site-specific geotechnical investigations would be undertaken to support the seismic design of the proposed pipeline and related facilities where they may be exposed to strong ground motions or permanent ground displacement due to surface fault rupture, liquefaction, or seismically induced landsliding.

In the *Seismic Assessment Desktop Study* report, for the proposed new Line 2 and delivery pipeline segments, Trans Mountain's preliminary assessment focused on surface fault rupture hazard, ground motion predictions, liquefaction susceptibility and opportunity, and seismically induced landslide potential. These topics are discussed individually below.

Surface fault rupture

Trans Mountain said that the greatest seismic threat arises from the potential for active faults, with hazards related to strong ground motion and permanent ground displacement due to surface fault rupture. Trans Mountain considered a fault to be *active* if there is clear evidence of post glacial slip occurring within the Holocene epoch (approximately the past 11,600 years), and to be *potentially active* if evidence for post-glacial activity is uncertain or equivocal. Trans Mountain said that no confirmed active faults have been identified along the route. However, it identified four faults with suspected Quaternary (occurring approximately in the past 2.6 million years) or post-glacial activity that intersect or approach the proposed pipeline corridor (refer to Figure 7). These are:

23 Earthquake magnitude is measured using the moment magnitude (Mw) system, a logarithmic scale that measures the size of earthquakes in terms of the energy released.

24 Trans Mountain's seismic hazard assessment uses values from the 2010 NBCC model for the model. Trans Mountain said that if the 2015 model comes into force before final design and construction, it may elect to adopt smaller design ground motions in southwestern B.C. where 2015 values are less than the 2010 values. In these instances, deterministic ground motions would govern the Project's seismic design.

- Sumas Fault, around RK[25] 1115;
- Vedder Mountain Fault, between RK 1075 and 1106;
- Fraser River-Straight Creek fault system, around RK 1045; and
- Rocky Mountain Trench, between KP 505 and 525.

Trans Mountain retained the Department of Earth Sciences at Simon Fraser University (SFU) to determine whether the Project corridor crosses Holocene faults within the Lower Mainland and Fraser Valley. The study concluded that, where LiDAR coverage was available, Holocene faults are unlikely to intersect the Project; however, Holocene faults were not precluded outside the zone of LiDAR[26] coverage. Trans Mountain responded that LiDAR has been acquired for: a 750 m wide strip along the complete Line 2 corridor; the Burnaby Mountain area; all of Abbotsford; most of Chilliwack; most of the Fraser Valley between Chilliwack and Hope; and a strip approximately 4 km wide along the North Cascade Mountains bounded by the southern Fraser Valley.

Trans Mountain said that the collection and review of LiDAR digital terrain models for portions of the route passing near the four suspected Quaternary faults is underway as part of detailed design. Trans Mountain also said that, for locations where faults are suspected but cannot be identified through LiDAR, additional investigations, including the use of geophysics, would be considered.

Trans Mountain said that, if a specific fault was found to pose an unacceptable risk to the Project, it would develop a fault-specific crossing design to mitigate risk to an acceptable level.

Natural Resources Canada (NRCan) recommended that Trans Mountain provide the results from ongoing fault mapping, as well as the specific conclusions and final results on the four potentially active faults, (Sumas, Vedder Mountain, Fraser River-Straight Creek, Rocky Mountain Trench) to the Board on completion. NRCan recommended that Trans Mountain provide specific conclusions regarding whether the Vedder Mountain and Sumas faults have been active during the Holocene epoch. NRCan also recommended that Trans Mountain provide the Board with results of the Fault Lineament Study that will be used as part of the detailed design.

The City of New Westminster said that the existence of potentially active faults is not known, noting that the investigation of potentially active faults by SFU Department of Earth Sciences had not been completed.

Ground motion

Trans Mountain said that the performance of pipelines in response to seismically induced ground shaking and ground deformation depends on many factors, including proximity of the pipeline to the fault rupture site, ground motion characteristics, pipeline properties, and welding procedures.

Trans Mountain provided ground motions maps for a range of peak ground accelerations and spectral acceleration periods. Trans Mountain said that two approaches are commonly used to estimate earthquake ground-motion amplitudes: probabilistic and deterministic. A comparison of probabilistic and deterministic ground motion predictions was provided in the *Seismic Assessment Desktop Study*. Ground-motion hazard maps presenting probabilistic ground motions were provided as part of the desktop study. Trans Mountain said that the Project would be designed to withstand the larger of:

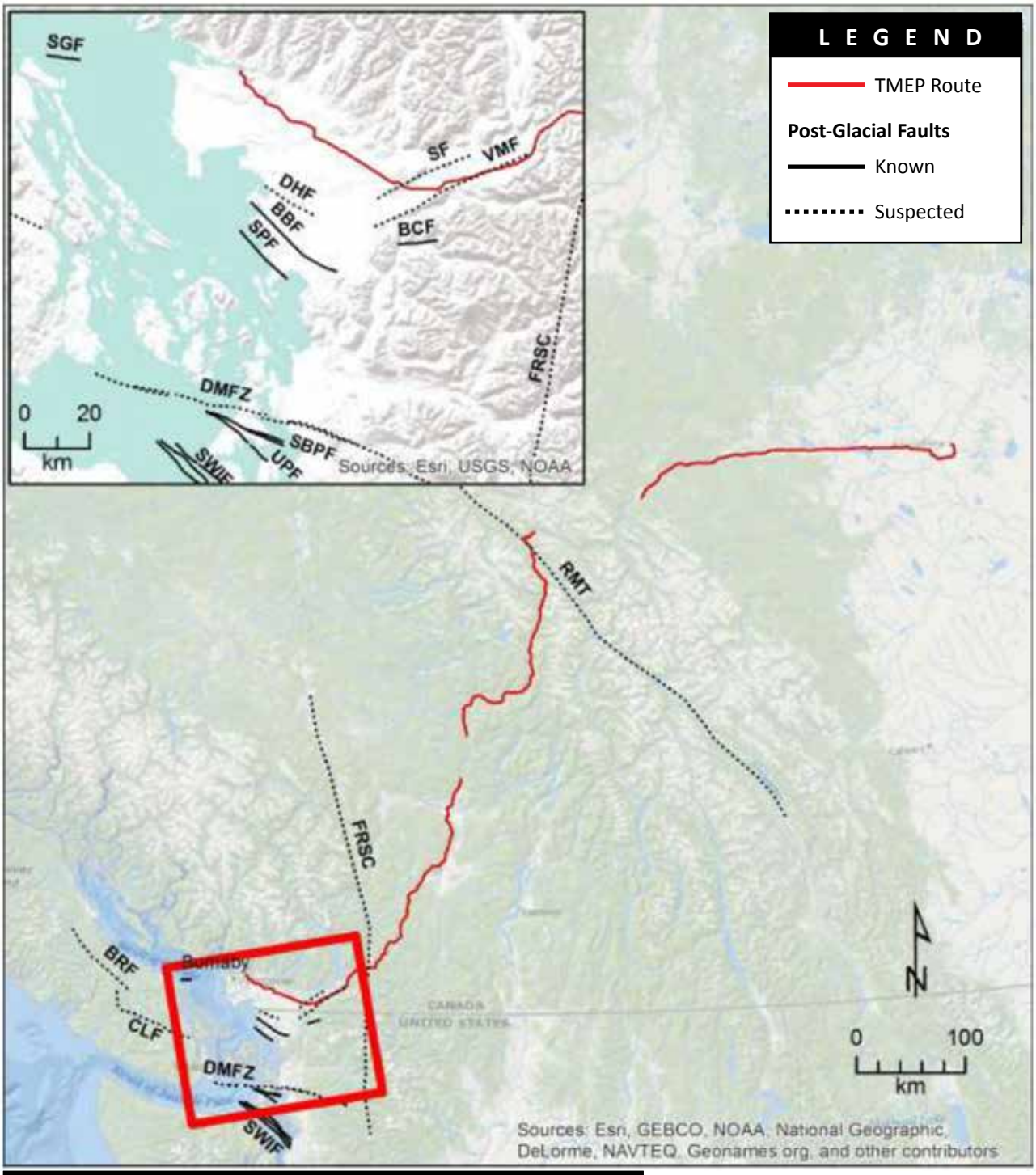
- ground motions with a 1:2,475 annual probability of exceedance, as provided by the National Building Code of Canada, modified to reflect site conditions; or
- deterministic ground-motion predictions for credible earthquake sources, modified to reflect site conditions.

Trans Mountain said that the Project would also be designed to withstand permanent ground displacement, transient ground displacement, and seismic wave propagation arising from earthquakes that produce design-level ground motions.

25 RK stands for reference kilometre and is used to identify locations along the applied-for route. KP stands for kilometre post and is used to identify locations along the existing Trans Mountain pipeline system.

26 LIDAR is a remote sensing technology that measures distance by illuminating a target with a laser and analysing the reflected light. According to Trans Mountain, LiDAR is the only remote-sensing tool that gives accurate, high-resolution images of the ground surface, and offers the best chance of characterizing lineaments and identifying suitable locations for site-specific investigation.

Figure 7 : Location of faults



Abbreviations

Faults abbreviated as follows:
CSZ: Cascadia Subduction Zone
BRF: Beaufort Range
CLF: Cowichan Lake
SGF:Strait of Georgia
SWIF: Southern Whidbey Island
DMFZ: Devils Mountain
SBPF: Strawberry Point
UPF: Utsalady Point
SPF: Sandy Point
BBF: Birch Bay
DHF: Drayton Harbor
SF: Sumas
VMF: Vedder Mountain
BCF: Boulder Creek
FRSC: Fraser River-Straight Creek
RMT: Rocky Mountain Trench

Inset map area shown as red box.

Trans Mountain said that the 1:2,475 APE hazard levels used in the seismic hazard update should yield larger displacements near the proposed facilities than a magnitude 9 subduction-interface event off the west coast of Vancouver Island. Therefore, ground displacement triggered by a magnitude 9 subduction-interface event would not affect infrastructure designed in accordance with the Project's seismic hazard update.

Trans Mountain said that an earthquake on a particular fault might damage the pipeline if the peak ground acceleration (PGA) caused by that earthquake exceeded that of the Project's design level along the pipeline corridor. However, based on its analysis, Trans Mountain concluded that there were no credible scenarios where the PGA would exceed the 1:2,475 APE for the Project.

Burnaby Residents Opposing Kinder Morgan Expansion (BROKE) filed a report on the seismic hazard assessment and mitigation strategies for the Project, focusing on the Burnaby area. The report looked at the earthquake hazard in terms of peak ground shaking, and documents other shaking hazards, including shaking duration and time dependent hazards such as aftershocks. BROKE expressed the view that the proposed design for a 1:2,475 annual probability of exceedance is a minimum life-safety standard guideline and that higher seismic design standards are often adopted for infrastructure of great importance to society, such as schools, hospitals, dams, nuclear plants. The BROKE report also examined the likelihood of peak ground motions exceeding the 1:2,475 APE for earthquakes from various sources.

In response to BROKE's concerns regarding long-duration shaking, long-period ground motions, and time-dependent shaking hazards, Trans Mountain said that it had considered each of these and determined that they were either very unlikely or not applicable to the design of the Project.

Metro Vancouver sought a commitment from Trans Mountain to design the Project more conservatively, including an evaluation of the impacts on the Project of a magnitude 9.0 or greater earthquake. Metro Vancouver also requested the rerouting of the pipeline around or beneath liquefiable deposits, including the Coquitlam land fill, the use of higher fabrication, welding and inspection standards prescribed by strain-based design, and the use of thicker walled pipe to withstand a worst-case scenario earthquake event.

Liquefaction and lateral spreading

Trans Mountain provided an assessment of liquefaction susceptibility for the various types of terrain encountered along the proposed pipeline route in accordance with a project-specific liquefaction susceptibility classification system. Liquefaction potential, described as a qualitative combination of susceptibility and opportunity, was found to be highest in the seismically active Fraser River floodplain, with some liquefaction potential existing into the Cascade Mountains.

The liquefaction hazard potential was classified for different areas along the corridor based on the findings from the desktop study as very high, high, moderate, low, or very low. Trans Mountain said that, as part of the Project's iterative design process, geotechnical investigations would be completed first at the very high potential sites, followed by the high and moderate potential sites, until Trans Mountain was satisfied that all sites with liquefaction-triggered ground displacement potential had been characterized. Geotechnical site investigation at sites with high and moderate liquefaction potential would be completed in 2015 and 2016.

Trans Mountain said that the outcome of the liquefaction assessment includes a determination of the displacement associated with lateral spreading. This would be compared against the acceptable displacement associated with the pipe's stress and strain capacity, and would determine whether the pipeline remains within the allowable design limits according to industry codes and standards.

Potential mitigation measures for liquefaction-related geohazards include pipe material specifications, pipe wall thickness, mechanical protection (such as concrete coating), reduced welding defect allowances, construction methodology (such as appropriate earthen backfill materials to limit restraint of the pipeline), and rerouting. Strain-based design would be considered at locations where other mitigation measures could not be relied on to protect the pipeline from large ground displacements. These locations would be identified during detailed engineering and design through ongoing geotechnical investigations at seismically susceptible sites.

The City of New Westminster said that the lower Brunette River watershed is subject to liquefaction in the event of a major earthquake and recommended that a complete risk assessment, including an inventory of seismic hazards, be completed before further review of pipeline design was carried out.

In a letter of comment, Ian Stephen questioned Trans Mountain's assertion that no historical earthquakes have occurred near Vedder Mountain Fault or Sumas Fault. He also recommended a route change due to the potential for compounding risks where the Vedder Mountain and Sumas Faults are in proximity to each other, based on the increased risk of liquefaction, flooding, and earthquake-triggered river bank activity.

Seismically induced landslides

Trans Mountain said that site-specific displacement estimates required consideration of several surface and subsurface characteristics, obtainable mostly thorough geological and geotechnical investigation. Future work includes site-specific field reconnaissance investigations of landslide-prone terrain. Where landslide-prone terrain is confirmed, Trans Mountain said it would evaluate the potential for earthquake triggering and ground displacement.

Views of the Board

The Board accepts Trans Mountain's approach to seismic design, including the design for the larger of ground motions with a 1:2,475 annual probability of exceedance, as provided by the National Building Code of Canada, or deterministic ground-motion predictions for credible earthquake sources. The Board finds that this approach is consistent with the design of other major projects in similar circumstances and will result in a conservative design in keeping with relevant regulations, codes, and standards.

Regarding concerns expressed by BROKE, Metro Vancouver, and others on the selection of seismic design parameters and the design levels for predicted ground motions, the Board finds Trans Mountain's analysis to be acceptable. Trans Mountain has provided detailed responses to the concerns of intervenors and has demonstrated that the Project will be designed to withstand predicted ground motions and displacements for reasonably foreseeable seismic events, including in-slab, shallow-crustal and subduction-interface earthquakes.

To verify that Trans Mountain has adequately assessed the likelihood of recent or active faulting, (i.e., during the Holocene epoch), the Board would impose Condition 69 requiring Trans Mountain to provide the results of fault-mapping studies to the Board prior to the commencement of construction. The condition would also require Trans Mountain to provide the specific conclusions and final results, as recommended by NRCan, on four potentially active faults (Sumas, Vedder Mountain, Fraser River-Straight Creek, Rocky Mountain Trench) along with potential hidden faults, including consideration of the potential for compounding risks due to the proximity of the Vedder Mountain and Sumas Faults.

To confirm that the potential for liquefaction-triggered ground movement is adequately assessed in detailed engineering and design, the Board would impose Condition 68 requiring Trans Mountain to identify sites with very high, high, and moderate liquefaction potential and describe how the potential for liquefaction-triggered ground movement will be mitigated at each site.

6.1.6 Strain-based design considerations

Pipelines are designed to withstand several types of loads. Some loads, such as the weight of the pipe and weight of the soil over the pipe, are permanent and remain constant over time. Other loads, such as internal pressure, are operational, and create stresses in the pipeline as long as loads are applied. Some loads are environmental and can impose stresses for short or long durations. Most pipelines in Canada are designed using stress-based design, whereby the pipe is designed to accommodate a maximum stress that is set below the level at which the pipe would permanently deform.

Strain is the deformation experienced by the pipe as a result of the applied stresses. Certain events, such as ground movement, can impose additional stresses and strains on the pipeline. In these circumstances, strain-based design may be required. As an alternative to stress-based design, strain-based design allows for limited deformation to occur in the pipe by controlling allowable strains to a safe level. Strain-based design typically requires more stringent control in terms of quality of welds, testing, handling procedures, and monitoring during operation.

Trans Mountain said it would consider using strain-based design where other mitigation measures cannot be relied on to protect the pipeline from large ground displacements caused by infrequent geohazards

(i.e., slope movement and earthquake-triggered lateral spread displacements resulting from liquefaction). Strain-based design would be considered at seismically susceptible and other geohazard sites identified through ongoing geotechnical investigations.

Trans Mountain said that pipeline design and strain-based analysis would be completed in accordance with CSA Z662, with strain analysis and capacity completed in accordance with Z662 Annex K, *Standards of acceptability for circumferential pipe butt welds based upon fracture mechanics principles.*

Trans Mountain said that full-scale verification testing would be considered and undertaken where the weldment strain-based design parameters are not within the validation data range of the fracture mechanics model being considered. Trans Mountain submitted that it was premature to commit to a full-scale test verification program until strain capacity and strain demand were determined.

Views of the Board

Strain-based design allows for higher stresses and greater pipe deformation than the more conventional stress-based design. As such, strict attention to quality control during pipe manufacture, installation, maintenance, and operation will be required to ensure that specified strain limits are not exceeded. Strain-based design is useful where earth movements may occur, such as on unstable slopes or areas with higher liquefaction potential. The Board accepts Trans Mountain's proposed use of strain-based design, subject to the requirement that Trans Mountain provide the Board with more information on the intended application of strain-based design, including the locations, rationale, and adequacy of the strain-based design where applied (Condition 70).

6.1.7 Watercourse crossings

Hydrology

Trans Mountain filed a Route Physiography and Hydrology Report that focused on the physical geography of the proposed route including topography, surficial geology, bedrock geology, and watercourse crossings. The report identified notable (or hydraulically significant) watercourse crossings, defined by Trans Mountain as having watershed catchment areas greater than 50 km², which was used as a proxy for watercourse crossings where significant forming processes, such as bank erosion or scour, may occur. Trans Mountain said that additional investigation and hydrologic assessment would be carried out as part of detailed engineering and design.

Trans Mountain said that detailed engineering and design involves the determination of the preferred crossing method and crossing design for every crossing along the route, based on the quantification of the magnitude and frequency of occurrence of hydrotechnical hazards, such as scour, channel degradation, bank erosion, encroachment, and avulsion. Quantifying these hydrotechnical hazards relies on the analysis of remotely-sensed datasets, such as LiDAR and site-specific data collected during hydrotechnical field investigations and detailed surveys. Trans Mountain said that field investigations and bathymetric surveys were scheduled, and committed to providing revised flood frequency estimations to the Board upon completion.

Design

Watercourse crossing methods include open-cut, isolated and trenchless methods. Trans Mountain proposes two types of open-cut crossing techniques; mainline trenching and designed open-cut. It proposes two types of isolated crossing techniques; pumps with or without dams, and dams with flumes. Trenchless methods proposed for the Project include boring, horizontal directional drilling (HDD), micro-tunneling, and tunneling. Trans Mountain provided a description of its watercourse crossing review process and stated that crossing methods and timing would be finalized during the detailed engineering and design phase.

Trans Mountain said that detailed engineering related to hydrotechnical design included two steps:

- the characterization of hydrotechnical hazards at watercourse crossings; and
- the provision of design recommendations in the form of minimum depth of cover and setback distances away from the banks of the watercourse.

Trans Mountain committed to adopting the 1:200 year flood event, as required by the Province of British Columbia, to determine the necessary depth of cover at all watercourses. Watercourse crossings would

have a site-specific engineered crossing design, a generic watercourse crossing design or, where no hydrotechnical hazard was identified, a specified 1.2 m minimum depth of cover. Where the potential depth of scour exceeds 1.2 m, a depth of cover sufficient to prevent pipeline exposure during a 200-year flood event would be provided. Trans Mountain committed to the use of heavy-walled pipe at all major and most minor watercourse crossings.

Trans Mountain said that it would obtain real time flow measurements immediately prior to commencing any mid-sized and large open-cut crossing using the isolation method. If flow volumes exceed threshold limits for the isolation method, Trans Mountain would reschedule or implement contingency methodology. Trans Mountain said that it would use a refined version of *Pipeline Associated Watercourse Crossings Guidelines, 3rd Edition* by CAPP, CEPA, and CGA[27] to assess, plan, construct, operate, and maintain the pipeline-associated watercourse crossings.

Trans Mountain identified 23 major watercourse crossings as being favourable for HDD and provided preliminary Geotechnical and HDD Feasibility and Design reports for most of these. Trans Mountain said that the information submitted in the HDD feasibility reports would be augmented with additional detailed engineering and design investigations and studies, and that HDD execution plans would be a construction deliverable by the eventual HDD contractors. Trans Mountain provided a draft HDD specification and said that the specification would be further refined during detailed engineering and design.

In response to questions regarding the feasibility of the proposed HDD crossing of the Fraser River, Trans Mountain said that the feasibility of the crossing had been comprehensively demonstrated on the basis of:

- the preliminary geotechnical assessment;
- previous similar HDD crossings successfully installed nearby; and
- the current state of practice in the HDD industry.

Trans Mountain said that a hydraulic fracture evaluation has been completed for the Fraser River crossing to evaluate the ability of the site soils to maintain a supporting fluid pressure column within the bore during drilling. Additionally, Trans Mountain expects that the HDD contractor will revisit the need for further geotechnical investigations and would conduct investigations as necessary prior to construction.

In response to concerns of participants including the Upper Nicola Band regarding the effects of climate change, Trans Mountain said that it is currently not possible to reliably predict how climate change will affect future flood events, but noted that the general tendency of a warmer climate with shifts in runoff-generating mechanisms is for an increase in hydro-meteorological extremes. This would likely lead to more frequent and more severe scouring events, such as debris flows. Trans Mountain said it would adaptively manage potential residual effects associated with changing climate through its Natural Hazard Management Program (refer to section 6.10.2).

The Nooaitch Indian Band filed a hydrology report that stated it was reasonable for Trans Mountain's hydrologic studies to be at the general or screening level, on the understanding that further work is required in detailed design. The report commented on the use of estimated values for peak flows in ungauged catchment areas and cautioned that inaccurate seasonal flow estimates could result from not accounting for variability between watersheds. According to the Nooaitch Indian Band, this could result in underestimating scour depth and the required depth of cover, which could lead to increased risk of pipeline exposure, damage, or failure.

Nooaitch Indian Band recommended that further hydrologic analysis in detailed design should include site-specific estimates of peak and seasonal flows and that climate change should be accounted for. It recommended that a re-alignment of the HDD crossing of the Coldwater River at RK 958 should be considered to reduce the risk of pipeline exposure due to erosion and channel avulsion. It also recommended that the HDD crossing of the Thompson River at RK 847 should be reviewed to assess the risk of avulsion and lateral bank erosion on the south bank near the entry point.

The City of New Westminster said that the route along the north and east bank of Brunette River is within an area that experiences flash flood conditions. It said that Provincial guidelines recommend municipalities plan for a 0.5 m sea level rise by 2050 and a 1 m rise by 2100. The City of New Westminster recommended

27 Canadian Gas Association

that Trans Mountain consider several mitigation strategies, including rerouting the pipeline, using thicker-walled pipe, relocating HDD exit and entrance points above flood levels, as well as placing paired automatic shut-off valves on either side of fish-bearing waterways. The City of New Westminster expressed concern that watercourse flood and scour analysis and bank mitigation for Brunette River and associated creeks was not available for review during the hearing.

Metro Vancouver sought commitments from Trans Mountain to use HDD techniques under waterways, and to place the entrance and exit points of the HDD more than 30 m from waterways. Metro Vancouver also sought a commitment that Trans Mountain use thicker walled pipe and casing in pipeline sections near or under waterways as protection from unanticipated scour.

The Board also received comments from participants regarding Trans Mountain's selection of a 1 in 200 year design flood for scour estimates at river crossings.

Views of the Board

The Board is of the view that Trans Mountain's approach to the design of watercourse crossings is in keeping with current industry standards and practices, and that Trans Mountain has adequately responded to the questions and concerns raised throughout the hearing regarding watercourse crossing design, including the effects of climate change, flash floods, scour depths, and sea level rise. The Board notes that the hydrologic information provided by Trans Mountain on watercourse crossings is preliminary, and that Trans Mountain committed to providing revised flood frequency estimations based on field investigations and bathymetric surveys that were ongoing during the hearing.

To verify that Trans Mountain is using representative hydrological data in calculating flood frequency estimates, the Board would impose Condition 65 requiring Trans Mountain to file updated flood frequency estimates for notable (i.e., hydrologically significant), watercourse crossings. The Board is satisfied that, with Trans Mountain's commitment and the fulfillment of this condition, the watercourse crossings will be designed, constructed and operated safely, and in accordance with appropriate codes and standards.

Trans Mountain committed to carry out additional geotechnical investigations and to reassess the feasibility for the horizontal directional drill (HDD) of six significant watercourse crossings. Also, Trans Mountain may propose the HDD of additional watercourse crossings, including the Salmon River, based on the outcome of its detailed engineering and design. In order to assess the feasibility of these crossings in accordance with the NEB's Filing Manual, the Board would impose Condition 67 requiring Trans Mountain to file outstanding HDD feasibility and design reports and drawings for the crossings identified in the condition, as well as any other river crossings where a trenchless crossing method is being considered.

6.1.8 Infrastructure crossings

According to Trans Mountain's preliminary list of crossings, there are more than 2,700 crossings of existing linear infrastructure along the proposed route. Trans Mountain said that crossings would be individually assessed to determine the most appropriate crossing method and design. Crossing of highways, high-use gravel roads and railways would be constructed using a bored crossing method, which would have a minimum effect on traffic or interruption to communication or utility services. Crossings of low-use gravel roads, minor roads and trails would be completed by conventional open-cut crossings.

Trans Mountain said that the depth of cover for the pipeline would be a minimum of 0.9 m in mineral soil and 0.6 m in rock. Additional cover would be required at road crossings, watercourse crossings, railway crossings, and at other locations as required. In these circumstances, the minimum depth of cover would be the greatest of CSA Z662 requirements, the depth specified in crossing agreements and applicable regulations of other authorities, or the additional cover which could be established during the detailed engineering phase. According to Trans Mountain, it would carefully assess each crossing during the detailed engineering phase to identify and mitigate potential hazards. Trans Mountain said it would also consider depth of cover in the risk based design process as a mitigation measure for third party damage.

Clearance

Trans Mountain said that a minimum clearance of 0.3 m would apply to the crossing of existing buried facilities, such as foreign pipelines, buried electrical cables, fiber optic cables and utilities (i.e., water and sewer pipes), in accordance with CSA Z662. In urban areas, a minimum clearance of 0.7 m would apply, where practical, and a precast slab would be installed between the new pipeline and adjacent facilities. The clearance between the new pipeline and any other parallel pipeline, cable or other utility would not be less than 1.0 m.

High voltage current interference

B.C. Hydro operates an electrical transmission system which has a number of unshielded power lines in close proximity to the proposed Line 2 pipeline. B.C. Hydro identified over 100 locations where the proposed pipeline crosses, or is located within 30 m of existing B.C. Hydro electric transmission infrastructure. B.C. Hydro engineering practice requires that pipelines maintain a 30 m separation from its power lines. Trans Mountain said that it would observe B.C. Hydro's 30 m separation requirement where it is practical to do so. However, it said there are specific route locations where maintaining the 30 m separation would be impractical.

CSA-C22.3 No. 6-13 standard sets out the requirements for the coordinated operation of pipelines and power lines with line-to-line voltages greater than 60 kV. The CSA standard recommends a separation distance of at least 10 m between pipelines and power lines with shield wires. When the power lines are unshielded , the CSA standard states that a 10 m separation distance is not as effective in reducing the probability of damage to the pipeline during power line fault conditions and advises pipeline and power line companies to establish an agreement to avoid unsafe conditions.

Clause 5.3 of CSA-C22.3 standard states that it is difficult to quantify the safe distance between pipeline and power line with shield wires under fault conditions. It further states that, historically, a 10 m separation distance appears to be an acceptable conservative value. Trans Mountain does not agree with the third paragraph of Clause 5.3 of the CSA standard. Trans Mountain believes that, in many instances, a 10 m separation distance between power lines and pipelines is sufficient under fault conditions. However, Trans Mountain committed to complying with CSA C22.3 No.6-M91, which is a previous version of the standard without the 10 m separation distance requirement.

Trans Mountain committed to an engineered solution agreeable to B.C. Hydro to mitigate any adverse effect on the pipeline resulting from an abnormal condition of the power system involving electrical ground faults. Trans Mountain also committed to reduce hazardous induced voltages on its pipelines to meet a maximum steady state voltage and to limit transient voltages to meet the requirements of IEEE Standard 80[28].

View of the Board

Clause 5.3 of CSA-C22.3 No 6-13 states that it is difficult to quantify the safe distance between the pipeline and power line fault current discharging facilities. The Board notes from the standard that, historically, a 10 m distance between pipelines and power lines with shield wires appears to have been a conservative safe distance. When the power line does not have shield wires, the standard states that 10 m separation is not as effective in reducing the damage to the pipelines, and advises the pipeline and power line companies to establish an agreement in these circumstances.

CSA Z662-15 states, "where buried pipelines are close to high fault current-carrying grounding networks, remedial measures can be necessary to protect the pipeline from resulting potential gradients in the earth near the pipelines". Given that CSA C22.3 No. 6 13 does not categorically present a scope of an engineered solution for a separation distance of power lines from pipelines whereas CSA Z662-15 recommends "remedial measures", the Board is of the view that Trans Mountain's commitment of an engineered solution is consistent with the recommendations of CSA Z662-15. The Board would impose Condition 50 requiring Trans Mountain to demonstrate that it has developed an engineered solution in agreement with B.C. Hydro.

With respect to other infrastructure crossings, the Board notes that Trans Mountain has provided several commitments to address the concerns of participants related to crossing methods, traffic

28 The Institute of Electrical and Electronics Engineers (IEEE) Guide for Safety in AC Substation Grounding

control during construction, crossing depths, future developments, and potential impact to existing infrastructure. The Board expects Trans Mountain to work with municipalities and utility companies during detailed engineering and construction to address these concerns.

6.1.9 Corrosion control

Trans Mountain said that external corrosion would be prevented by external pipe coating and a cathodic protection (CP) system. Approximately 90 per cent of the new pipeline segments will be externally coated with fusion bond epoxy (FBE). The external coating would be factory-applied in accordance with CSA Z245.20 and KMC's coating standards. The remaining pipe would be coated with factory-applied abrasion resistant overcoat, or three-layer polyethylene where additional protection from mechanical damage is required, such as at watercourse crossings, bored crossings and rocky terrain.

According to Trans Mountain, coating specifications for field girth welds would be developed during the detailed engineering phase. Trans Mountain said that its field-applied coating specifications would incorporate the requirements of the latest edition of the relevant CSA coating standards.

Trans Mountain said that the CP system would be used as a secondary corrosion control measure for the pipeline. CP would be applied by impressed current ground beds located along the pipeline. Trans Mountain said that test stations for monitoring the effectiveness of CP levels would be installed at appropriate locations.

According to Trans Mountain, the CP system would be common to both the Line 1 and Line 2 pipelines. Trans Mountain said the proposed common CP system concept is similar to the common CP system currently in operation between the recently constructed FBE-coated TMX Anchor loop, and the older coal tar enamel-coated original pipeline. Trans Mountain submitted a report demonstrating the effectiveness of this common CP system. The report concluded that the protection of both pipeline systems is acceptable in accordance with CSA Z662 and other applicable standards[29].

Trans Mountain said the selection of coatings that are compatible with a CP system is critical in preventing external corrosion. External corrosion is rarely found on a pipeline coated with FBE if adequate CP is available. With proper application of the external coating, degradation or disbondment of the coating is unlikely. However, if this was to occur and groundwater was to contact the pipe, the surface of the pipe would still be protected from corrosion by the CP system.

Trans Mountain said that the risk of internal corrosion for the Line 2 pipeline is not expected to be higher than for the existing pipeline. The product proposed to be transported in the Line 2 pipeline is similar to the products currently being transported in the existing pipeline, where internal corrosion is not experienced as a systemic issue. Trans Mountains said that the pipeline would not be coated internally. Trans Mountain said given the planned ILI reassessment interval of five years on the Line 2 pipeline, it is reasonable to expect that any internal corrosion features that may initiate will be detected before they can reach a critical flaw size. Any required maintenance can be developed and implemented as a pre-emptive measure. Therefore, according to Trans Mountain, the probability of a failure from internal corrosion is assessed as being negligible.

Views of the Board

The Board is of the view that the combination of external coating and cathodic protection, along with Trans Mountain's proposed monitoring, would help to identify and mitigate external corrosion. Following applicable standards and procedures during the coating application would help to achieve a high quality external coat to protect the pipeline. The Board is satisfied with Trans Mountain's proposed corrosion control measures.

Nevertheless, the Board expects Trans Mountain to monitor the pipeline for both external and internal corrosion during operation, and to include external and internal corrosion monitoring programs in the Integrity Management Plan. Should the Project be approved, the Board may use compliance activities, such as audits, to verify the implementation of these monitoring programs.

29 Canadian Gas Association: OCC-1- Recommended Practice for the Control of External Corrosion on Buried or Submerged Metallic Piping Systems and NACE SP0169-Control of External Corrosion on Underground or Submerged Metallic Piping Systems.

6.1.10 Mainline valves and valve locations

Trans Mountain said that the location and spacing of remote block valves (those not located at pump stations) on the Line 2 pipeline was initially determined in accordance with CSA Z662. Factors considered in choosing preliminary valve locations included the co-location of existing valve sites on adjacent pipelines, accessibility, and site suitability for construction and operations. Trans Mountain said that no threshold outflow volume was used in deciding the primary valve locations. To limit consequences associated with a pipeline leak or rupture, Trans Mountain would consider the following when selecting valve locations: topography; environmentally sensitive areas 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). Trans Mountain said that the proposed valve locations may be adjusted slightly to optimize functionality and minimize aesthetic impacts.

Trans Mountain provided a list of preliminary valve locations for Line 2. Line 2 would have approximately 55 check valves[30] and 72 remote mainline block valves, of which 71 would be automated. In addition, there would be 12 mainline block valves and 11 associated check valves located at the new pump stations.

Metro Vancouver questioned Trans Mountain's commitment regarding the placement of automatic shut-off valves, particularly on either side of fish-bearing waterways. Trans Mountain said that it is proposing to use remote main line block valves with check valves on the downstream side of major watercourse crossings, and not automatic shut-off valves. Trans Mountain explained that valve operation should not be automatic because the automatic shutdown of the pipeline without initiation by a control room operator has the potential to damage the pipeline or exacerbate a spill.

Trans Mountain said that the locations of the final valve site would be established through an iterative risk-based design process. This would include investigating the potential benefit associated with moving valves closer and/or adding valves. Trans Mountain provided spill outflow modelling results for the Line 2 pipeline, including calculated spill volumes during a full-bore rupture. The volume calculation was based on the assumption that the mainline block valves located upstream and downstream of the failure site would be fully closed in 15 minutes of detecting a low pressure alarm. This includes 10 minutes to detect the alarm and shut down the pump, and five minutes for full valve closure. Trans Mountain said that the iterative risk–based design process utilizes outflow volume as the basis of a sensitivity analysis to investigate the benefit of placement of additional valves or the modification of valve placement. Trans Mountain said that the risk–based design process is a more rigorous approach than simply limiting outflow volumes to some fixed value. This is because a criterion based solely on outflow volume is not capable of evaluating other factors that would otherwise be relevant to a risk assessment, such as environmental sensitivity or likelihood of occurrence. For example, there are some circumstances where outflow volume is relatively insensitive to the addition of block valves due to the position within a pipe segment and its associated elevation profile. According to Trans Mountain, under such circumstances, there may be 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 third party damage.

Trans Mountain said that valve locations would be finalized in detailed design and their locations would be submitted to the Board and communicated to relevant stakeholders through Technical Working Groups (TWGs). The proposed valve locations have been discussed with municipalities that have engaged with Trans Mountain and have initiated joint TWGs. As an example of this approach, Trans Mountain said that it was reviewing suggestions from the City of Abbotsford on a valve location within their city.

Trans Mountain said that the refinement of valve placement is only one approach to risk management. Trans Mountain said that, in the context of the valve placement optimization and incorporation into the risk assessment, certain risk-based design criteria were important in evaluating the benefit of additional valves. The types of risk mitigation measures that will be considered in the risk-based design process include failure prevention and spill mitigation measures to ensure that risk is managed to levels that are ALARP. More information on Trans Mountain's proposed risk-based design criteria is provided in section 6.1.3.

30 The general purpose of a check valve is to automatically open to allow forward flow, and automatically close to prevent reverse flow (i.e., back flow) when the pumps are stopped.

Views of the Board

The proper placement of mainline block valves helps minimize the consequences of a rupture by limiting the outflow volumes[31]. Valve placement is also important in isolating pipeline segments during maintenance activities. Trans Mountain has provided the preliminary mainline block valve locations for Line 2. The Board notes Trans Mountain is using a risk-based approach to optimize the preliminary valve locations. The Board would impose Condition 17 requiring Trans Mountain to demonstrate that the final valve locations will be able to minimize outflow volumes such that the level of risk is managed to As Low As Reasonably Practicable (ALARP). The condition would require Trans Mountain to demonstrate that the placement of additional valves has been implemented until a point of diminishing return has been achieved with respect to limiting outflow volumes.

The Board accepts the rationale provided in Trans Mountain's response to Metro Vancouver concerning the placement of automatic shut-off valves; however, the Board notes that Trans Mountain is planning to utilize a number of check valves. These are generally proposed at locations at the downstream end (in relation to the flow of oil) of major watercourse crossings, where oil would be flowing uphill under normal operating conditions. The Board is of the view that in an event of a pipeline failure, check valves could minimize the outflow volumes by automatically preventing backflow. Condition 17 would require Trans Mountain to confirm, with the use of transient analysis, that operation of check valves and main line block valves will not cause unsafe transient pressures on the Line 2 pipeline.

6.1.11 Control system and leak detection

Control system

Trans Mountain said that the expanded Trans Mountain system would be operated and monitored 24 hours per day, 365 days per year, by the CCOs at the Primary Control Centre (PCC) in Sherwood Park, AB, using a SCADA system. The Westridge Marine Terminal (WMT) would be operated and monitored from the WMT Control Centre, with continuous monitoring at the PCC. A Secondary Control Centre in south Edmonton, maintained as a hot standby site with the same functionality as the PCC, would be available when the PCC is unavailable. Pump stations and terminals in the expanded system will include Emergency Shut Down systems that would operate automatically under certain abnormal operating conditions and could also be activated remotely from the PCC or locally by field operations. The SCADA system would be used to collect information about fluid parameters, valves positions, pump status, and the status of other safety devices. It would also be used to transmit commands for the operation and control of the pipeline system.

Leak detection

Trans Mountain said that the leak detection systems for the expanded TMPL system would be in compliance with CSA Z662, Annex E: *Recommended practice for liquid hydrocarbon pipeline system leak detection*. Trans Mountain identified KMC's computational pipeline monitoring (CPM) system as being the primary leak detection method. The CPM method would be used in combination with complementary leak detection methods, which could include:

- monitoring by the CCO using the SCADA system;
- scheduled line balance calculations;
- aerial and ground surveillance patrols;
- in-line inspection tools that can detect small defects; and
- in-line inspection tools with acoustical microphones that can detect small leaks.

Trans Mountain said that it intends to implement a number of technology advancements and improvements in the expanded pipeline system, including a second CPM system that would operate in parallel with the

31 Outflow volumes (i.e., spill volumes) from a pipeline failure comprise volumes expelled due to kinetic energy and potential energy. In liquid pipelines, the kinetic energy (flow of liquid) comes from pumps. Thus, the spill volumes due to kinetic energy can be stopped by stopping the pumps. The potential energy comes from gravity due to differences in elevation. The placement of mainline block valves, also called isolation valves or sectionalizing valves, can reduce spill volumes due to potential energy.

existing system. Trans Mountain said that current Canadian regulations require only a single leak detection system, whereas regulations in Germany require two parallel systems. In recognition of this higher standard, and for continuous improvement, Trans Mountain said that it would be installing a second CPM system on the existing TMPL system. If successful, the second CPM system would also be implemented for the Project, thereby exceeding regulatory requirements and maximizing CPM leak detection capability. In addition, Trans Mountain said that it is currently participating in two joint industry projects to investigate the viability of commercially available external leak detection technologies and aerial surveillance systems. The external leak detection technologies include vapor-sensing tubes, fiber-optic distributed temperature sensing systems, hydrocarbon-sensing cables and distributed acoustic sensing systems. The aerial surveillance systems include volatile organic compound sensing and temperature sensing from a helicopter or fixed-wing aircraft.

Trans Mountain anticipates that in populated areas or along multi-use transportation corridors, unintended spills may be discovered and reported by external parties.

Trans Mountain said that the CPM system would be able to monitor pipeline performance continuously. The CPM system would not automatically shut down the pipeline but would generate an alarm notifying the CCO of a possible leak. The CCO would use prescribed procedures to determine if the alarm is a probable false alarm or a probable leak. If the evaluation leads to a determination of a probable leak, the CCO would use the SCADA system to shut down the pipeline and immediately dispatch field operations personnel to verify if there is a leak, or otherwise identify the cause of the alarm. A Simulation Specialist would be on call 24 hours a day, 365 days a year, to assist the CCO in the analysis of the leak alarm.

Upper Nicola Band and Edward Farquhar questioned Trans Mountain about the sensitivity[32] of the CPM system. Trans Mountain responded that, for the proposed Line 2, the sensitivity is anticipated to be in the range of 2 per cent to 5 per cent of the design flow rate. Trans Mountain said it will follow API 1149: *Pipeline Variable Uncertainties and Their Effects on Leak Detectability*, an accepted industry approach for estimating sensitivity thresholds, to calculate the sensitivity during the detailed engineering phase. The Province of British Columbia asked how Trans Mountain would verify the sensitivity and accuracy of the CPM system. Trans Mountain said that it conducts performance tests on the CPM system annually using historical SCADA system data in a pipeline simulator, where process variables are manipulated to simulate a leak. Trans Mountain also said that, while not a legislative requirement, it follows the API Recommended Practice 1130: *Computational Pipeline Monitoring for Liquids*, which includes testing on an annual basis to verify the sensitivity and accuracy of the leak detection system.

Views of the Board

Reliable and accurate pipeline control and leak detection systems are vital for the safe operation of a pipeline system. These systems also play an important role in reducing consequences of an accidental release. The Board recognizes that leak detection is an evolving technology. Trans Mountain has committed to implementing complementary leak detection technologies to enhance its leak detection capabilities and to continually improve its leak detection system. The Board is of the view that Trans Mountain's commitment will improve performance of the leak detection system. The Board would impose Condition 115 requiring Trans Mountain to provide an update on the status of complementary leak detection technologies that it is considering, and the timelines for their implementation. The condition would also require Trans Mountain to provide a plan to validate the performance (i.e., sensitivity, accuracy, reliability and robustness) of the leak detection system within the first year of Project operations.

Trans Mountain said it anticipates that external parties may recognize and report a spill. Condition 115 would require Trans Mountain to file a copy of its public awareness program, including spill recognition and reporting procedures.

Trans Mountain assumed a 10 minute interval to detect an alarm and shut down pumps in calculating spill outflow volumes from a full bore pipeline rupture. However, this time interval is not mentioned in Trans Mountain's leak detection procedures. Trans Mountain said that a trained Control Centre Operator (CCO) would recognize the indications of a large leak in much less than 10 minutes and

32 CPM sensitivity is a measure of the size of a leak that a CPM system is capable of detecting.

would initiate an immediate shut down. Trans Mountain is currently reviewing its procedures to introduce a rule directing the CCO to perform a controlled shutdown of the pipeline when a leak cannot be ruled out in a given time period after initial indication. Condition 115 would require Trans Mountain to describe how this rule has been introduced into its procedures. Should the Project be approved, the Board may use compliance activities, such as audits, to verify the implementation of these procedures.

6.1.12 Construction

Joining of line pipe

Trans Mountain said that the average pipe joint length will be 24 m in cross-country situations, while in some urban areas and other restricted access sections along the pipeline route, pipe lengths could be reduced to 18 m or 12 m. Production welding of the pipeline would be performed by a combination of manual and mechanized methods with Shielded Metal Arc Welding (SMAW) and Flux Core Arc Welding (FCAW) methods. For tie-in welds, a low hydrogen manual SMAW procedure and/or a semi-automatic FCAW procedure would be used. Welding specifications would be developed during the detailed engineering phase.

Trans Mountain said that as part of the process to tie the existing TMPL segments into the proposed Line 2 pipeline, welding would be necessary on the existing TMPL while it is liquid filled. The carbon equivalent of the existing TMPL is typically less than 0.50 per cent but may be greater at the tie-in location. Appropriate metallurgical tests would be conducted prior to initiating the tie-in to ensure the application of appropriate welding specifications and welding procedures.

Non-destructive testing (NDT) of welds

Trans Mountain said that every welded joint to be subjected to fluid pressure would be examined by appropriate non-destructive testing (NDT) methods to validate the integrity of the welds. Trans Mountain would have certified inspectors to monitor welding and NDT activities to ensure compliance to project specifications and procedures. Periodic audits would be performed by third party welding and NDT specialists employed by Trans Mountain. NDT specifications for the Project would be developed during the detailed engineering phase.

Quality management during construction

Trans Mountain said that it would develop construction specifications for the construction activities during the detailed engineering phase. The prime contractor for each mainline pipeline spread or pipeline facility would develop and implement a Contractor's Construction Quality Management Plan, subject to the approval of Trans Mountain.

According to Trans Mountain, an inspection team of qualified and experienced personnel would inspect all phases of pipeline construction activities to ensure compliance with legislative requirements, permit conditions, procedures, specifications and drawings. In addition, quality audits of the construction work would be undertaken to ensure that the work is being completed in accordance with the Trans Mountain Expansion Project Pipeline Construction Specification and Project Pipeline Quality Management Program (QMP). Trans Mountain's QMP for the engineering, procurement and construction of the Project will be developed during the detailed engineering phase.

Geohazard risk management during construction and operation

Trans Mountain provided a summary of potential constructability problems related to each type of geohazard along with a description of potential options for mitigation. Trans Mountain also provided example scenarios of how stability of the terrain may be affected by construction, including landslides, rock fall, rock slides, and erosion.

Trans Mountain said that the likelihood of landslides initiating due to pipeline construction activity can be reduced through careful construction practices, including the use of experienced grading foremen, the management of surface and subsurface drainage, avoiding the placement of fill on potentially unstable slopes and minimizing the height of cut slopes.

Trans Mountain said that during grading of the new right-of-way, the potential for localized instability and rock fall concerns would be identified. In these instances, qualified geotechnical engineers would review the location of concern and, where warranted, prepare site-specific mitigative designs.

Trans Mountain said that it would carry out a Terrain Stability Assessment for steeper or wetter slopes, or slopes potentially impacted by geohazards where warranted. Terrain Stability Assessment involves classification according to a system used by the British Columbia Ministry of Forests and Ministry of Environment[33] that rates the likelihood of slope failures initiating as a response to clearing and construction, but does not specifically identify existing natural geohazard processes. Trans Mountain said that slopes that are potentially subject to natural geohazards would be identified through its Natural Hazards Management Program (refer to section 6.10.2). Trans Mountain committed to developing a management plan for terrain stability prior to start of construction that would be implemented during construction and would continue through operation.

Pressure testing

Trans Mountain said that before being commissioned, every component of the pipeline would be pressure tested using water to verify integrity in compliance with CSA Z662 and the OPR. Before or after the pressure test, each pipeline section would be inspected using a caliper tool to check for anomalies such as ovality, dents and buckles. Any defects exceeding allowable limits of CSA Z662 would be cut out and replaced with pre-tested pipe.

Views of the Board

The Board notes that Trans Mountain would develop required welding specifications and procedures during the detailed engineering phase. The Board would impose Condition 111 requiring Trans Mountain to file its joining programs with the Board prior to commencing welding. The Board would use this information for compliance verification activities during the Project construction stage.

The OPR requires companies to examine the entire circumference of each pipeline joint by radiographic or ultrasonic methods. The Board is of the view that delaying of radiographic or ultrasonic examination of the final tie-in welds (i.e., welds that are not subjected to a leak test during hydrostatic testing) is essential in identifying possible delayed hydrogen cracking in the weldments. It is the Board's view that the length of time required for delayed hydrogen cracks to initiate is not well understood. As a precautionary measure, the Board would impose Condition 114 requiring Trans Mountain to delay non-destructive examination of the final tie-in welds and any associated repair welds for at least 48 hours from completion of the weld.

The Board is of the view that there is an elevated risk of geohazards occurring during construction due to the rugged terrain and the potential for high levels of precipitation along portions of the pipeline route. To ensure that any geohazards encountered during construction are identified and addressed, the Board would impose Condition 66 requiring Trans Mountain to develop and file an updated Risk Management Plan to address the threats of geohazards, to be modified as geohazards are encountered during construction.

The Board is of the view that some flexibility will be required in addressing geohazards as they are encountered during construction. To allow field change decisions for geohazard mitigation in accordance with pre-approved criteria, the Board would impose Condition 51 requiring Trans Mountain to file, for approval, a field changes manual for geohazard mitigation.

6.2 New Westridge delivery pipelines

6.2.1 Overview

Following a geotechnical investigation in the fall of 2014, Trans Mountain proposed a tunnel through Burnaby Mountain (tunnel option) as the preferred option for the new Westridge delivery pipelines. Trans Mountain requested that the Board examine, as an alternative, the corridor via Burnaby streets that

33 Refer to Forest Practices Code, 1999. Mapping and Assessing Terrain Stability Guidebook. 2nd edition, British Columbia, Ministry of Forests and Ministry of Environment.

Trans Mountain had initially proposed in its Application (streets option). Trans Mountain estimated that the tunnel option would cost $64.6 million and would require 23 months to construct, with an additional 10 months required for early procurement. The streets option was estimated to cost $27 million and would require seven months to construct.

6.2.2 Tunnel option

Design approach

Trans Mountain said that the tunnel would be approximately 2.6 km long, at least 4 m in diameter, and would be constructed using a tunnel boring machine . The tunnel entry would be located within the Burnaby Terminal and the exit would be at the WMT. In addition to the two proposed NPS 30 delivery pipelines, Trans Mountain is considering the installation of a third pipeline in the tunnel to replace the existing NPS 24 Westridge Delivery Pipeline. According to Trans Mountain, the third pipeline would be part of a separate regulatory application. Figure 8, Figure 9 and Figure 10 provide options for the proposed orientation of the pipelines within the tunnel.

Trans Mountain said that following installation of the pipelines, the tunnel would be backfilled with impermeable concrete or grout to reduce the potential for pipe movement from fluctuations in temperature, and to prevent the tunnel from being a flow path for groundwater.

Figure 8: Orientation of the two NPS 30 delivery pipelines, if the pipe segments are welded outside the tunnel

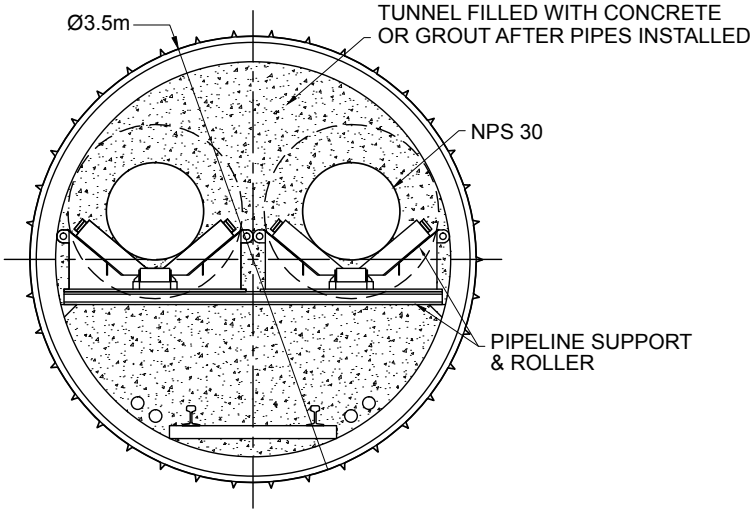


Figure 9: Orientation of the two NPS 30 delivery pipelines, if the pipe segments are welded inside the tunnel

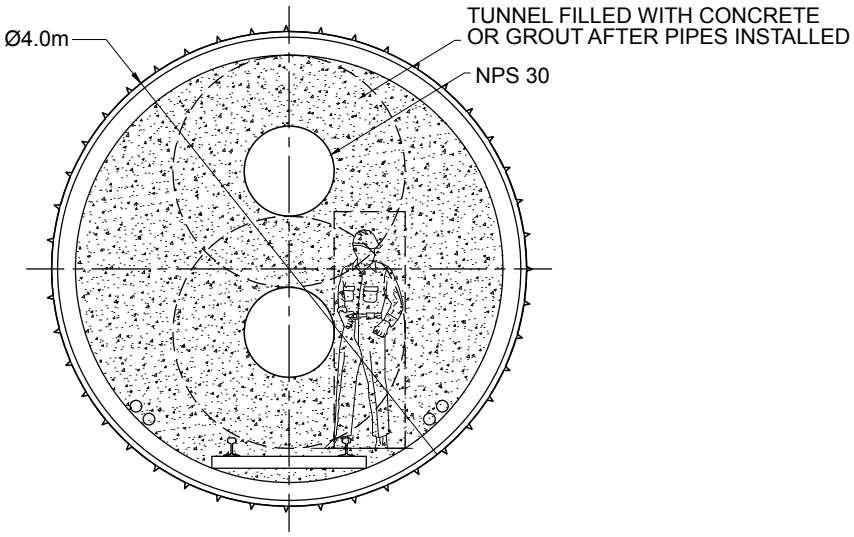
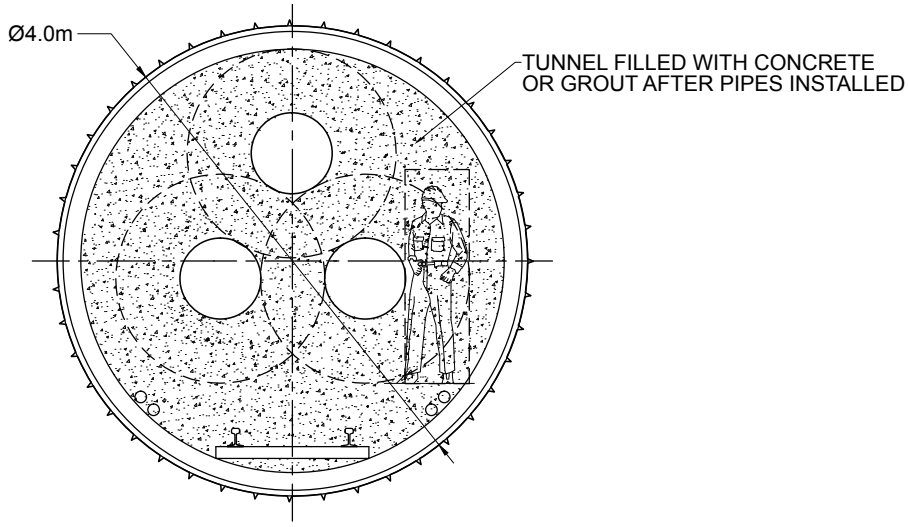


Figure 10: Orientation of the three NPS 30 delivery pipelines, if the pipe segments are welded inside the tunnel



Trans Mountain said that its tunnel design would incorporate design features and operating procedures that recognize the unique nature of the installation and the lack of accessibility for future maintenance and repair. The tunnel design would be included within the risk-based design of the pipeline segments, and risk mitigation would include the selection of an appropriate pipeline wall thickness that reflects the nature of the installation, a high integrity pipeline coating, and stringent quality assurance measures.

According to Trans Mountain, the impermeable concrete or grout backfill would provide a secondary containment system through the entire length of the tunnel. Trans Mountain said that, while concrete backfill represents an unconventional installation configuration for transmission pipelines, there is ample experience with down hole (production) applications that indicate the effectiveness of impermeable cement as a means of creating a seal in a casing in which the pressure membrane has been breached. Trans Mountain also provided a list of tunnelled and backfilled hydrocarbon pipelines completed since 2010 that are operating internationally.

Trans Mountain provided a preliminary risk assessment comparing unmitigated risk profiles of the tunnel option and streets option. The assessment concludes that the tunnel option has a significantly lower risk profile than the streets option.

Geotechnical design

Trans Mountain filed a Westridge Delivery Pipelines routing update which contains the results of geotechnical and geophysical investigations from the drilling of four boreholes and geophysical surveys at the entrance and exit of the proposed tunnel. Trans Mountain said that it had adequate information to confirm the feasibility and detailed design of the Burnaby Mountain tunnel option. Moreover, based on its assessment, Trans Mountain determined that an HDD was not feasible.

Trans Mountain said that excess material from the tunnel would be disposed of at an approved location and that safe disposal would need to be considered due to the potential presence of acid generating rock. Regarding seismic activity and the effects of ground shaking on the buried pipeline, Trans Mountain said that ground shaking on its own would have little effect on the integrity of the pipeline. According to Trans Mountain, underground structures such as the delivery pipeline incur appreciably less damage than surface structures, and the reported damage decreases with increasing overburden depth. In addition, Trans Mountain expects that underground facilities constructed in soils would incur more damage compared to pipelines constructed in competent rock, and lined and grouted tunnels would be safer than unlined tunnels in rock.

Using the results from terrain mapping, field verification, air photo review, and an independent evaluation by SFU's Department of Earth Sciences, Trans Mountain concluded that there is no evidence of active faulting on Burnaby Mountain, and that the tunnel option had a lower hazards rating than the option of trenching in the streets of Burnaby.

The City of Burnaby filed a geotechnical report commenting on Trans Mountain's Burnaby Mountain geotechnical investigation, stating that the number of boreholes was insufficient to characterize the

stability and rock mass characteristics for the proposed tunnel route. Trans Mountain agreed with the City of Burnaby's statement that the rock mass and ground conditions encountered in the boreholes is of variable quality and said that the selected tunnel boring machine would need to be capable of dealing with the expected range of ground conditions.

The Board received a letter of comment regarding the likelihood, magnitude and possible effects of a major earthquake on the pipeline, and stating that it would be difficult or impossible to monitor and repair the pipeline after the tunnel is backfilled with grout.

Tunnel operation

Trans Mountain said that operating procedures for the tunnel would include inspection, monitoring, and testing systems to provide an early indication of anomalies and allow for preventative measures to stop a potential leak from the pipeline. Possible repair techniques, given that the pipelines would be inaccessible after the tunnel is grouted, would include the installation of a smaller pipe, internal insert or slip lining, replacement of the pipeline through a new tunnel, or conventional overland routing.

Trans Mountain acknowledged that the avoidance of cracking in the concrete or grout backfill could not be guaranteed, and said that if a leak were to occur at an inaccessible location in the concrete-encased pipeline, it would consider:

- draining the delivery line segment upon detection of the leak;
- using cleaning pigs and nitrogen to remove any residual oil adhering to the pipe wall;
- assessing repair or replacement options; and
- completing a risk assessment to determine if any leaked oil has the potential to impact area receptors.

Trans Mountain committed to completing baseline ILI surveys for the Westridge Delivery pipelines after entering into service.

6.2.3 Streets option

Design approach

Trans Mountain requested that the Board assess the Burnaby streets option as an alternative to the Burnaby tunnel.

Trans Mountain said that the alternate corridor was designed to accommodate two NPS 30 pipelines using conventional pipeline construction techniques for installation. However, due to restricted workspace, one of the NPS 30 pipelines would have to be constructed before the other, extending the duration of the impacts to local traffic flow and residences along the pipeline route.

Trans Mountain committed to using continuous heavy wall pipe for the delivery pipelines in excess of the minimum requirements of CSA Z662 for the streets option. Trans Mountain said that the risk-based design process would be used to select the pipe wall thickness, along with other mitigation measures during the detailed design and engineering phase.

Views of the Board

The tunnel option would take longer to construct and would be much more costly than the streets option. However, as noted by Trans Mountain, the tunnel option would reduce disruption during construction, minimize risk during operation, and would have a lower hazards rating than trenching twice through the streets of Burnaby.

Regarding the City of Burnaby's concern with Trans Mountain's geotechnical investigation, the Board is of the view that the level of detail of the geotechnical investigation for the tunnel option is sufficient for the purpose of assessing the feasibility of constructing the tunnel. The Board notes that a second phase of drilling is planned for the development of construction plans at the tunnel portals, and that additional surface boreholes or probe holes could be drilled from the tunnel face during construction. The Board is of the view that both the tunnel and street options are technically feasible, and accepts Trans Mountain's proposal that the streets option be considered as an alternative to the tunnel option.

The Board is not aware of the use of the concrete or grout-filled tunnel installation method for other hydrocarbon pipelines in Canada. The Board is concerned that damage to the pipe or coating may occur during installation of the pipelines or grouting, and that there will be limited accessibility for future maintenance and repairs. The Board is also concerned that there may be voids or that cracks could form in the grout. The Board would require Trans Mountain to address these and other matters, including excavation, pipe handing, backfilling, pressure testing, cathodic protection, and leak detection, through the fulfillment of Conditions 26, 27 and 28 on tunnel design, construction, and operation.

The Board would impose Condition 29 regarding the quality and quantity of waste rock from the tunnel and Trans Mountain's plans for its disposal.

The Board would also impose Condition 143 requiring Trans Mountain to conduct baseline inspections, including in-line inspection surveys, of the new delivery pipelines in accordance with the timelines and descriptions set out in the condition. The Board is of the view that these inspections would aid in mitigating any manufacturing and construction related defects, and in establishing re-inspection intervals.

Trans Mountain's possible installation of a third pipeline in the tunnel to replace the existing NPS 24 delivery pipeline, although not part of the Application, would have an effect on the design and construction of the tunnel and the proposed new delivery pipelines. The Board therefore requires Trans Mountain to provide further information with regard to this proposal prior to commencing construction of the tunnel (Condition 20).

6.3 New pump stations

6.3.1 Design Approach

According to Trans Mountain, the pump stations are designed to ensure safe and efficient operation, incorporating a number of operational, safety and containment features. Trans Mountain said that the primary focus of the design process was to reduce the risk of a failure to the greatest extent practicable, with a secondary focus on limiting negative impacts in the event a failure does occur. To achieve this, Trans Mountain implemented a risk-based design process, integrated feedback from the consultation process, and relied on its operating experience with the existing Trans Mountain Pipeline. Trans Mountain said that the safety of facilities would be assured through proper engineering design, material specification and selection, and consistent application of KMC's Facilities Integrity Management Program (FIMP).

Trans Mountain provided a preliminary pump station risk assessment, including prevention and consequence reduction measures, and said that the assessment would also be used to inform detailed design.

Trans Mountain has 23 active pump stations and 1 deactivated station (Niton, AB) on its current pipeline system. Following hydraulic analyses, Trans Mountain determined that the optimum configuration requires 11 new pump stations for Line 2. The new Line 2 pump stations would include one new site at Black Pines, B.C. while the ten remaining sites would be co-located at the existing pump station sites. Two sites would also replace the currently active Wolf, AB and Blue River, B.C. pump stations while utilizing their existing electrical infrastructure.

On Line 1, the results of the hydraulic analyses determined that the deactivated Niton Pump Station would need to be reactivated, and a new pump station would be required at Black Pines, B.C. The existing Jasper, AB Pump Station would be reconnected to Line 1 and fitted with a drag reducing agent injection system. New pump units would also be added to the Sumas Pump Station and the Kamloops Pump Station.

The existing pump stations at Albreda, Stump, Hope and Wahleach are not hydraulically required for Line 1 operation; however, Trans Mountain said that a study would be conducted to determine if their continued availability would improve system reliability.

Table 5 provides a summary of pumps and motors for Line 1 and Line 2 after the Project. On Line 1, the pump station maximum operating pressures would vary between 5,890 kPa and 9,930 kPa. The maximum operating pressures at all Line 2 pump stations would be 9,930 kPa. Trans Mountain confirmed that piping design, materials, welding, fabrication, non-destructive testing and pressure testing would comply with CSA Z662.

Trans Mountain carried out geotechnical site investigations at 11 proposed pump station locations and provided preliminary geotechnical reports for each (Black Pines, Blackpool, Blue River, Edmonton Terminal, Edson, Gainford, Hinton, Kamloops, Kingsvale, McMurphy, and Wolf). The reports included recommendations for site grading and compaction, foundation design, road construction and containment ponds, along with recommendations for further studies.

Infrared flame detectors would provide fire detection within the pump buildings. Combustible gas detection would also be installed within each pump building. Pump station discharge pressure transmitters would signal overpressure situations. Depending on the level of the detected overpressure condition, protection measures would range from an alarm requiring action of the operator to an automatic pipeline shutdown.

Each pump station would have emergency shutdown (ESD) systems designed in accordance with CSA Z662. Trans Mountain confirmed that initiation of an ESD would result in the immediate shutdown of all running pump units, and the closing of station suction and discharge valves.

Table 5: Summary of pump stations and motors for Line 1 and 2 after the Project

	Line 1 Pumps			Line 2 Pumps		
	Approximate KP from Edmonton	**Status**	**Number of pumps & Motor sizes**	**Approximate RK**	**Status**	**Number of pumps & Motor sizes**
Edmonton	0.0	Existing	4 @ 1,865 kW (2,500 HP)	0.0	New	5 @ 3,730 kW (5,000 HP)
Stony Plain	49.5	Existing	2 @ 3,730 kW (5,000 HP)			
Gainford	99.4	Existing	3 @ 1,492 kW (2,000 HP)	117.4	New	3 @ 3,730 kW (5,000 HP)
Chip	147.0	Existing	2 @ 3,730 kW (5,000 HP)			
Niton	173.4	To be Reactivated	2 @1,492 kW (2,000 HP)			
Wolf	188.0	To be Deactivated	2 @ 3,730 kW (5,000 HP)	206.1	New	2 @ 3,730 kW (5,000 HP)
Edson	228.8	Existing	3 @ 1,492 kW (2,000 HP)	247.2	New	3 @ 3,730 kW (5,000 HP)
Hinton	317.8	Existing	2 @ 3,730 kW (5,000 HP)	339.4	New	4 @ 3,730 kW (5,000 HP)
Jasper[1]	369.5	Existing	2 @ 1,865 kW (2,500 HP)			
Rearguard	476.8	Existing	2 @ 3,730 kW (5,000 HP)			
Albreda	519.1	Potential deactivation[2]	3 @ 1,492 kW (2,000 HP)			
Chappel	555.5	Existing	2 @ 3,730 kW (5,000 HP)			
Blue River	588.9	To be Deactivated	2 @ 3,730 kW (5,000 HP)	614.6	New	2 @ 3,730 kW (5,000 HP)
Finn Creek	612.5	Existing	2 @ 3,730 kW (5,000 HP)			
McMurphy	645.0	Existing	2 @ 1,492 kW (2,000 HP)	671.7	New	2 @ 3,730 kW (5,000 HP)
Blackpool	710.0	Existing	2 @ 3,730 kW (5,000 HP)	736.9	New	2 @ 3,730 kW (5,000 HP)
Darfield	742.0	Existing	2 @ 1,492 kW (2,000 HP)			
Black Pines	783.7	New	2 @1,865 kW (2,500 HP)	810.7	New	2 @ 3,730 kW (5,000 HP)

	Line 1 Pumps			Line 2 Pumps		
	Approximate KP from Edmonton	**Status**	**Number of pumps & Motor sizes**	**Approximate RK**	**Status**	**Number of pumps & Motor sizes**
Kamloops	823.0	Existing	1 @ 447.6 kW (600 HP) 2@ 1,865 kW (2,500 HP) 2 @ 3,730 kW (5,000 HP)	850.9	New	4 @ 3,730 kW (5,000 HP)
		New	1 @ 3,730 kW (5,000 HP)			
Stump	862.7	Potential deactivation[2]	2 @ 3,730 kW (5,000 HP)			
Kingsvale	924.9	Existing	3@ 1,865 kW (2,500 HP)	955.5	New	3 @ 3,730 kW (5,000 HP)
Hope	1011.8	Potential deactivation[2]	2 @ 3,730 kW (5,000 HP)			
Wahleach	1045.9	Potential deactivation[2]	2 @ 3,730 kW (5,000 HP)			
Sumas	1082.0	Existing	2@ 1,492 kW (2,000 HP)			
Sumas Puget Sound	1082.0	Existing	2@ 1,492 kW (2,000 HP)			
	1082.0	New	1 @1,865 kW (2,500 HP)			
Port Kells	1124.3	Existing	2@ 3,730 kW (5,000 HP)			

1 - Drag-reducing agent (DRA) injection capability to be added at Jasper Pump Station.

2 - Deactivation subject to results of a reliability study.

6.3.2 Leak detection and containment

Trans Mountain said that the existing SCADA system would be expanded to accommodate the new instrumentation and control signals from the pump stations. For new pump stations, Trans Mountain said it would install ultrasonic flow meters on the discharge side of all pump stations to improve leak detection sensitivity.

Trans Mountain said that pumps would have mechanical seal leak detection systems that would activate an alarm in the Control Centre in the event of a failure. Pump buildings would have floor sumps with level switches that would cause an alarm in the event of an accidental product release. The leak containment design at new pump station sites would employ a hydrocarbons containment area. Containment areas would have hydrocarbon detectors that would notify the SCADA system if a leak occurs. A concrete pad and/or liner system would be installed under the outdoor pump station piping, extending towards the containment area. The containment area would hold surface run-off until the contents could be examined and verified to be acceptable for release. Spill containment with hydrocarbon detection would also be located at in-line inspection sending and receiving traps.

Views of the Board

The Board is satisfied with Trans Mountain's approach to pump station design. Trans Mountain has committed to using appropriate standards for the design, including CSA Z662. In addition, Trans Mountain's risk-based design, including hazard identification and assessment, is incorporated into its pump station design process. The Board also recognizes that Trans Mountain benefits from its pump station operations experience on the existing Trans Mountain pipeline in the design process for new pump stations.

The Onshore Pipeline Regulations requires that pump stations be designed to prevent soil, groundwater and surface water contamination. Accordingly, leak detection and spill containment are vital to the continued safe operation of pump stations. The Board accepts that Trans Mountain's proposed pump station leak detection and containment design complies with regulatory requirements.

6.3.3 Design temperature

Trans Mountain said that station piping would have a minimum design temperature of -29°C and a maximum design temperature of 38°C. The minimum design temperature was based on Trans Mountain's standard for facilities. Trans Mountain said that "low temperature" designated materials would be required to satisfy a minimum design temperature below -29°C, and that there is significant additional materials cost to acquire "low temperature" materials. Trans Mountain said that "low temperature" materials are not necessary for terminal and station piping because daily average temperatures are very rarely less than -29°C, even in Alberta. However, Trans Mountain acknowledged that over the last five years the average daily temperature has fallen below -29°C in Edmonton on a number of occasions. Trans Mountain also said that active terminal and station piping are kept warm by internal product flow, while idle piping systems would require time to cool to extreme low temperatures. Furthermore, Trans Mountain would electrically heat trace and insulate critical valves and drain piping wherever extreme low temperatures could occur.

Trans Mountain selected a maximum design temperature of 38°C for terminal and station piping based on Trans Mountain's tariff, which limits incoming commodities to 38°C. Trans Mountain said that it is extremely rare for temperatures to rise above 38°C anywhere along the Trans Mountain system; however, Trans Mountain acknowledged that ambient temperatures in Kamloops, B.C. rose above 38°C on three occasions over the last five years. Trans Mountain said that hydraulic modelling also confirmed that crude oil temperatures would not rise above 38°C anywhere along Line 2, considering a flow rate of up to approximately 131 160 m^3/day (825,000 bbl/day). Trans Mountain said that the selected maximum design temperature provides a reasonable margin for potential future expansion, while limiting the unnecessary cost of building facility piping to withstand the stresses of operating at temperatures higher than 38°C.

Views of the Board

The specification of suitable design temperatures is necessary to determine appropriate notch toughness[34] values for above ground piping at facilities. Materials with adequate notch toughness must be utilized so that the piping will be resistant to failure, particularly when subjected to low temperatures. According to CSA Z662, minimum design temperatures for above ground sections of facility piping must consider the lowest metal temperature attainable in service, which can be affected by internal fluid and ambient temperatures.

The Board is of the view that Trans Mountain has not demonstrated the appropriateness of its proposed minimum design temperature for above ground facility piping. Although Trans Mountain proposed -29°C as the minimum design temperature for facility piping, it has acknowledged that the ambient temperature has fallen below -29°C in the vicinity of the Project on numerous occasions over the last five years. Furthermore, Trans Mountain used average daily temperatures to justify their material temperature specifications, as opposed to daily temperature extremes. The Board is of the view that this is not a conservative approach. Although flowing oil could aid in sustaining greater than ambient metal temperatures, isolated piping segments would eventually reach ambient temperatures, given sufficient time.

The Board is also of the view that Trans Mountain has not demonstrated the suitability of the proposed maximum design temperature of 38°C for facility piping. Trans Mountain presented evidence indicating that the ambient temperature has risen above the proposed maximum design temperature in at least one location along their system. Furthermore, the reliance on tariff requirements alone does not preclude temperature excursions from occurring. Therefore, the Board would impose Condition 8 requiring Trans Mountain to demonstrate compliance with CSA Z662 in their above ground facility design temperature specifications, based, in part on location-specific extreme daily maximum and minimum temperatures, as opposed to average temperatures.

34 Notch toughness is an indication of the resistance of a steel to fracture under suddenly applied loads at a notch, or flaw.

6.3.4 Construction

Trans Mountain committed to constructing pump stations in accordance with the OPR and CSA Z662. Welding, fabrication and non-destructive examination of pump station piping would be completed in accordance with applicable industry and company standards and specifications. Trans Mountain said that comprehensive construction schedules for each pump station will be developed during the detailed engineering and design phase.

Trans Mountain said that all piping would be hydrostatically pressure tested in accordance with applicable standards, including Trans Mountain's Station Hydrostatic Test Standard. Piping constructed in fabrication shops would be hydrostatically pressure tested prior to delivery to the site. Site fabrication pipe would be hydrostatically tested onsite.

Views of the Board

The Board finds that Trans Mountain's plan to develop a Project-specific joining program meets the requirements of the OPR. The Board would impose Condition 111 requiring Trans Mountain to file its joining program in order to assess the adequacy of Trans Mountain's internal specifications with respect to the welding and non-destructive examination of facilities, including pump stations.

The Board is of the view that Trans Mountain's plan to hydrostatically test all pump station piping is appropriate. The Board would impose a condition requiring Trans Mountain to submit their pressure testing program to the Board to evaluate, among other things, the acceptability of its Station Hydrostatic Test Standard with respect to regulatory requirements (Condition 112).

6.4 Terminal expansions

6.4.1 Design

Trans Mountain said that current crude and refined product capacity of the Trans Mountain system, including those tanks approved but not yet constructed, is 57 tanks with a combined shell capacity of 1 718 690 m^3 (10,810,000 barrels)[35]. Trans Mountain said that its preliminary engineering assessment indicated that with the expanded pipeline capacity, it would require 20 new tanks at Edmonton, Sumas, and Burnaby, ranging in size from 11 920 m^3 (75,000 barrels) to 63 600 m^3 (400,000 barrels),and having a combined total shell capacity of approximately 876 040 m^3 (5,440,000 barrels). Trans Mountain said that these tanks would be constructed within the existing terminal property lines, requiring no additional new land. In addition, the existing Tank 9, in Edmonton, and Tank 74, in Burnaby, will be demolished to make room for the new tanks. Two of the new tanks will assume the numbering designations of the demolished tanks. With the addition of the new tanks, there will be 75 tanks at these locations, having a total shell capacity of approximately 2 558 130 m^3 (16,090,000 barrels). The numbers and capacities of the new and existing tanks are provided in Table 6. Trans Mountain said that further studies were underway to verify that the numbers and sizes of the new tanks were optimal.

35 Trans Mountain said that the shell capacities of each tank referred to in its Application were not the working capacities. The working capacity (the volume contained between the low working levels and the high working levels) varies for both existing and new tanks, and depends on tank design. This volume is about 85 to 90 per cent of the shell volumes.

Table 6: Existing and new tank capacities

Location	Existing or under construction		New Tanks		Total	
	# of tanks	Capacity, m^3 (barrels)	# of tanks	Capacity, m^3 (barrels)	# of tanks	Capacity, m^3 (barrels)
Edmonton	35	1 274 310 (8,015,000)	5	209 070 (1,315,000)	39*	1 470 660 (9,250,000)
Sumas	6	113 680 (715,000)	1	27 820 (175,000)	7	141 500 (890,000)
Burnaby	13	267 900 (1,685,000)	14	627 990 (3,950,000)	26*	883 170 (5,555,000)
Westridge	3**	62 800 (395,000)	0	0	3	62 800 (395,000)
Total	57	1 718 690 (10,810,000)	20	864 880 (5,440,000)	75	2 558 130 (16,090,000)

* Total number of tanks account for tanks that will be demolished (one at Edmonton Terminal, and one at Burnaby Terminal).

** WMT currently has three jet fuel storage tanks. The jet fuel facility is not regulated by the NEB.

Safety

Trans Mountain said that the tanks and their associated infrastructure would be designed to meet the Canadian Council of the Ministers of the Environment (CCME) Standard 1326, the Environmental Code of Practices for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products, API Standard 650 (API 650) Welded Steel Tanks for Oil Storage, and CSA Z662. Foundation design would be based on Provincial Building Code requirements using geotechnical information specific to the site.

Trans Mountain said that tank spacing will be in accordance with National Fire Protection Association (NFPA) Standard 30 and the National, Alberta and B.C. fire codes, with spacing between adjacent tanks equal to or greater than the sum of their respective diameters divided by four. Fire protection systems will be in accordance with NFPA Standard 30, other applicable NFPA standards, and the National, Alberta, and B.C. fire codes.

In order to prevent the overfilling of tanks, each tank will be equipped with a radar gauging system for liquid level measurement and overfill protection. Redundant instrumentation for overfill protection will be provided. Trans Mountain said that secondary containment would be designed in accordance with CSA Z662, NFPA Standard 30, and the National, Alberta and B.C. fire codes, where applicable.

Trans Mountain said that it intended to install water and foam fire protection systems on or nearby the proposed new tanks to address a number of fire scenarios at each terminal. The fire scenarios contemplated by Trans Mountain included tank floating roof rim seal fires, tank full surface fires, adjacent tank cooling, and releases to secondary containment. Trans Mountain said it would finalize the fire protection systems for each terminal during the detailed engineering and design phase, and committed to adhering to the applicable NFPA standards in their design and installation.

Trans Mountain said that all terminal piping will conform to the requirements of CSA Z662 for low vapour pressure liquids, and to the requirements of all applicable codes, standards, specifications and recommended practices that are incorporated by reference in CSA Z662. Component fabrication, construction and installation will be rigorously inspected to ensure that the prescribed designs are followed.

Trans Mountain said it would externally coat the tanks with a zinc primer/urethane top-coat system. The tank floor top and the interior 1 m (3.3 ft) of the lower shell would be coated with epoxy.

Trans Mountain said that all new tanks and associated piping will be hydrostatically tested.

6.4.2 Secondary containment

Edmonton Terminal

The Trans Mountain Terminal in Edmonton is divided into two terminal areas. Tanks added in the West Tank Area (WTA) require additional containment capacity, as specified in the regulations. Specifically, 100 per cent of the capacity of the largest tank, plus 10 per cent of the capacity of the other tanks that share the common impoundment area, is required. This containment capacity will be partially provided by the remote impoundment (RI) recently constructed to serve the East Tank Area (ETA). The remaining containment capacity will be provided within the WTA common impoundment (CI).

Trans Mountain said that it sized the RI, based on the requirements of NFPA 30, to have a capacity equal to the working volume[36] of the largest tank in the ETA (approximately 61 200 m^3, or 385,000 barrels). Since the RI is normally open to the ETA CI, the RI has additional capacity for all of the water that can collect in the RI from a 1 in 100 year, 24-hour precipitation event (approximately 31 800 m^3 or 200,000 barrels). Since the largest tank being added in the WTA is equivalent to the size of the largest tank in the ETA, the RI can also serve the WTA, in accordance with NFPA 30. 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. Therefore, a new storm water retention area, the remote impoundment annex (RIA), would be constructed at the north end of the WTA to handle accumulated precipitation from the WTA.

Trans Mountain said that NFPA Code 30, the only applicable code that addresses remote impounding, does not specify or provide guidance on the design flow rate to a remote impoundment, thereby leaving the design to engineering judgment. Trans Mountain said it had never experienced a catastrophic failure of a storage tank and that the spill rates associated with storage tanks were relatively low. Therefore, Trans Mountain believes that storm water flow should govern the design of the WTA drainage system. Figure 11 illustrates the proposed Edmonton Terminal plot plan, including the five new tanks in the WTA and the secondary containment system.

Strathcona County required Trans Mountain to conduct a risk assessment for the proposed Project, in line with the County's risk requirements for developments in their industrial areas. Because of Strathcona County's relationship with the City of Edmonton, the risk assessment points out the impact of this Project on the City of Edmonton and its acceptability. A 1.5 km distance from the City of Edmonton was used as a guideline for setting the boundary for a risk assessment conducted for Strathcona County who referred to the Major Industrial Accidents Council of Canada (MIACC) criteria as their guide for risk assessments for development proposals in their area. Within the 1.5 km radius of the west tank farm facility, there are other hazardous industries, including a refinery, oil product storage, pipeline operations, a railway, industrial trucking operations, a steel fabricator, and an industrial design products operation that would be impacted.

Trans Mountain commissioned a risk assessment report for the expansion of the Edmonton Terminal WTA. The proposed expansion of the WTA includes the addition of five new tanks and the demolition of an existing tank. The WTA will house 14 tanks located within a single CI. Trans Mountain said that the single CI would be designed to drain any spilled oil or water from firefighting through a series of channels to the RIA located remotely from the tanks in the northwest corner of the site. The RIA consists of one lagoon capable of holding 14 300 m^3 (90,000 barrels) and will overflow to the existing RI, if needed. The RI and the RIA form the basis of a fire scenario for the report.

The risk assessment report highlighted the need for prevention of releases and ignition sources to address risks associated with flammable liquid. The hazard and risk analysis focused on a fire related to a major tank spill and the radiant heat effect of the flames. The smoke plume from a fire and consideration of the sulphur component in the oil, which has been recognized as a health concern, was also analyzed. The report noted that the analysis focused on a single tank releasing its contents of up to 63 600 m^3 (400,000 barrels) and did not consider the "knock-on"[37] effect of that spill within the CI. The report noted that the probability of this happening was very low, and that this concern would need to be addressed by the design and emergency planning needs of the Project.

36 Trans Mountain interprets the terminology for secondary containment capacity requirements in CSA Z662, NFPA 30, AFC, and BCFC to mean the capacity of a storage tank when the liquid level is at the high working level, rather than at the top of the shell (the nominal shell volume).

37 The release of neighbouring tank contents as a result of the initial tank release.

Figure 11: Edmonton Terminal plot plan

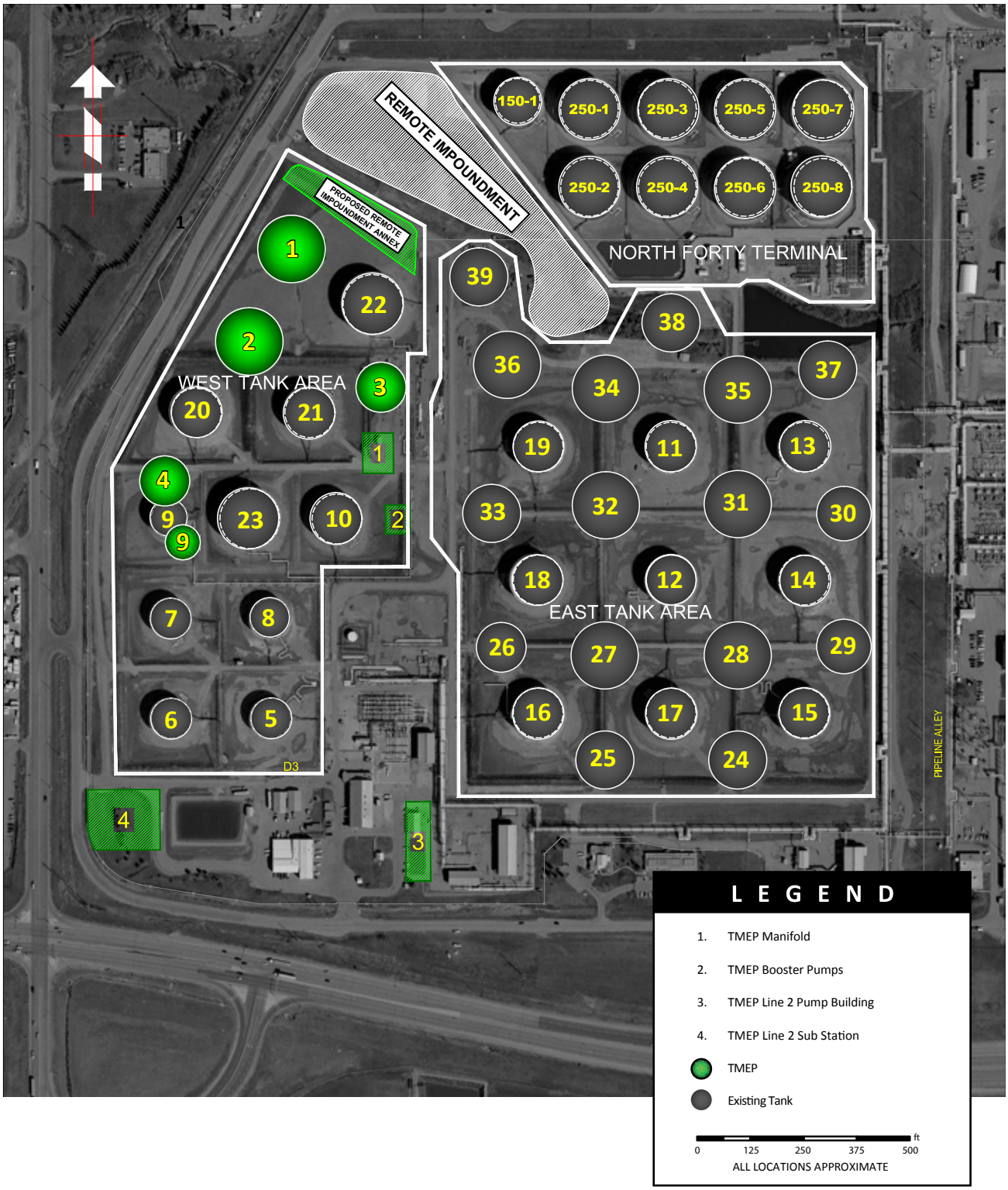
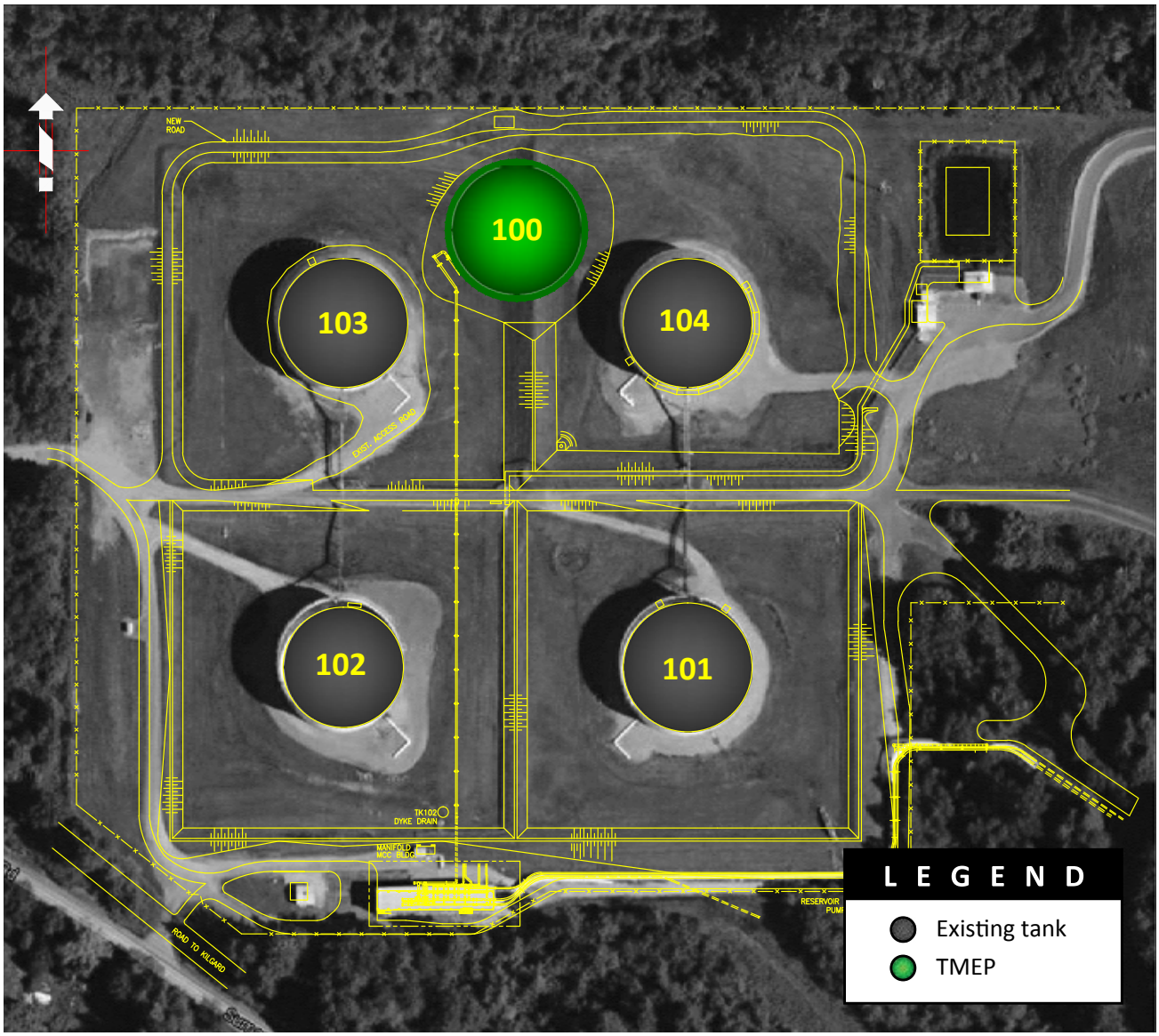


Figure 12: Sumas Terminal plot plan



To determine the size of a potential oil fire scenario, the report considered the surface area of a spill that would be exposed to air. The report noted that if one of the tanks were to spill their contents, it would fill the RIA and possibly the CI. If the spill exceeded the capacity of the RIA, it would overflow into the RI, creating a larger surface area and fire scenario, having a radiant heat impact of 282 metres from the edge of the RI. This distance would include some other industrial businesses and therefore, these would need to be included in emergency planning.

The final scenario evaluated a major dike fire where a major release would not drain to the RIA and RI but would be contained within the CI. Following ignition, the radiant heat impact would be felt outwards from the CI centre for 824 m, or about 540 m from the dike walls. The report indicated that this scenario was less probable as it would require an additional blockage event to obstruct drainage to the RIA and RI. Consequently, the report concluded it was not a realistic worst-case scenario.

Trans Mountain believes that the credible worst-case release rate for the largest proposed storage tanks in the Edmonton Terminal West Tank Area (WTA) would be caused by a component failure located at the bottom of the tank. Based on the preliminary design, Trans Mountain anticipated that the piping configuration for the storage tanks would consist of an NPS 30 tank line between the terminal valve manifold and the tank. The tank will have two NPS 20 nozzles that would be used to connect the NPS 30 tank line. A credible worst-case scenario could involve the failure of an NPS 20 tank nozzle or a failure of a flange connection in the NPS 30 tank line. These could be the result of an earthquake exceeding the design earthquake, or mechanical damage (i.e., a vehicular strike). In either of these scenarios, Trans Mountain did not believe that the release rate would be equivalent to a full-bore failure (open-ended pipe), but would more likely involve a crack or tear in the nozzle or pipe, or a leaking flange connection. In Trans Mountain's view, a credible worst-case release rate is 50 per cent of the release rate from two NPS 20 nozzles or 14 400 m^3/hour (90,580 bbl/hour) in Edmonton.

Trans Mountain indicated that the design flow rate from the WTA to the RIA would be 3 240 m^3/hour (20,380 bbl/hour) based on storm water flow from a once in five years, one hour precipitation event. The design flow rate from the RIA to the RI would be marginally higher at 3 600 m^3/hour (22,640 bbl/hour). Trans Mountain concluded that it would take 19 hours for the entire contents of the largest tank to drain into the RI, and that in such an extreme case, the oil would not escape the CI area; however, a certain amount of pooling could occur. Trans Mountain said that the largest tanks in the proposed design are situated very near to the RIA and if deemed appropriate by emergency responders, the volume in the affected tank might be reduced during the spill event by pumping to other storage tanks within Edmonton Terminal, the capability for which would exist within the proposed infrastructure design.

Sumas Terminal:

The tanks at Sumas are normally used to hold batches of crude oil to be shipped on the Puget Sound Pipeline to refineries in Washington State. One new tank with a shell capacity of 27 820 m^3 (175,100 barrels) was proposed by Trans Mountain. Trans Mountain said that the berm between Tank 103 and Tank 104 would be partially removed to allow space for the installation of the new tank (Tank 100), and replaced with a concrete wall. Figure 12 displays the proposed Sumas Terminal plot plan, including Tank 100. Trans Mountain said that the existing capacity of the Tank 104 containment area would be maintained, while Tank 100 would 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, would ensure that the shared containment capacity was in accordance with CSA Z662 and the B.C. Fire Code (BCFC). Trans Mountain said that the shared containment area would be lined with an impervious membrane liner. Storm water runoff would be collected in the lower part of the shared containment area for observation prior to release to the natural drainage course on the south side of the property. Trans Mountain said that as an additional precaution, discharging storm water would flow through an oil/water separator.

Similar to the Edmonton Terminal WTA, Trans Mountain commissioned a risk assessment report for the Sumas Terminal. The report examined scenarios involving a fire within the terminal's secondary containment areas, and the radiant heat impacts to the terminal, workers, and the public. The analysis did not consider the "knock-on" effect of neighboring tank releases resulting from the initial tank release, stating that the probability of such an event occurring was very low.

Referencing the MIACC criteria, the report concluded that the distance associated with an acceptable level of risk to personnel and the public ranged from 101 m to 198 m from the terminal's secondary containment walls.

Burnaby Terminal

The Burnaby Terminal, shown in Figure 13, is uphill of the neighborhood of Forest Grove, and a Metro Vancouver drinking water reservoir and pump station. Trans Mountain said that due to space limitations, some of the storage tanks at the Burnaby Terminal will share containment areas with other tanks, and that this containment capacity would be in accordance with CSA Z662 and the BCFC. CSA Z662 and the BCFC require containment of 100 per cent of the capacity of the largest tank plus 10 per cent of the capacity of the other tanks that share the common containment area. The containment for Tanks 96, 97, and 98 will be partially provided by RI adjacent to the tanks. For some tanks, secondary containment will be partially provided by RI, in accordance with the requirements of NFPA Code 30.

Based on preliminary design work completed to date, Trans Mountain estimated that the total secondary containment volume would be approximately 530 000 m^3 (3,350,000 barrels), which is more than 60 per cent of the total proposed storage tank capacity at high working levels. Trans Mountain said that the volume of the existing tertiary containment, which will be retained in the expansion, is approximately 80 000 m^3 (500,000 barrels). Trans Mountain said that this increases the total containment volume to more than 70 per cent of the total proposed product storage volume, and is nearly twelve times the capacity of the largest tank.

Trans Mountain submitted a risk assessment report for the Burnaby Terminal following the proposed expansion. The report analyzed scenarios involving pool fires within the terminal's secondary containment areas, and the radiant heat impacts to the terminal, workers, and the public. The report found that the risk of greatest concern was a pool fire. Referencing the MIACC criteria, the report concluded that the distance associated with an acceptable level of risk to personnel and the public ranged from 86 m to 224 m from the terminal's secondary containment walls. The report stated that the results were within the acceptable level of risk as recommended by the MIACC criteria. The report also concluded that although a boil-over would be a highly unlikely event, it should be considered in emergency response planning due to the potential for widespread damage.

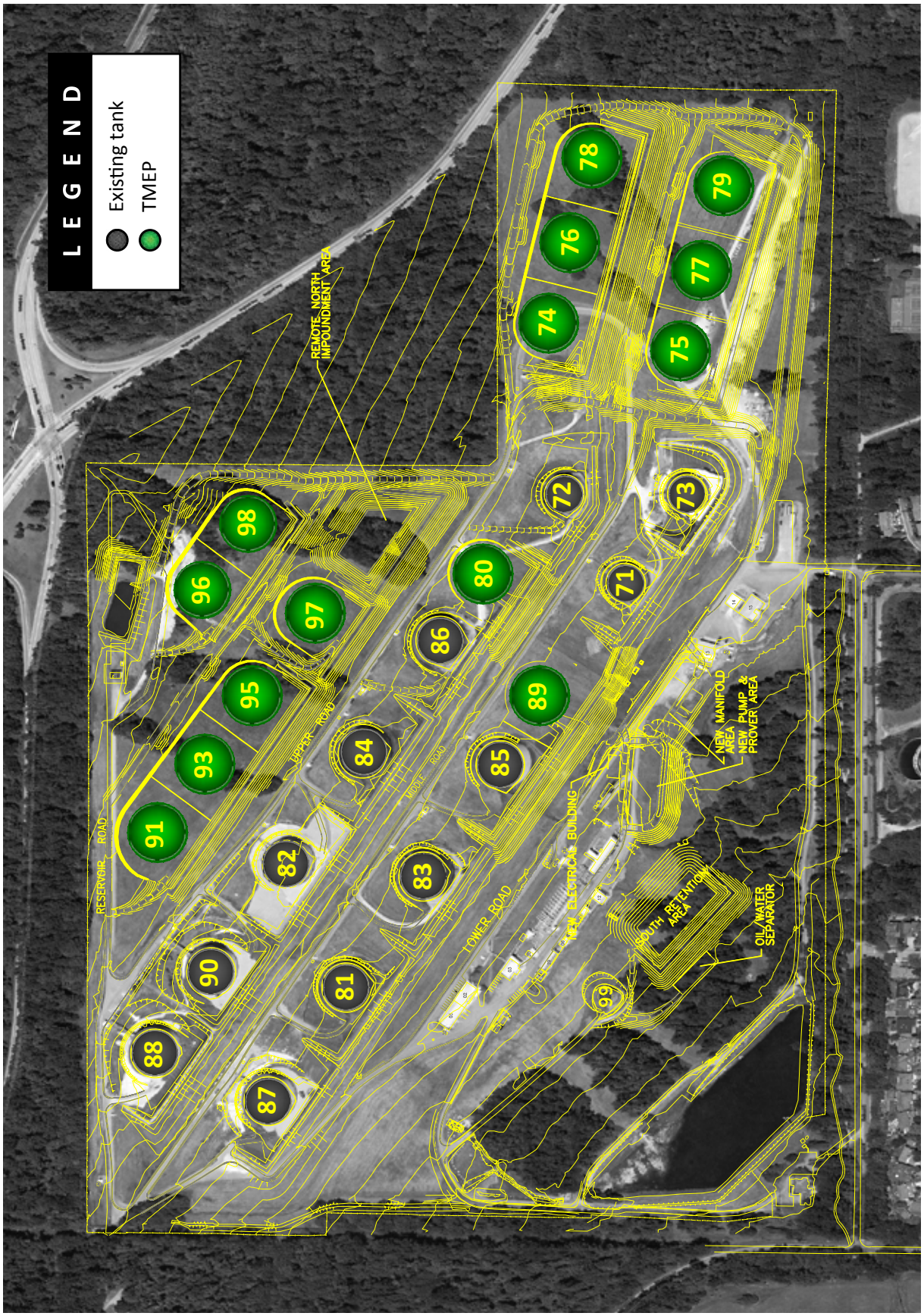
Trans Mountain considers the worst-case release scenario at Burnaby Terminal to be the entire volume of proposed Tank 74, Tank 76, or Tank 78, which will be the largest tanks on site. These tanks share a common containment area. The estimated capacity of each tank, at high working level, is approximately 51 700 m^3 (325,000 barrels) requiring a secondary containment capacity of approximately 62 040 m^3 (390,000 barrels). Trans Mountain estimated the volume of storm water from a 1 in 100 year, 24-hour precipitation event to be approximately 2 950 m^3 (18,560 barrels). The volume of water used to fight a full-surface fire and cool adjacent tanks was also estimated to be approximately 3 250 m^3 (20,440 barrels), for a total volume of approximately 6 200 m^3 (39,000 barrels). Trans Mountain concluded that the approximately 10 340 m^3 (65,040 barrels) of excess secondary containment capacity would be more than sufficient to allow for accumulated precipitation and water used in firefighting.

Trans Mountain said that firefighting water and storm water were inherently considered in determining the secondary containment capacity in accordance with NFC and the BCFC. Trans Mountain pointed to Clause 4.3.7.3.3 of the NFC and BCFC, which it said implies that the 10 per cent marginal capacity for each additional tank is intended for accumulated precipitation and water used in firefighting.

Trans Mountain said that none of the codes and standards that cover containment volume at storage tank terminals, including CSA Z662, NFPA Code 30, the NFC, or the BCFC, contemplate simultaneous multiple-tank failure scenarios. Trans Mountain said that storage tanks are designed to the rigorous requirements of API 650, are spaced according to the applicable requirements of codes and standards, and that working tanks are only filled to capacity for part of the time they are in operation.

Trans Mountain said that multiple-tank failure scenarios are expected to have extremely low (near zero) probabilities. However, it noted that following the Project, the aggregate containment at Burnaby Terminal is adequate for a number of multiple-tank failure scenarios. With respect to shared containment areas, the rupture of three full tanks, specifically Tanks 74, 76 and 78, would be the hypothetical worst-case multiple tank failure scenario. In this scenario, containment would require the full use of secondary containment, and excess oil would flow into the tertiary containment area. Trans Mountain said the amount of space in tertiary containment depends on storm water management in the containment area and following significant storm events (i.e., 1 in 100 year, 24-hour precipitation event), the capacity could be exceeded. Trans Mountain advised that, based on detailed modelling of the operation of the expanded system,

Figure 13: Burnaby Terminal plot plan



the total volume of oil in tanks 74, 76 and 78 is expected to average 54 400 m^3 (342,000 barrels), which is about 57 per cent of the shared secondary containment. The total volume of oil in the three tanks is expected to exceed the available secondary containment less than seven per cent of the time; and the tanks are expected to be at their maximum capacities four per cent of the time. Trans Mountain was of the view that additional mitigation was not necessary because it was extremely unlikely that three tanks would fail from a seismic event exceeding the design seismic event immediately after a 1 in 100 year, 24-hour precipitation event.

The City of Burnaby and the Burnaby Fire Department expressed concern that a seismic event could lead to simultaneous tank failures and the release of product, overwhelming the facility retention provisions. Trans Mountain replied that to consider the likelihood of simultaneous multiple-tank failures and uncontained releases of oil properly, it was important to contemplate the levels of utilization of the Burnaby Terminal tanks. Trans Mountain said it had completed simulations of the anticipated onsite storage volumes at the Burnaby Terminal following the expansion. The associated tank utilization histograms indicated that 556 460 m^3 (3,500,000 barrels) would be expected 99.5 per cent of the time, while on average, a total volume of 233 870 m^3 (1,471,000 barrels) is anticipated. Trans Mountain highlighted that the combined total secondary and tertiary containment capacity at Burnaby Terminal, approximately 610 000 m^3 (3,850,000 barrels), is roughly 10 per cent greater than the amount of oil that would be at the terminal 99.5 per cent of the time.

Trans Mountain believed that the credible worst-case release rate for the largest proposed storage tanks at Burnaby Terminal would be associated with a component failure located at the bottom of the tank, similar to that described for the Edmonton Terminal.

Trans Mountain said that proposed design of the expanded Burnaby Terminal would also allow oil to be transferred simultaneously from new tanks to other new or existing tanks by gravity induced flow or by use of the WMT delivery line pumps. Trans Mountain anticipated that a transfer rate of up to 6 960 m^3/hour (43,800 bbl/hour) would be possible, using three sets of WMT pumps simultaneously. Trans Mountain said that in the extremely unlikely event of an uncontrolled fire in a single tank, or tank failure at the same time as a fire in the shared secondary containment area, the volume of oil in the other two tanks could be rapidly reduced to less than the capacity of the shared secondary containment.

The preliminary design flow rates from the secondary containment areas to the partial remote impoundment area are based on the theoretical maximum flow rates for two parallel NPS 36 diameter pipes for the Tank 96 and Tank 98 shared secondary containment area. Two parallel NPS 42 diameter pipes determine the theoretical maximum flow rates to the partial remote impoundment for the Tank 97 secondary containment area. Trans Mountain said that the pipe sizes were selected such that the flow rates would be close to the credible worst-case release value (i.e., the release rate through one NPS 20 tank nozzle, with the tank at high working level).

Trans Mountain said its assumption that the flow from the secondary containment areas to the partial RI should be close to the worst-case release rate was very conservative. In each case, the design is such that the secondary containment area must be nearly full before flow to the partial RI will take place. For the secondary containment area to be full, the majority of the contents of the tank from which the release is occurring must drain, which will reduce the head above the release point, slowing the release rate. In addition, the full secondary containment area will reduce the differential head, further slowing the release rate. The somewhat lower design flow rate for the Tank 96 and Tank 98 shared secondary containment area, as compared to the Tank 97 secondary containment area, reflects the earlier overflow of the Tank 97 secondary containment area and the higher residual head in Tank 97 when the overflow occurs.

The City of Burnaby and the Burnaby Fire Department submitted reports which questioned Trans Mountain's choice of worst-case scenario as a pool fire. Concerns were raised regarding fire and safety risks at the terminal, in particular those associated with boil-overs. The City of Burnaby said that boil-over occurs when water at the base of a tank of a crude oil turns to steam upon contact with heat descending through the oil from a full surface fire. The volume of steam may explosively eject the contents of the tank and immediately be ignited by the surface fire, generating a massive fireball supplemented by drops of burning fuel.

Trans Mountain said that the risk of boil-over has been overstated, and emphasized the design and operational measures which would minimize the potential for water accumulation within the tanks.

Trans Mountain said that all of the proposed new storage tanks would have water-draw piping, which could be used to remove water if deemed necessary. It also said that the proposed new storage tanks would have fixed external roofs to provide an additional barrier to rain-water ingress into the tanks. Trans Mountain said that the new tanks would have a cone-shaped bottom, sloping down towards a centre sump where the tank inlet / outlet line(s) would terminate. The anticipated high utilization of the tanks would ensure that any small amounts of settled water would be flushed out during the next delivery, preventing water accumulation. Trans Mountain identified further risk reduction measures, including the automated fire detection and suppression systems that would prevent and/or extinguish fires that could lead to a boil-over event. Lastly, Trans Mountain said that because boil-over can only occur following a burn period of many hours, emergency management measures, including evacuations, would be highly effective in reducing consequences to the public.

Views of the Board

Secondary containment is required by CSA Z662 and the provincial fire codes to accommodate the release of an entire tank of product, regardless of the low probability of occurrence. As noted by Trans Mountain, NFPA Code 30 is the only applicable code that explicitly references remote impounding. The requirements focus on the control of spills so that the spilled liquid does not collect around tanks. Some of these requirements include:

- *the drainage route shall have a slope of not less than one per cent away from the tank for at least 15 m toward the impounding area;*
- *the drainage route shall be located so that if the liquid in the drainage system is ignited, the fire will not seriously expose tanks or adjoining property; and*
- *the impounding area shall be located so that when filled to capacity, the liquid will not be closer than 15 m from any property line that is or can be built upon, or from any tank.*

Based on the evidence provided by Trans Mountain for the Edmonton Terminal West Tank Area (WTA), the time required to transfer the entire contents of the largest tank from the common impoundment (CI) to the remote impoundment annex (RIA), and then to the remote impoundment (RI), is 19 hours. In this scenario, there is the potential for oil to back up in the common impoundment and pool around the tanks. If ignited, tanks could be exposed to a pool fire. As currently described by Trans Mountain, the design of the WTA may not meet the requirements of NFPA Code 30. The Board would impose Condition 23 requiring Trans Mountain to submit the Edmonton WTA design, and to demonstrate that its design fully complies with NFPA 30.

The Burnaby Terminal is uphill of the neighborhood of Forest Grove. An issue of potential concern is the possibility, however remote, of a multiple-tank failure in a common impounding area exceeding the available secondary containment capacity under certain conditions. The Board would impose a condition requiring Trans Mountain to demonstrate that the secondary containment system would be capable of draining large spills away from Tank 96, 97 or 98 to the partial RI. Trans Mountain must also demonstrate that the secondary containment system has the capacity to contain a spill from a multiple-tank rupture scenario (Condition 24).

The City of Burnaby and the City of Burnaby Fire Department raised concerns about fire and safety risks at the Burnaby Terminal following, in particular, those associated with boil-overs. Trans Mountain claimed that boil-over events are unlikely, yet did not quantify the risks through rigorous analysis. The Board is of the view that a complete assessment of risk requires consideration of the cumulative risk from all tanks at a terminal. The Board would impose conditions requiring Trans Mountain to revise the terminal risk assessments, including the Burnaby Terminal, to demonstrate how the mitigation measures will reduce the risks to levels that are As Low As Reasonably Practicable (ALARP) while complying with the Major Industrial Accidents Council of Canada (MIACC) criteria considering all tanks in each respective terminal (Conditions 22 and 129).

6.4.3 Geotechnical design considerations

Trans Mountain said that seismic design of earthen, concrete, and steel structures, including foundations, containment berms, pipe racks, other support systems, and piping, would 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. Seismic design of storage tanks, including consideration of sloshing and other effects, would be in accordance with the latest edition of the American Petroleum Institute Standard 650 (API 650), Welded Tanks for Oil Storage, Annex E, which is the recognized North American standard. As with the pipelines, the tanks and other facilities would be designed for seismic loading corresponding to a 2 per cent probability of exceedance in 50 years, which is equivalent to a 1:2,475 annual probability of exceedance (APE).

Trans Mountain said that seismic design would be undertaken by experienced and competent professional engineers registered in the province where the facility is to be located. Geotechnical programs, which would include borehole and other investigative methods to obtain sub-surface data, would be conducted, and the results and recommendations of registered professional engineers and geologists would be used to inform the seismic designs.

Edmonton Terminal West Tank Area (WTA)

The proposed redevelopment of the WTA included the demolition of an existing tank, construction of new tanks and berms, construction of new utility buildings, site grading and construction of new ancillary facilities. Trans Mountain's Geotechnical Investigation Report Enhanced FEED[38] Stage (Final) for the WTA provided geotechnical recommendations to support the civil and structural design. The report recommended pile foundations for the support of proposed facilities. The report also included a list of recommendations for further geotechnical investigations and follow-up.

Burnaby Terminal

The scope of Trans Mountain's geotechnical work included a review of available site and soils information, a geotechnical subsurface investigation, and preliminary analyses and engineering review based on initial design concepts. The review included the results of geotechnical investigations, which involved the drilling of 163 boreholes. Trans Mountain said that additional geotechnical investigation and analyses will be necessary for the final design stage of the project.

Trans Mountain said that the tanks would be installed on a flat surface and that the geology is well suited to support the new tanks. Trans Mountain said that the slope stability measures and foundation design details for the proposed expansion of the Burnaby Terminal would be finalized during the detailed engineering and design phase of the Project.

Trans Mountain said that the choice of materials is a recognized method of mitigation against the effects of permanent ground displacement that may occur as a result of seismic activity. This would include the selection of appropriate backfill materials to limit strain on the pipe and adjusting pipe wall thickness to increase the pipe's resistance to deformation. In accordance with API 650, storage tank materials would be specified to have certain properties, including thickness, chemical composition, and strength, as part of the seismic design process. Trans Mountain confirmed that it expected the proposed pipelines and the storage tanks at Burnaby Terminal to withstand a significant seismic event.

Trans Mountain said that it had not yet begun the detailed design for the storage tanks, but that it believed the new tanks proposed for Burnaby Terminal would meet the criteria of API 650, Welded Steel Tanks for Oil Storage, Annex E[39] to be assigned Seismic Use Group (SUG) I, which includes "storage tanks in a terminal or industrial area isolated from public access that has secondary spill prevention and control ..."

38 Front End Engineering Design

39 American Petroleum Institute (API) Standard 650, Welded Steel Tanks for Oil Storage, Annex E, defines the seismic use groups as:

SUG III tanks are those providing necessary service to facilities that are essential for post-earthquake recovery and essential to the life and health of the public; or, tanks containing substantial quantities of hazardous substances that do not have adequate control to prevent public exposure.

SUG II tanks are those storing material that may pose a substantial public hazard and lack secondary controls to prevent public exposure, or those tanks providing direct service to major facilities.

SUG I tanks are those not assigned to SUGs III or II.

The commentary on API 650 Annex E states "For example, tanks serving the following types of applications may be assigned SUG I ... 1) storage tanks in a terminal or industrial area isolated from public access that has secondary spill prevention and control...."

The City of Burnaby filed a review of Trans Mountain's Preliminary Geotechnical Assessment Report for Burnaby Terminal, which identified several areas of concern or geotechnical deficiencies that it stated should be addressed before the Project progresses. The review stated that the foundation design of the tanks was not adequate for the stage of the study, that there was no mention of foundation anchoring, that there was no review of the historical geotechnical performance of the current tank farm facility, and that there was no overall slope hazard assessment.

Trans Mountain responded to each of the concerns identified by the City of Burnaby and asserted that its Preliminary Geotechnical Assessment Report for Burnaby Terminal was valid and complete for the stage of design for which it was prepared.

BROKE questioned the appropriateness of Trans Mountain's selection of a 1:2,475 annual probability of exceedance for the design of the Project, stating that higher earthquake design standards are often applied to dams and nuclear power plants. The report stated that all of B.C. Hydro's 41 hydroelectric dams are currently being re-built or retrofitted to withstand a severe earthquake, equivalent to a 1 in 10,000 year return period (1:10,000 APE).

Sumas Terminal

Trans Mountain proposes the construction of one new tank at the existing Sumas Terminal. The tank and its foundation would be designed in accordance with API 650 and CCME[40] guidelines. As with the Burnaby Terminal, Trans Mountain expects the new Sumas tank would meet the API 650 criteria for SUG I. Trans Mountain said that it had not yet completed a preliminary geotechnical report for the Sumas Terminal.

Views of the Board

The Board acknowledges the concerns of participants regarding the preliminary nature of the geotechnical design evidence provided. However, the Board is of the view that the design information and the level of detail provided by Trans Mountain with respect to the geotechnical design for the Edmonton Terminal West Tank Area and the Burnaby Terminal are sufficient for the Board at the application stage. The Board notes that more extensive geotechnical work will be completed for the detailed engineering and design phase of the Project.

With regard to the Sumas Terminal, the Board notes that the preliminary geotechnical report is outstanding. The Board would impose Condition 32 requiring Trans Mountain to file its preliminary geotechnical report for the Sumas Terminal prior to commencing construction.

With regard to the selection of Seismic Use Group (SUG) for the design of the tanks, the Board notes that Trans Mountain has not made a final determination. Nevertheless, should the Project be approved, the Board will verify that Trans Mountain's tanks have secondary controls to prevent public exposure, in accordance with SUG I design criteria, by way of Conditions 22, 24 and 129.

6.5 Westridge Marine Terminal Expansion

6.5.1 Design approach

The purpose of the WMT is to load various types of crude oil onto Aframax or Panamax class tankers or tank barges, and unload jet fuel from tankers and barges. The expanded WMT will receive crude oil batches from the Burnaby Terminal through two proposed 762 mm diameter (NPS 30) delivery pipelines, in addition to the existing delivery pipeline.[41]

Trans Mountain said it would expand the existing terminal by removing the existing dock[42] and replacing it with a new dock complex with three berths, each capable of loading Aframax class vessels. One of these berths will be capable of receiving jet fuel. A small utility dock with multiple berths for tugs, pilot boats, spill

40 Canadian Council of Ministers of the Environment (CCME) guidelines regarding water and soil quality, including Canada-wide standards for petroleum hydrocarbons in soil.

41 Trans Mountain is considering replacement of the existing delivery pipeline with a third 762 mm diameter (NPS 30) pipeline in the Burnaby Tunnel.

42 WMT currently has one dock with one berth and has three jet fuel storage tanks. Batches of oil, destined for WMT for loading onto tankers or barges, are collected in the storage tanks at Burnaby Terminal and delivered to WMT's existing 610 mm (NPS 24) diameter pipeline. Trans Mountain intends to file a separate application for decommissioning of the existing dock pursuant to section 45.1 of the OPR. The jet fuel facility is not regulated by the NEB.

response vessels and equipment, and boom boats would also be constructed. Table 7 provides an overview of the proposed docks and berths.

Table 7: Dock and berth overview

Dock	Berth	Product	Pipe diameter
1	1	Crude oil export + jet fuel import	Crude: 762 mm (30") Jet Fuel: 305 mm (12")
2	2	Crude oil export	Crude 914 mm (36")
	3	Crude oil export	Crude 914 mm (36")
3	4	NA - Utility Dock	NA

Process piping at the WMT will be designed for a peak loading rate of 4 635 m^3/hour (700,000 bbl/d). The design flow rate is intended to allow an Aframax class vessel to load a cargo of 106 500 m^3 (670,000 bbl) in 24 hours, allowing for one hour of ramp up and one hour of ramp down.

Dock layout

Trans Mountain said that the design of the dock complex is governed by the following primary criteria:

- provide the highest level of navigational safety;
- provide the capability for the simultaneous loading of three Aframax class vessels;
- allow the existing dock to remain in service while the new dock complex is under construction;
- minimize the overall footprint and impact to community views; and
- eliminate deep-water dredging and reduce the amount of dredging for the foreshore.

Trans Mountain said that the chosen dock design is considered to be optimal in meeting all of the above criteria. Trans Mountain also said that the Port Metro Vancouver (PMV), the Pacific Pilotage Authority (PPA) and the B.C. Coast Pilots (BCCP) were provided with the results of Trans Mountain's fast time simulation for the proposed dock layout for the WMT, which confirmed the safety of navigation and safe maneuvering in and around the dock layout. Trans Mountain said that, after reviewing the simulation results, these bodies confirmed that the proposed dock layout was the preferred layout. Figure 14 illustrates the plot plan of the proposed WMT.

Loading arms & vapour recovery arms

Trans Mountain said that three 406 mm diameter (NPS 16) loading arms at each berth, one of which would be considered as an installed spare, and the two remaining arms would be used to load crude oil onto tankers. The maximum flow rate capacity of one 406 mm diameter (NPS 16) loading arm is 4 140 m^3/hr (26,000 bbl/hr). At Berth 1, there would also be a 305 mm (NPS 12) diameter unloading arm for receiving jet fuel.

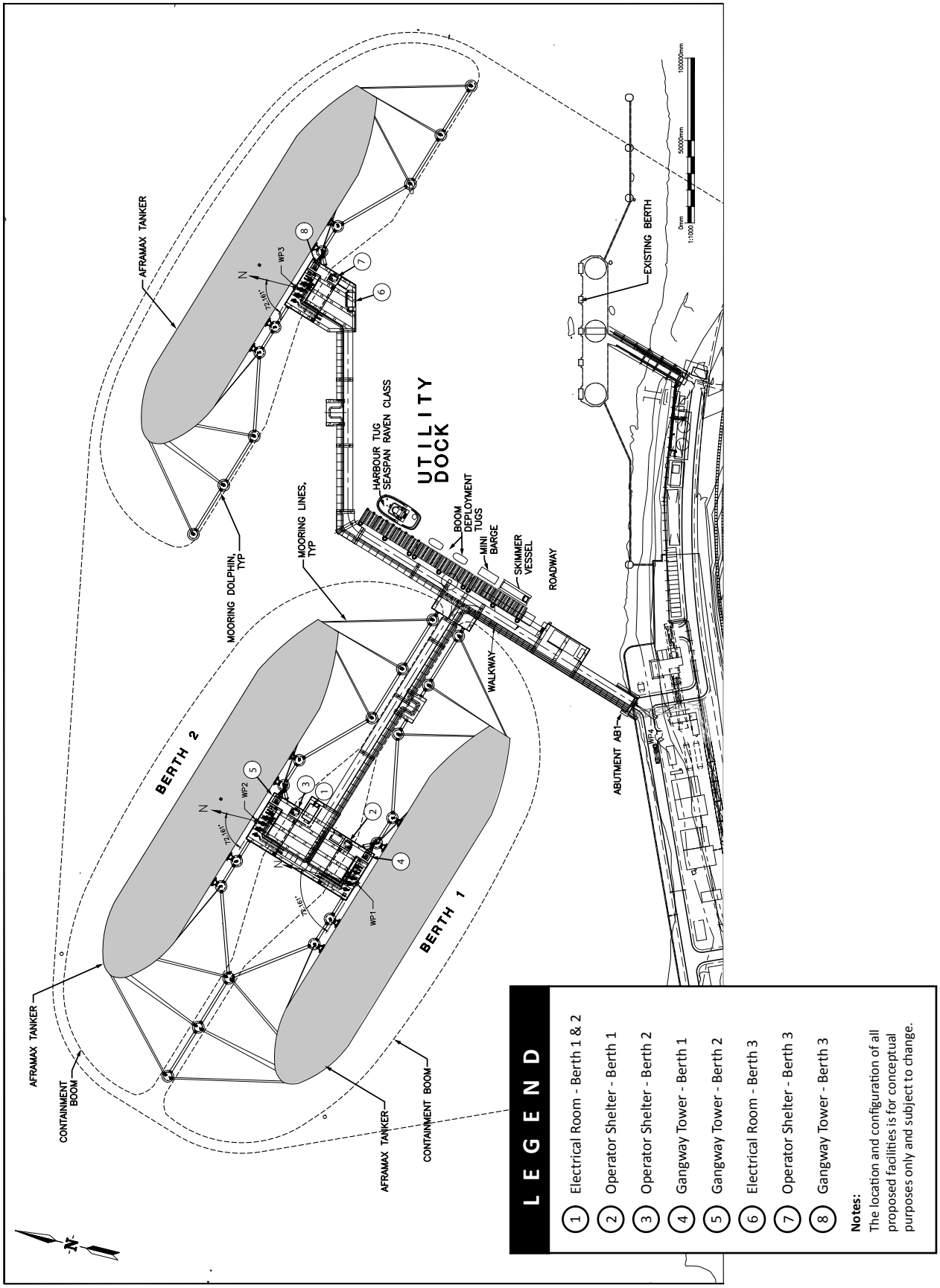
Trans Mountain said that since vessel loading will not be permitted without a functioning vapour recovery system, it would consider the need for a spare system, either installed or ready for quick installation. The proposed vapour recovery arms would be 305 mm (NPS 12) in diameter.

In designing the loading arm, Trans Mountain said that it would use the Oil Companies International Marine Forum (OCIMF)'s Design and Construction Specification for Marine Loading Arms, which is the foremost international design specification for marine loading arms.

Emergency Release Couplers and Systems

Trans Mountain said it is reviewing the advantages and disadvantages of including emergency release couplers (ERCs) and emergency release systems (ERS) for the proposed loading arms at the WMT. Trans Mountain said it 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. During the detailed engineering and design phase, Trans Mountain will assess the potential for tsunamis caused by seismic events and landslides to determine if the application of ERCs and ERSs at WMT is warranted. In response to a concern raised by the Squamish

Figure 14: Westridge Marine Terminal layout



Nation, Trans Mountain said that a tsunami would be unlikely to cause significant damage to the WMT as the terminal would be designed and constructed to current design codes and standards, and industry best practices. Also, if the wave were to move the vessel beyond the allowable motion range of the cargo loading arm, an automatic shutdown device would be triggered to stop the flow of crude oil and, if needed, disconnect the loading arms.

Tanks

Trans Mountain said it eliminated two previously proposed vapor recovery tanks from the design. Trans Mountain said it also has a desire to eliminate the proposed relief tank if it is technically feasible to do so. This will be determined during detailed engineering, after the completion of transient hydraulic studies on the existing NPS 24 delivery line.

Control system and fire protection

The control system for the new facilities will be integrated with the existing WMT control system and will comply with existing control philosophies. All transitional vessel loading and unloading activities (start, ramp-up, ramp down and stop) will be controlled and monitored from the new WMT control building. Once a steady state operating condition has been reached primary control responsibility will be handed over to the Control Centre Operator (CCO) located in the Primary Control Centre (PCC). During this steady state stage, the WMT control centre will also have the ability to monitor various parameters associated with the loading operation. 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.

According to Trans Mountain, a new fire protection system will consist of a firefighting water system and a foam system. The system design will be completed during the detailed engineering phase.

Shore-sourced oil spills

Trans Mountain said the safety of the operations at WMT will be assured through proper engineering design, material specification and selection, and consistent application of Kinder Morgan's Facility Integrity Management Program (FIMP). To mitigate shore-sourced oil spills caused by defective shore-based equipment such as piping, manifolds, valves, metering system and loading arms, the design and operations control measures will include:

- appropriate design and construction of the dock and mooring component;
- construction of containment devices surrounding potential shore sources such as the metering skid, onshore piping manifold and the loading arms area;
- placement of emergency stop buttons at several locations, including near the loading connection, with ability for the operators on the vessel to initiate immediate cessation of cargo loading; and
- implementation of detailed operating procedures for product loading and unloading.

Views of the Board

Trans Mountain has committed to design, construct, and operate the Westridge Marine Terminal (WMT) in accordance with applicable regulations, standards, codes and industry best practices. The Board accepts Trans Mountain's design approach, including Trans Mountain's effort to eliminate two vapour recovery tanks in the expanded WMT by modifying the vapour recovery technology. The Board considers this to be a good approach for eliminating potential spills and fire hazards. The Board would impose Condition 21 requiring Trans Mountain to provide its decision as well as its rationale to either retain or eliminate the proposed relief tank.

The Board would require Trans Mountain to consider all components on the docks carefully, in particular the loading arms, to eliminate potential spills. The Board requires Trans Mountain to conduct a study on the necessity of an emergency release system for the loading arms during both normal and abnormal operating conditions (Condition 84). The Board agrees with Trans Mountain that a tsunami would be unlikely to cause significant damage to the WMT for the reasons provided by Trans Mountain.

Trans Mountain said it will complete the design of the fire protection system for the WMT during the detailed engineering stage. The Board requires Trans Mountain to demonstrate the adequacy of the fire protection system to suppress fires for the scenarios identified in the final risk assessment (Condition 127). The Board also requires Trans Mountain to file its final risk assessment for the WMT, for approval, demonstrating the mitigation measures will reduce the risks to levels that are As Low As Reasonably Practicable (ALARP) while complying with the Major Industrial Accidents Council of Canada (MIACC) criteria for risk acceptability (Condition 129).

6.5.2 Geotechnical design

Westridge Marine Terminal offshore facilities

Trans Mountain's draft Preliminary Westridge Marine Terminal Offshore Geotechnical Investigation report provides information for input to the siting considerations and screening level evaluation of various pile foundation design options. The purpose of the investigation was to obtain subsurface soil information in the area of the proposed new berthing structure and, based on this information, to carry out geotechnical analyses as input to the overall marine structure design of the new terminal. Trans Mountain also undertook geophysical investigations to establish the bathymetry in the survey area, including the accessible intertidal area, and to survey the sub-bottom and determine subsurface acoustic hard layer profiles. Trans Mountain said that it would determine the need for any additional geotechnical work after the preferred pile design option is selected.

Trans Mountain said that the specific details related to the numbers and sizes of piles were preliminary and would be finalized during the detailed engineering and design phase, and that all dock structures would be designed and constructed in accordance with applicable codes and standards.

Trans Mountain acknowledged that an earthquake could trigger a landslide in Burrard Inlet. Trans Mountain said that it was undertaking a study of the potential size of a landslide generated tsunami and its potential effect, which would be used to inform detailed design. Trans Mountain was of the view that, due to its sheltered location, there is an extremely low likelihood that a large tsunami created by an offshore earthquake could reach the WMT.

Trans Mountain said that the potential for sea level rise at WMT would be accounted for in the detailed design primarily by ensuring that the deck elevation of the structures is set high enough to avoid flooding or wave damage should the predicted sea level rise occur.

The City of Burnaby filed a geotechnical review of Trans Mountain's draft Preliminary WMT Offshore Geotechnical Investigation report. The review identified a number of concerns and deficiencies in the geotechnical investigation that, it stated, would need to be addressed at the current stage or the detailed design stage, and concluded that the report does not present a comprehensive geotechnical assessment of the site.

NRCan requested clarification of Trans Mountain's assumptions regarding existing seabed integrity and the proposed configuration of piles and trestles. NRCan said that it was satisfied that Trans Mountain will be undertaking a comprehensive geotechnical program prior to the detailed design phase.

Stephen Hardy noted that the WMT is in a seismically active location and said that the draft conditions regarding foundations and pile design for the WMT should explicitly include a specification for seismic hazard.

Westridge Marine Terminal onshore facilities

Trans Mountain has not completed a geotechnical report for the WMT onshore facilities and said it would commit to filing the report as a condition of approval.

Views of the Board

The Board acknowledges the City of Burnaby's concern regarding the level of detail of the geotechnical information provided in the hearing for the Westridge Marine Terminal (WMT) offshore facilities. However, the Board is of the view that Trans Mountain has demonstrated its awareness of the requirements for the geotechnical design of the offshore facilities and accepts Trans Mountain's geotechnical design approach.

To confirm that soil conditions have been adequately assessed for input to the final design of the WMT offshore facilities, the Board would impose conditions requiring Trans Mountain to file a final preliminary geotechnical report for the design of the offshore facilities, and the final design basis for the offshore pile foundation layout once Trans Mountain has selected the pile design (Conditions 34 and 83).

To verify the geotechnical design approach for the WMT onshore facilities the Board would impose Condition 33 requiring Trans Mountain to file a preliminary geotechnical report for the onshore facilities prior to the commencement of construction.

The Board would examine the geotechnical reports upon receipt and advise Trans Mountain of any further requirements for the fulfilment of the above conditions prior to the commencement of construction.

6.6 Transfer of active pipeline segments to Line 2 Service

Trans Mountain proposes a change in the operation of two active pipeline segments that are currently part of the existing TMPL to heavy crude operation on the proposed Line 2:

- Hinton AB to Hargreaves B.C. – a 150 km length of 914 mm outside diameter (NPS 36) pipeline constructed in 2008; and
- Darfield to Black Pines B.C. – a 43 km length of 762 mm outside diameter (NPS 30) pipeline constructed in 1957, deactivated in 1984 and subsequently reactivated in 2004.

Trans Mountain also provided a list of existing facility equipment and systems, including substation electrical and control infrastructure, mainline block valve power and control, and backup power that would be either moved to Line 2 service or shared with Line 2.

Trans Mountain provided an engineering assessment for the two active pipeline sections, which it said was prepared in accordance with CSA Z662 requirements. The engineering assessment included:

- a review of pipeline design, materials, construction and operation specifications;
- a review of integrity management and maintenance records; and
- Fitness for Service assessments of corrosion, cracking and mechanical damage.

Trans Mountain concluded that the engineering assessment demonstrates that the two active pipeline segments can safely operate in Line 2 heavy crude service. Trans Mountain committed to providing an updated engineering assessment following the completion of crack baseline inspections and prior to the active pipeline segments being placed into Line 2 service.

Views of the Board

The active pipeline segments transferring to Line 2 service are currently under Board jurisdiction, and managed through Trans Mountain's existing Integrity Management Plan. Therefore, within the context of the Project's conceptual design, the Board finds that the information provided in Trans Mountain's engineering assessment is sufficient to evaluate the feasibility of transferring the active pipeline segments to Line 2 service. The Board is of the view that Trans Mountain's engineering assessment does not include a comprehensive evaluation of imperfection growth, or a rationale for the proposed in-line inspection schedule. Trans Mountain committed to providing an updated engineering assessment addressing these concerns. The Board would impose a condition requiring Trans Mountain to submit the updated engineering assessment of the two active pipeline segments transferring to Line 2 service. The Board also requires Trans Mountain to acquire a certificate with a supporting report from an independent certification body confirming the fitness for service, under the operating conditions of Line 2, of the Darfield to Black Pines segment (Condition 122). The Board requires this segment to meet the same level of operational safety as newly constructed pipe in Line 2 service.

6.7 Reactivations

6.7.1 Pipeline reactivations

Trans Mountain proposes to reactivate two segments of 609.6 mm (NPS 24) outside diameter pipeline, constructed in 1953:

- A 150 km long pipeline segment from Hinton, AB to Hargreaves, B.C., deactivated in 2008; and
- A 43 km long pipeline segment from Darfield to Black Pines, B.C., deactivated in 2004.

These two pipeline segments would become part of Line 1, while the pipeline segments currently in operation at these locations would become part of the new Line 2. The deactivated segments are currently filled with nitrogen, capped, cathodically protected, and surveillance has been maintained. Trans Mountain committed to reactivating the pipeline segments in accordance with the OPR and CSA Z662.

Trans Mountain completed a preliminary engineering assessment, including a threat-based assessment, as a first step toward satisfying the requirements of the OPR for reactivation. Trans Mountain said that the purpose of the preliminary engineering assessment is to document the integrity management status of the pipeline segments to be reactivated, and the measures that Trans Mountain would employ to verify the integrity of the two pipeline segments prior to reactivation. The threat-based engineering assessment was conducted as an alternative to a quantitative engineering assessment because the required in-line inspections were not completed at the time of the submission. Trans Mountain committed to filing a final engineering assessment incorporating the results of the hydrostatic testing and the in-line inspection and repair program prior to the reactivation of the pipeline segments.

Reactivation steps

Trans Mountain said that prior to reactivation, it would inspect the two pipeline segments using in-line inspection tools to identify and locate metal loss, mechanical damage, and axially oriented cracks. Trans Mountain would then conduct digs to verify in-line inspection tool sizing accuracy and to complete any required repairs. The final step prior to reactivation would involve hydrostatic testing in accordance with CSA Z662 to qualify the pipeline segments at a minimum to their former maximum operating pressures.

Trans Mountain also committed to inspecting the reactivated segments with a specialized high-resolution ultrasonic tool within the first two years of operation, to locate any defects that were not identified during previous reactivation steps. All identified defects would be assessed and repaired as required.

Upper Nicola Band expressed concern regarding the current and future condition of the reactivation segments, and the impacts of a rupture or an undetected leak.

Parks Canada Agency (Parks Canada) said that it understands that details regarding the extent of the mitigation work would only be known following the completion of in-line inspections. Parks Canada recommended that Trans Mountain file a quantitative risk assessment for the portion of the Project within Jasper National Park prior to the planned commencement of reactivation. Trans Mountain explained that it could not file a quantitative risk assessment because there is no universally recognized means of quantifying the environmental and socio-economic consequences associated with a crude oil spill. While failure frequencies are quantifiable, consequences are expressed as qualitative index scores. As a result, the risk assessment would become semi-quantitative; therefore, Trans Mountain committed to completing a semi-quantitative risk assessment once the integrity verification activities and analysis have been completed.

Views of the Board

In accordance with section 45 of the OPR, companies under the Board's jurisdiction are required to apply to the Board for the reactivation of pipelines deactivated for 12 months or longer. The reactivation application must include the reasons and procedures to be used for the reactivation. The Board requires companies to include in their application, an engineering assessment complying with CSA Z662 that demonstrates the integrity of the pipeline system and its suitability for its intended service.

Typical reactivation applications assess the current integrity status of the pipeline through, among other techniques, an analysis of in-line inspections, excavation and repair data, corrosion and crack

growth, and fatigue modelling. Trans Mountain's reactivation engineering assessment describes a plan to determine fitness for service; however, it does not evaluate the current integrity status of the reactivation segments based on the actual results of the proposed activities, as the activities have not been completed. The Board acknowledges the concerns raised by Upper Nicola Band and Parks Canada. The Board would impose Conditions 19 and 152 requiring Trans Mountain to file, following the completion of all reactivation activities, and prior to commencing construction of the Project, a final engineering assessment confirming the current integrity status of the two reactivation segments. In addition, an independent certification body must provide an assessment of the fitness for service of the segments prior to commencing construction of the Project, and continued assurance of the fitness for service of the segments beyond the initial certification period.

6.7.2 Facility reactivations

Trans Mountain intends to reactivate two station isolation valves on the existing 609.6 mm outside diameter (NPS 24) pipeline at Jasper Pump Station. Trans Mountain said that it would complete an engineering assessment for these valves to ascertain their fitness for service.

The Niton Pump Station, which has been deactivated since 2006, will also be reactivated for service on Line 1 as part of the scope of the Project. Trans Mountain said that, among other things, reactivation would generally include:

- inspection of pumps, motors, and large diameter valves, and completion of any maintenance requirements identified during the inspections;
- hydrostatic testing of station piping;
- reactivation of the SCADA system; and
- recommissioning of existing mechanical, electrical, instrumentation, and control systems.

Trans Mountain committed to completing an engineering assessment of the Niton Pump Station in accordance with CSA Z662 requirements to demonstrate that the pump station is suitable for its intended operation on Line 1.

Views of the Board

Trans Mountain has not provided an engineering assessment demonstrating the fitness for service of the Niton Pump Station for its intended operation on Line 1. Therefore, the Board would impose Condition 31 requiring Trans Mountain to submit, prior to commencing pump station construction, an engineering assessment demonstrating that the Niton Pump Station is suitable for its intended operation.

6.8 Line 1 operational changes

6.8.1 Capacity

Trans Mountain said that in response to growing demand and the changing needs of shippers, it had made various modifications to add throughput capacity and facilities to the existing pipeline system constructed in 1953. As a result, between 1957 and 2013, the capacity of the system gradually increased from 23 845 m^3/day (150,000 bbls/day) to 47 690 m^3/day (300,000 bbl/day).

The existing TMPL system carries a variety of crude oil batches in a single line between Edmonton and the Burnaby area, shipping 20 per cent heavy crude oil and 80 per cent light crude oil and refined products. As part of the Project, Trans Mountain would increase the Line 1 operating capacity to 55 640 m^3/day (350,000 bbl/day), delivering refined products and light crude oil in batches. While Trans Mountain said that it does not intend to transport significant amounts of heavy crude oil on Line 1, it would have the capacity to transport small amounts of batched heavy crude oil at a capacity of less than the 55 640 m^3/day (350,000 bbl/day) capacity for light crude. Trans Mountain said that experience with the existing Trans Mountain Pipeline system has shown that impacts to capacity occur with the introduction of less than 10 per cent heavy crude oil in batches. Moreover, the transportation of approximately 30 per cent heavy crude oil in batches has the same impact on capacity as if the system were transporting 100 per cent heavy crude oil.

Trans Mountain performed a hydraulic analysis on Line 1 based on the proposed capacity increase, and determined that: the Niton Pump Station would need to be reactivated; that a drag reducing agent (DRA) injection facility would be required at Jasper; and that a new pump station would be required at a new site at Black Pines. Trans Mountain also determined that the existing Albreda, Stump, Hope, and Wahleach Pump Stations would not be required for regular operation of Line 1. These stations would be deactivated unless reliability studies undertaken during the detailed engineering and design phase indicate that their continued availability would be beneficial.

Trans Mountain said that the relief station at Hope currently protects the existing pipeline downstream of the Coquihalla summit from overpressures due to valve closures and pipeline shut down events, and will continue to protect Line 1 in the future. A pressure relief valve will be installed upstream of the back pressure control valve(s) on Line 2 and will share the facility. Trans Mountain said that the design basis for both the pressure control and pressure relief systems will be determined during the detailed design and engineering phase.

Trans Mountain submitted an engineering assessment of the existing TMPL pipeline segments to demonstrate their suitability for operation under the proposed Line 1 operating conditions. The engineering assessment concluded that the existing TMPL could safely operate in Line 1 service based on regular in-line inspection monitoring, an effective integrity management program, an assessment of the remaining defects in the pipeline, and a comprehensive third party damage prevention program.

Lisa Craig said that plans to determine the state of the existing pipeline and its ability to accommodate the increased flow were not outlined, and expressed concern that this put the safety of her family and community at risk. Trans Mountain replied that it has provided information relevant to these concerns in an engineering assessment of the active TMPL segments that would be incorporated into Line 1 service. Trans Mountain said that the assessment indicates that the segments are safe to operate under the operating pressures and volumes proposed by the Project.

The City of Surrey filed an engineering report concluding that the TMPL is nearing the end of its useful life, and that the pipeline through the City of Surrey should be abandoned and replaced with a larger diameter pipeline to increase the hydraulic capacity of the Project. Trans Mountain replied that information placed on the record confirms that the existing TMPL is managed and monitored as required by CSA Z662 and the OPR, and that there is no evidence that the pipeline is nearing its end of life. Likewise, Trans Mountain said there is no evidence suggesting that the pipeline should be replaced.

Shxw'ōwhámel First Nation submitted a report prepared by Accufacts Inc. (Accufacts) that found Trans Mountain is proposing major changes to Line 1 which have not been adequately addressed in the Project application. Accufacts believes that Line 1 is at a much greater risk of rupture than what Trans Mountain has indicated in its submissions to the Board.

Trans Mountain replied that the Accufacts report implies that operating pressures would be increased with the increase in throughput. However, Trans Mountain said that the increase in throughput would be achieved primarily through the reduced viscosity of the proposed line fill as opposed to increased operating pressures. Trans Mountain said that the new operation would result in certain segments of the pipeline experiencing slightly higher normal operating pressures, while others would experience slightly lower normal operating pressures. Trans Mountain said that their assessment of the active TMPL segments that would be incorporated into Line 1 service shows that the changes are minor in nature, and would not exceed current maximum operating pressures.

6.8.2 Leak detection and slack line flow

Trans Mountain said that the existing SCADA system would be thoroughly assessed and upgraded as necessary to ensure that it can be used successfully to monitor and control the expanded TMPL system. Trans Mountain confirmed that under steady-state conditions, Line 1 would not be in slack line 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 said that it is likely that slack line flow will continue to be a feature of operations in this segment as it is today. Trans Mountain will consider the application of back pressure control, but it may not be feasible due to the existing pipe configuration and specifications. Trans Mountain said that slack line flow conditions have a negative impact on real-time transient models because the number of uncertainties

increases compared to packed line flow. In slack line flow conditions, the reliability, sensitivity, and accuracy of the CPM system would decrease, resulting in an increase in estimated detectable leak thresholds.

Trans Mountain said that the slack line flow section of the existing pipeline has been inspected multiple times with state of the art in-line inspection (ILI) technology in recent years, and a hydrostatic test on the section was performed successfully in late 2013. In the event that the CPM system calculates that slack line flow may occur elsewhere in the existing pipeline, a warning message is sent to the CCO who then takes appropriate measures to adjust pressure set points to prevent the pipeline from reaching slack line flow conditions. The CCO continues to monitor the pipeline to ensure that it is properly packed.

Shxw'ōwhámel First Nation filed an engineering report that found that Trans Mountain would operate at least one of the pipelines in the Project in slack line flow. The report noted that slack line flow operation could limit the effectiveness of leak detection systems, and recommended that Trans Mountain demonstrate the efficacy of its leak detection system.

Trans Mountain replied that Line 1 would not be in slack line flow at its full design flow rate; however, Line 1 would experience slack line flow in the segment downstream of the Coquihalla summit at 50 per cent and 75 per cent of its design flow rate. Mitigation measures to eliminate slack line flow in this flow regime, such as back-pressure control, would not be possible as the pressures necessary to ensure operation without slack line flow would exceed the maximum operating pressures in this segment. Trans Mountain said that slack line flow conditions are difficult for CPM systems to model, and that the CPM system would decrease sensitivity levels for segments with column separation in order to model line conditions to the best of the system's ability. However, Trans Mountain highlighted that as part of a systematic approach to leak detection, it relies on complementary leak detection approaches in addition to the CPM system to detect leaks, as set out in section 6.1.11.

6.8.3 Risk assessment

Trans Mountain said it performs annual risk assessments of the existing TMPL using a semi quantitative approach. Quantitative failure frequencies (in failures per year) and qualitative consequence values (i.e., index-based) are used to express semi-quantitative risk scores for any pipeline segment relative to the risk scores for other pipeline segments along the TMPL. The risk results are in turn, used to prioritize and select the most effective risk mitigation measures for the pipeline. Trans Mountain said that because the risk scores are semi-quantitative, they have no physical relevance outside the scope of the risk analysis. However, the risk results are useful for highlighting locations of high risk relative to other locations along the pipeline.

Trans Mountain said that the objective of the risk assessment is to support an integrity management program of an existing pipeline by guiding assessment and mitigation activities. This differs from the objective of the Line 2 risk assessment, which is to support the risk-based design of a new pipeline. Furthermore, the two risk assessments use different data sets. As a result, the risk assessments are not directly comparable to one another.

6.8.4 Mainline valves

Trans Mountain said that the results of the risk assessment provide input to the prioritization of system improvements to reduce the operational risk for the pipeline. This process has resulted in the requirement for new valves and the automation of existing valves to mitigate potential spill volumes and the associated consequences.

Trans Mountain said that it has an established and ongoing process for assessment and upgrades of remotely operable valves 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 the risk assessment of Line 1, outflow modelling, and overland flow modelling. Trans Mountain committed to undertaking a reassessment of potential outflow volumes using the increased average post-expansion throughput volumes expected on Line 1. The results will be assessed to determine the need for additional remotely operable valves, or the need to convert existing manual valves to remote operation.

Trans Mountain said that valves being upgraded to automated valves on the existing TMPL, which would become part of Line 1, tend to require more than five minutes to close. Recently automated sites require approximately eight minutes to close in order to minimize shutdown volumes while avoiding transient

overpressure events. Trans Mountain did not provide an assumed time for field personnel to access pipeline block valves that cannot be operated remotely following a release event. It said that the time for field staff to access particular manual remote block valves would depend on a number of factors, including the time of day, weather conditions, and the conditions of the access route to the particular block valve. For the purpose of outflow volume calculations, Trans Mountain assumes that access occurs after the total gravity drain has completed.

Trans Mountain said that the remainder of the manual block valves on the sections of Line 1 that are not being modified by the Project would continue to be evaluated in accordance with the established process for considering improvements to reduce the consequences of potential releases on the operating TMPL. It said that a multi-year plan for the automation of existing valves, installation of new automated valves and installation of new check valves has been established.

Trans Mountain said that based on its preliminary plan, it would automate some of the manual block valves on the reactivation segments to close in five minutes. Other valve sites are not planned for automation because check valves would prevent backflow in the event of a release. Trans Mountain said that a number of valve sites within Jasper National Park and Mount Robson Provincial Park are not planned to be automated, based on the principle of minimizing new disturbances in these areas. In addition, Trans Mountain said that it based its valve automation decisions on whether a significant reduction in outflow volumes would be realized. Following detailed design, Trans Mountain committed to finalizing its plan for automating existing valves, or installing new valves within the reactivation segments.

Trans Mountain listed a number of Line 1 main line block valves located at pump stations and terminals which would be modified to have a closure time of five minutes, or the shortest time possible as determined by a Line 1 surge analysis. Other pump station and terminal valves are included in Trans Mountain's long-term modification program.

Views of the Board

The active TMPL is currently under Board jurisdiction and is being regulated accordingly through ongoing compliance activities. Regarding the existing TMPL and its suitability for operation with increased capacity in Line 1 service, the Board finds the pipeline's condition to be acceptable. The Board has examined the predicted operating pressures along Line 1 and finds that that they would not exceed the current maximum operating pressures of TMPL. Likewise, the proposed service fluids have properties within the range of those currently being transported. The Board is of the view that a combined larger diameter single pipeline through Surrey would be feasible for a single product pipeline system. However, because Line 1 would operate in batched service, combining streams from Line 1 and Line 2 into a single pipeline would involve significant operational difficulties.

The Board agrees with Shxw'ōwhámel First Nation's concern that slack line flow conditions can negatively impact the capabilities of leak detection systems, and therefore must be controlled or eliminated to the extent practicable. The Board would impose Condition 135 requiring Trans Mountain to identify locations along Line 1 where slack line flow may occur under various operating pressure scenarios, and to provide operational measures for its detection and prevention.

The Board finds that Trans Mountain's multiple system approach to leak detection is acceptable, and recognizes Trans Mountain's commitment to evaluate and upgrade the existing SCADA system. Prompt leak detection is essential in minimizing the consequences of a release, particularly when considering the increase in capacity proposed for Line 1, and the potential for greater release volumes. Therefore, the Board would impose Condition 115 requiring Trans Mountain to provide a plan for improving the performance of the existing leak detection system.

The Board acknowledges Trans Mountain's process of annual risk assessment, outflow volume modelling, and the determination of valve upgrades and additions on the proposed Line 1. Because Trans Mountain said it would finalize its valve automation and installation plan following detailed design, the Board would impose Condition 18 requiring Trans Mountain to provide the supporting risk assessment on Line 1, including outflow volume modelling results following mitigation. This information will assist the Board in determining the adequacy of Trans Mountain's proposed valve upgrades on Line 1 with respect to minimizing the consequences of a release.

The evidence shows the majority of the Line 1 remote block valves will be manually operable, and that Trans Mountain does not have an assumed time to access manually operable remote block valves following a release. The Board finds that in certain scenarios, the use of automated main line valves in place of manual valves could minimize release volumes in the event of a rupture. The Board is of the view that valve type, location, and closure time are vital in limiting release volumes on Line 1. Trans Mountain confirmed that it has a multi-year plan for valve upgrades along Line 1, yet did not provide the details of this plan. Therefore the Board finds that Trans Mountain has not adequately demonstrated how release volumes would be minimized. To address this, the Board would impose Condition 18 requiring that Trans Mountain provide its multi-year plan for valve upgrades and additions on Line 1, and demonstrate that risks are managed to levels that are as low as practicable. Should the Project be approved, the Board may use compliance activities, such as audits and inspections, to verify the implementation of the Line 1 valve upgrade plan.

6.9 Electrical matters

6.9.1 Power system and motor protection for facilities

The electrical protection system protects power systems and pump motors in the pump stations and terminals. Trans Mountain said that it would use integrated digital protection and motor management relays for protecting the pump motors. For the overcurrent/overload and ground fault protection of pump motors and facilities, Trans Mountain said that it would use:

- a fuse/vacuum contactor/relay combination for protection against electrical faults and overloads;
- 400 A and 720 A vacuum contactors (with interrupting capacities of 7000 A and 7200 A, respectively); and
- neutral grounding resistors to all stations and terminals, for limiting the ground fault currents to a low magnitude.

Trans Mountain expected that the above protection system would clear a severe electrical fault within 8.33 milliseconds (msec) and said that it would not be considering three-phase circuit breaker and relay combinations for motor protection. Trans Mountain said that additional measures would be implemented if scenarios were identified during the detailed engineering phase that indicated a vacuum contactor was unable to clear a specific fault.

Trans Mountain said that it would incorporate arcing faults mitigation in its design. This would involve upgrading the relay settings and could include relays with fiber optic arc sensor capabilities or arc resistant switchgear. Final configurations for each location would be determined during the detailed engineering phase.

Views of the Board

The Board observes that a number of incidents have occurred with regard to electrical power systems in pipeline facilities due to ground faults and arcing faults. When designing a protection system to prevent equipment damage from all types of fault current, it is desirable to minimize the magnitude of the fault current. The Board notes that Trans Mountain has committed to installing neutral grounding resistors at all of its facilities to limit the ground fault current to a low level.

The Board observes that due to abnormal conditions in power systems in pipeline facilities, ground fault current can exceed the design limit. If such a fault is not cleared quickly, it can gain energy and escalate into an arcing fault. The Board is aware that, in some cases, arcing faults in pipeline facilities have triggered fires. As arcing faults have the potential to cause safety and integrity issues, the Board issued Safety Advisory SA 2015-03 on 4 May 2015 which recommended the clearance of ground faults before the faults escalate to arcing faults. Trans Mountain said that it would use a fuse/vacuum contactor/relay combination that will be suitable to clear a severe fault within 8.33 msec. While it is desirable to clear severe faults as quickly as possible, the Board is of the view that Trans Mountain has not demonstrated, using time-current characteristics, under what conditions a fault would be cleared in 8.33 msec. The Board would impose Condition 30 requiring Trans Mountain to confirm that it has implemented settings to clear ground faults that can override any pre-set time delays that may be used for coordination between various protective devices.

Another challenge faced during a severe ground fault is that stored energy from other running motors may feed ground faults. This results in an increase to the total fault current. SA-2015-03 addresses this issue, recommending that companies take measures to prevent the reverse flow of stored energy from other electrical equipment. It is the Board's view that Trans Mountain has not provided a satisfactory solution to this concern. The Board would impose Condition 30 requiring Trans Mountain to implement measures in its final design to prevent reverse flow of energy from other equipment during an electrical fault.

6.9.2 Battery system for uninterruptible power supply (UPS)

Trans Mountain said that UPS systems would provide emergency power to the critical loads, such as SCADA systems, communications systems at all pump stations, terminals, and station isolation valves at stations, without sending or receiving traps. Emergency power would be supplied from the batteries connected with the UPS systems. The batteries would be charged during the time when the utility power is available. In the event of power failure, a transfer switch would transfer the input of the UPS systems from the utility power to the standby generators. The stored energy would be used to maintain power to the critical loads until standby generation comes on line.

Trans Mountain said that the types and sizes of the battery systems would be determined during the detailed engineering phase. The battery types would be determined based on the service conditions, the UPS manufacturer recommendations, and best engineering practices identified during detail engineering design.

Views of the Board

Uninterrupted Power Supply (UPS) systems are critical to pipeline operations. Emergency power will be required to a number of critical loads throughout the Project. It is essential that the batteries have adequate capacity and rating so that emergency power can be supplied to the critical load.

The Board is of the view that the storage and ventilation of batteries require special attention for safe and reliable operation of batteries. Rule 26-546 of the CSA 22.1 No. 15, Canadian Electrical Code Part-1 (CEC) states that:

"Storage battery rooms or areas shall be adequately ventilated; storage batteries shall not be subjected to ambient temperatures greater than 45oC or less than the freezing point of the electrolyte."

The Board observes that Trans Mountain has not yet committed to any specific standard for the design of the UPS systems where battery banks are an integral part of the UPS systems. Therefore, the Board would impose Condition 101 requiring Trans Mountain to file a list of the code(s) it would follow during UPS system design and operation.

6.10 Safety and Loss Management System

Overview

The National Energy Board's OPR requires that all pipeline companies under its jurisdiction have a management system approach that enables companies to meet their obligations for safety, security and protection of the environment. Companies must establish, implement and maintain the management system to effectively manage and reduce risk, and promote continual improvement.

Trans Mountain said that it will continue to operate the expanded TMPL system in accordance with KMC's current Integrated Safety and Loss Management System (ISLMS). Trans Mountain said that the ISLMS was developed in response to the 2013 amendments to the OPR, and that it applies to all activities involving the design, construction, operation and abandonment of the TMPL system.

Trans Mountain said that systems integrity management involves structured risk identification and assessment. Integrity risk assessment results are used to prioritize maintenance activities and in-line inspection programs. Trans Mountain said that these activities and programs are formalized in its Pipeline Integrity Management Program (IMP) and the Facilities Integrity Management Program (FIMP). Each Integrity Management Program includes the elements outlined in Annex N of CSA Z662 and confirms the operational reliability of all system components, including pump stations, terminals, remote mainline block valves and other facilities.

6.10.1 Pipeline Integrity Management Program

Trans Mountain said that the primary focus of the IMP is on the prevention of releases through the identification, assessment and management of hazards. The IMP also addresses the mitigation of the impacts of releases on people and the environment should they occur. Trans Mountain said that a baseline risk assessment would be conducted during the technical development of the expansion pipeline. The risk assessment will consider all major pipeline threats, including external corrosion, internal corrosion, cracking, third party damage, material defects, outside forces (geotechnical) and operational error. Following start-up of the expanded system, Trans Mountain would undertake annual risk assessments, with risk management activities directed toward a fundamental goal of continual improvement.

Trans Mountain said that in-line inspection (ILI) tool runs would be scheduled in accordance with Kinder Morgan's Integrity Management Program. Trans Mountain described the ILI programs as continual assessment processes with standard intervals of five years between ILI inspections. Any anomalies detected that may grow to become an integrity threat before the next scheduled ILI inspection are either repaired or scheduled to be reassessed with an earlier ILI inspection.

Trans Mountain said that post-construction ILI inspections would be performed in addition to hydrostatic testing of the new Line 2 pipeline segments to identify any construction damage that would require repair. This would also provide baseline geometry data. It said that within a year of the new pipeline segments entering into service, a baseline ILI survey of pipeline geometry and metal loss would be undertaken with a high-resolution tool, and that a high-resolution USCD tool would be run in each of the new Line 2 pipeline segments within the first five years of operation.

Trans Mountain said that, in addition to the ILI program, other major prevention programs used on the existing Trans Mountain system include a Damage Prevention Program and a Natural Hazards Management Program. These programs would be enhanced to include the expanded TMPL system pipelines. Specifically, these programs include:

- a CP system monitoring program that consists of close interval pipe-to-soil surveys completed on a five year rotating cycle, monthly verification of the proper functioning of rectifiers and ground-beds, and annual test lead surveys (a baseline close interval survey will also be completed during the first years of operation of the expanded TMPL system);
- a slope stability monitoring and assessment program that consists of monitoring identified slopes for potential ground movement using instrumentation, visual inspection, comparisons of successive ILI runs, or a combination of these, and evaluating the potential impacts on pipeline integrity;
- a stream crossing monitoring program to ensure that erosion does not compromise the depth of cover that is required to protect the pipeline against coating damage or unacceptable stresses; and
- general depth of cover monitoring surveys conducted on a five year rotating cycle.

6.10.2 Natural Hazard Management Program

Trans Mountain said that the purpose of the Natural Hazard Management Program is to develop and maintain an inventory of hydrotechnical and geotechnical sites, and to implement a schedule of site inspections, detailed investigations, maintenance and mitigation to manage the likelihood of pipeline exposure and impact from geohazards. Trans Mountain said that its approach follows the framework of a risk management program as outlined in CSA Z662, and also the CEPA Pipeline Watercourse Management Recommended Practice.

Trans Mountain said that, following construction, the list of geohazards identified along the Project route would be incorporated into KMC's Natural Hazard Management Program, which has been systematically implemented on its existing pipeline system since 1998. Trans Mountain said that this would allow it to adaptively manage geohazards and respond to changing conditions, such as climate change. Trans Mountain would monitor slopes for potential rock fall, slope instability, and slope erosion through regular patrol of the pipeline right-of-way during operations and would mitigate where required.

Trans Mountain committed to carrying out a baseline natural hazard assessment within the first year of operation, and to update the Natural Hazard Management Program no less frequently than every five years thereafter.

6.10.3 Facility Integrity Management Program

Trans Mountain said that the safety of the facilities in the expanded TMPL system would be assured through the enhancement and application of the existing Facilities Integrity Management Plan (FIMP). Like the IMP, the FIMP has processes for the identification of all integrity hazards that could affect the safe operation of facilities, the assessment of these hazards, and the management of the hazards to prevent and mitigate the impact of petroleum releases and petroleum fires. The FIMP includes a continual assessment process that will ensure the completion of all maintenance and testing activities required for the effective operation of all preventative and consequence reduction systems.

Trans Mountain said that the FIMP uses a qualitative risk assessment process which will be applied to the development of the Project facilities early in the design process to ensure that appropriate preventive measures and consequence reduction measures are incorporated. The FIMP risk assessments will be complementary to the hazard and operability study reviews (HAZOP) conducted as part of the design process for all facilities. Trans Mountain said that the FIMP requires that risk assessments be completed on three year intervals, and will also require the periodic monitoring and assessment of facility piping under a formalized risk-based inspection program.

Trans Mountain said that inspections of all pump station and terminal piping would be included as part of scheduled maintenance activities. Aboveground piping will be visually inspected to confirm that there is no external corrosion, evidence of leakage, or other conditions that would indicate the pipe is not fit for service. Underground piping will be monitored by a combination of ILI, where feasible, and other condition monitoring technologies. Trans Mountain said that mechanical equipment, including pumps and valves, electrical equipment such as transformers and motors, and instrumentation equipment such as meters and transmitters, are inspected at prescribed intervals. In some cases, equipment will have alarms to indicate certain operating parameters are not within specifications. Safety systems will be inspected and tested on a regular basis to confirm their correct functioning.

Trans Mountain said that equipment and systems at all facilities in the expanded TMPL system will undergo preventative maintenance to ensure the facilities meet all applicable legislative and company standards, and operate safely and with the highest levels of reliability. The frequency of inspections will be determined by legislative requirements, risk assessments, operating experience and manufacturers' recommendations. Trans Mountain said that the preventative maintenance program would be refined through the comprehensive tracking and analysis of incidents, including leaks, security incidents, near misses, significant equipment malfunctions and process upset conditions.

Trans Mountain said that monitoring programs for the facilities in the expanded TMPL system will include:

- scheduled pump station and terminal surveillance rounds and visual inspections;
- a site water handling systems and oil detection systems inspection program;
- a tank inspection program, in accordance with American Petroleum Institute (API) 653[43];
- a valve inspection and testing program;
- a pressure vessel inspection program;
- an aboveground pipe inspection program;
- a piping integrity program;
- a flange integrity program;
- a coating inspection program;
- a marine structures inspection program;
- an electrical substation breaker thermal inspections program;
- a cathodic protection system inspection and testing program;
- a fire-suppression system inspection and testing program;
- a protective devices and alarms inspection and testing program; and
- an air quality monitoring program at the terminals.

43 API Standard 653- Tank Inspection, Repair, Alteration, and Reconstruction

Trans Mountain said that integrity issues identified during daily, monthly or annual inspections, or other scheduled inspections are entered into the Computerized Maintenance Management System (CMMS) and prioritized for corrective maintenance.

Views of the Board

As described in this chapter and in Chapter 7, the Board is of the view that a management systems approach provides a consistent framework for the design, development and implementation of a company's protection programs. It also provides the basis for the cyclical planning, implementation, review, and adjustment of operational activities, which is essential for a company to effectively address risks, manage its resources appropriately, and achieve the desired outcomes.

The OPR requires companies to develop, implement and maintain, among other programs, an integrity management program that anticipates, prevents, manages and mitigates conditions that could adversely affect safety or the environment during the design, construction, operation, maintenance and abandonment of a pipeline. The Board is of the view that obtaining initial baseline information regarding the position and condition for the new Line 2 and new delivery pipeline segments is beneficial in identifying potentially injurious manufacturing and construction defects at an early stage, and is helpful for planning future integrity management activities. While Trans Mountain has committed to carry out some of the in-line inspections, the Board is of the view that, in some cases, the inspections should be initiated sooner after commencing operations than proposed by Trans Mountain, and that additional inspections should be conducted. Therefore, the Board would impose Condition 143 requiring Trans Mountain to conduct baseline inspections in accordance with the timelines and descriptions set out in the condition. In some cases, the inspections must be conducted within six months of commencing operations, and in no case will they be conducted more than two years after commencing operations.

The Board would also impose Condition 148 requiring Trans Mountain to file Geographic Information System (GIS) data for the Project within one year after commencing operations. The Board expect Tran Mountain provide the GIS data to local governments and Aboriginal groups upon request.

To verify that input to the Natural Hazard Management Program is current and accurate, the Board would impose Condition 147 requiring Trans Mountain to file with the Board the results of its baseline natural hazard assessment within one year of commencing operations, to update it at intervals not exceeding every five years, and to integrate it into the Natural Hazard Management Program.





7.0





Construction and operations

The *National Energy Board Onshore Pipeline Regulations* (OPR) require a regulated company to design, construct, operate and abandon a pipeline in a manner that ensures the safety and security of the public and the company's employees, the safety and security of the pipeline, and the protection of property and the environment. In order to meet these obligations, the company must establish, implement, and maintain a systematic, explicit, comprehensive and proactive management system which integrates emergency management, integrity management, safety management, security management, and environmental protection programs.

Management system elements and related requirements are detailed in the OPR, sections 6.1 through 6.6, and fulfill the cycle of "plan, do, check, act." Across all program areas and throughout the lifecycle of the pipeline, a company must identify all hazards and potential hazards, and evaluate and manage the associated risks. This includes developing and implementing controls to prevent, manage and mitigate the identified hazards and risks, and communicating these controls to anyone who is exposed to the risks.

Throughout the lifecycle of a pipeline, from approval, through construction and subsequent operation and maintenance to abandonment, the Board employs the compliance verification approach outlined in Chapter 3 of this Report to hold the pipeline company accountable for meeting its regulatory requirements. Regulatory requirements include:

- conditions of National Energy Board (NEB) Orders and Certificates;
- the NEB Act and regulations, including the OPR which references standards and applicable codes; and
- companies' own policies, plans, systems and commitments (including commitments made in the course of a hearing) which become regulatory requirements under provisions of applicable conditions and regulations.

NEB technical staff track and assess condition compliance, and conditions requiring approval of the Board must obtain that approval before the company can proceed with the next phase of the project. Through compliance verification activities, such as audits, inspections, meetings, and review of condition filings, and other manuals and reports, the Board verifies a company's regulatory compliance and assesses the adequacy and effectiveness of a company's management system and programs.

This chapter addresses the plans and programs which Trans Mountain said it would develop to manage safety, security and emergencies during and pertaining to Project construction. These plans and programs would be consistent with, and complementary to, existing measures that apply to Trans Mountain's current facilities and operations. Trans Mountain said it would update all existing plans and programs to include the Trans Mountain

Expansion Project prior to commencing operations, as outlined later in this chapter. For further information regarding Trans Mountain's Emergency Management Program during operation, refer to Chapter 9.

This chapter also discusses:

- Trans Mountain's proposed measures to ensure compliance with regulatory requirements during construction and subsequent operation of the Project; and
- conditions the Board would impose to make Trans Mountain's commitments and plans regulatory requirements, and to assist the Board and public in tracking Project progress and verifying regulatory compliance.

7.1 Safety, security and emergency management during construction

Trans Mountain said that it would develop plans pertaining to construction safety, security and emergency management during the detailed design phase of the Project and submit them to the Board prior to construction.

7.1.1 Construction safety

Trans Mountain said that it would develop a Health and Safety Management Plan (HSMP) during the detailed engineering and design phase to reduce risk, and protect the health and safety of workers and the public during construction. The HSMP would conform to and incorporate OPR requirements, federal occupational health and safety requirements, applicable provincial requirements, industry standards, and Kinder Morgan Canada Inc.'s policies, standards and manuals. The HSMP would set requirements for Trans Mountain's prime contractors and allow for continuous improvement during construction.

While Trans Mountain would be the prime contractor for "pump stations, terminals and other facilities", Trans Mountain said that an external prime contractor would be assigned to each mainline pipeline spread. Each prime contractor would be required to:

- conduct a risk assessment for construction of the assigned Project component;
- develop and implement a Project Specific Safety Plan (PSSP) to meet the requirements of the HSMP; and
- submit its PSSP to Trans Mountain for approval at least 60 days prior to commencing construction.

Trans Mountain referenced numerous health and safety requirements that would be included under the HSMP, including the development of additional plans by itself or its prime contractors and the implementation of these plans during construction. Plans to be developed that directly affect public safety during construction include Traffic and Access Control Management Plans (TACMPs) and detailed contractor-developed Traffic Control Plans (TCPs). As well, a blasting management plan, fire prevention and fire contingency planning to reduce the risk of wildfires, and a noise control plan to minimize the effects of construction-related noise on the public and worker health would be developed.

Safety considerations particular to the proposed Project include construction in close proximity to the existing operating Trans Mountain Pipeline (TMPL) system and construction within the confined space of the proposed Burnaby Mountain tunnel.

With regard to construction activities in the vicinity of existing operational storage tanks, Trans Mountain committed to develop site-specific safe work procedures and mitigation measures for Edmonton, Sumas and Burnaby.

With regard to the Burnaby Mountain tunnel, Trans Mountain determined that the preferred option for the Westridge Delivery Pipelines would be a tunnel approximately 2.6 km long and at least 4 m in diameter, as described in Chapter 6, section 6.2. Trans Mountain said that the final configuration of tunnel diameter and pipe installation would depend on the selected contractor's means and methods. However, the final tunnel diameter would be sized to provide a clearance envelope around each pipe to carry out all necessary pipeline related work in accordance with worker health and safety regulations.

Several participants expressed concerns regarding public health and safety issues, such as traffic, emergency access, noise and dust. Specific concerns are described and addressed in Chapter 11.

Trans Mountain said that controls to ensure public safety during construction would be determined through detailed construction planning and consultation with municipal authorities and stakeholders.

These controls would be integrated into the HSMP and PSSPs. Trans Mountain said that it would implement a communications program to ensure local businesses and the public were made aware of potential construction impacts, including general safety requirements, lane restrictions, road closures and alternate access plans.

Trans Mountain said that access for emergency services would be a critical component of the TACMPs and local TCPs. TACMPs would include Incident Plan and Public Information Plan sections that would consider potential impacts to emergency vehicle access and service to communities, and ensure that municipalities, emergency response providers, and the general public were made aware of any potential traffic impacts or disruptions by the Project. TCPs would be developed in consultation with provincial and municipal representatives, and would take into account emergency vehicle traffic continuity.

Views of the Board

Sections 18 to 20 of the National Energy Board Onshore Pipeline Regulations require companies to take various measures to ensure the safety of employees, contractors, the public and the environment during pipeline construction, including developing a construction safety manual and submitting it to the Board. Construction safety manuals for the Project would consist of the overarching Health and Safety Management Plan, as well as individual contractor Project Specific Safety Plans, which would be developed prior to construction.

The Board would impose Condition 64 requiring submission of these manuals in advance of construction to ensure that regulatory requirements are met and safety risks pertaining to the Project are addressed, including tunnel construction and construction in close proximity to operating pipelines and facilities. The Board requires more information following detailed design of the proposed tunnel to ensure that any work conducted by workers within the tunnel can be completed safely. Therefore, the Board would impose Condition 26 requiring that confined space entry procedures for the Burnaby Mountain tunnel be submitted to the Board for approval.

The Board is of the view that additional public safety concerns will be addressed by implementation of Traffic Control Plans, Access Management Plans, Noise Management Plans, and Environmental Protection Plans, to be submitted in response to the conditions found in Chapters 10 and 11 (Conditions 47, 72, 73, 74, 78, 80, 81 and 86).

7.1.2 Construction security

Trans Mountain said that prior to commencing construction, it would conduct security risk assessments for all construction areas and implement appropriate controls, which could include physical barriers and signage, security personnel, and daily inspections during construction. A construction security management program would be developed in compliance with the OPR and would be complementary to the existing security management program for Trans Mountain operations.

Many participants expressed concern over potential vandalism or terrorism affecting the pipeline and facilities during construction and operations.

Trans Mountain said that security threats, such as vandalism or terrorism, would be addressed through the security risk assessments, development of the construction security management program, and updates to the existing operations security management program. Additionally, Trans Mountain said that it requires situations including trespass and sabotage to be addressed by the site-specific emergency response plans that would be developed by each prime contractor. Trans Mountain said that Kinder Morgan Canada (KMC) has a comprehensive security program that was developed over many years in consultation with security experts and the RCMP, but in order to maintain the effectiveness of the programs, details of the current program, proposed security program changes and the construction security program were confidential.

Views of the Board

Section 47.1 of the National Energy Board's Onshore Pipeline Regulations requires companies to develop, implement and maintain a security management program. Guidance notes further indicate that pipelines must be designed, constructed, operated or abandoned in accordance with the applicable provisions of Canadian Standards Association Z246.1: Security management for petroleum and natural gas industry systems.

The Board would impose Condition 63 requiring Trans Mountain to confirm, prior to construction, the development of the security management program for Project construction. Due to the sensitive nature of security matters, Trans Mountain would not be required to file a copy of this program with the Board. Trans Mountain would maintain the program in its own offices and establish protocols to prevent the inadvertent release of sensitive security information (such as security risk assessments and controls) which could put the public, property and environment at risk. Once Trans Mountain has filed confirmation that the security management program for Project construction has been developed, NEB security management specialists would follow up with Trans Mountain to assess the program and verify that it is adequate and effective to address security conditions that could adversely affect people, property or the environment during Project construction.

7.1.3 Emergency preparedness and response during construction

To manage potential emergencies during Project construction, Trans Mountain said that it would develop and implement an Emergency Response Plan (ERP) separate from, and complementary to, Trans Mountain's ERPs for operations, which are discussed in Chapter 9. Trans Mountain said that its construction ERP would be designed to ensure timely and appropriate emergency response in compliance with regulatory requirements and industry standards, and would guide the prime contractors' development of detailed site-specific ERPs. The site-specific ERPs would address personal injury or health incidents, environmental damage, fires, floods, earthquakes, rock slides, avalanches, sabotage, trespass and other emergency situations that could occur during construction. Contingency plans for potential emergencies and other events during construction are compiled in the Project Environmental Protection Plans.

Several municipalities said that the construction ERPs should be developed in consultation with applicable federal and provincial agencies, local government authorities and emergency first responders. Trans Mountain replied that it would continue to consult with stakeholders, including municipalities and their emergency responders, during the development of site-specific construction ERPs prior to the start of Project work.

Views of the Board

Section 32 of the National Energy Board's Onshore Pipeline Regulations requires companies to develop, review and update emergency procedures manuals, and submit manuals and updates to the Board. The Board would impose Condition 89 requiring submission of the construction Emergency Response Plans (ERPs) in advance of construction to ensure that regulatory requirements are met and that potential emergencies during construction are addressed. The Board notes Trans Mountain's commitment to continued consultation with stakeholders, including municipalities and their emergency responders, during development of its construction ERPs.

7.2 Safety, security and emergency management during operations and maintenance

Trans Mountain said that, if approved, the completed Project would be integrated into Trans Mountain's existing programs and management system, which would be updated accordingly. Given the prominence of concerns expressed during this hearing relating to emergency management during operation of the Project, KMC's emergency management program for operating pipelines is discussed separately in Chapter 9. The safety and security management aspects of the Project during operation are discussed below.

Trans Mountain said that it would continue to operate the expanded TMPL system in accordance with KMC's current Integrated Safety and Loss Management System (ISLMS). The ISLMS was developed in response to the 2013 amendments to the OPR and applies to all activities involving the design, construction, operation, and abandonment of the TMPL system. Trans Mountain said that the ISLMS is the basis for ensuring a strong safety culture with an emphasis on continuous improvement. It outlines KMC's commitment to establishing, implementing, monitoring and continuously improving processes and controls to ensure that KMC is conducting business in a safe, environmentally responsible and sustainable manner. KMC's Environment, Health and Safety (EHS) management system is imbedded within the ISLMS.

Trans Mountain said that KMC implemented the EHS management system to ensure that risk to employees, contractors, the public, and the environment is minimized. The EHS management system integrates emergency management, security, health and safety, and environment programs, and emphasizes EHS impact prevention and continuous improvement.

Trans Mountain said that KMC's Operations Facility Security Plan identifies security measures that are required at different types of facilities at differing threat levels. The security plan is based on NEB and other national, provincial and international security standards. As for existing Trans Mountain facilities, security systems would be selected and installed at new Project facilities in accordance with considerations such as threat monitoring and analysis, tracking and trending of security incidents, and assessment of overall system and individual facility vulnerabilities.

The B.C. Wildlife Federation commented that security programs and/or systems should extend to any parts of the pipeline that have unburied pipe, including expansion joints or pigging stations, as any unburied pipe could be a target for vandalism. Trans Mountain responded that security programs and/or systems will extend to all parts of the Project during construction and operations, including parts of the pipeline that are unburied. Other participants' concerns and Trans Mountain's responses regarding security management during Project operation are discussed in section 7.1 in combination with construction security concerns.

Many participants expressed health and safety concerns about the pipeline expansion through their communities. Some expressed specific concerns about air emissions; impacts of potential spills, ruptures or tank fires; appropriateness of pipeline routing or facility location in proximity to residences and schools; and marine safety. These concerns are discussed in Chapters 9, 10, 11 and 14. Other participants expressed general concern or lack of trust regarding Trans Mountain's safety record and commitment, as well as the general safety of the Project and the overall TMPL system. The Georgia Strait Alliance said that one of the reasons most frequently cited in a web based survey of its supporters regarding opposition to the proposed Project, was a lack of trust in the Project proponent in general and its safety record in particular. One respondent to the survey said that Kinder Morgan's safety record was abominable and the company could not be relied on to operate safely.

Some participants supported Trans Mountain's attention to safety or pipeline safety in general. While most comments collected by the Simon Fraser Student Society and The Graduate Student Society at Simon Fraser University were opposed to the pipeline, the societies said that the infrequency of serious incidents, the current need for oil, and the relative safety of pipeline transport versus rail were themes in student feedback that was supportive of the proposed Project.

Views of the Board

Section 47 of the National Energy Board's Onshore Pipeline Regulations (OPR) requires companies to develop, implement and maintain a safety management program that anticipates, prevents, manages and mitigates potentially dangerous conditions and exposure to those conditions. The Board acknowledges public concern regarding Trans Mountain's commitment to safety, and notes that Trans Mountain has an established Health and Safety Management System, which is subject to continuous improvement and ongoing NEB compliance verification activities.

Section 47.1 of the OPR requires companies to develop, implement and maintain a security management program, and associated guidance notes indicate that pipelines must be designed, constructed, operated and decommissioned or abandoned in accordance with the applicable provisions of Canadian Standards Association Z246.1. The Board would impose Condition 63 requiring Trans Mountain to confirm, prior to commencing operations, that it updated its existing operations security management program to incorporate the Project. Due to the sensitive nature of security matters, Trans Mountain would not be required to file a copy of this program with the Board. Trans Mountain would maintain the program in its own offices and establish protocols to prevent the inadvertent release of sensitive security information (such as system and facility vulnerability assessments, threat monitoring, and identification of critical infrastructure) which could put the public, property and environment at risk. Under the OPR, the security management program would then be subject to assessment and ongoing NEB lifecycle compliance verification to confirm adequacy and effectiveness to address security conditions that could adversely affect people, property or the environment during Project operation.

7.3 Compliance verification

Trans Mountain described plans, programs, and management systems, including the Project Environmental Compliance Program, Project HSMP, and corporate ISLMS which it would develop or update and implement to ensure compliance with regulatory requirements, encourage continuous improvement, and reduce risk during construction and subsequent operation of the Project. Furthermore, Trans Mountain said that an inspection team of qualified and experienced personnel would inspect all phases of construction activities to ensure:

- compliance with procedures, specifications, and drawings;
- compliance with all applicable legislative requirements, approved permit conditions, and undertakings; and
- conformance with Project health, safety, security, and environmental plans and procedures.

Many commenters expressed concerns regarding how the NEB would enforce the Project's conditions. They expressed a perception that the conditions were self-reporting checklists for the company with no regulatory status or associated monitoring, enforcement or penalties. Lovel Pratt said that it was imperative that if the NEB chooses to permit the Project, all of the conditions be legally binding and transparently verifiable by all directly affected stakeholders and concerned Canadian, United States, First Nation and Tribal citizens.

Other commenters expressed concern that no conditions could prevent human error, mitigate the overall environmental effects of the Project, or prevent or effectively remediate oil spills and the resulting damage to the environment.

In comments on draft conditions associated with general Project compliance, some participants expressed concerns that the phrase "unless the NEB otherwise directs" gives the Board excessive power to alter the conditions or release Trans Mountain from the need for compliance. Participants also expressed concerns regarding condition and commitments tracking and compliance verification, and listed commitments which they said were not adequate or adequately captured in the latest update to the commitments tracking table filed by Trans Mountain during the hearing. Trans Mountain replied that it is conducting a comprehensive quality assurance/quality review process to ensure it has documented all commitments that are not confidential and that are on the NEB's record, and invited parties to direct any noted errors or omissions from the commitments tracking table to Trans Mountain for resolution. A number of participants also expressed a desire to be consulted with regard to construction scheduling, and notified of schedule updates and construction progress.

Views of the Board

The Board notes that Trans Mountain has committed to inspect all phases of construction activities to ensure that all requirements are met, and has taken a management system approach to reduce risk and facilitate continuous improvement during construction and operations. The Board agrees that Trans Mountain must be held accountable for complying with regulatory requirements, including conditions and commitments outlined in the hearing.

The Board would impose several overarching conditions (Conditions 1, 2, 3, 4 and 5), the effect of which would be to make all commitments, plans or programs, included, referenced or agreed to on the hearing record, regulatory requirements of the Board. Furthermore, to assist the Board and all stakeholders in tracking construction progress and compliance (and to assist the Board in planning appropriate compliance verification activities), the Board would impose conditions requiring Trans Mountain to file commitments tracking tables, phased filing information, a list of temporary infrastructure sites, construction schedules, construction progress reports, and a signed confirmation of Project completion and compliance (Conditions 6, 10, 61, 62, 106 and 139).

The intent of the phrase "unless the NEB otherwise directs" in Condition 1 is to provide the Board with some flexibility to vary conditions in a timely manner, if needed, without requiring the Governor in Council approval. Changes would be considered by the Board on a case-by-case basis, within the context of the conceptual design presented by Trans Mountain in its application and the hearing, the associated level of safety and environmental protection, and the recommendation and decisions of the Board and the Governor in Council. More substantial changes to the Project would require a variance pursuant to section 21 of the NEB Act, and variance of a Certificate would not be effective until approved by the Governor in Council.

Some potential changes were already contemplated in the hearing process, subject to overall approval of the Project, and, if required, would be implemented by Trans Mountain in compliance with the relevant conditions (for example, Condition 108 related to contingency watercourse crossings and Condition 51 related to field changes for geohazard mitigation). If Trans Mountain wishes to make other changes to the approved Project pursuant to Condition 1 or section 21 of the NEB Act, the company would be required to submit an application to the Board, and the change could not be implemented until and unless it was assessed by NEB technical staff and approved by the Board.

The intent of Condition 6 is not to duplicate commitments made in other plans, programs or manuals which are filed with the Board. Instead, the intent is to capture commitments scattered throughout the hearing record, such as in responses to information requests or in reply argument, and compile them in a format that is readily accessible to the public, Trans Mountain personnel and NEB staff, such that commitments are tracked and implemented. The Board acknowledges Trans Mountain's ongoing review of its commitments tracking table (including the quality assurance/quality review process referenced in its reply to comments on draft conditions) and invitation for parties to direct any errors or omissions to Trans Mountain for resolution.

The Board notes the numerous mechanisms and commitments in place for coordination and consultation between Trans Mountain, and municipalities and landowners during construction planning. The Board does not require such consultation to be incorporated into Condition 62. The intent of construction schedule filings under this condition is not to consult on construction schedule development but to keep parties informed and updated with regard to the Project schedule, and thus assist the Board and those interested in tracking construction progress and compliance with other conditions and commitments.

If the Project is approved, the Board would employ its established lifecycle compliance verification and enforcement approach, as described in Chapter 3, to hold Trans Mountain accountable during construction and the subsequent operation and maintenance of the Project. Additionally, condition filings are publicly posted on the NEB's Regulatory Document Index, and condition compliance status, inspection reports, audit reports, Inspection Officer Orders, Board Orders and Administrative Monetary Penalty Notices of Violation are all publicly posted on the NEB's Compliance and Enforcement webpage.





8.0



Environmental behaviour of spilled oil

Trans Mountain said that the expanded Trans Mountain Pipeline (TMPL) system would have the capability to transport light and heavy crude oils, including diluted bitumen. Trans Mountain said that oil properties provide information about their potential behaviour and fate in the environment, and the potential environmental effects if a release were to occur.

Trans Mountain and a number of other participants provided information on the fate and behaviour of spilled oil. As part of its public interest mandate under the NEB Act, the Board has used this information to inform its assessment of potential environmental and socio-economic effects of oil spills, and response planning regarding the Project and related marine shipping[44]. The information and Board views within this chapter are particularly relevant to Chapters 9, 10, 11 and 14 and should be considered when reading those chapters.

The majority of concerns raised by participants about the fate and behaviour of spilled oil in relation to the Project and related marine shipping focused on spills in marine and freshwater aquatic environments. Therefore, although this chapter does discuss spills on land, it focuses predominantly on spills in aquatic environments and not on terrestrial spills. Spills on land are also discussed in Chapter 9.

8.1 Weathering processes and the fate and behaviour of spilled oil

8.1.1 Land

Trans Mountain said that an oil spill on land would tend to move downslope, sink downward under gravity, and spread horizontally on the surface and in the subsurface. When the mobile oil encounters an impermeable soil structure, such as bedrock or the water table, downward movement stops and the oil spreads laterally or down the slope of the more impermeable layer. Eventually oil stops moving and is trapped in the soil or natural depressions. However, even when immobilized, the oil continues to lose mass through water (dissolution) and

44 In its 10 September 2013 letter, the Board determined that although the increased marine shipping to and from the Westridge Marine Terminal is not part of the Project proposed by Trans Mountain, by way of Issue #5 in the Board's List of Issues, the potential environmental and socio-economic effects of those marine shipping activities, including the potential effects of accidents or malfunctions that may occur, are relevant to the Board's consideration of the application under the National Energy Board Act.

vapour (evaporation) phases and through biodegradation. The natural rate of depletion through these processes becomes progressively slower with time as the remaining hydrocarbons include increasingly more complex components that resist weathering. The rate and extent of movement is influenced by various factors, including properties of the hydrocarbon such as density and viscosity; type and properties of the receiving substrate; temperature; and soil saturation. Trans Mountain said that fresh diluted bitumen has a higher potential to penetrate substrate but as the oil weathers, the penetration potential would resemble that of bunker oil.

8.1.2 Aquatic environments

Trans Mountain said that weathering processes are similar for hydrocarbons in freshwater and marine environments, with some differences in the rate and extent at which the processes occur, due to differences in physical, chemical and hydrodynamic conditions of the receiving environments. A spill can be expected to initially float except in cases where the hydrodynamics of the receiving water are such that the oil becomes entrained through turbulent flow.

Trans Mountain said that spilled hydrocarbons undergo changes in physical and chemical properties due to the natural weathering processes of evaporation, emulsification, natural dispersion, dissolution, oxidation, interaction with particulates, and biodegradation. Physical and chemical changes occur immediately and rapidly upon release. Trans Mountain said that although these processes usually act simultaneously, their relative importance varies with time and determines the hydrocarbon fate and behaviour. The rate of change in oil properties due to weathering is dependent on a number of factors, including spreading (or containment) and environmental variables, such as temperature, currents, turbulence, winds, and sediments. Trans Mountain said that spreading, evaporation, emulsification, and dispersion and, to a lesser degree, dissolution, are initially the most important processes in oil weathering that affect the mass balance of the oil. Interactions with particulates, photo-oxidation, and biodegradation are slower, longer-term processes that determine the ultimate fate of the hydrocarbons.

Trans Mountain described the weathering processes associated with an oil spill at sea (Figure 15). Similar processes would occur for an oil spill in fresh water.

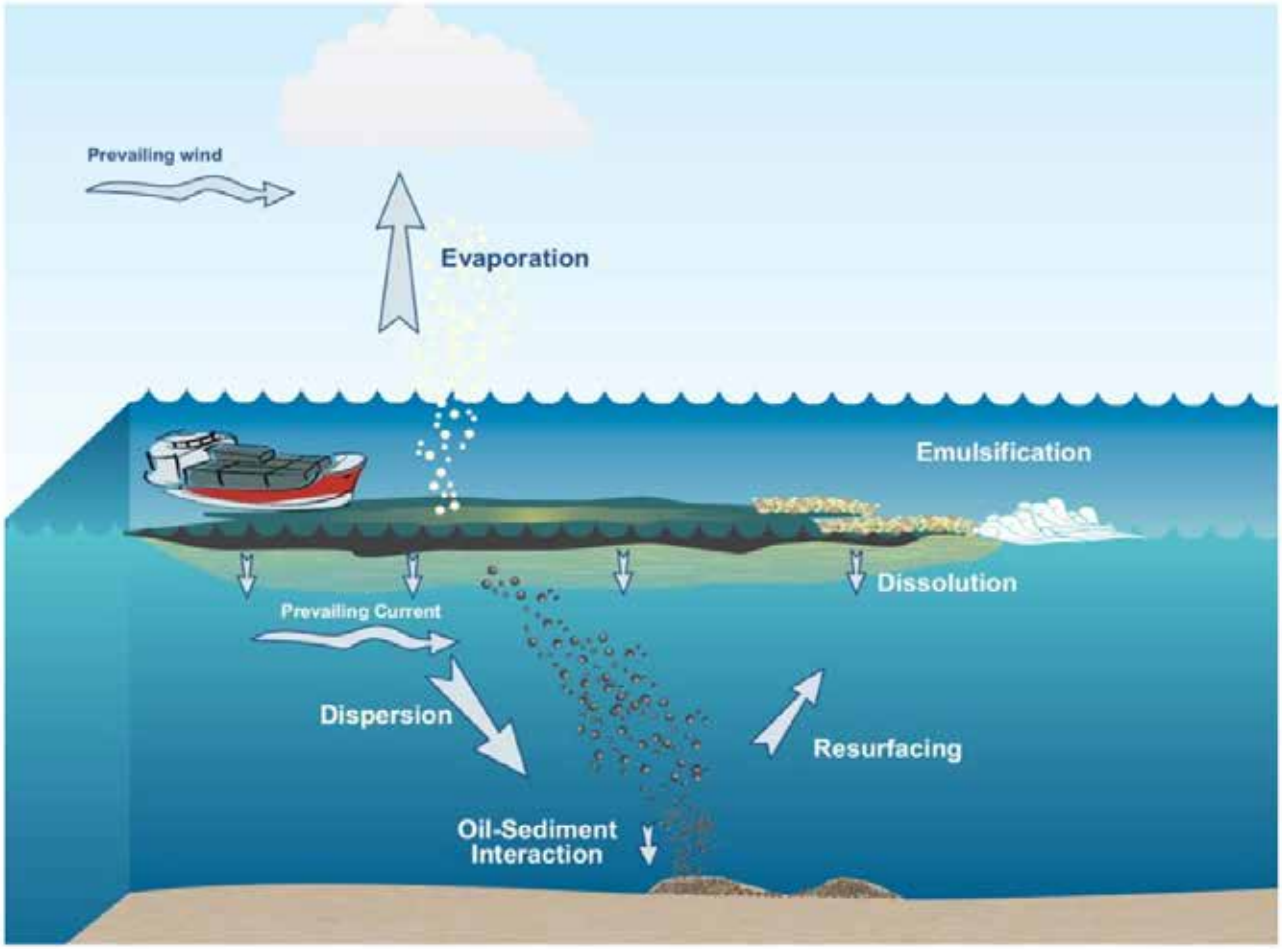
Trans Mountain said that typically, once released into the marine environment, oil begins to weather and after a period of time, it can submerge or begin to sink. When released into water, lighter components of hydrocarbons would begin to evaporate; some would dissolve into the water column, and the remainder would float as long as the density of the remaining oil is less than the density of the water into which it was released. Wave action can cause water-in-oil emulsions, which would drive the mixture towards neutral buoyancy. Adhesion to bottom sediment (e.g., beaches, riverbeds) or other sinking material can cause the oil to be submerged.

Trans Mountain said that to understand how different oils change over time while at sea, it is important to understand how weathering processes interact. Wind speed, wave heights, water temperature, salinity levels and sediment levels affect the fate and behaviour of oil in the marine environment. The speed by which weathering occurs depends on the buoyancy and viscosity of the oil. Trans Mountain said that oil slicks quickly spread to cover extensive areas of the sea surface, and variations in the thickness of the oil are typical. The rate at which the oil spreads is affected by the viscosity of the oil, as well as prevailing environmental conditions, such as temperature, water currents, tidal streams and wind speeds. The more severe the conditions, the more rapidly the oil would spread and break up.

Trans Mountain said that oil released to fresh water would be transported by the water, and that the factors influencing transport could include current speeds, size and form of the freshwater body, and wind. As oils are transported within the water body, portions may adhere to substrates or vegetation and become stranded along shorelines. To a limited degree, some residue may be retained within coarse stream or river bed substrates. Changes in water level within freshwater or tidal systems may flood or inundate areas where hydrocarbons are stranded, and refloat a portion of that material. Alternatively, falling water levels or tides may strand hydrocarbons along higher water lines or in overbank areas following flood events.

Trans Mountain said that as oils are transported, normal weathering processes continue to change the character of the oil. The rate of spreading, dissolution and dispersion of oil would be less in the low turbulence environments of ponds and lakes compared to the Burrard Inlet or an estuary setting, but higher in highly turbulent rivers where the oil would also move downstream and spread laterally. Ice formation in freshwater bodies would affect how the oil is partitioned and would have implications for cleanup strategies and persistence of the oil. For example, diluted bitumen spilled under ice would be expected to have lower evaporation and weathering rates.

Figure 15: Oil weathering processes at sea (similar processes occur in a freshwater environment)



8.2 The potential fate and behaviour of oil transported by the Project

8.2.1 The products

Trans Mountain said that the expanded TMPL system could transport light and heavy crude oils, including diluted bitumen, which would form a large proportion of the crude oil shipped from the Westridge Marine Terminal (WMT). Trans Mountain said that the tariff on its pipeline system limits the maximum density of oil shipped to 940 kg/m^3 and a maximum viscosity of 350 centistokes.

Trans Mountain said that to enable transport through the pipeline, bitumen is mixed with diluent. Typical diluents are natural gas condensate (light oil recovered from natural gas production) and synthetic crude oil (partially refined bitumen). Trans Mountain said that, in effect, the diluent is added to replace the light hydrocarbons lost from microbial degradation of the oil sands. Diluted bitumen is a stable, homogenous mixture that behaves similar to other natural crude oils when exposed to similar conditions and undergoes a weathering process. Trans Mountain said that diluted bitumen is not a bitumen in suspension, in emulsion, or a two-phase liquid.

Trans Mountain said that the shipping, oil spill response and insurance industries use the terms persistent and non-persistent oils for transportation and oil spill response planning purposes. Less persistent oils that are spilled are expected to remain in the environment for lesser time than higher persistence oils. Trans Mountain said that some simple grouping of oil types has been developed based on oil density. These oil groups range from I to V with Group I oils being the least persistent and Group V being the most persistent. Generally, oils with a lower density would be less persistent.

Trans Mountain said that Group I oils tend to dissipate completely through evaporation within a few hours and do not normally form emulsions. Group II and III oils can lose up to 40 per cent by volume through

evaporation but, because of their tendency to form viscous emulsions, there is an initial volume increase as well as a curtailment of natural dispersion, particularly in the case of Group III oils. Group IV oils are very persistent due to their lack of volatile material and high viscosity, which preclude both evaporation and dispersion. Trans Mountain said that sometimes a Group V classification is used to collectively classify oils whose density is higher than that of water and would likely sink when spilled in water.

For oil spill response planning purposes, Trans Mountain said that diluted bitumen is a Group III hydrocarbon with a specific gravity equal to or greater than 0.85 and less than 0.95. Trans Mountain said that diluted bitumen, while typically rated as a Group III product, displays heavier oil behaviour when weathered. It said that the densities for the weathered oils that it tested show that they would fall under the Group IV category (specific gravity equal to, or greater than, 0.95 and less than 1.0) within the first 24 hours following a spill. This is due to initial evaporation of the lighter ends.

Numerous participants expressed concerns that diluted bitumen is likely to sink when spilled in water. Ms. Michelle Baudais said that diluted bitumen can separate in water and the bitumen component would then sink. Similarly, the Pender Islands Conservancy Association and Musqueum Indian Band said that, in the event of a spill, the solvent component of the diluted bitumen could evaporate to the point where the residual bitumen sinks.

Ms. Carol MacLeod and several other participants said that diluted bitumen is substantially different from "crude oil" and that diluted bitumen contains diluents that are highly carcinogenic.

Trans Mountain said that diluted bitumen and other crude and fuel oils with similar physical properties are transported throughout the world. It said that the general behaviour of these oils is similar with respect to fate and weathering, and spill countermeasures. Trans Mountain said that shortly after most of the evaporative loss through weathering, the remaining diluted bitumen behaves similarly in many physical respects to other heavy crude oil and common heavy fuel oils, such as Bunker C.

8.2.2 Weathering and aggregate formation

As discussed in section 8.1, oils undergo a weathering process when exposed to the environment. Trans Mountain said that the key difference between diluted bitumen and a medium crude oil is a shorter weathering timeframe for diluted bitumen. It would generally take many days or weeks for the medium crude to weather and/or emulsify to achieve the characteristics of heavy oil, whereas a diluted bitumen may weather to a heavy oil state within one or a few days, depending on its original formulation and the active weathering processes.

Trans Mountain said that diluted bitumen products do not sink upon spilling on water. However, diluted bitumen, similar to other heavy crude and refined oils may achieve densities greater than 1000 kg/m^3 only after extensive weathering and/or sediment and water uptake. Trans Mountain said that there are multiple factors that lead to potential oil submergence or sinking. Oil viscosity can affect spreading which in turn can affect evaporation and dispersion rates. Differences in oil viscosity also contribute to changes in water and sediment uptake. Trans Mountain said that it is a well-established fact that sediment interaction with medium to heavy crude oils or fuel oils may result in submergence or sinking, as may occur with weathered diluted bitumen.

Trans Mountain said that oil-sediment interaction is not simply a function of sediment availability for the process of aggregate formation, but that the natural dispersion of oil droplets, oil viscosity, and other factors contribute to the process. A high level of energy is required to form stable aggregates. Trans Mountain said that when sediment concentrations and wave energy levels are high enough, the formation of aggregates can occur.

Trans Mountain referred to recent research conducted by NRCan and Alberta Innovates in which the authors concluded that low viscosity oils that readily disperse form oil mineral aggregates while higher viscosity oils do not disperse easily and so form less oil mineral aggregates. Consequently, increased interaction of conventional crude with sediment occurred due to its low viscosity. A diluted bitumen with higher viscosity did not disperse into the water column and a lower quantity of oil mineral aggregates formed.

8.2.3 Biodegradation

Trans Mountain said that the main difference between oil sands deposits and those from the rest of the Western Canadian Sedimentary Basin is that oil sands formed nearer to the surface. This resulted in oil sands deposits being subject to more microbial activity. Microbes digested most of the lighter fractions in these deposits. What remains are the heavier fractions that result in the denser, more viscous crude oil known as bitumen.

Trans Mountain said that bacterial decay of diluted bitumen in the marine environment occurs as bacteria degrade the constituent hydrocarbons in the slick. It said that the resident population of bacteria along the tanker route is clearly small due to the general absence of a food source, as the Strait of Georgia is generally free of oil slicks. Trans Mountain said that after a spill incident, the resident population would initially multiply, as it consumed the newly available food source. At some point, the population would reach a maximum and ultimately, after a period of perhaps months, the population would return to near its initial size.

Trans Mountain said that for spills in freshwater environments, such as the Fraser River watershed, Thompson River watershed, Lower Nicola watershed, and the Upper Nicola watershed, river flow and limited industrial human activities on water in these watershed, would likely limit the size of the background oil-degrading bacterial population. Hence, the biodegradation process would take a longer time to evolve compared to areas where a natural oil degrading population may exist, such as in some harbors or downstream areas where background oil from runoff or boats is more prevalent. Trans Mountain said that inland waters along the pipeline route tend to contain higher nutrient levels compared with seawater, which may enhance the rate of microbial degradation of hydrocarbon.

The degree of biodegradation that may occur after a spill of oil sands products would be dependent on the extent to which the bitumen deposit was (naturally) degraded prior to extraction and the inherent biodegradability of the diluent. Therefore, Trans Mountain said that source bitumen that originally underwent a high degree of biodegradation would likely experience little further degradation after a release and weathering of the lighter diluent components. Trans Mountain said there has been little research done on oil sands products with respect to biodegradation and that this is an area for recommended research.

Trans Mountain said that a diluted bitumen spill to freshwater would not entirely be left to biodegrade. Only after all spill response cleanup and treatment had reached approved regulatory endpoints, and in consideration of net environmental benefit, could some portion of oil be left to biodegrade and this would typically involve a monitoring program to gauge progress.

The City of Vancouver said that, after initial evaporation, the biodegradation of remaining polycyclic aromatic hydrocarbon compounds depends on numerous factors, including the availability of microbes capable of degrading polycyclic aromatic hydrocarbons , oxygen, and inorganic nutrients to support microbial metabolism and growth, as well as the temperature, viscosity, and relative surface area of the oil. The City said that, as biodegradation and photo-oxidation proceed, the residual bitumen eventually hardens into an asphalt-like material that has low bioavailability of any remaining toxic compounds. Should diluted bitumen find its way into hypoxic subsurface sediments, there may only be modest changes in composition for decades or even a century.

Natural Resources Canada (NRCan) said that biodegradation of the largest components of all crudes and heavy fuel oils in the environment is relatively slow. With time, natural processes like photo-oxidation can break down the oil into smaller molecules allowing biodegradation of the oil. NRCan said that it was studying new spill treatment agents aimed to enhance rates of photo-oxidation of petroleum spilled on water and if successful, these treatment agents would become another tool for use during spill response.

The Squamish Nation said that heavier hydrocarbon compounds, such as those found in high proportions in diluted bitumen, are the most resistant to microbial degradation.

8.2.4 Submerged and sunken oil

Trans Mountain said that all heavy oils, including heavy crudes and fuels such as Bunker C, have the potential to become submerged or sunken when exposed to the right combination of conditions, such as weathering, overwash, sediment load and mixing energy. Exposure to a single condition is unlikely to cause heavy oils to become submerged or to sink.

Trans Mountain said that the Joint Review Panel for the Enbridge Northern Gateway Project found that although there is some uncertainty regarding the behavior of diluted bitumen spilled in water, the weight of evidence indicated diluted bitumen is no more likely to sink to the bottom than other heavier oils with similar physical and chemical properties. The Panel found that diluted bitumen is unlikely to sink due to natural weathering processes alone, within the timeframe in which initial, on-water response may occur, or in the absence of sediment or other particulate matter interactions.

The Shxw'ōwhámel First Nation (Shxw'ōwhámel) raised concerns about submerged and sunken oil[45]. Shxw'ōwhámel said that for all oil spills, every incident of submerged oil presents a unique set of conditions based on the type of oil, the environment in which it is spilled, and other physical processes. The Shxw'ōwhámel said that several main processes have been identified which could cause oil to sink or become submerged. For example, where the oil's density is greater than the water in which it is spilled, the oil would sink to the sea/riverbed. Should the oil then move to an area with higher water densities, it may rise again.

The Shxw'ōwhámel said that, where the oil has a density close to the water in which it is spilled, wave action and currents can cause it to become submerged for periods and even trapped in the water column. This emulsification and weathering can also cause lighter oils to increase in density and become closer to that of the water. There must also be sufficient wave energy to push fragments of oil below the water's surface. The Shxw'ōwhámel also noted the potential for floating oil to interact with high concentrations of suspended sediment and submerge or sink.

The Shxw'ōwhámel said that large masses of oil that have a density close to that of water may be submerged for periods from surface turbulence. This phenomenon is called over-washing. Over washing time increases with oil density and wave size. High-viscosity, high-density oils do not spread as a coherent slick but can form "rafts" or "blobs" under the effect of waves. These blobs can be pushed rather deep into the water and take a long time to resurface.

The City of Vancouver said that under near worst-case ambient conditions of warm summer temperatures and moderate winds, spilled diluted bitumen may begin to submerge in the surface layer of the Fraser River plume and Burrard Inlet about 24 hours following initial release. The City of Vancouver said that this possibility must be addressed in oil spill risk assessments. The City of Vancouver said that the surface waters of Burrard Inlet and the Fraser River estuary are often brackish, within the Fraser River discharge plume, and approach the density of freshwater. It said that diluted bitumen is more likely to submerge as water salinity decreases. The City of Vancouver referred to studies indicating that volatility losses alone may increase the density of diluted bitumen enough to cause it to submerge in fresh or brackish water.

Environment and Climate Change Canada (ECCC) said that salinity stratification (i.e., differing layers of salinity) in the Fraser River mouth has been documented in the scientific literature. Based on the behaviours and properties of oil sands products reported in ECCC publications and in the literature, ECCC said that it expects that mixed-salinity conditions could affect the behaviour and fate of oil spilled in this type of environment.

Living Oceans Society said that, similar to the Nestucca barge spill, a spill of diluted bitumen would likely be entrained and submerged in the water column and transported to various areas along the west coast. It said that higher sea states typical of the more exposed waters along the Strait of Juan de Fuca and the west coast of Vancouver Island would promote entrainment of diluted bitumen into the water column, making the oil difficult to track.

8.2.5 The Gainford Study

Trans Mountain conducted research on the fate and behaviour of diluted bitumen in sea water (the Gainford Study). Trans Mountain said that this research complemented other laboratory and bench-scale tests on the fate and behavior of heavy crude oil made from Alberta oil sands. The research included a weathering test of diluted bitumen spilled in a marine environment over a 10 day period. The tests were tank tests intended to simulate wave and current conditions within Burrard Inlet, with water temperature averaging about 15°C. Two types of diluted bitumen likely shipped on the Trans Mountain system, Cold Lake Winter Blend (CLWB) and Access Western Winter Blend (AWWB), were tested.

45 Sunken oil is spilled oil which has negative buoyancy and will sink to the sea/riverbed. Submerged oil is spilled oil that has near-neutral buoyancy and has been submerged below the surface.

Trans Mountain said that the Gainford Study and other tests have shown that, like other crude oils, the density of the oil increases as the lighter components evaporate. The rate at which this occurs lessens as the density and viscosity of the oil increases. The relative density of the diluted bitumen observed in the Gainford Study reached that of fresh water in eight to ten days. Trans Mountain said that no evidence of sunken or submerged diluted bitumen was observed during the Gainford Study. There was little evidence of small droplets (natural dispersion) into the water column. Instead, the oil tended to form relatively continuous floating patches on the tank surface.

Trans Mountain said that weathering through evaporative loss alone is not expected to cause the diluted bitumens it tested to submerge or sink in marine conditions, even at 0°C water temperature, and that Government of Canada research also acknowledged this. Trans Mountain said that diluted bitumen could sink in fresh water at colder water temperatures but only after weathering for many days. The Gainford tests showed potential sinking of weathered diluted bitumen in freshwater after approximately eight days.

Trans Mountain concluded that the behaviour of both CLWB and AWWB proved to be no different from what might be expected of other conventional heavy crudes when exposed to similar conditions. It said that the potential for oil submergence or sinking is not unique to diluted bitumen and has been documented for a number of spills.

The Squamish Nation said that the Gainford Study and other research used unrealistically thick oil slicks which reduced evaporation rates. It said that had a more natural slick thickness been used, it is likely that weathering losses, and hence density increases and submergence and sinking would be substantially faster.

Trans Mountain said that diluted bitumens, like all oils, will spread if unconfined. It said that research indicates that weathered diluted bitumens exhibit strong tendencies to form a more continuous thick mat, rather than a thin sheen, on water.

Trans Mountain concluded that based on the Gainford Study and other research, regardless of the evaporation rates assumed, the weathered diluted bitumens tested remained floating at least for the duration of each of the study periods: 13 days and 5 days on freshwater flume studies and for 10 days on brackish water.

8.2.6 Spill response methods in the Gainford Study

Trans Mountain said that the Gainford Study assessed the effectiveness of mechanical skimming equipment, dispersants, beach cleaning agents, and in-situ burning on CLWB. Overall, Trans Mountain concluded that alternate oil spill response methods, such as the use of dispersants and in-situ burning, were not as effective as mechanical means. Trans Mountain said that all of the mechanical skimmers tested were effective in recovering product, whether fresh, emulsified, or naturally weathered, after a 10-day exposure to ambient element conditions. Trans Mountain said that weathered CLWB did ignite in in-situ burn tests for up to 24 hours. It said that the study showed that fresh to very weathered CLWB could be effectively removed from a hard substrate through a combination of shoreline cleaner (Corexit 9580) and low to moderate water pressure flushing. Trans Mountain said that these techniques may not be suited for all types of shorelines. However, they are generally appropriate for coarse-grained materials (gravel, cobbles, and boulders, including coarse sediment mixes).

Trans Mountain said that since diluted bitumen behaves similarly to other products due to the effects of weathering, emergency response procedures and cleanup techniques for diluted bitumen would be similar to other heavy crude oil products for which emergency responders have developed procedures and techniques to respond to accidental spills. Trans Mountain said that Western Canada Marine Response Corporation participated in the Gainford Study.

In addition to the findings in the Gainford Study, Trans Mountain summarized research conducted for the American Petroleum Institute. The study indicated that diluted bitumen products may not form emulsions that are as stable as emulsions formed by some heavy conventional oils. This could result in an improved window of opportunity to burn the diluted bitumen products in-situ when compared to conventional crude oils. Both heavy conventional crude oils and diluted bitumen products achieved high viscosities when weathered. These high viscosities would require that specialized heavy oil skimmers and oil handling systems be used in a spill response. These heavy oil response packages would be effective on both oil types but may be needed somewhat earlier in the response operation in the case of diluted bitumen spills.

Chemical dispersants are likely to be a viable option for both the heavy conventional and diluted bitumen crudes only when the oils are relatively fresh and have not weathered and increased in viscosity to the point where the dispersant no longer mixes well with the oil. The window of opportunity for dispersant use would be short for both of these oil types. Trans Mountain said that the American Petroleum Institute study corroborates many of the findings of earlier studies.

8.2.7 Government of Canada research on the behavior, fate and transport of diluted bitumen

Following Trans Mountain's Gainford Study, the Government of Canada completed a study on the behavior, fate, and transport of diluted bitumen. The research was conducted by ECCC, Fisheries and Oceans Canada, and Natural Resources Canada. The Government of Canada study and Trans Mountain's Gainford Study assessed the same oil types (Access Western Blend and CLWB). The Government of Canada study concluded that the question of whether diluted bitumen products spilled in the marine environment will float or sink depends on their exposure to a number of natural processes and the duration of exposure.

Trans Mountain compared the results of the Gainford Study and Government of Canada study and concluded that the Government of Canada results were generally supportive of the results in the Gainford Study. In particular, Trans Mountain said that both studies:

- showed that the weathered oils are expected to remain floating on saltwater;
- indicated that both oils would float on freshwater for a period of days;
- acknowledged that other contributing factors, such as sediment uptake, may lead to some portion of oil becoming neutrally or negatively buoyant;
- concluded that diluted bitumen oils display high viscosity and increased density relatively quickly during weathering, but otherwise behave similar to how heavy conventional crude oils and heavy refined products would behave if spilled on water;
- noted that water uptake within the oil matrix, mostly through entrainment, affects the density and viscosity; and
- documented physical properties and behaviours of the oils that make them amenable to onwater mechanical response countermeasures, such as booming and skimmers, but less amenable to dispersant use.

Trans Mountain said that the Government of Canada research indicated that fresh CLWB formed a stable emulsion with sufficient agitation. As compared to stable emulsions, mesostable emulsions generally break down substantially within one week. Trans Mountain said that more stable emulsions may be expected to break down more slowly. The degree and rate of breakdown could range from a week to more than a month and would depend on the degree of stable emulsion formation and other variables, such as ambient temperatures and exposure to air and sunlight.

ECCC said that the Government of Canada study was conducted at higher sediment concentrations than typically found in the Fraser River to demonstrate which sediment interactions with oil products were important. Further work would be needed to characterize the behavior of specific oils and to determine how important sediment interactions might be for a spill into the river or its outfall into the Salish Sea.

Elizabeth May and the Pacheedaht First Nation referred to other Government of Canada research which indicated that chemical composition differences in diluted bitumens could make one type of diluted bitumen more prone to submergence than another. The research indicated that tar balls of AWB could submerge in brackish water, and potentially sink in fresh water, after seven days of weathering in the absence of interaction with suspended particulates. The research also indicated that diluted bitumen products may sink in the open marine environment as a result of interaction with suspended sediment particles under a high energy environment.

ECCC said that where research topics overlapped, there was, in general, good agreement between Trans Mountain's research on the behavior and fate of diluted bitumen with the Government of Canada's recent research. ECCC said that there continues to be significant knowledge gaps and uncertainties for the behaviour of the hydrocarbon product classes tested in areas such as evaporation characteristics between different diluted bitumen types; emulsion behavior; shoreline adhesion; and oil/suspended sediment

interactions. ECCC said that additional research in these areas would further strengthen spill response planning and risk assessment.

NRCan said that it was developing and expanding its capabilities to do research specific to the behaviour of diluted bitumen in water environments, including wave tank testing, and that it had shared preliminary results within the research community. NRCan said that it would be collaborating with ECCC and Fisheries and Oceans Canada (DFO) on this research. Information is typically provided publicly at response community meetings and through peer-reviewed publications.

8.2.8 Chemical characteristics of diluted bitumen

ECCC recommended that Trans Mountain commit to providing spill responders and regulators a specific suite of test data for all types of hydrocarbon products to be shipped, before shipping, to facilitate appropriate spill response preparedness. Trans Mountain said that it would not commit to providing additional information at this time as it believed further testing of the major product types shipped on its pipeline system should be informed by the results of research conducted by the Royal Society, and the Pipeline and Hazardous Materials Safety Administration work referred to in section 8.4.

Trans Mountain also said that there is already an extensive database on oil composition and properties in the public domain, and that it also collects and maintains comprehensive data related to the physical and chemical characteristics of all oils transported on its system. Trans Mountain makes this information available to regulators and spill responders and trains its personnel in safely approaching a spill site. Trans Mountain said that it is able to identify the product in a storage tank and/or specific pipeline location quickly, and almost immediately provides a material safety data sheet, including the product name, to incoming first responders. As part of its ongoing public awareness program, Trans Mountain said that it also provides training to first responders that includes considerations for safest approach to a release.

The City of Vancouver said that spilled diluted bitumen loses its volatile components more quickly than normal crude oils. This can create greater inhalation and safety hazards. The City of Vancouver said that concentrations of polycyclic aromatic hydrocarbons in diluted bitumen, the most toxic components of petroleum, are comparable to typical concentrations in crude oils. Spilled diluted bitumen retains polycyclic aromatic hydrocarbons longer than conventional crude oils, and are degraded mainly through slow biodegradation and photo-oxidation. Monoaromatic hydrocarbons evaporate within the first hours to days of a spill. The City of Vancouver, the District of North Vancouver, and NS NOPE said that evaporation of diluents, including benzene, from a bitumen spill is a health and safety risk to spill responders.

The Musqueam Indian Band said that the evaporation of the lighter fraction diluent in diluted bitumen is an important weathering process. It said that approximately 50-70 per cent of volatile hydrocarbons are evaporated from heavy oil within 10 to 20 hours after a spill. It referred to research indicating that this process has been shown to take place relatively quickly, over a period of several hours to a few days. A study of diluted bitumen weathering showed that most of the volatile diluent evaporated within 24 to 48 hours. It said that recent Government of Canada research indicates that, in general, the fate and behaviour of spilled diluted bitumen is similar to that of lighter fuel oils soon after a spill, with behavior changing to that of heavier fuel oils as weathering progresses.

The Squamish First Nation said that the chemical composition and physical properties of bitumen are key to understanding their behavior and environmental fate. It said that, compared to conventional crude oil, diluted bitumen has a greater proportion of light and heavy end molecules and less middle weight molecules. This may cause the lighter components to evaporate more quickly and leave a thicker, more viscous product behind when spilled in water. Diluted bitumen has a higher asphaltene content which may make it more likely to emulsify.

Trans Mountain noted that several intervenors questioned the relative toxicity of diluted bitumen to other crude oils. Trans Mountain said that in general, polycyclic aromatic hydrocarbons content is low in diluted bitumens compared to many other crude oils and that multiple chemical analyses indicate that diluted bitumens should not be considered more toxic than other crude oils. Trans Mountain said that the human health risk from inhalation of light-end hydrocarbons is not unique to diluted bitumen.

8.2.9 Past spill events

Enbridge Kalamazoo Spill

Trans Mountain referred to Enbridge Pipelines' July 2010 spill of approximately 3 200 m^3 of diluted bitumen near Marshall Michigan. Approximately 1 300 m^3 of diluted bitumen spilled into the Kalamazoo River system. Trans Mountain said that upon entering the water, the density of the crude oil was slightly less than that of water, and therefore it floated, forming an oil slick that flowed downstream where some became stranded along the banks and in calmer or backwater areas. High river flows entrained some of the oil into the water column (resulting in submerged oil) and transported it downstream. Dam spillways may have resulted in the formation of emulsions. Weathering of the lighter components and interaction of the submerged oil with suspended sediments resulted in its sinking in the water column, and the sedimentation of some crude oil on the river bottom in quiescent or net-depositional areas of the riverbed once flows decreased. Trans Mountain said that the spilled oil may also have picked up sediment through overland movement prior to entering a watercourse which may also have contributed to a portion of the submerged/sunken oil, as did sediment interaction as a result of cleanup techniques. Trans Mountain said that there is a great deal of uncertainty in the amount of oil that was subsequently not recovered and left on the river bed.

The Shxw'ōwhámel First Nation noted the uncertainty in estimates of how much oil sunk during the Kalamazoo spill. The Squamish Nation said that the U.S. EPA had estimated that 10–20 per cent of the spilled oil sank to the river bottom through turbulent mixing with suspended sediment.

Trans Mountain's Burnaby Spill

Trans Mountain said that some of the diluted synthetic bitumen product from the 2007 Westridge delivery line spill in Burnaby reached the surface waters of Burrard Inlet, where it was collected and cleaned from shorelines. Trans Mountain said that, based on the rapid response, the oil was readily recoverable using conventional spill recovery equipment, including booms and skimmers, with oil recovery estimated to be greater than 90 per cent. No submerged or sunken oil was noted during that incident.

The Squamish Nation said that favorable weather conditions probably accounted for the higher than average oil recovery rate.

Nestucca Barge Spill

Trans Mountain said that a spill of Bunker C heavy marine fuel oil from the Nestucca barge off Grays Harbor, Washington in 1988 resulted in some of the oil being entrained and submerged in the water column. Trans Mountain said that the high energy wave environment was most likely responsible for the submergence. Some of this oil washed up on the coast of Vancouver Island approximately two weeks later. Trans Mountain said that the density of the oil spilled was about 985 kg/m^3.

Lee Harding also referred to the submergence of oil following the Nestucca spill and subsequent washing up of the oil on Vancouver Island.

Living Oceans Society discussed the Nestucca spill and said that the physical properties and chemical composition of bitumen mined from the Alberta oil sands are closely comparable with those of Bunker C oils. Living Oceans Society said that compared with Bunker C oil, the relatively low viscosity of the diluted bitumen would allow it to spread much more quickly to form a thin slick. Once most of the diluent evaporated, the remaining bitumen may become susceptible to submergence or sinking, and more generally its behaviour in the environment would become very similar to that of Bunker C oil.

Other Spills

Trans Mountain provided an overview of other spills in similar environments. It said that studies associated with these spills provide a basis for evaluating the fate, transport and effects of hypothetical pipeline spills of diluted bitumen resulting from the Project. The case studies examined occurred in a freshwater environment, and were located in a cold temperate zone or subarctic location. Trans Mountain said that the spilled oil had physical and chemical properties similar to the diluted bitumen assessed in the ecological risk assessment which formed part of its application. Based on this review and its own research, Trans Mountain concluded that there is some potential for diluted bitumen products to sink in fresh water under some conditions (e.g., interactions between oil and suspended and bed sediments). It said that this

could occur for any crude oil. Trans Mountain concluded that the primary fate of spilled diluted bitumen is expected to include weathering (including evaporative loss and dissolution into water) and shoreline stranding, with sinking expected to remain a minor loss pathway.

8.3 Modelling the potential fate and behaviour of diluted bitumen spills

8.3.1 Potential fate and behaviour of a diluted bitumen spill in a freshwater environment

To understand the fate and behaviour of spilled oil, Trans Mountain selected representative spill scenarios in fresh water bodies along the pipeline route and analyzed them for potential effects. The receiving environments included the Athabasca River, North Thompson River, and the Fraser River. A credible worst-case spill volume, ranging from 1 250 to 2 700 m^3, was modeled at each location as part of Trans Mountain's spill outflow modelling and spill extent mapping for a full-bore rupture scenario. Winter, summer, and spring and fall conditions were assessed. Predicted oil fate varied with the conditions assessed. Most of the oil transported downstream, either on the water or entrained in the water, was generally predicted to eventually strand along the shorelines. In some cases, shoreline oiling was predicted to be quite high. Formation of oil mineral aggregates was predicted to be limited in all of the scenarios assessed, although weathered oil attached to sediment or other particles was predicted to submerge or settle in lower energy areas in some cases. In winter conditions, oil could be trapped under the ice.

Trans Mountain said that the conditions of sufficient suspended sediment concentration and turbulence energy level that would result in the formation of oil mineral aggregates and subsequent sinking are rarely encountered along the lower Fraser River. Trans Mountain said that the Kalamazoo River, the site of the Enbridge Marshall, Michigan spill, has much higher turbidity levels and a more turbulent flow regime. Trans Mountain said that, in the Fraser River, oil that might be deposited to sediment would not find a low flow area where it could be trapped, as it did in the Kalamazoo River. It said that the oil would continue to be dispersed and moved down-river by natural process in the river bed. These processes would tend to break the oil up and further admix it with sand and silt particles, which would also help to facilitate biodegradation of the oil.

As part of its stochastic modelling of spills in the marine environment, discussed below, Trans Mountain also conducted spill modelling for one freshwater location, downstream of the Port Mann Bridge. This location was determined to be representative of a hypothetical incident resulting from an on-land pipe failure. The simulated spill size was 1 250 m^3.

Modelling results for this spill showed that the average length of shoreline affected by the spill ranged from a minimum of 25 km during spring, to a maximum of 36 km during winter. The majority of the oil (74 per cent) became trapped on shore. Trans Mountain said that the amount of oil bound up in oil-mineral aggregates was negligible, even though the potential to form oil mineral aggregates was greater in the Fraser River than in any other sites of study. However, Trans Mountain said that the required energy level to mix the oil and form the oil mineral aggregates was not present in the river. The amount of submerged oil was greater than at the other sites because of the lighter surface water density in the Fraser River.

Trans Mountain said that the differences observed within seasons reflected the strong dependence of the oil on flow conditions in the Fraser River. During the spring and summer when the freshet was at its maximum, the oil was carried out onto the Strait of Georgia and impacts were noted at shorelines along the Gulf Islands and into Boundary Bay. In fall and winter, the oil generally remained within the river, at least for the three-day modelling period.

The Shxw'ōwhámel First Nation conducted oil fates modelling that indicated that, within 48 hours, the density of Cold Lake Blend would reach 0.99 g/cm^3 meaning that it could potentially submerge in fresh water. The modelling showed almost no dispersion of the oil.

The Musqueam Indian Band said that overall, the literature comparing condensate-diluted bitumen to other oil types strongly suggests that, when diluted bitumen is released to surface water, it has the potential to behave as conventional oil, floating on water and becoming emulsified. Over a matter of a few hours weathering would cause spilled diluted bitumen to lose the condensate diluent by evaporation becoming non-buoyant and potentially sinking. Based on current evidence, the presence of suspended sediment with sizes of fine- to coarse-sized sand may render oil non buoyant and cause it to sink. The Musqueam Indian Band said that there remains much uncertainty regarding the buoyancy of diluted bitumen spills in water,

particularly in brackish estuaries, such as the mouth of the Fraser River. The Musqueam Indian Band said that, in summary, current research on the fate of diluted bitumen indicates, that if released into the Fraser River, it could potentially remain buoyant persisting on the surface, become stranded on shore, and/or sink to the bottom sediments as it weathers and is transported downstream.

8.3.2 Potential fate and behaviour of a diluted bitumen spill in a marine environment

Trans Mountain conducted stochastic (or probabilistic) computer modelling at five locations to simulate the weathering of spilled diluted bitumen in a marine environment (Figure 16).

The locations modeled include:

- Westridge Marine Terminal (Location A);
- Strait of Georgia (Location D);
- Arachne Reef (Location E);
- Juan de Fuca Strait (south of Race Rocks) (Location G); and
- Buoy J (Location H).

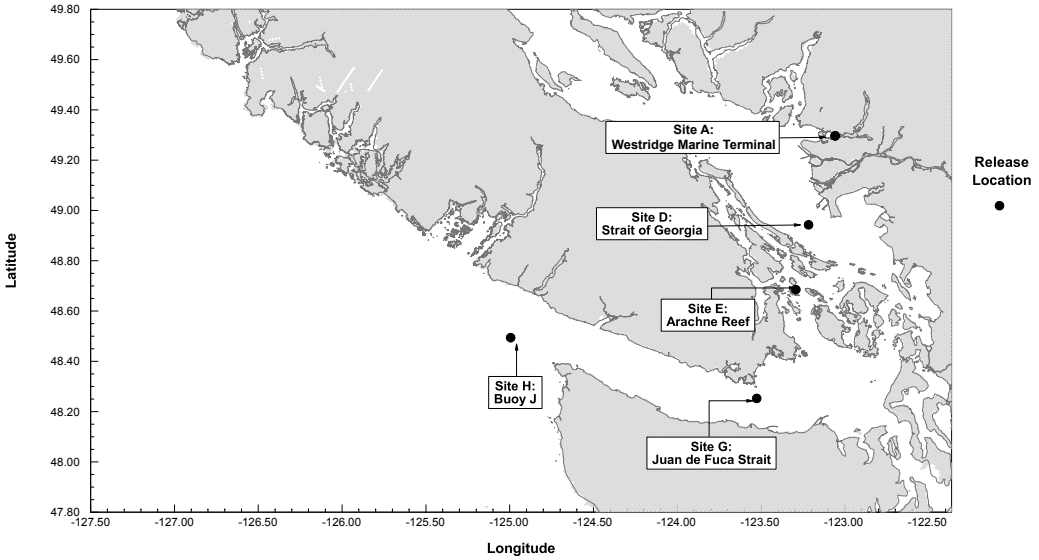
As discussed in Chapter 14, section 14.4.2, three locations along the shipping route were not modeled as the marine shipping quantitative risk analysis indicated that an incident in these areas would not likely result in an oil spill.

The modelling was conducted for two spill sizes: a large or credible worst-case scenario (16 500 m^3 for the marine sites and 160 m^3 for the Westridge site), and a medium spill case scenario (8 250 m^3 for the marine sites and 10 m^3 for the Westridge site).

Trans Mountain said that basic weathering information, such as that gained through its Gainford Study, can be used in modelling to forecast what may be expected to happen with oils under a much wider range of assumed conditions. It said that the Gainford tests were conducted to reflect average conditions of Burrard Inlet. Trans Mountain said that its research on oil fate and behaviour, and associated stochastic spill modelling were then used to inform spill response planning.

Trans Mountain said that it selected CLWB, which is diluted with condensate, as a representative product for modelling hypothetical spill scenarios since its properties are comparable to other diluted bitumen products transported on the Trans Mountain system. Trans Mountain said that the potential for light-end hydrocarbons contained in the CLWB to volatilize, dissolve or be biodegraded in the hours and days following an oil spill leads to a greater potential for the weathering oil to achieve a density that could sink, either through interaction with suspended sediment particles, or directly, if the density of the weathered oil were to exceed the density of the ambient water.

Figure 16: Map of spill locations for the stochastic simulations



Trans Mountain said that stochastic modelling generates a probability map for oil exposure for the study area. A different map is generated for each combination of spill volume, location, and season. The stochastic modelling captured the effects of tides, winds, estuarine flow and influence from the open Pacific Ocean. Trans Mountain said that the resulting probability maps do not provide information on a specific spill, but indicate the area that is at risk. It said that an actual spill would only affect a small part of this area, but all parts are at risk. Trans Mountain said that the modelling was conducted over four seasons and showed potential areas contacted by a spill, the length of oiled shoreline, and the mass balance of the oil. (Mass balance refers to the volume of oil: on water; evaporated; retained on shorelines; dissolved; dispersed; bio-degraded; and lost through oil-mineral aggregation.)

Trans Mountain said that stochastic modelling is widely used to develop an understanding of the likely behaviour of an oil slick in the event of a spill. It said that an accidental oil spill from a Project-related tanker in transit would, depending on local currents, be driven by winds, tides and estuarine circulation, and spread and move away from the spill site. Trans Mountain said that the waters between Vancouver Island and the mainland and the interconnecting channels are influenced by tides and freshwater from the Fraser River, as well as other rivers draining into these waters. Surface winds are generally south-easterly in the winter, and north-westerly in the summer. However, weather and wind patterns can change daily.

Trans Mountain said that it chose the areas for spill modelling based on areas with the highest probability of a spill and areas that represented the range of variability in oceanographic and meteorological conditions. To provide more conservative results, the scenarios modeled assumed no spill response measures.

Trans Mountain said that the modelling illustrates the importance of developing mitigation strategies that are operational within a very few hours of the start of the incident. It said that the length of shoreline oiled is relevant for determining potential ecological damage, and for estimating shoreline cleanup resources that would be required in the event of a spill.

Trans Mountain said that the mass balance of the spilled oil provides a good summary of a particular spill or, when averaged across all spills, a good understanding of spill behaviour for a spill that would occur in a particular season. It said that the amount of oil bound up in oil-mineral aggregations was negligible for all sites modeled, including the Strait of Georgia site which would be influenced by the Fraser River Plume. For all locations modeled, the majority of the oil was predicted to strand on shore. The length of shoreline oiled depended on location and conditions modeled and ranged from approximately 30 km to 450 km. Trans Mountain said that where stranding of oil on shore was predicted, it was likely to occur relatively shortly after an oil spill.

Trans Mountain said that its stochastic modelling considered the possibility of oil submerging at depth or sinking, and that the amount of oil predicted to sink or submerge in marine waters was essentially zero.

Specific to modelling conducted at Buoy J, Trans Mountain said that depending on the season, between 7 per cent (winter) and 31 per cent (summer) of the spilled oil was left on water after 15 days. The fate of the oil left on water after 15 days would be determined by the prevailing wind and surface current conditions over the course of the spill. Oil remaining on the water after 15 days would either move onto shore or, under the effect of the prevailing currents and winds, continue offshore to be ultimately dispersed in the Pacific Ocean.

The City of Vancouver expressed concern that oil submergence in the high-sediment plume of the Fraser River discharge during spring and summer would be hastened if inorganic suspended particulate material entrained in the water column adheres to the oil, increasing the density of the aggregate formed.

The Islands Trust Council said that it attended a Western Canada Marine Response Corporation (WCMRC) oil spill exercise in which the oil spill simulation software indicated that more than 30 km of Islands Trust Area shoreline would be oiled within 24 hours. Once oil is stranded on shores, the Islands Trust Council expected a lower than average recovery rate because the Salish Sea's sheltered waters are not as effective at naturally washing and flushing shorelines compared with more exposed ocean environments.

Living Oceans Society said that a 16 000 m^3 diluted bitumen spill would likely cause heavy shoreline oiling on tens of kilometres of beaches, and less severe but still substantial oiling on hundreds of kilometres, with numerous resultant environmental effects. It said that the extent of shoreline oiling associated with the Arrow 10 000 m^3 bunker C spill off the coast of Nova Scotia was broadly consistent with the modelling results presented in the Trans Mountain application, suggesting that the modelling results are generally

reasonable as estimates of the extent of likely oiled shoreline. Lingering sediment contamination could occur on a decadal time scale. Living Oceans Society said that more persistent oiling would likely result from a spill of diluted bitumen because the initial viscosity of the diluted bitumen would be much lower than the Bunker C oil released during the Arrow spill, so diluted bitumen would more readily penetrate into porous shorelines.

The City of Vancouver said that the effects, persistence, and fate of oil impinging on shorelines would depend strongly on the shoreline morphology and the environmental conditions at the time of oil stranding. Oil is least persistent on bedrock outcrops and rocky headlands because these provide relatively little surface area for adhesion and are often exposed to more energetic wave conditions that promote oil removal. Oil stranded on rocky armoured beaches may be quite persistent if it penetrates beneath the armour layer and becomes trapped in finer-grained underlying sediments. Penetration of oil stranded on the surface of sandy beaches is limited by low hydraulic permeability. Similarly, penetration of oil stranded on mudflats would likely be limited. Oil stranded on or along marine marshes or intertidal eelgrass beds may persist for years to decades if the oil associates with decaying vegetative material that may impede biodegradation of the oil.

The Pender Islands Conservancy Association said that the Pender Islands have predominantly fractured rock and gravel beaches which would be exceedingly difficult to clean in the event of a diluted bitumen spill.

The Pacheedaht First Nation said that approximately 40 per cent of the shoreline within its traditional territory would be classified as having a long oil residency index.

The Tsleil-Waututh Nation, City of Vancouver and the City of Burnaby conducted modelling of an oil spill in Burrard Inlet using an alternative model. Oil spill trajectories from four oil spill scenarios in Burrard Inlet were modeled with spill volumes ranging from 8 000 m^3 at the WMT to 16 000 m^3 for a tanker spill at two locations in Burrard Inlet and one location at English Bay. This modelling demonstrated that in the event of a spill of the size modeled, oil would spread quickly throughout Burrard Inlet and beyond.

The Tsleil-Waututh Nation, City of Vancouver and the City of Burnaby said that the model results documented that the vast majority of spilled oil would strand on the shoreline within 24-48 hours. They said that the model described the spread and movement of generic, non-specific floating oil and that neither the oil's physical or chemical properties, nor weathering were assessed, as consideration of these factors is not required to understand the trajectory of spilled oil on the water surface.

As discussed in Chapter 14, section 14.4.2, Trans Mountain said that the spill volumes modeled by the Tsleil-Waututh Nation, City of Vancouver, and the City of Burnaby were not credible scenarios. Trans Mountain said that the modelling method used by those participants was appropriate for providing basic information for spill response but it was not appropriate for a detailed and comprehensive environmental and socio-economic study. Trans Mountain said that the modelling undertaken was based on an unmitigated spill scenario and that in such a scenario, it would be expected that a spill would impact a large percentage of shoreline given the confined geophysical environment of the subject area.

ECCC said that the modelling tools used by Trans Mountain appear to be appropriate. ECCC recommended that additional model verification and validation be undertaken and that a wider range of environmental inputs be built into the models.

Trans Mountain said that WCMRC, as the certified Response Organization on the west coast, maintains resources for spill response including models for planning and response. Trans Mountain said that the model used in support of its Application was not developed specifically for the Application, and the model is the property of a private consultant. It said that this consultant had indicated that they were willing to work collaboratively with WCMRC to make the model available under license, to provide consultancy services related to the model, and if desired, to improve the model's ease of use for active spill response. Trans Mountain said that WCMRC would be responsible for ongoing maintenance and updating of the model and the associated funding should they choose to use it as a response resource.

8.4 Additional research on the fate and behaviour of diluted bitumen

Trans Mountain discussed areas for additional research on the fate and behavior of diluted bitumen. It said that a number of references broadly agree that the fate and weathering of diluted bitumen in a marine environment is contingent on multiple factors, and that more research/experimentation is necessary to fully understand the behaviour of spilled diluted bitumen under a wide range of circumstances and conditions.

Trans Mountain said that the Joint Review Panel for the Enbridge Northern Gateway Project recommended additional research on diluted bitumen to be completed under the guidance of a Scientific Advisory Committee. Trans Mountain said that it has agreed to participate in and support the Scientific Advisory Committee process recommended by the Joint Review Panel and that it was working with the Canadian Energy Pipeline Association (CEPA) and the Canadian Association of Petroleum Producers (CAPP) to create broad industry support in this effort. Trans Mountain said that a framework for development of the Scientific Advisory Committee and its objectives had been established and formation of a management team was expected to be completed in the third quarter of 2014. This team would consist of representatives from Trans Mountain, industry, and government agencies. The management team would lead the prioritization and refinement of research elements to be conducted in 2015. Trans Mountain said that, as part of such a joint effort, it was willing to provide funding and contributions in-kind, or both, for research to advance oil fate and behaviour knowledge applicable to detailed emergency preparedness and response planning.

Trans Mountain discussed research on the fate and behavior of diluted bitumen in aquatic environments being undertaken by the Royal Society of Canada and the United States Pipeline and Hazardous Materials Safety Administration[46]. Trans Mountain said that the Royal Society of Canada work was being undertaken in response to a request from CEPA and CAPP, and that Trans Mountain, as a CEPA member company, has agreed to support the work of the expert panel through CEPA. Trans Mountain said that a purpose of the Pipeline and Hazardous Materials Safety Administration work was to analyze whether the properties of diluted bitumen differ sufficiently from those of other crude oils commonly transported in U.S. transmission pipelines to warrant modifications of the regulations governing spill response plans, spill preparedness, or clean up.

Research topics in the above two noted studies include:

- crude oil behaviour in different water types under a range of environmental conditions;
- crude oil chemical composition and toxicity to organisms in aquatic ecosystems;
- microbial processes on crude oils in aquatic ecosystems;
- remediation of crude oils in water and sediments;
- priorities for additional research; and
- optimal strategies for spill preparedness, spill response and environmental remediation.

The Canadian Coast Guard said that, as part of the package of World Class Tanker Safety System initiatives, the federal government is examining the characteristics and behaviour of how various blends of oil react in the marine environment. Scientists from DFO, ECCC and NRCan are conducting this research on how it may affect the sensitivities of the environment, including marine habitats and the fisheries resources they support. The Canadian Coast Guard said that this scientific information would inform the Canadian Coast Guard's knowledge of petroleum products and how they interact in the marine environment, and how to determine the best strategies for response. The findings would also be relevant to the response planning for the terrestrial portion of the Project.

The Squamish Nation said that the most significant knowledge gaps related to diluted bitumen fate and behaviour are poorly understood weathering rates and processes in a wide range of environmental conditions and different behaviours between different diluted bitumen blends.

Trans Mountain said that, although additional research would continue to provide details of specific properties and behaviour under controlled test conditions, the existing information on diluted bitumen and intermediate to lighter heavy fuel oils allows modelling of their fate and behaviour for purposes of the application and spill response planning.

46 In response to a request to file late evidence, the Board decided in Ruling 105 that the research conducted for the United States Pipeline and Hazardous Materials Safety Administration would not form part of the Board's evidentiary record for the Project, and gave reasons for its decision. As a result, the Board did not consider this research in its deliberations.

Views of the Board

The Board is satisfied that sufficient evidence has been placed on the record regarding the fate and behavior of an oil spill to support assessment of potential spill-related effects and spill response planning. The Board's views focus on the fate and behavior of oil, primarily diluted bitumen, spilled in aquatic environments. The Board's views on clean up and remediation of spills to land are included in Chapter 9.

Trans Mountain provided evidence, including its Gainford Study, modelling, and a review of other research and past spills, that indicates diluted bitumen acts initially as a Group III oil but quite quickly weathers to a heavier Group IV oil state. This evidence indicates that after initial weathering, diluted bitumen behaves similar to other heavy crude oils and common heavy fuel oils, such as Bunker C. Environment and Climate Change Canada (ECCC) said that, in general, there was good agreement between its research and Trans Mountain's Gainford Study, although ECCC also identified knowledge gaps and uncertainties regarding the fate and behavior of diluted bitumen. The Board notes ECCC said that the modelling tools used by Trans Mountain were appropriate.

The Board's views must be considered in the context that the fate and behavior of any spilled oil ultimately depends on the specific physical and chemical properties of the spilled oil and environmental conditions at the time of the spill event. These conditions, in turn, affect the chemical and physical properties of the spilled oil and subsequent weathering processes and environmental effects, as noted by Trans Mountain, ECCC, and the City of Vancouver.

Trans Mountain provided evidence that diluted bitumen is not a simple two phase product in which the diluent portion evaporates when spilled, leaving the bitumen portion behind. Rather, diluted bitumen is a blended product with its own unique weathering properties. Trans Mountain's research, and that of the Government of Canada, and evidence filed by the Musquem Indian Band indicate that these properties include rapid initial weathering and potential to form emulsions in water.

The Board differentiated between the sinking of oil to the bottom of the sea or watercourse, and the submergence of oil to below the water surface.

Evidence filed by parties, such as Trans Mountain and the Government of Canada, and past spill examples indicated that diluted bitumen would not typically sink in large quantities, or as a continuous mat in both freshwater and marine environments. Included in this evidence were the results of research conducted by Trans Mountain, the Government of Canada, and Alberta Innovates. Trans Mountain also referred to the findings of the Joint Review Panel for the Enbridge Northern Gateway Project with regard to the potential for diluted bitumen to sink in an aquatic environment.

The weight of the evidence indicates that any sinking would likely be in limited quantities and only after sufficient weathering over a period of days or interaction with sediment and other organic matter under the right environmental conditions. Elizabeth May and the Pacheedaht First Nation referred to Government of Canada research indicating that some diluted bitumen products could submerge in brackish water or potentially sink in fresh water after approximately seven days of weathering in the absence of interaction with suspended particulates.

The Board is of the view that depending on weathering state and environmental conditions, spilled diluted bitumen could be prone to submergence in an aquatic environment. A number of parties filed evidence confirming this view. This potential for submergence must be considered in response planning.

Evidence filed by parties such as Trans Mountain, Islands Trust Council, Living Oceans Society, Tsleil-Waututh Nation, City of Vancouver and the City of Burnaby indicates that, if it is not recovered off the water surface, the majority of spilled diluted bitumen could strand on shore, in both a freshwater and marine environment. The extent of shoreline stranding and residency on the shoreline would depend on environmental and shoreline conditions. In a marine spill, the product could also be dispersed out to the open ocean, depending on circumstances. The Board accepts that shoreline stranding would necessitate shoreline cleanup activities which could be challenging due to the persistent nature and viscosity of weathered-diluted bitumen.

Specific to the modelling conducted by the Tsleil-Waututh Nation, City of Vancouver and the City of Burnaby, the Board accepts the parties' position that oil could strand on shore within Burrard Inlet and area. The Board's views on the spill sizes modeled by the parties are included in Chapter 14.

Based on evidence provided by the Squamish Nation, Natural Resources Canada, the City of Vancouver and Trans Mountain, the Board is of the view that heavier hydrocarbon compounds, such as diluted bitumen, that are not recovered during spill response, are likely to be persistent in the environment and resistant to additional biodegradation. Over time, degradation would likely occur but the rate and amount of such degradation would depend on specific circumstances associated with the spill.

The Board's views on spill response are primarily discussed in Chapters 9 and 14.

The fate and behavior of spilled products must be considered during response planning, and the response to Group IV products requires appropriate cleanup strategies and equipment. Evidence filed by Trans Mountain, Living Oceans Society, and Shxw'ōwhámel First Nation indicates that such equipment and strategies are available. Nonetheless, the Board is of the view that weathered diluted bitumen could pose particular challenges in response and clean up due to its potential for submergence and emulsion formation, persistent chemical and physical properties, and potential for shoreline stranding. These characteristics also lessen the potential for use of counter measures, such as dispersants and in-situ burning. Environmental conditions and spill-specific factors would influence the use of such response tactics. The Board is of the view that these response challenges are not unique to diluted bitumen spills, but can be associated with heavier oil products in general.

The Board heard concerns from many participants regarding the toxicity of diluted bitumen and the fact that it contains carcinogenic compounds, such as benzene. Evidence filed by Trans Mountain, including research conducted by Government of Canada and the National Research Council, indicates that although it may be more persistent in the environment, the actual toxicity of diluted bitumen is comparable to, or lower than other crude oils.

Parties such as Trans Mountain and ECCC noted the need for additional research on the fate and behavior of spilled oils. The Board acknowledges that there is ongoing research on the fate and behavior of spilled oils, including diluted bitumen products. This research is being conducted by the Royal Society of Canada, the United States Pipeline and Hazardous Materials and Safety Administration, and the Government of Canada. The Board is of the view that the results of this research should continue to inform the potential fate and behavior of spilled oils and assist companies and spill response agencies in spill response planning.

Several parties filed evidence indicating that bitumen is quite volatile during the initial stages of a spill. The Board accepts that this volatility must be considered from an oil behavior, and public and responder safety perspective. Trans Mountain has committed to provide, to regulators and first responders, timely information on the physical and chemical characteristics of any product spilled, and that it trains its personnel and other first responders in safely responding to a spill. In light of this information, the Board does not see the need for ECCC's recommendation that Trans Mountain commit to providing spill responders and regulators, before shipping, a specific suite of test data for all types of hydrocarbon products to be shipped to facilitate appropriate spill response preparedness.

ECCC recommended that additional model verification and validation be undertaken for Trans Mountain's marine spill model. The evidence shows that the model is the property of a private consultant which has offered to work collaboratively with Western Canada Marine Response Corporation to further development of the model. The Board is of the view that it is within the purview of Western Canada Marine Response Corporation (authorized under the Canada Shipping Act) to pursue this further, should it see value in the model as an additional response tool

The Board's views on how the fate and behavior of spilled oil could affect spill response in areas such as response times and resources required, and environmental and socio economic resources are included in Chapters 9, 10, 11 and 14.





9.0





Emergency prevention, preparedness and response

9.1 Overview

As part of its public interest mandate and under its approach to lifecycle regulation, the National Energy Board (Board) requires regulated companies to demonstrate that they are able to safely build and operate their facilities in a manner that protects people and the environment. In the hearing, participants expressed concern about the potential for spills from pipelines, including the Edmonton, Burnaby and Westridge Marine Terminals and tankers associated with the Project. This chapter examines Trans Mountain's ability to anticipate, prevent, and respond to project accidents and malfunctions. The risk of a spill associated with Project-related marine shipping is discussed in Chapter 14. The environmental and socio-economic effects of spills from the Project are discussed in Chapters 10 and 11 respectively.

The *Onshore Pipeline Regulations* (OPR) require companies regulated by the Board to use management systems to achieve safety, environmental protection, and other regulatory requirements. Management systems must be in place for the key program areas contained in the OPR, including:

- Integrity;
- Safety;
- Security;
- Environmental Protection; and
- Emergency Management.

A pipeline company is required to have a systematic, comprehensive, and proactive risk management approach integrated into its overall management system throughout the lifespan of a pipeline system. This includes design, construction, operation, maintenance, and abandonment. The OPR also reflect the Board's expectation for continual improvement with regard to safety, security, environmental protection, and the promotion of a safety culture.

A company would be audited and evaluated against the legal requirements identified in the NEB Act and its associated regulations, other relevant legislation and regulations, and any commitments made by a company or conditions contained within the applicable project certificates or orders.

With respect to emergency management, a company must develop and implement an Emergency Management Program (EMP) for all aspects of its facilities, including pipelines, loading facilities, tank farms and operational activities. A company's EMP should include the following elements:

- EMP development (hazard assessment), which ensures that all persons and parties that may be involved in responding to an emergency are knowledgeable of company facilities, the hazardous products involved, and emergency procedures to be followed in the event of an incident or emergency;
- Emergency Procedures Manual, which is regularly reviewed and updated, with the current version filed with the Board;
- Liaison Program with first responders, which establishes and maintains liaison with all parties that may be involved in an emergency situation;
- Continuing Education Program for all appropriate agencies, organizations and the public adjacent to its pipeline, to inform them of the location of the facilities, potential emergency situations, and emergency procedures to be followed;
- Emergency response training;
- Emergency response exercises;
- Incident and response evaluation; and
- Emergency response equipment.

The EMP must include procedures for receiving and disseminating information to first responders, adjacent commercial, industrial, or pipeline operations, product receivers, and members of the public who may be involved in responding to an emergency, or who may be impacted by an actual or threatened act of terrorism or other criminal activity.

Trans Mountain said that it would employ prevention and mitigation measures, such as engineering designs that eliminate or minimize integrity threats, construction and quality assurance practices that will ensure the integrity of the pipeline and facilities through to commissioning, and ongoing Integrity Management Programs (IMPs), that will be applied once the pipeline and facilities are operational.

9.2 Spill prevention

Trans Mountain said that it considers the prevention of spills to be its primary goal and will employ the necessary management systems and resources to ensure that this goal is achieved on the Project.

In response to the City of Vancouver's questions about Trans Mountain's overall systems analysis to spill prevention and whether the analysis considered, and will continue to consider, legislation, government oversight, local government capacity, local community capacity, and private businesses, Trans Mountain said that its risk-based approach for the pipeline and terminals was focused on the identification of potential risks and the development of site specific and general mitigation measures addressing those risks to prevent failures and reduce the likelihood of oil spills from occurring. Trans Mountain said that local government capacity and local community capacity were considered when assessing construction methods and would be further considered as operating practices are developed. Trans Mountain said that, as an example of this, based upon feedback from local government and local communities, it proposed that the pipelines from the Burnaby Terminal to the Westridge Marine Terminal (WMT) be rerouted using a trenchless construction method that would ensure that these pipelines were not routed directly through the local community. In addition, Trans Mountain said, subject to other considerations, it may be possible in the future to reroute the existing pipeline.

9.2.1 Pipeline spill prevention

This section discusses additional measures pertaining to prevention of pipeline spills or minimizing their potential environmental effects through other spill prevention and mitigation measures. An assessment of Trans Mountain's risk-based approach to design, the likelihood of a spill from the Project and other mitigation intended to prevent spills is discussed in Chapter 6.

Trans Mountain said that spill prevention and mitigation measures are embedded throughout the full project lifecycle and start with the risk assessment of engineering designs at the earliest stages of the project. Formalized risk assessments are conducted to allow for early identification of all applicable hazards

and suitable control measures in addition to code-based design. Trans Mountain has a pipeline integrity management program that will help ensure long-term spill prevention and implement the appropriate mitigation when needed.

Trans Mountain said that the semi-quantitative risk assessment and the company's 60-year operating history demonstrate that the probability of a large pipeline spill is low.

In response to numerous intervenor requests for details respecting Trans Mountain's spill experience in relation to its assessment of risk, Trans Mountain provided a list of spills that have occurred since 1961. Trans Mountain said that from 1961 to the end of 2013, it had reported approximately 81 spills to the NEB, including a number of incidents which were below the reportable threshold. Trans Mountain said that approximately 70 per cent of the releases were contained on Kinder Morgan Canada Inc. (KMC) property and resulted in no residual environmental effects after clean up and remediation.

Trans Mountain also said that since the in-service date in 2008, there have been no reportable spill incidents on the Anchor Loop section in Jasper National Park or Mount Robson Provincial Park. Trans Mountain said that it investigates all hydrocarbon release incidents on the Trans Mountain Pipeline system. For the seven incidents that have occurred since 2005, the investigation reports included recommendations to prevent future incidents or improve the Company's incident response. For example, a review of the Burrard Inlet release in 2007, where a City of Burnaby contractor struck the Westridge Delivery Line, resulted in the implementation of a Pipeline Protection Department. The Pipeline Protection Department has the sole responsibility to protect the pipeline and associated facilities through pipeline and associated facilities markings, issuance of permits for safe work around pipeline and associated facilities, as well as responding to B.C. and Alberta One Calls.

In response to additional questions from the City of Burnaby and the Strata NW313 on whether Trans Mountain had incorporated learnings from the 2007 Westridge Delivery Line spill into its EMP document procedures, Trans Mountain said that it has made significant changes to its pipeline protection standards and procedures for approval of third-party ground disturbance work near the pipeline. Among the many changes was a requirement that a Trans Mountain inspector must be on site during any mechanical excavation or other ground disturbance within 7.5 m of the pipeline to ensure compliance with the terms of the approval. Trans Mountain said that it continues to facilitate public awareness and monitors ground disturbance activity within close proximity to the pipeline or right-of-way.

Trans Mountain said that the Sumas Tank Farm release in 2012, where a broken pipe on the roof drainage system was contained on company property, resulted in a learning. It showed that there was the need to develop a community air monitoring program which would address concerns the public had related to emissions and identify when evacuation of local residents would be necessary.

The Province of British Columbia and Matsqui First Nation raised concerns about Trans Mountain's spill prevention measures and response strategies for high consequence areas. Trans Mountain said that its target release volumes were established along the entire right-of-way, including at high consequences areas. A conservative estimate of 10 minutes was selected for the Control Center Operator to accurately diagnose a "worst-case" scenario rupture, followed by 5 minutes for the full closure of the remote block valves. Trans Mountain said that full-bore rupture modelling provided a worst-case unmitigated scenario to help the company prioritize locations for spill response planning, and develop strategies to reduce associated consequences. Trans Mountain said that the company has established procedures and training for response to abnormal operating conditions including response to ruptures. Annual training including both knowledge testing and performance testing is completed for each control centre operator on general operating procedures which include response to ruptures.

Trans Mountain said that it had reviewed the investigation reports from the Enbridge Marshall incident into the Kalamazoo River and considered the recommendations from these investigations in context to KMC's established control centre operating practices and procedures. Some of the activities that resulted from its review of these recommendations included providing additional hydraulics training for all control centre operators, review and clarification of roles and responsibilities of personnel regarding response to abnormal operating conditions including response to ruptures, and a review and update of certain control centre procedures and leak detection procedures.

In its response to the District of North Vancouver's concern of whether Trans Mountain considered human error in its risk assessment and the development of spill response times for the spill scenarios, Trans Mountain said that the potential for human error was taken into account in the risk model using several mechanisms so that the risk was not underestimated. These mechanisms included historical human error accident data, human performance error rates (mistakes), human reliability error rates (e.g., incapacitation due to heart attack), and parameters selected towards the conservative end of credible ranges

In its response to Matsqui First Nation concerns on how human error factored into spill response times in the spill scenarios, Trans Mountain said that human errors are a key consideration in the development of the procedures and processes that must be followed by control centre personnel. These are also built into the training program and the spill scenarios were developed to reflect this. Trans Mountain added that effects of human errors are continuously mitigated in several ways and the need for communication is built into control centre procedures.

Trans Mountain said that Emergency Response Plans (ERPs) have been developed for the existing Trans Mountain Pipeline (TMPL) system and would be enhanced and implemented on the expanded TMPL system. These plans detail prescriptive procedures, activities and checklists to ensure consistent response to incidents with the common objective of protecting company personnel and contractors, the public, public property, and the environment.

In response to the City of Burnaby's concerns regarding Trans Mountain's response capabilities, available resources and ability to sustain an effective response should an incident occur, Trans Mountain said that no spills are acceptable and that the acceptable frequency is zero. It said that spill prevention measures are implemented for every identified hazard and that from a risk analysis standpoint, likelihood of failure values are calculated to identify conditions where additional prevention methods should be considered. Trans Mountain said that a risk-based design process goes beyond the minimum requirements of CSA Z662 and involves an iterative approach in which risks and the associated factors that are driving the risk are identified and mitigated through the implementation of appropriate mitigation measures. Using this approach, mitigation measures can be pre-emptively identified and incorporated at the design stage to address the principal risks. Trans Mountain said that examples of this would be state of the art instrumentation for leak detection, selection of valve locations to reduce potential spill volumes in high consequence areas and deployment of equipment (e.g., boom deployment able to contain 1500 m^3 around vessels being loaded at the WMT) to prevent system leaks and allow for the containment, isolation, and recovery of any hydrocarbon that may be released.

9.2.2 Westridge Marine Terminal spill prevention

Trans Mountain estimated the credible worst-case spill at the WMT resulting from an incident during loading of a tanker to be 160 m^3. Trans Mountain said that for oil spill modelling purposes, 20 per cent of the oil released was assumed to escape the containment boom which would be placed around tankers during loading (i.e., 32 m^3). Trans Mountain said that the return periods of a spill associated with tanker loading are 34 and 234 years for spills less than 10 m^3 and 103 m^3 respectively. Chapter 14 discusses return periods in more detail.

Trans Mountain said that operational spills, should they occur at the WMT, would be mitigated through the use of protective booming at the terminal and around vessels being loaded.

In response to the City of Port Moody's concerns about the effectiveness of booms in stormy seas and turbulent waters, Trans Mountain said that the selection of its booms need to meet wind speed (up to 16 knots) and wave height (up to 1 metre) requirements for Transport Canada equipment designations of shoreline, sheltered and unsheltered water capability. Trans Mountain said that while these conditions are rare in the vicinity of the WMT, it acknowledged that it needs to be and is prepared to adjust its tactics, boom use (conventional booms versus higher current booms such as Current Busters) and configuration (e.g., double booming techniques) to address the reduced effectiveness of booming and skimming operations under such conditions.

Trans Mountain outlined its parameters for stopping loading of a tanker in the event of excessive wind speeds at the WMT. Trans Mountain said that the current parameters are within the limits set at other marine oil terminals internationally and that limitations for the future would be determined as part of detailed engineering design study for the WMT expansion.

To address the City of Vancouver's concerns regarding fires aboard vessels at the WMT, Trans Mountain said that fire onboard an Aframax or Panamax tanker at berth at the WMT is prevented by adhering to a strict systems approach. This approach includes global regulation on tanker design, construction methods, preventative equipment and processes, such as maintaining cargo tanks in inert condition at all times, only fitting or using intrinsically safe equipment, crew training and certification.

Trans Mountain said that since the implementation of mandatory use of inert gas on all crude oil tankers, the threat of cargo-related fire and explosion onboard a tanker has been almost eliminated. Such threats, resulting from collisions or other high-energy impacts, have been further reduced by the advent of double-hull tankers. Tanker crews are trained to maintain an onboard environment that is free of ignition threats, and various prevention and detection elements are designed in tanker construction.

Trans Mountain said that tanker cargo tanks are kept in inert condition (oxygen content less than eight per cent) at all times, even while loading the tank, further reducing the possibility of fire or explosion involving the tankers cargo tanks. Trans Mountain said that at the WMT, vapour generated in a tanker's cargo tanks during loading is collected and piped to shore for processing. The combined effect of a "closed loading system" further reduces the likelihood of a fire during cargo loading.

Views of the Board

The Board agrees with Trans Mountain that spill prevention and mitigation measures start with the risk assessment of engineering designs at the earliest stages of the project, and are embedded throughout the full project lifecycle. In Chapter 6, the Board provides its view on Trans Mountain's approach to facility design.

Even though advances in technology, regulatory requirements and industry best practices contribute to prevention of oil spills, oil spills can still happen. The Board finds that although all possible environmental conditions cannot be replicated or known, it expects a company to be prepared for spills of all sizes, in all conditions, be well organized to respond quickly by following its emergency preparedness and response procedures and incorporate local considerations. The Board finds that this situational awareness was incorporated in Trans Mountain's spill prevention strategies, spill preparedness and response planning.

The Board requires a company to reduce risk wherever possible, that includes consideration of routing alternatives. The Board notes that Trans Mountain proposed a trenchless reroute of the pipeline from the Burnaby Terminal to the Westridge Marine Terminal due to routing directly through a local community. The Board finds that some level of risk is inherent in the Project and a precautionary approach requires that accidents and malfunctions be planned for. Specific details regarding the location, extent, and effects of a large spill cannot be known in advance because many relevant factors cannot be quantified. In addition to prevention measures, the Board took into account additional information to allow planning, and response preparedness for a wide range of spill scenarios, including credible worst-case scenarios.

Parties such as City of Vancouver, City of Burnaby and the Province of British Columbia argued that Trans Mountain had not provided enough information to inform the Board about emergency preparedness and response. The Board does not share this view. The Board finds that a large spill, due to a malfunction or accident from the pipeline or the terminals, can be mitigated through prevention measures as well as being prepared and response ready. The Board finds that Trans Mountain and other parties have provided extensive evidence regarding oil spill modelling, prevention measures, firefighting systems and firefighting activities at terminals, planning and response to inform the Board's views and requirements regarding malfunctions, accidents, and emergency preparedness and response planning at this stage and for the condition compliance stage of the lifecycle regulatory process. The Board also finds that the broad range of spill prevention and mitigation measures committed to by Trans Mountain, including those to address human error for control centre personnel, are comprehensive and appropriate.

The Board finds that Trans Mountain has provided adequate information to assess the measures, tools, plans, and processes in place to prevent accidents and malfunctions from happening. Pipeline spill prevention measures would include pipeline routing, design, materials, construction techniques, maintenance and implementation of controls to address hazards, and operating procedures that

support the integrity of the pipelines and keep the products contained in the system. The Board discussed Trans Mountain's approach to pipeline and facilities design in Chapter 6. Trans Mountain's design decisions that contribute to spill prevention and mitigation include:

- *specifying quality pipe material to minimize fracture initiation;*
- *specifying pipe wall thickness, depth of cover and mechanical protection to minimize the risk of damage from external forces;*
- *routing the pipeline to avoid geotechnical hazards;*
- *installing communication systems and instrumentation to control, monitor the pipeline and detect leaks;*
- *undertaking detailed hydraulic analyses to establish operation limits including overpressure protection; and*
- *installing valves in locations that reduce potential spill volumes in high consequence areas.*

The Board also finds the key aspects of the Pipeline Integrity Management System that would ensure long-term spill prevention and mitigation include:

- *undertaking annual risk assessments including the identification, assessment and management of newly identified hazards;*
- *using in-line inspection (ILI) to assess pipe movement and the presence of damage and defects;*
- *identifying, monitoring and remediating threats such as unstable soils and low depth of cover at water crossings as part of the Natural Hazard Management Program;*
- *implementing a Pipeline Protection Program, with a primary focus on preventing pipeline damage from ground disturbance activities;*
- *monitoring the effectiveness of the cathodic protection system through the implementation of annual test lead surveys and close interval pipe to soil surveys every five years;*
- *completing pipeline repairs in accordance with technical code requirements and KMC standards;*
- *implementing system upgrades and technological improvements through a sustaining capital program; and*
- *promoting continuous improvement through tracking of performance indicators and showing measurable risk reduction.*

The Board finds that the above spill prevention and mitigation measures would adequately support the integrity of the pipeline and related facilities. These measures would contribute in preventing and minimizing any size of spill (i.e., both minor and a major spill). The Board finds that Trans Mountain has incorporated appropriate prevention and mitigation in its design and operation of the pipelines and the terminals to reduce the possibility of a fire or explosion and to avoid spills or lessen their effects through appropriate containment and recovery measures. Trans Mountain outlined examples of prevention and mitigation measures, such as:

- *secondary containment equipped with hydrocarbon detection;*
- *fire detection and suppression equipment for storage tanks;*
- *adequate number of fire and foam monitors at each berth capable of reaching the cargo deck area of the tanker;*
- *emergency release couplers at the loading arms;*
- *overfilling detection at the tanker vessel; and*
- *leak detection at the pipeline.*

Trans Mountain said that the above examples of prevention and mitigation measures would prevent system leaks and potential spills from occurring but if they do occur, the measures allow for the containment, isolation, and recovery of any hydrocarbon that may be released. It also committed to deploy booms around tankers before loading arms are connected.

According to the Board's incident database, the majority of occurrences are minor spills from NEB-regulated companies. Most of these spills occurred at station facilities from defective components or fittings, malfunctions. These spills have typically been confined to company property. Trans Mountain's Facility Integrity Management Program (FIMP) includes monitoring and preventative programs for management of the hazards that could affect the safe operation of facilities to prevent and mitigate the impact of petroleum releases and petroleum fires. Should the Project be approved, the Board would use its compliance verification activities to assess implementation and adequacy of the FIMP.

The Board finds that no spill is acceptable from a facility that it regulates. If a spill does occur, the Board has developed guidelines to facilitate well-documented and successful remediation and will be the lead agency to ensure the most stringent criteria for remediation of soil and groundwater are met. Other regulators such as provincial environment and health departments, as well as municipalities, federal departments and Aboriginal groups may be involved and may be consulted at various stages in the remediation process.

The Board finds that should the Project be designed, constructed and operated according to the fulfillment of its certificate conditions and Trans Mountain's commitments, the probability of accidents and malfunctions associated with the Project resulting in a large spill, is very low. Examples of large spills include full-bore rupture of a pipeline, larger spill in a facility that migrates off company property, or a breach of a storage tank spilling and igniting its entire volume. The Board also finds that, over the life of the Project, the probability of accidents and malfunctions associated with the Project resulting in a small spill is high. Small spills would include those caused by relatively minor equipment failure or human error and would likely occur on Trans Mountain-owned property such as pump stations and tank farms. In the event of a small spill, response personnel and equipment would be readily available and clean up would be expected to be effective. Trans Mountain's commitments would be enforced under the Board's regulatory regime.

In the event of a spill, Trans Mountain said that its Emergency Management Program (EMP) for the existing facilities, existing emergency response manuals and reference material, understanding and implementation of the Incident Command System, internal and external inventory of spill response equipment, exercise and training programs and its commitment to a comprehensive review of the EMP to address the needs of the Project, would help the company respond and manage an incident more effectively

9.3 Trans Mountain's Emergency Management Program

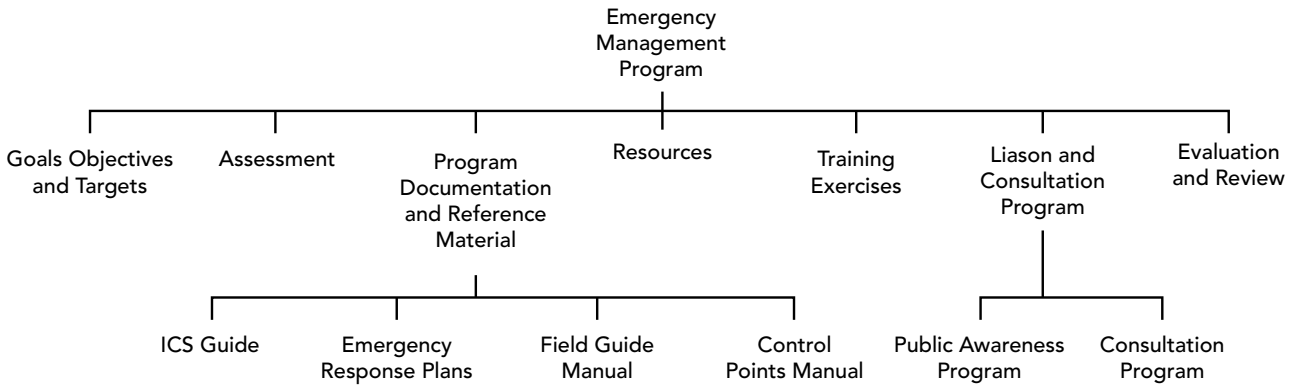
Trans Mountain said that it would review and revise its existing Emergency Management Program (EMP) to address the needs of the expanded pipeline system. The existing EMP will form the foundation for the revised program. Trans Mountain said that the revision of the EMP would include the final design of the Project in conjunction with the existing Line 1 operations, conditions imposed by the Board, and the Province of British Columbia's Five Conditions.

The Province of British Columbia said that minimum requirements must be met by heavy oil pipeline projects. Two of those requirements relate to emergency response, and Trans Mountain said that they would be addressed within the EMP review for the Project:

- World-leading marine oil spill prevention, response, and recovery systems for B.C.'s coastline and ocean to manage and mitigate the risks and costs of heavy oil pipelines and shipments; and
- World-leading practices for land oil spill prevention, response, and recovery systems to manage and mitigate the risks and costs of heavy oil pipelines.

Trans Mountain's EMP is illustrated in Figure 17 below. Trans Mountain said that the EMP outlines the most critical elements for a response to an emergency. The EMP allows for the development of supplemental and supporting documents that address key elements. Thus, the EMP provides a common, structured framework for the development of a skilled and trained workforce, allocation of spill response equipment and resources to appropriate locations, and development of response time targets and pre-defined tactics for expedient and effective response to a pipeline emergency.

Figure 17: Emergency Management Program elements



The EMP is made up of a number of elements used to guide Trans Mountain's emergency planning and response to specific incidents. Trans Mountain said that the EMP documents could provide generic procedures for a response to an incident at any location along the TMPL system, or site-specific procedures for terminals and areas that require tactical response plans. As part of its EMP, Trans Mountain produces the following plans and supporting documents for the pipelines, terminals and tank farms:

- the Incident Command System (ICS) Guide;
- Emergency Response Plans (ERPs): Westridge Marine Terminal ERP, Trans Mountain Pipeline ERP, Terminal and Tank Farms ERP;
- Control Point Manual;
- Tactical Response Plans (e.g., HCAs, submerged and sunken oil);
- Geographic Response Plans;
- Trans Mountain Field Guide;
- Fire Safety Plans; and
- Fire Pre-Plans.

The EMP also considers response tactics for many following types of events, including: pipeline failure, tank failure, fire or explosion related to a tank or spill, submerged oil, and a spill event in the tunnel through Burnaby Mountain.

Trans Mountain said that it uses the Incident Command System (ICS) to guide planning and management processes used in incident response. In Trans Mountain's view, the ICS provides effective coordination and well-established protocols and procedures to manage an incident and provide multi-agency coordination system through a Unified Command structure.

A number of intervenors, including the City of Surrey and Mr. Calvin Taplay, requested a sequence of procedures that would be implemented in the event of an incident and raised questions as to whether the company is able to respond effectively. Trans Mountain provided a list of typical steps that would be taken after a spill. The steps included:

- immediate shutdown of pipeline or other source of release and allow pressure to dissipate to prevent additional release of hydrocarbon and isolate the source of the spill from the rest of the system;
- immediately contact local emergency services and trained Trans Mountain technicians for dispatch to the location, to help secure the area and commence air monitoring to ensure air quality for those in the immediate vicinity;
- control centre issues an Emergency Response Line (ERL) notification to the Incident Management Team (IMT). Upon notification the IMT calls the conferencing line to get information about the incident and begin pre-assigned response duties;
- immediately following the ERL conference call, Trans Mountain notifies the Transportation Safety Board of Canada (TSB) and NEB;
- Liaison Officer begins notifications to other groups not included in the above notifications;

- Logistics Section Chief begins identification of resources required for the response and ordering supplies and equipment; and
- Planning Section Chief begins planning recovery operations and contacting team members required including the Environmental Unit Leader.

Many participants said that Trans Mountain and other responsible agencies must engage in broad consultation in the development of emergency plans and that it must share information about those plans. Simon Fraser University (SFU) said that, in order to properly prepare, maintain, and update its Comprehensive Emergency Management Plan (CEMP), it is especially important that SFU has a clear understanding of all possible risk scenarios to SFU, their likelihood and the potential impacts to SFU, so as to be able to develop procedures and emergency management plans to be followed in response to a specific event. SFU said that it was willing to engage in a dialogue with Trans Mountain to understand the potential risks from the existing Tank Farm and WMT operations and the risks posed by the Project better.

In response to requests for consultation on its emergency response planning, Trans Mountain said that, as part of construction planning and the EMP review for the Project, it will consult with municipalities and first responders, including SFU, the Province of British Columbia, the District of North Vancouver, the Fraser Valley Regional District, the City of Port Moody, the City of Burnaby, the City of Kamloops and emergency response providers.

Mr. Peter Smith said that local authorities have raised concerns over their ability to deal with a major spill or fire. Mr. Smith said that there is little co-operation between those who need to work together, which gives him little confidence in their ability to deal with an emergency situation

The City of Burnaby said that Burnaby first responders (e.g., fire fighters, RCMP) do not have the capacity or technical training to mitigate a major fire event, such as a multiple tank fire, storage tank boil over, or a release of toxic gas products simultaneously with operations. It said that these first responders would not be able to protect community lives and property outside the facility fenceline and elsewhere in the city in the event of such an incident. The City of Burnaby said that, in order to keep such a major event from escalating, first responders would have to provide interior facility operations simultaneously with exterior fenceline emergency operations, which would leave significant gaps in the broader protection of lives, properties, as well as surrounding environmentally sensitive areas and conservation lands in and around the city.

Trans Mountain said that the current Burnaby Terminal facility has detection, mitigation and fire prevention measures in place for potential fires, which include fire water reservoir and pump system, fixed and portable fire-fighting monitors, an inventory of fire-fighting foam concentrate, and fire-fighting foam trailers. Trans Mountain added that the fire-fighting measures would be further enhanced as part of the Terminal expansion design. These enhancements would include industry-leading fire protection equipment, such as fixed tank rim seal and full-surface fire-fighting foam suppression systems for each new tank installed to ensure that rim seal and full-surface fire suppression systems can be deployed by the push of a button.

Trans Mountain said that the fire-fighting foam suppression systems would be backed up by portable foam and water monitors. Trans Mountain said that the installed fire suppression measures would exceed applicable code requirements. These measures, when combined with tank operating procedures to minimize the accumulation of water within the tanks as well as the extensive maintenance program, would reduce the likelihood of a fire, escalation to a full-surface fire or the potential to have a boil over event to an extremely low probability. If all mitigation fails for preventing a full surface fire, the company said that it has all the equipment on-site to extinguish a full surface fire within the industry standard timeline. Trans Mountain believes that this will prevent a full surface fire thus a boil over event. Trans Mountain said that the design of the expanded Burnaby Terminal would ensure safe access from two directions for all possible fire locations within the terminal facility. The proposed primary and secondary access routes at the Burnaby Terminal will be designed and constructed in accordance with the International Association of Fire Chiefs Emergency Vehicle Size and Weight Regulation Guideline. The primary access routes at Burnaby Terminal will be designed so as to allow the movement of emergency apparatus and equipment, and would allow emergency response access from a minimum of two independent directions.

Trans Mountain said that although the City of Burnaby has not agreed to meet, it is committed to pursuing a mutual aid agreement with the City of Burnaby and to discuss the enhancements for the emergency management program. Trans Mountain also expressed its desire to meet and discuss the design of the fire protection system at Burnaby Terminal prior to the design being finalized.

The City of Port Moody and the City of Kamloops said that Trans Mountain has given little information about the resources that it would direct to the city in the event of a spill or accident. The City of Port Moody said that it does not know what to expect in such an instance and was concerned it would be ill equipped to make any decisions about how to respond to a spill or accident that might affect it.

To address the City of Kamloops concerns about the impact of their work force and the incremental demand it may create upon the city's local emergency services (i.e., firefighting and policing) should an incident occur, Trans Mountain said in the event a municipality is not able to respond or there are competing requirements for local emergency response capacity during an incident, the company would cooperate with local agencies in the overall response and secure additional resources from outside the affected area. Trans Mountain said it was Kinder Morgan Canada's preference to enter into a Unified Command with municipal, provincial and federal authorities to ensure a safe and thorough response to any emergency. In the event that a municipality cannot respond, it would procure additional resources and use the Incident Command System to prioritize objectives to ensure the safety and protection of the public, employees, contractors, the environment, and property.

Trans Mountain said that it is committed to ongoing consultation with municipalities, local and regional emergency responders, police services, fire services and other relevant services to identify and discuss issues in order to meet municipal emergency response requirements, such as continued availability of roadways for use by emergency vehicles.

In addition to consultation with emergency management professionals, first responders and communities along the pipeline corridor, Trans Mountain said that it would engage the general public about pipeline safety and emergency response. Trans Mountain said that it has conducted numerous public consultation meetings in Burnaby and in the neighbouring communities in B.C.'s Lower Mainland since 2012. Emergency planning and response was consistently a topic presented on information boards at public events. Trans Mountain said that this engagement would continue and it will ensure the public have an ability to engage and ask questions about Trans Mountain's pipeline safety and ERPs in the continued engagement.

The Province of British Columbia and the City of Burnaby said that they wanted full disclosure of the EMP documents because it was critical that participants have the opportunity to evaluate the adequacy of the EMP. They said that Trans Mountain's offer to provide copies of the EMP documents to local, provincial, and federal authorities on a confidential basis is of no assistance in the context of the hearing. Trans Mountain said that it had provided, and will continue to provide, the City of Burnaby, the Province of British Columbia and other first responder agencies with copies of its EMP documents.

The Province of British Columbia and the City of Burnaby expressed concerns about the timing of Trans Mountain's detailed spill preparedness and response planning. They said that Trans Mountain had not provided sufficient information or an appropriate level of detail during the application process to demonstrate that the company could respond effectively to a spill. It was their view that Trans Mountain should provide additional information before the Board made its recommendations regarding the Project.

Trans Mountain said that the Emergency Management Program has been developed and enhanced through a combination of learnings from table-top and field deployment spill exercises, and through experience gained through response to live spills, such as the third party strike on the Westridge pipeline in 2007. The existing EMP will form the foundation of the revised program. Trans Mountain said that it was focused on prevention and mitigation measures to reduce the likelihood of oil spills occurring and, if a spill occurs, to limit the consequences through the mature emergency management program that is in place.

Trans Mountain said that it anticipates undertaking the following work as part of developing and enhancing its existing EMP, including making updates to:

- geographic elements, such as control point manuals and Trans Mountain's GIS-based Geographic Response Plan (GRP);
- pre-Shoreline Cleanup and Assessment Techniques (SCAT) and SCAT training;
- equipment and resource need assessment; and
- information gained through first responder, community, Aboriginal, and municipal engagement and consultation.

Trans Mountain said that the updated EMP will also reflect the recent Canadian Energy Pipeline Association Mutual Emergency Assistance Agreement, finalized plans with Western Canadian Spill Services, and any new additions

as a result of the B.C. land based spill initiative. The underlying basis for the review of the EMP would include performance standards for estimated response time and response capacity.

Trans Mountain said that the detailed review would be developed collaboratively with stakeholders over of the next two years. Consultation to date has indicated a strong interest in pipeline safety and emergency response. Trans Mountain said that plans include continued engagement with emergency planners and first responders to solicit input to planning efforts and to enhance understandings of pipeline hazards, emergency readiness, and roles and responsibilities in the event of a spill. Finalized EMP documents and supporting documents will be completed in advance of commissioning and operation of the Project.

9.4 Emergency response

Trans Mountain said that it takes full responsibility for any emergency that results from the TMPL system and its facilities. Should an incident occur, Trans Mountain said that staffing and mobilization of an Incident Management Team (IMT) would begin immediately. The IMT members are trained and regularly exercise in a number of ICS positions. Trans Mountain said that each of the key positions in the ICS structure has at least three individuals trained and prepared to respond, ensuring a fully functional response team at all times. Trans Mountain said that it has pre designated potential Incident Command Post (ICP) and Staging Area locations along the current pipeline corridor and in communities where its facilities are located.

Participants raised questions about how Trans Mountain would communicate with the municipalities, residents, businesses, and schools regarding evacuation, coordination of a response, and expected roles in the event of an incident. Trains Mountain said that at the time of the spill incident, it would consult with the local municipal authority to determine the best course of action to protect the public, including immediate notifications as required. KMC's role in notification of schools, businesses and residents would primarily be to provide local emergency services agencies with air quality measurements and other relevant status information on an ongoing basis to help inform the best course of action and subsequent actions taken to direct residents to shelter in place or to evacuate. Trans Mountain said that it was committed to timely communications with those that are directly impacted by any emergency event. The methods used for informing the public include door-to-door delivery of information, social media, traditional media, website updates and a phone hotline.

In response to the NDP's questioning about additional preventative practices for areas of high population density, Trans Mountain said that areas with high population density would have increased pipeline protection activity, including higher patrol frequencies for preventing third party damage from unauthorized ground disturbance activities. Public awareness activities and security measures would also be increased in areas with high population density.

Trans Mountain said that it would work with external emergency response services in a pre planning capacity. Trans Mountain said that, for example, the City of Burnaby Fire Department has been an active participant in annual training at its facilities. Trans Mountain said that it would continue working with the City of Burnaby regarding its existing operations and, as noted previously, it is committed to engaging the City of Burnaby with respect to response planning for the Project.

9.4.1 Emergency response capacity

In response to participants' concerns that Trans Mountain does not have the appropriate equipment to respond to an incident, Trans Mountain said that it maintains a network of internal and external response resources and personnel. A rigorous training and response exercise program is in place for all operations and head office staff that ranges from detailed equipment deployment drills to full ICS management and organization training and deployment. Trans Mountain said that it belongs to a number of response organizations and participates in mutual aid exercises to supplement the company's self-reliant response capability. Trans Mountain said that it has contracts and master services agreements with a number of response contractors to supply equipment and personnel during an emergency.

Trans Mountain said that it belongs to a number of response organizations and participates in mutual aid exercises to supplement the company's self-reliant response capability. Trans Mountain said that equipment and responder resources could be sourced with mutual aid agreements between WCMRC and Western Canadian Spill Services. The main use would be for marine spills, but the resources can also be used for inland spills as well. Trans Mountain said that the Emergency Response Plans (ERPs) also contain detailed documentation in terms of procedures, staffing, and other relevant information about contract response resources.

Trans Mountain said that, although the maximum response time for field operations personnel to mobilize to site is not defined, field personnel are stationed strategically along the pipeline in order to be able to respond promptly to issues that arise anywhere along the pipeline route. Oil Spill Containment and Response (OSCAR) units are currently deployed by dedicated response personnel. The response personnel are headquartered at approximately 14 locations along the pipeline system. Their response time to site will depend on their location relative to the response area, weather and other factors. For response to water bodies, access routes to spill response control points identified along the existing pipeline are pre-defined and available for use by Trans Mountain spill responders to transport spill response equipment and put into operation.

For response to spill locations on land, Trans Mountain said that vehicular access typically occurs using a combination of roads and pipeline right-of-way. In areas of wet or steep terrain on the right-of-way, tracked vehicles may be required to assist the wheeled vehicles, or may be used to transport required equipment and personnel from response staging area to spill response site.

According to Trans Mountain, a highway tractor is required to transport each OSCAR unit to the spill response staging area. Trans Mountain said that it owns a number of these vehicles and these are located at station sites along the pipeline. The OSCAR units are spaced approximately 2-3 hours of road travel time, allowing for an OSCAR to reach any point on the pipeline within 1-1.5 hours of leaving the stations where they are stored. Trans Mountain said it also maintains jet propelled watercraft.

In responses to spills on both water bodies and on land, Trans Mountain said that if surface access proves to be impaired, alternate access routes and or transportation methods, such as helicopter deployment, may need to be used. The decision to transport equipment by helicopter is made by the Incident Command Post at the time of an incident.

Shxw'ōwhámel First Nation said that the containment and recovery of oil in rivers is often made even more complicated by currents, limited access, debris, ice, snags, and various other issues. Conditions in the Fraser River would render the use of conventional oil response techniques essentially impossible during much of the year. Shxw'ōwhámel First Nation was of the view that bottom booms, filter fences, and trenches must be quickly deployed and their success is highly dependent on bottom current conditions and type of oil. Shxw'ōwhámel First Nation said this would prove to be next to impossible in the currents found in many parts of the Fraser River.

The City of Vancouver, Tsleil-Waututh Nation, and Tsawout First Nation assessed the logistics associated with a pipeline spill at the Port Mann Bridge crossing of the Lower Fraser River. They found that, depending on river velocities, there may not be sufficient time to mobilize and deploy equipment in time to control the spill before it reaches the Fraser Delta.

Trans Mountain said that substantial tidal effects in the Fraser River west of the Port Mann Bridge would slow the flow of both water and spilled substances and provide additional response time. In addition, Trans Mountain said that it uses a multi-modal approach to oil spill response and clean up, whereby equipment and booms would be deployed close to the source at intermediate distances from the source as well as downstream to capture and clean up the product from river banks and marine environment that could have escaped the deployed boom.

Trans Mountain said that the assessment submitted by the City of Vancouver, Tsleil-Waututh Nation, and Tsawout First Nation was overly conservative and did not acknowledge the design and operational parameters for the pipeline such as the pipeline design, construction, and maintenance methods that make a pipeline leak into the Fraser River a low likelihood event in the first place. Trans Mountain said that it would its risk assessment information to refine the pipeline crossing design. Trans Mountain said that at the Port Mann Bridge crossing, it determined that extra heavy wall pipe (19 mm wall thickness) would be placed at appropriate depths under the river and at entry/exit points to ensure that the pipeline is highly protected against flooding, bank erosion, scour and avulsion.

Shxw'ōwhámel First Nation, Squamish Nation, the City of Chilliwack, the Township of Langley and the Province of British Columbia expressed concerns about a spill migrating into groundwater and the long-term impacts as a result of contamination. Trans Mountain said that it puts considerable effort into preventing releases. When releases occur, timely and effective emergency response prevents impacts to groundwater in most cases. Trans Mountain said it recognizes the importance of aquifers that communities

depend upon and that it is committed to engaging communities that have specific concerns related to protection of municipal water sources, and would consider the installation of monitoring wells in strategic locations. Trans Mountain said that it would accurately reflect the location of drinking water supply sources within 100 m of the pipeline, its facility, or areas that could be impacted from a release to help inform emergency response.

Trans Mountain said that, if a pipeline release impacts a community's use of an aquifer, it would source and pay for an alternate water supply to meet the needs of the community until groundwater remediation was complete, and groundwater quality met provincial and federal criteria for its intended use.

Trans Mountain also outlined a number of techniques to contain spills and prevent them from entering watercourses. Trans Mountain said that response options would vary depending on the local terrain and the potential for the oil to migrate through the soil. Soil, water, and groundwater contamination would require remediation and would be completed to applicable environmental quality standards for the area and local land use.

Tsleil-Waututh and Tsawout First Nation, and the City of Vancouver said that Trans Mountain's Application lacks critical detail about how responders would manage practical and logistical considerations that are critical to successful river response, such as site access, travel routes, boat launch access, and tactical planning.

Trans Mountain said that it would enhance its year-round emergency response capability by developing Geographic Response Plans (GRPs) that would consider the various environmental conditions that may be encountered, for example, at the Fraser and North Thompson Rivers. GRPs would become a part of the enhanced EMP.

The GRP project would include:

- a review of both Lines 1 and 2 with production of a response capability analysis;
- development of a complete set of GRPs covering both Lines 1 and 2. The analysis referenced above will serve as a key foundational element for the new GRPs that would be developed. The GRPs will provide responders with guidance and detailed information on access, deployment and product recovery as well as strategies and tactics relevant to environmental conditions throughout the year;
- guidance for KMC responders for other environmental factors such as full or partial ice cover of rivers, streams and lakes, forest fire and smoke, avalanche and flooding conditions.;
- a full review of control points including spacing, access suitability under various environmental conditions and others;
- consultation with First Nations, local and regional governments, as well as Trans Mountain's existing mutual aid partners; and
- shoreline Cleanup and Assessment Technique (SCAT) guidance.

The City of North Vancouver raised concerns about Trans Mountain's capability to contain and recover diluted bitumen. Trans Mountain said that the initial response to a diluted bitumen spill is no different than responding to any other conventional heavy crude oil spill. Trans Mountain said that the products shipped on its system are, by tariff, restricted from having a specific gravity greater 0.94 and would not sink in their unweathered state. Quick response ensures that weathering of spilled oil can be minimized. Trans Mountain said that it trains over 100 field and office response team members, several times a year in the ICS, which provides a common response mechanism for responders and others who are part of the response community. It also said that its WMT staff receive hands-on boat training and carry necessary Transport Canada certification for the operation of the on-site response boat.

Squamish First Nation and Andhra Azevedo were concerned with the difficulties of recovering sunken oil, and whether Trans Mountain had the capability to respond to a spill. Trans Mountain said that if some spilled oil sinks, due to extended weathering and interaction with suspended sediment as a result of a combination of factors such as weather or access, and it could not be easily recovered during the emergency phase (such as oil in shallow water or along shorelines), it would be treated as a post-emergency recovery function. Trans Mountain also said that the remedial actions, including actions required to recover sunken oil, would be developed by the responsible party and regulatory authorities

working as part in a Unified Command and would be guided using Net Environmental Benefit Assessment (NEBA) principles. Trans Mountain added that the approach to sunken oil remediation would be similar to cleanup of industrially contaminated sediments in waterways. Each situation would be unique and, where warranted, methods may include:

- capturing the oil where currents and hydrographic conditions are amenable to the deployment of oleophilic material to trap the oil;
- remobilization, containment, and removal of the oil through agitation of sediments (raking, dragging, pneumatic agitation);
- bulk removal of the oil through pumping and/or dredging; or
- long-term monitoring and natural attenuation in areas where remedial actions pose more harm than benefit.

In response to Squamish First Nation's questions regarding the equipment Trans Mountain has to recover sunken oil, Trans Mountain indicated that WCMRC owns equipment to recover floating oils, over-washed oils and submerged and sunken oils that have been purposely re-mobilized for recovery on the surface. Trans Mountain said that neither Trans Mountain nor WCMRC maintains equipment to specifically recover sunken oil and that such equipment can be procured from dredging and remediation contractors.

Trans Mountain said that enhancing its emergency response service or equipment providers list prior to operation of the expanded pipeline system would be part of the enhanced EMP being completed post-decision, during the final design phase of the Project. Trans Mountain said that the EMP would be one of the key inputs to inform the company as to what its future response resource needs will be.

9.4.2 Consultation and evacuation in emergency situations

The Province of British Columbia, Mr. Calvin Taplay, Wembley Estates Strata Council and Simon Fraser University, raised concerns about the adequacy of Trans Mountain's consultation with the public and local authorities in the event of an emergency situation. Trans Mountain said that municipalities' Emergency Measures Offices are often responsible for developing emergency evacuation plans. These offices are not only tasked with planning and implementing emergency response measures, but also with ensuring the overall protection of the public impacted by an incident. Trans Mountain said that it is committed, willing, and able to work with local authorities to determine the best course of action to protect the public and the environment during an incident. It said that it does not plan to develop tactical evacuation plans for municipalities or institutions since it does not have the authority to implement such plans unilaterally.

Ms. Dorothy Doherty said those residents who live close to the Burnaby Terminal need to be included in and be made aware of relevant components of the EMP in order to be informed and aware of the hazards. Ms. Dorothy Doherty said that residents who live close to the Burnaby Mountain Terminal may have difficulties evacuating, in the event of an incident, as evacuation from this area is limited and complex. She said that, if any of the routes are blocked, residents could be trapped, with no way of evacuating.

Halston Hills Housing Co-op and Ms. Doherty asked how teachers and schools should respond if an incident was to occur. Trans Mountain said that the company is open to working with individual schools and School Districts to fully support their safety efforts and ensure their Emergency Response Plans and Trans Mountains' are coordinated.

Trans Mountain said that teachers should respond to a pipeline emergency similar to the way they respond to other emergencies at school, and contact emergency services immediately. If a release is suspected or faint odour detected within the school, they should shelter in place unless advised otherwise by emergency services. For a more substantial release, where strong petroleum odours exist in close proximity to the school, emergency services will advise evacuation to a safe location, in an upwind direction, if possible. The school should also call emergency services and Trans Mountain to report any suspected pipeline issues.

9.4.3 Firefighting capabilities at the Westridge Marine Terminal

In the event of a fire at the WMT, Trans Mountain said that area municipalities have firefighting boats and that harbour tug operators also operate firefighting capable tugs from their bases in Vancouver Harbour.

The Province of British Columbia asked Trans Mountain if it would provide its own firefighting resources to fill any existing gaps in firefighting capabilities at the WMT. Trans Mountain said a consortium of municipal

fire departments currently supports emergency response for a marine fire in the Burrard Inlet, including the City of Vancouver, City of Burnaby, City of Port Moody, as well as the District and City of North Vancouver. The City of Vancouver is taking the lead in negotiating a new consortium and funding arrangement for new fire boats and additional training of firefighters to provide continuous coverage. As a tenant of the Port and given its relationship with Port Metro Vancouver, Trans Mountain said it sees an opportunity to support the City of Vancouver's initiative and contribute towards the cost of the new consortium in addition to having Seaspan Marine and SMIT Harbour Towage available to operate firefighting capable tugs from their bases in Vancouver Harbour.

Trans Mountain said that, in the event of a fire or explosion aboard a vessel at berth at the WMT, the ship's machinery spaces are protected with fixed firefighting equipment, such as CO_2, high expansion foam and water mist systems. Trans Mountain said that such systems effectively extinguish a fire in any of these spaces. Trans Mountain said that fire in a vessel's galley or accommodation could be managed effectively by the crew using the ship's firefighting equipment, such as fire hoses and extinguishers, or, depending on the space, fixed equipment such as sprinklers. Trans Mountain outlined training requirements for a tanker crew for fire prevention and response. Trans Mountain said the probability is low of a fire in the galley or accommodation escalating into a fire and explosion involving the cargo, and thus not considered credible.

Trans Mountain said that the WMT has the capacity to apply water and foam to the deck of a tanker at berth. If necessary, water can be supplied to the vessel's fire mains using the international shore connection. Trans Mountain said that current available firefighting foam for response at the WMT includes 5,600 liters stored at the WMT and 40,850 liters stored at the Burnaby Terminal. Additional quantities can readily be obtained from other Kinder Morgan Canada terminals and also through mutual aid partners.

The City of Port Moody raised a specific concern about expected response time and response agencies for fire at the WMT and on vessels in Burrard Inlet. Trans Mountain said that Westridge personnel would immediately activate the fire suppression system and monitoring according to the Fire Pre-Plans, municipal firefighters would arrive at the Terminal within 15 minutes, and that industrial firefighting contractors would arrive at site within 6-12 hours.

9.4.4 Spill response at the Westridge Marine Terminal

Trans Mountain said that it takes a systems approach for on-water oil spill response. It selects countermeasures appropriate for the physical properties of the oil, its fate and behaviour, and the environmental conditions where the release occurred. This requires the deployment of adequate and well-maintained equipment by a knowledgeable crew managed under a formal incident management system comprised of key stakeholders from industry, government, and communities. Trans Mountain said that the safety of first responders and other response personnel is a key concern, and that every effort is made to ensure that these persons are not put at risk. Trans Mountain said that the Westridge facility response plan, including spill response capacity, would be enhanced as part of the Project.

The TERMPOL Review Committee said that under the CSA, 2001, the WMT, as a prescribed Oil Handling Facility (OHF), must have oil spill response capability, an Oil Pollution Emergency Plan, and an Oil Pollution Prevention Plan. An OHF must also have equipment, personnel, and training and exercise programs that allow it to deploy an immediate response in the event of an oil spill as well as response equipment and resources on site to immediately and safely contain and control an oil spill incident at the facility. As an existing OHF, the WMT already has such plans in place, which will be revised and updated if the Project moves forward.

Trans Mountain committed to submitting its Oil Pollution Emergency Plan for the WMT to Transport Canada for review at least six months before operations begin at the WMT.

Trans Mountain said that WMT operations are equipped to provide immediate response in the event of a spill. It said that the loading operations are enclosed within a boom, additional response equipment is kept on site and personnel are trained based on KMC's (as the operator) Westridge Emergency response plans. Trans Mountain said that it has additional booms stored at Westridge that can be deployed quickly.

Trans Mountain said that, if a spill was to occur, the responsible party (Trans Mountain for a pipeline spill; the tanker owner for a tanker spill) would work with regulatory agencies in a Unified Command to determine both response and remediation strategies appropriate for the specific circumstances of the

event. Response strategies employed would focus on controlling the source of the spill, preventing released oil from entering a waterbody, promptly removing oil from the water surface, and removing from the shoreline stranded oil that could be remobilized.

Trans Mountain's evidence was that the spill location and the environmental conditions during the response influence operational effectiveness. Winds, waves, and currents (tidal or wind driven) would affect the following mitigation efforts:

- ability to quickly reach the spill site;
- deployment of booms to contain, concentrate and reduce the spreading of spilled oil;
- mechanical skimming to recover oil from the surface of the water; and
- transfer of recovered oil from smaller skimming vessels into sufficient larger units for temporary storage.

Regarding shoreline protection and mechanical recovery methods such as booming, Trans Mountain said that based on historical response times and regulatory requirements, secondary boom would be deployed at the WMT within one hour of a spill. Federal standards require WCMRC to respond to a spill within six hours for any spill in Port Metro Vancouver. Trans Mountain said that WCMRC has consistently responded to incidents in far less time. Under its proposed enhanced response planning, Trans Mountain said that it and WCMRC have committed to initiating spill response within the Port Metro Vancouver area within two hours.

WCMRC also intends to develop specific oil spill Geographic Response Strategies (GRS) that will form part of area Geographic Response Plans (GRPs) and priority Shoreline Cleanup Assessment Techniques (SCAT) for the coastal shoreline of B.C. As a demonstration project, WCMRC has developed a working Geographic Response Plan system for the areas surrounding the WMT. It said that the results of the demonstration project proved valuable and would be carried out through the province.

To challenge and validate response assumptions, Trans Mountain simulated a response in the event of a spill at the WMT. At the start of the simulation, the state of tide showed that oil would quickly touch the shorelines to the west of Westridge near Shell docks, and also the shorelines near Maplewood flats. Trans Mountain said that its priority would be to set up collection booms near Shell docks as other locations, such as Maplewood flats and Cates Park, are WCMRC pre-determined boom deployment location in Burrard Inlet. Based on the simulated environmental conditions at the time, the immediate goal of the booms in the scenario was to deflect the oil away from the shoreline west of the WMT and out into open water spaces where it would be more accessible to skimmers.

In the simulation, 300 metres of deflection boom was deployed west of the Shell Dock within three hours, and an additional 400 metres of deflection boom was deployed beyond that point within 4-hours. By the fourth hour, the simulation depicted crews deploying 1,667 metres of protection boom at Cates Park and an additional 867 metres of boom in the area near Westridge. Within 12 hours of the spill, environmental conditions had reduced the thickness of the remaining oil outside the boom to under 10-microns (50-microns is generally considered the threshold for effective mechanical recovery; thicknesses below that value are considered sheens). Trans Mountain said that WCMRC continues to work on developing geographic response plans and look into improving techniques of shoreline oiling prevention including tactical deployment of booms at pre-determined boom locations.

Trans Mountain said that, in the event of an emergency, it can provide air plume dispersion modelling in a short period of time. In the event of a spill, Trans Mountain said that it immediately implements an air monitoring program which would provide site and community air contaminant concentration data to Emergency Services before dispersion modelling results would be available.

For a spill from a tanker at berth at the WMT that may fall under joint responsibility between the vessel operator and marine facility operator, depending on the specifics of the spill, Trans Mountain said that either the Canadian Coast Guard (for a spill originating on water) or the National Energy Board (for a spill originating from the pipeline on land) would be the lead federal agency. The response would be managed under an Incident Command System (ICS) structure with the vessel owner, Trans Mountain, and the appropriate authorities participating in a Unified Command. Decisions as to the appropriate level of response would be determined by Unified Command.

Views of the Board

Trans Mountain's Emergency Management Program

The Board is satisfied with Trans Mountain's commitment to review and revise its existing Emergency Management Program (EMP) to address the needs of the expanded pipeline system. The existing EMP would form the foundation for the revised EMP and be subject to the Board's regulatory requirements and compliance verification activities.

One of the most serious concerns among communities affected should an oil spill occur from a Trans Mountain facility is whether Trans Mountain has the capability to manage the incident effectively. Trust and respect are earned, not given. The public deserves to know that, should an incident occur, there are capable people in place to respond and to make competent decisions on mobilisation of equipment and resources, spill detection, tracking and monitoring, and on implementing the most appropriate response strategies.

The development of a comprehensive EMP with appropriate training of personnel and first responders, and consulting and liaising with those potentially involved in an incident response, will help clarify roles and responsibilities, as well as protect the safety of workers and the public. The Board is satisfied that Trans Mountain takes full responsibility for emergency response related to an incident from the Trans Mountain Pipeline system and its facilities. The Board recognizes that even with sophisticated oil spill prevention and safety measures in place, the risk of an oil spill remains.

The Board heard from participants who stressed the importance of consultation between Trans Mountain and municipalities, first responders, Aboriginal groups and others in the development of Trans Mountain's enhanced EMP. The Board is satisfied with Trans Mountain's commitment to consult with first responders, communities, Aboriginal groups, and regulatory authorities. The objective of this consultation is to enhance its EMP documents for the Project, by gaining local knowledge of the challenges that would be present in different locations at different times of the year. The Board is satisfied that Trans Mountain is committed to building relationships and better understanding of municipal emergency response programs through emergency response exercise and consultation.

Detailed design work and a comprehensive review of the company's existing EMP would be required, post approval, to further inform Trans Mountain's emergency preparedness and response planning. Additional information would be required by the Board to ensure that Trans Mountain's company's EMP documents and capabilities are in place. The Board has included Conditions 90, 117 and 124 related to Trans Mountain's commitment to enhance its existing Emergency Management Program to incorporate the needs of the Project, including consultation with Appropriate Government Authorities, first responders and potentially affected Aboriginal groups.

To verify compliance with Trans Mountain's commitments regarding emergency preparedness and response, and to demonstrate that Trans Mountain has developed appropriate site-specific emergency preparedness and response measures, the Board requires Trans Mountain to demonstrate that it is able to respond immediately to all spills and to incorporate response time targets to an emergency for each 10-km long segment of the pipeline (Condition 125).

Emergency response

The Board heard preparedness is part of a larger response framework based on guiding principles that includes incident prevention, preparedness, rapid and coordinated response and restoration. Preparedness includes planning for credible incident scenarios, developing strategies for effective response, training response teams and resourcing appropriate supplies, equipment and personnel. Engagement of stakeholders in the planning process will better ensure an efficient and effective response if an incident should occur.

The Board finds that an effective response does not guarantee recovery of all spilled oil, and that no such guarantee could be provided, particularly in the event of a large terrestrial, freshwater, or marine spill. The oil spill preparedness and response commitments made by Trans Mountain cannot ensure recovery of the majority of oil from a large spill. Recovery of the majority of spilled oil may be possible under some conditions, but experience indicates that oil recovery may be very low due to

factors, such as weather conditions, difficult access, and sub-optimal response time, particularly for large marine spills.

Participants said that Trans Mountain had not demonstrated that its spill response would be effective. Some had differing views as to what an effective spill response would entail. The Board is of the view that an effective response would include stopping or containing the source of the spill, reducing harm to the natural and socio-economic environment to the greatest extent possible through timely response actions, and appropriate follow-up and monitoring and long-term cleanup. The Board is of the view that these elements are addressed in Trans Mountain's design of its response plans.

Trans Mountain and other parties have provided sufficient information to inform the Board's views and requirements regarding emergency preparedness and response planning at this stage in the lifecycle of the regulatory process. Information filed by Trans Mountain was also supplemented by extensive information filed by hearing participants through letters of comment and written evidence.

The Board finds that Trans Mountain and other participants provided sufficient information on oil spill modelling, response planning, and prevention and response measures at this stage of the lifecycle regulatory process. The Board does not share the view held by the Province of British Columbia, the City of Burnaby and Shxw'ōwhámel First Nation that Trans Mountain did not provide enough information to inform the Board about proposed emergency preparedness and response planning.

The Board shares concerns raised by the City of Burnaby Fire Department and others about the need for adequate resources to respond in the case of a fire. The Board finds the 6-12 hour response time proposed by Trans Mountain for industrial firefighting contractors to arrive on site as inadequate, should they be needed immediately for a response to a fire at the Burnaby Terminal. The Board would impose conditions requiring Trans Mountain to complete a needs assessment with respect to the development of appropriate firefighting capacity for a safe, timely, and effective response to a fire at the Westridge Marine Terminal (WMT) and at the Edmonton, Sumas, and Burnaby Terminals. The conditions would require Trans Mountain to assess and evaluate resources and equipment to address fires , and a summary of consultation with appropriate municipal authorities and first responders that will help inform a Firefighting Capacity Framework (Conditions 118 and 138).

When infrastructure is sited, collaboration will be instrumental in achieving a balance of trust, values and preferences necessary for successful emergency response. Effective collaboration requires a clear understanding of roles, responsibilities and tasks among all first responders as well as a common understanding of the situation at hand. This can only be achieved if relationships are built through a perceived need and willingness to collaborate outside the stress of an incident. The Board considers it the mutual responsibility of Trans Mountain and stakeholders to collaborate. Those that do not collaborate or engage in relationships are negatively impacting the preparation and readiness for emergency response. The Board heard about the benefits of collaboration during the City of Abbotsford's final argument. In response to the City of Abbotsford's concerns regarding the absence of an OSCAR unit in Abbotsford, Trans Mountain had moved a unit to its facility in Abbotsford.

During final argument, the Board also heard from the District of North Vancouver, the Fraser Valley Regional District, the Township of Langley, the City of Abbotsford and the Fraser-Fort George Regional District about the lack of consultation to date and the company's failure to incorporate feedback into emergency response planning. They also expressed concerns over fire departments not being equipped or trained for pipeline emergency response, and not having a functional understanding of the various liquids that they could be responding to should an oil spill occur. In addition, the Board heard about the need for emergency response plans and documents developed by Trans Mountain to have meaningful input from local governments, emergency response organizations and first responders, and the need for full-bore rupture exercises. The Board is of the view that consultation and communication between Trans Mountain and local governments, emergency response organizations and first responders is needed. This consultation and communication must be transparent, genuine, ongoing, structured, collaborative and respectful. The Board is satisfied with Trans Mountain's commitment to ensure first responders within local communities and Aboriginal groups are aware of their roles and responsibilities, receive adequate

training with respect to emergency incidents that could occur along the pipeline, and have the opportunity to consult and provide input with respect to the enhanced EMP for the Project.

The Board finds that spills can occur and depending on circumstances, spill location and volume, spills may require significant resources, amplifying the need and importance for Trans Mountain to consult and communicate with the aforementioned groups on the complexity of emergency response and the company's ability and capability to respond efficiently and effectively to an incident, should one occur. The Board has imposed Conditions 90, 117 and 124 to help facilitate consultation and communication between Trans Mountain and Appropriate Government Authorities, first responders and potentially affected Aboriginal groups.

The Board finds that written evidence provided by the City of Vancouver, Tsleil-Waututh Nation, and Tsawout First Nation provided additional insight into how far an oil spill might travel downstream and that recovery may not be possible, specifically in the Fraser and North Thompson Rivers. Trans Mountain provided sufficient modelling information indicating the potential extent of downstream oil transport. Trans Mountain has considered this information in its response planning and development of Geographic Response Plans as well as tactical response plans. Based on the evidence, in the Board's view, adequate preparation and planning can lead to an effective response, but the ultimate success of the response would not be fully known until the time of the spill event due to the many factors which could inhibit the effectiveness of the response. The Board is of the view that Trans Mountain is being proactive in its planning and preparation for effective spill response. The Board has included a condition for Trans Mountain to conduct full-scale exercises and test a variety of scenarios including a full-bore rupture into the Fraser River at the Port Mann Bridge as well as a full-bore rupture into the North Thompson River, under high flow conditions (Condition 153).

The Board heard that should a spill occur, it was important to protect the environment during and after the spill event. The Board is of the view that it is important to have site-specific data in advance of any spill in order to plan ahead of time. This was raised, in particular, for areas such as the Fraser and Thompson Rivers. Site-specific tactical plans were raised as being extremely useful for enabling rapid deployment of response resources, thereby limiting the impact of a release.

The Board heard that river systems such as the Fraser River, North Thompson River, Coquihalla River, and Coldwater River undergo marked seasonal variations in rates of flow, ice cover, accessibility, and other factors that impact and challenge emergency response operations. Environmental conditions that may reasonably exist for any time of year need to be considered and incorporated into emergency preparedness planning and response, selection of response equipment, and training of personnel.

The Board finds that Trans Mountain has appropriately identified issues which are particularly important for the project for inclusion in its emergency preparedness and response planning process. These include issues such as response under challenging environmental conditions, identification of sensitive and high consequence areas and response measures for submerged and sunken oil that may have escaped deployed boom or containment and will be addressed during remediation. The Board notes that terrestrial spills and spills that impact river banks or shorelines are typically cleaned up in accordance with relevant guidelines and criteria, although long-term monitoring and remediation may still be required.

Being prepared to respond to an incident includes assessing the availability (both local and regional) and the appropriateness of resources (equipment and response personnel) that will be brought to bear during the first 24 to 96 hours, from local sources and from regional sources in order to execute and implement standard and site-specific emergency response procedures and strategies. To facilitate the procurement and the mobilization of emergency response equipment needed during an incident, it is advantageous to own emergency response equipment or have mutual aid agreements or third party contractor agreements which should be prearranged with other industry operators in the region. Equipment caches and agreements may allow for the expedited release of key oil response equipment needed to respond effectively to a major incident before cascading resources can arrive from outside the region, if needed. The Board is satisfied that Trans Mountain has access to internal and external equipment and has mutual aid agreements in place to execute, if needed, should an incident occur.

The Board heard from intervenors that they were concerned about evacuations during an incident resulting from a Trans Mountain facility. While the Board understands that it is primarily the responsibility of a municipality to execute an evacuation, there is a need for a company to map out and support the mobilization and coordination of all relevant agencies and resources. This includes providing clear direction and regular and reliable information to the public and to first responders, which is important for a timely response.

The Board is of the view that Trans Mountain should be more proactive in its approach, as a generic evacuation plan cannot be applied to address all scenarios. Any plan must be based on the particular risks - and in this case, the risks that Trans Mountain facilities potentially pose - for the public living in and working in an area where evacuation could be necessary, and be further adapted according to events as they evolve. Trans Mountain is in the best position to understand the facilities' hazards, and how those hazards will impact the public. The Board is of the view that additional effort needs to be made in this area and has imposed Condition 123 to address Evacuation Plans. The Board also heard Simon Fraser University's (SFU) concerns about evacuation and the challenges related to accessibility to the University via the Burnaby Mountain Parkway and Gaglardi Way intersection, should an incident at the Burnaby Terminal occur. This condition will also require open and transparent dialogue for Trans Mountain to address SFU's concerns.

Detailed design work, consultation and planning would be required, post approval, to inform further Trans Mountain's emergency preparedness and response planning. Additional information would also be required to ensure that Trans Mountain's emergency preparedness and response plans and capabilities are in place. The Board requires Trans Mountain to report on implementation of its emergency response commitments that would involve consultation with appropriate government authorities, first responders and potentially affected Aboriginal groups. Trans Mountain would be required to report on:

- *its emergency response plan for construction (Condition 89);*
- *its consultation on improvements to the Emergency Management Program (Condition 90);*
- *updates on the improvements to the Emergency Management Program (Condition 117);*
- *its firefighting capacity at terminals (Conditions 118 and 138);*
- *its emergency preparedness and response exercises before and after commencing operation (Conditions 120, 136 and 153);*
- *its emergency preparedness and response exercise and training program including a schedule for tabletop and full-scale emergency response exercises (Condition 119);*
- *the consultation and development consultation of evacuation plans (Condition 123);*
- *the implementation of improvements to Trans Mountain's Emergency Management Program (Condition 124);*
- *its emergency preparedness and response plans for the pipeline and for the terminals (Condition 125); and*
- *its emergency preparedness and response plan for the WMT (Condition 126).*

The Board has a comprehensive regulatory regime in place related to pipeline and terminal design, safety, spill prevention and spill preparedness and response. Trans Mountain would be subject to this regime.





10.0





Environmental assessment

10.1 Overview

The Board considers environmental protection as part of its public interest mandate under the *National Energy Board Act (*NEB Act) and assesses environmental protection in each application before it. This includes the current Project where the Board is required to make a recommendation under section 52 of the NEB Act, which requires the Board to have regard to all considerations that appear to the Board to be directly related to the pipeline and to be relevant. Also, under section 52 of the NEB Act, the Board can consider any public interest that in the Board's view may be affected by the issuance of a certificate or the dismissal of the application.

The Board also has a mandate to conduct environmental assessments under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) for projects contained within that Act's *Regulations Designating Physical Activities*. The NEB's environmental assessments fulfill all requirements of both the NEB Act and the CEAA 2012, as applicable. As a responsible authority under the CEAA 2012, the Board must, in its report to the Governor in Council, set out its recommendation regarding the environmental effects of a project. Specifically, the NEB provides a recommendation that a project is likely, or is not likely, to cause significant adverse environmental effects after taking into account the implementation of mitigation measures. For effects that are likely to be significant, the Board must also recommend whether or not they are justified in the circumstances. As part of the Board's environmental assessment under CEAA 2012, the Board considers any cumulative effects that are likely to result from the Project in combination with environmental effects from other physical activities that have been or will be carried out. The Board also considers the environmental effects of accidents and malfunctions that may occur in connection with the Project.

The Trans Mountain Expansion Project (Project) involves constructing and operating an oil pipeline more than 40 km long that, if approved, would be regulated under the NEB Act. Therefore, the Project is contained within the *Regulations Designating Physical Activities* and the Board has conducted the necessary environmental assessment of it under the CEAA 2012. For the reasons outlined below in this section, the Board has assessed the potential effects of increased marine shipping associated with the Project under the NEB Act.

This chapter focuses on the changes caused to the biophysical environment by routine Project construction and operations, and on the consequences of potential spills from the pipeline and the facilities. This includes the Westridge Marine Terminal (WMT). The socio-economic effects of routine Project construction and operations are addressed in Chapter 11. Chapter 14 addresses potential effects of the routine operation of Project-related marine shipping, and the consequences of potential spills from Project-related tankers.

10.1.1 Scope of the environmental assessment under the CEAA 2012

The scope of the environmental assessment under the CEAA 2012 includes the following three elements:

1) The physical works and activities making up the Project (as described by Trans Mountain in its application and subsequent filings).
2) The biophysical and socio-economic elements that are likely to be affected by the Project.
3) The factors that must be taken into account in conducting an environmental assessment (described in section 19 of the CEAA 2012).

On 2 April 2014, the Board released the factors and scope of the factors for its environmental assessment under the CEAA 2012. This document is included as Appendix 10 to this Report.

10.1.2 Consideration of Project-related marine shipping

Marine shipping is considered in detail in Chapter 14. When the Board established the List of Issues to be considered in this hearing, it included Issue 5:

> *The potential environmental and socio-economic effects of marine shipping activities that would result from the proposed Project, including the potential effects of accidents or malfunctions that may occur.*

The Board stated that this would be considered under the NEB Act.[47] On 10 September 2013, the Board issued specific filing requirements[48] related to the environmental and socio-economic effects assessment of increased marine shipping that Trans Mountain should consider in its application to the Board. In the Board's overall public interest recommendation under the NEB Act, the Board took into consideration its findings on Issue 5.

In the Scoping Document, the Board said that increased marine shipping to and from the WMT were not part of the Project for the purposes of the CEAA 2012. The Board said that it would consider the potential effects of these shipping activities, and any associated accidents or malfunctions that may occur, under the NEB Act. To the extent that there is potential for the effects of the increased marine shipping to interact with the environmental effects of the Project as defined in the CEAA 2012, the Board would consider those effects under the cumulative effects portion of its CEAA 2012 environmental assessment.

Regardless of whether the Board's environmental assessment falls under the NEB Act or CEAA 2012, the Board provides one comprehensive environmental assessment that covers all regulatory requirements.

10.1.3 Potential effects associated with upstream and downstream activities

In its List of Issues for the hearing, the Board said that it did not intend to consider the environmental and socio-economic effects associated with upstream activities, the development of oil sands, or the downstream use of oil transported by the pipeline. During the hearing, the Parents from Cameron Elementary School, Burnaby, and the City of Vancouver, with the support of several other intervenors, requested that the Board expand its List of Issues to include these upstream and downstream effects. The Board decided against these requests in its 23 July 2014 Ruling No. 25, stating in part the following:

> *"The Project does not include upstream production and is not dependent on any particular upstream development; therefore, any link to environmental changes caused by such upstream production is indirect and is not necessarily incidental to Project approval.*
>
> *In addition, no particular upstream development is dependent on the Project."*

With respect to downstream use, the Board said:

> *"The Project does not include downstream use and is not tied to, or dependent on, any particular use in any particular destination... The effects of end use are not directly linked or necessarily incidental to the Board's regulatory process regarding the Project".*

47 NEB letter of 2 April 2014, Trans Mountain Expansion Project, Factors and Scope of Factors for the Environmental Assessment pursuant to CEAA, 2012 (Scoping Document).

48 This document was titled: Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increased Marine Shipping Activities, Trans Mountain Expansion Project

"[D]ownstream effects are more effectively assessed and regulated by the jurisdictions where the use occurs."

As a result and as fully detailed in Ruling No. 25, the Board did not consider these upstream and downstream effects in its assessment of the Project.[49] However, the Board did consider greenhouse gas emissions from Project construction and operation.

10.1.4 Responsibilities under other Acts

Fisheries Act

Under subsection 35(1) of the *Fisheries Act*, no person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery, unless such work, undertaking or activity is exempted, as per subsection 35(2) of the *Fisheries Act*.

The Board, and Fisheries and Oceans Canada (DFO) entered into a Memorandum of Understanding (MOU) on 16 December 2013. Under the MOU, the Board has the responsibility to assess potential impacts to fisheries from proposed NEB-regulated pipeline and power line applications, and notify DFO if any such works may likely require authorization under the *Fisheries Act*. DFO would then be responsible for issuing any *Fisheries Act* authorization(s). The MOU does not apply to marine terminals or marine shipping.

For this Project, the Board was responsible for reviewing Project works related to the construction of the pipeline and facilities (excluding the WMT), and refer any works to DFO that the Board determines may likely require authorization under the *Fisheries Act*. For a detailed discussion of this review, please see section 10.2.5 - Freshwater Fish and Fish Habitat. The Board was also responsible for conducting an environmental assessment of the potential effects of the Project (including the expansion of the WMT) on marine fish and fish habitat, as per the requirements of CEAA 2012 (section 10.2.14). The responsibility to review the potential effects from the expansion of the WMT on marine fisheries, under the *Fisheries Act*, remains the responsibility of DFO.

The Board also conducted an environmental assessment, under the NEB Act, of the potential effects on marine fish and fish habitat from Project-related marine vessels (Chapter 14, section 14.3.1 – Marine Fish and Fish Habitat). The responsibility to ensure that Project-related marine vessels, as well as all other marine shipping vessels, are in compliance with the *Fisheries Act* remains the responsibility of DFO.

Species at Risk Act

Pursuant to the *Species at Risk Act* (SARA), the Board is required to identify the adverse effects of projects that are contained within the CEAA 2012 *Regulations Designating Physical Activities* on each listed wildlife species and its critical habitat. The Board must also ensure that measures are taken to avoid or lessen those effects, and to monitor them.

On 23 April 2014, the Board notified the Ministers of Environment and Climate Change Canada (ECCC), DFO, and Parks Canada Agency that the Project, if approved and constructed, may affect a number of species listed on Schedule 1 of the SARA (SARA-listed species) and/or their habitat.

In meeting the Board's obligations under the SARA, the Board assessed the environmental effects of the Project on the SARA-listed species. The Board identified the potential adverse effects that the Project might have on listed wildlife species and their critical habitats. The Board considered the mitigation measures proposed to avoid or minimize those effects, and the plans to monitor their effectiveness. The Board also considered all reasonable alternatives (e.g., routing, design, mitigation) to reduce the impact on species' critical habitat. In addition to Trans Mountain's proposed measures, the Board would also impose conditions requiring Trans Mountain to implement measures that are consistent with any applicable recovery strategies and action plans.

Under the MOU with DFO, the Board has the responsibility to determine if proposed projects would impact aquatic species at risk, and to notify DFO of such impacts. DFO would then determine if permitting may be required under the SARA.

49 The City of Vancouver sought leave to appeal Ruling No. 25. Leave to appeal was dismissed by the Federal Court of Appeal on 16 October 2014.

10.1.5 Environmental and socio-economic assessment methods

In assessing the environmental and socio-economic effects of the Project, the Board considered the environmental and socio-economic setting, potential effects on valued components (both environmental and socio-economic), interactions between the valued components, the adequacy of Trans Mountain's proposed environmental protection strategies and mitigation measures to address them, environmental concerns or issues raised by intervenors and commenters, as well as the adequacy of Trans Mountain's own environmental and socio-economic assessment.

The Board generally adopted the spatial and temporal boundaries for each valued component as defined by Trans Mountain, for both Project effects and cumulative effects. The spatial boundaries (or study areas) are described in Appendix 11. For the temporal boundaries, the Board considered the planning, construction, operations and abandonment phases of the Project.

Section 10.2 provides detailed analyses of potential adverse environmental effects that were of elevated concern to the public or Aboriginal groups, or have potential environmental consequences that require additional measures or Board conditions to mitigate them. The absence of a discussion on a particular effect in this section does not imply that it was not assessed.

Where any effects (whether significant or non-significant) were predicted to remain after proposed mitigation is applied (i.e., residual effects), the Board assessed cumulative effects. This involved considering the residual effects associated with the Project in combination with the residual effects of other past, current and future (i.e., reasonably foreseeable) physical facilities and activities, and that have effects within the temporal and spatial boundaries and ecological context adopted for the Project assessment.

In evaluating the significance of cumulative effects, the Board focused on the total cumulative effects resulting from all physical facilities and activities as defined above, considered in combination with Trans Mountain's proposed Project. In section 10.1.5, see subsection on Cumulative effects for the Board's views on using this approach instead of that originally proposed by Trans Mountain.

In section 10.1.6, the Board discusses follow-up programs required under the CEAA 2012.

The Board's conclusion and recommendation to the Governor in Council on its overall CEAA 2012 significance determination for the Project is found in Chapter 2, section 2.4.

Indicator species based approach and species at risk

Trans Mountain used an approach based on indicator species[50] to estimate potential effects of the Project on other species, and used this same approach for species at risk. Several intervenors raised concerns that Trans Mountain did not assess certain species as part of the environmental assessment, and that some key indicator species were missing.

Trans Mountain said that using indicators to assess potential Project effects on biotic elements is a commonly-employed method in environmental assessment. It said that it chose key indicators to be representative of certain potential Project effects since it is not necessary to assess all species individually. It said that, based on the information provided for the selected indicators, one could infer the potential effect pathways and likely responses to disturbance of other species with similar ecological requirements. Nevertheless, at the request of the Board and ECCC, Trans Mountain completed, and filed as evidence, individual assessments for SARA Schedule 1-listed species that may be affected by the Project.

Views of the Board

The Board concludes that as long as the selected indicator species can reasonably represent other relevant species, then relying on this method of assessing Project effects is generally acceptable for most species that have similar habitat or ecological function and requirements, and that are likely to respond similarly to certain effects.

Given the potential for the Project to affect various SARA-listed species, their residences or their critical habitat, and considering their at-risk status and potential sensitivity to further adverse effects, the Board considered it appropriate, in general, to assess the Project's effects on each of those species

50 This approach involves using one species to represent the similar environmental characteristics of a group of species or a particular ecosystem.

individually. This provided the Board with greater certainty that effects are appropriately identified, addressed and effectively mitigated, taking the particularities of each species at risk into account. Therefore, the Board has applied this approach to its assessment of species at risk. Although effects and mitigation have been considered for each individual species at risk separately, the Board only provided a species-specific discussion if it was deemed to be necessary (i.e., if a species was likely to be impacted from the Project) in addition to its more general discussion.

Determining significance

In determining the significance of residual environmental and socio-economic adverse effects from Project construction and operations, after taking mitigation and offsets into account, the criteria the Board considered were temporal extent, reversibility, geographic extent and magnitude. Appendix 12 provides the common ratings for each criterion, and basic definitions for each rating. The Board took into account ecological and social context when arriving at its findings with respect to each criterion, in addition to any uncertainties with respect to potential effects. Appendix 12 also provides the Board's definitions of "likely to be significant" and "not likely to be significant." In general, Project effects are considered "likely to be significant" when effects are either of "high magnitude," or "long-term, permanent, and of regional or global extent."

The Board's evaluation of the likely significance of adverse effects is presented in a tabular format for most key valued components (or indicators within those components). For each residual effect considered in detail, the Board has provided its views, including a discussion of any additional mitigation or actions required by way of recommended conditions. The significance tables also include a discussion of cumulative effects.

Methods for assessing accidents and malfunctions

Trans Mountain said that the methods it used to assess the environmental and socio-economic effects of Project spills were different than the methods it used for assessing the effects of routine Project activities. It said that different methods were required because spills represent low probability, unpredictable events, and are unlike predictable, routine project activities. Trans Mountain used a structured risk assessment approach to identify the consequences of credible worst-case and smaller spills. It conducted ecological risk assessments and human health risk assessments to evaluate potential acute and chronic environmental and socio-economic effects. It said that it assessed the spatial extent, magnitude and time to recover from likely oil spill effects.

Several intervenors, including Pacheedaht First Nation, Squamish Nation questioned Trans Mountain's method for assessing the significance evaluation of spill effects and said that Trans Mountain did not provide significance determinations of adverse effects from accidents and malfunctions, and thus did not follow the requirements of the CEAA 2012. Intervenors said that most large magnitude spill events are of low probability and Trans Mountain did not consider low probability events in determining significance.

Some intervenors, including Chawathil First Nation and Cheam First Nation, said that Trans Mountain used credible worst-case scenarios rather than worst-case scenario spill models. They said that the significance of a spill event cannot be assessed simply by looking at the probability of its occurrence but rather, must also factor in the consequences of the event.

Trans Mountain said that the central test in the CEAA 2012 is whether or not a Project is likely to cause significant adverse environmental effects. It said that likelihood was evaluated as one of several significance criteria and its approach in evaluating significance represents the accepted practice, and that it is a practical and defensible means of fulfilling the requirements of the CEAA 2012.

Views of the Board

Under the CEAA 2012, the Board is required to take into account the significance of effects of accidents and malfunctions that may occur, and to provide a recommendation with respect to whether accidents and malfunctions that may occur are likely to cause significant adverse environmental effects. Given that every conceivable malfunction and accident cannot be considered in detail, the Board accepts Trans Mountain's approach of considering reasonably credible and representative events to gain an understanding of the types and magnitude of effects that could

result from potential accidents and malfunctions. Nevertheless, to provide a robust picture of the risks associated with the Project, the Board considers it important to analyze both the likelihood of such events and the significance of the effects that could result from such events, even if they are unlikely.

This chapter therefore includes a discussion of the potential environmental effects of a spill that might result from accidents and malfunctions involving the Project, such as a spill from the pipeline, from the storage terminals or from the Westridge Marine Terminal. Chapter 9 provides an assessment of the likelihood of such events occurring, and section 10.2.17 provides the Board's recommendation with respect to whether there are likely to be significant adverse environmental effects from any accidents and malfunctions.

Cumulative effects

Trans Mountain evaluated the significance of the Project's contribution to cumulative effects, rather than the significance of total cumulative effects (i.e., cumulative effects from past, existing and reasonably foreseeable physical facilities and activities, including the Project's effects). The Board questioned Trans Mountain regarding its methodology. Although Trans Mountain provided significance evaluations of total cumulative effects for each valued component as the Board requested, it maintained its argument that the Project's contribution to cumulative effects, rather than total cumulative effects, should be the key focus of the assessment.

Views of the Board

The Board does not accept Trans Mountain's position that the Project's contribution to cumulative effects, rather than total cumulative effects, is the appropriate focus for cumulative effects assessment.

Paragraph 19(1)(b) of the CEAA 2012 requires consideration of the significance of the environmental effects described in paragraph 19(1)(a), which includes the cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out. The Board finds this to mean that the focus of any cumulative effects assessment should be on the total cumulative effects. Consistent with this, the Board's Filing Manual states that the "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." By focusing on total cumulative effects, cumulative effects assessment differs from project-specific effects assessment, and considers what is often the primary threat to valued components; namely the total cumulative effects on that component.

The Board notes that, although the focus when considering the significance of cumulative effects should be on total cumulative effects, the Project's relative contribution to total cumulative effects is also relevant. Thus, for example, if total cumulative effects are considered to exceed a relevant threshold for a particular valued component, then effects on that component will generally be found to be significant unless the Project contribution to total cumulative effects is inconsequential. Such thresholds might include, for example:

- *Pollutants exceeding established standards or guidelines.*
- *A species being at risk because of cumulative effects.*
- *Habitat disturbance for a species of conservation concern or for a valued ecosystem exceeding an established threshold (such as for linear disturbance density) or otherwise being of sufficient concern to deserve no net loss.*

If there is no relevant threshold for a valued component but cumulative effects are nevertheless considered substantial, then effects on that component may be found to be significant unless the Project contribution to total cumulative effects is relatively minor.

Mitigation hierarchy and offset measures

The Board requires companies to make considerable efforts to **prevent or avoid** environmental impacts and, if impacts are unavoidable, to **minimize and reduce** them. Where residual effects remain (i.e., the effects cannot be avoided or fully mitigated), **offset** measures can be used to help counteract those effects on a local or regional level.

Offset measures should generally not be seen as a replacement for the other options preceding it in the mitigation hierarchy, but rather be considered a last resort when reasonable efforts at avoidance and mitigation have been exhausted. In such cases, offsets can prove to be an effective tool for balancing environmental protection and development.

In this chapter, the Board has introduced several conditions that would require Trans Mountain to develop offset plans to counter unavoidable residual effects on certain valued components. For example, the Board requires offsets for a number of valued components for which cumulative effects exceed a relevant threshold but reasonable avoidance and mitigation measures are not able to bring the Project contribution down to levels that are inconsequential.

The concept of offsets could vary for each valued component: however, there are some general principles, including:

- equivalency (i.e., compensating with equivalent ecological function at another site);
- additionality (i.e., providing protection beyond business-as-usual or what would have happened anyway);
- comparable location (i.e., offset site should have comparable ecosystem values such as species composition and habitat structure);
- timing (i.e., avoiding or allowing for time lags between impact and compensation);
- duration (i.e., ensuring offset sites are protected for an appropriate amount of time, which may be long-term); and
- accountability (e.g., formalized protection).

The Board expects these principles to be applied in offset plans.

10.1.6 Follow-up program

Trans Mountain committed to a post-construction environmental monitoring program. The Board would impose conditions requiring Trans Mountain to include consideration of soils, weeds, watercourse crossings, riparian vegetation, wetlands, rare plants, lichens and ecological communities, municipal tree replacement, wildlife and wildlife habitat, fish and fish habitat, marine fish and fish habitat, marine birds, marine mammals and species at risk, as part of its post-construction environmental monitoring program. Trans Mountain committed to continue to monitor any unresolved environmental issues remaining after five years, until they are resolved. The Board would impose other conditions incorporating monitoring requirements, such as a ten year monitoring requirement for grasslands.

Section 29(1)(b) of the CEAA 2012 requires a follow-up program. This is intended to verify the accuracy of the predictions regarding potential environmental effects and to determine if mitigation measures are working as intended. The Board's conditions would require Trans Mountain to undertake environmental monitoring, compare results with predicted effects, assess mitigation success, take remedial actions if needed, and report monitoring results and actions taken. Collectively, these requirements constitute a follow-up program under the CEAA 2012.

The Board's conditions also incorporate adaptive management, requiring the implementation of new or modified mitigation measures over the life of the Project in response to mitigation measures that do not achieve full success and to address unanticipated environmental effects.

10.1.7 Adaptive management

A number of participants discussed the interplay of adaptive management and the precautionary principle. Pro Information Pro Environment United People Network (PIPE UP), for example, emphasized adaptive management must be applied in a precautionary manner and said it is not appropriate if:

- potential effects and mitigation strategies are not sufficiently well known to control risk;
- the risk of harm to human health or species at risk may be serious or irreversible; or
- there is a lack of baseline information, conditions do not allow for effective monitoring using appropriate indicators, or there are no thresholds to trigger remedial action.

Views of the Board

The Board generally agrees with the cautions expressed by PIPE UP, as summarized above, concerning reliance on adaptive management, understood here to typically mean the planned application of corrective actions in response to the results of monitoring which is designed to determine if environmental effects and mitigation success are proceeding as expected. In situations where effects may be significant, the Board agrees with PIPE UP that adaptive management should generally not be relied upon to conclude effects will not be significant if there is insufficient understanding of the risks or of the efficacy of mitigation or corrective actions, or where there is insufficient confidence in the effectiveness of monitoring to determine the need for corrective actions. However, in appropriate circumstances, adaptive management can be an important part of the follow-up program for a project to allow for uncertainties. The Board's conditions also incorporate adaptive management, requiring the implementation of new or modified mitigation measures over the life of the Project in response to mitigation measures that do not achieve full success and to address unanticipated environmental effects. For example, Conditions 36, 37, 149 and 150 require Trans Mountain to provide a pre-construction assessment of caribou habitat that could be affected by the Project, a restoration plan for such habitat including quantifiable targets and performance measures to evaluate restoration effectiveness, a monitoring program to verify the effectiveness of restoration measures that includes protocols for how restoration measures will be adapted as required based on monitoring results, and reporting on such effectiveness and adaptations. More generally, for all valued environmental components, Condition 151 requires Trans Mountain to include goals, monitoring results, corrective actions taken, and the observed success of such actions, in each post-construction monitoring report.

10.1.8 Alternative means of carrying out the project

Section 19 of the CEAA 2012 identifies factors that must be considered in the environmental assessment of a designated project, including "alternative means" of carrying out the designated project that are technically and economically feasible and the environmental effects of any such alternative means.

The Board considered alternative means of carrying out the proposed Project, such as options for alternate locations, routes, construction methods and mitigation measures.

Trans Mountain committed to avoid sensitive areas as feasible when selecting the pipeline corridor and considered alternative construction measures such as trenchless watercourse crossings where that would reduce potential adverse environmental effects resulting from the Project. Trans Mountain committed to use least-risk timing windows and setback distances to reduce effects on wildlife and fish and their habitat during sensitive periods, Trans Mountain said that, in the event of conflicts between the least-risk windows and the construction schedule, it would consult with the appropriate regulatory authorities to develop appropriate mitigation.

A detailed discussion of alternative means of carrying out the Project is included in Chapter 11, section 11.1, along with the Board's views.

10.2 Environmental effects

In reaching its recommendations regarding the significance of adverse environmental effects on the valued environmental components, the Board considered Trans Mountain's environmental assessment, as well as all relevant evidence from intervenors and commenters, including where concerns were raised related to environmental issues resulting from Project construction and operations, and accidents and malfunctions that may occur in relation to the Project.

10.2.1 Air emissions

Trans Mountain conducted an air quality assessment to evaluate air emissions and greenhouse gas emissions that would be generated during Project construction and operations. The spatial and temporal boundaries used for the air quality assessment are described in Appendix 11.

In this section, the Board focuses on:

- ambient air quality;

- air emissions from the Edmonton Terminal;
- air emissions from the WMT and the Burnaby Terminal; and
- fugitive emissions[51] from the Project.

Ambient air quality

Trans Mountain said that the overall existing air quality conditions along the proposed pipeline corridor, with respect to the criteria air contaminants (particulate matter, carbon monoxide, nitrogen dioxide and sulphur dioxide), is very good with few exceedances of the relevant ambient air quality objectives. Trans Mountain said that all predicted Project-related concentrations are less than the applicable ambient air quality objectives, except where existing exceedances of applicable guidelines are already occurring (which are mainly attributed to existing background sources).

Living Oceans Society said that Trans Mountain has not provided the fundamental data needed to assess the quality of its air quality measurements, and specifically the quality of the ambient air quality measurements. It said that the background concentrations used in the model for short term concentrations (1-24 hour) were unrealistically high in comparison of average conditions. Living Oceans Society said that unrealistically high background concentrations make the Project's contribution to ambient concentrations appear smaller than it actually is. Living Oceans Society said that credible measurements would be needed to determine the actual impact of Project operations on pollutant concentrations relative to background, taking into account variations in background and Project concentrations across all seasons.

Trans Mountain said that it agrees with Living Oceans Society that ambient background concentrations vary in time and space; however, it took into account elevated background values in order to reflect a reasonable maximum operating scenario when evaluating the Project's potential effects.

Air emissions from the Edmonton Terminal

Trans Mountain predicted that the base case air quality (i.e., existing conditions reflecting all projects in the area, including existing Trans Mountain operations) near the Edmonton Terminal, exceeds Alberta's ambient air quality objectives for benzene (1-hour), xylene (24-hour), and hydrogen sulphide (24-hour) concentrations. It said that all anticipated Project-related concentrations are less than the applicable ambient air quality objectives. These contaminants are nonetheless predicted to exceed the applicable objectives when ambient background is included.

Trans Mountain said that the largest source of volatile organic compound (VOC) emissions due to the Edmonton Terminal's existing operations is the storage of light/synthetic crude oil products. It said that, overall, total annual volatile organic compound emissions would increase by 9 per cent between existing and Project-related operations at the terminal.

Trans Mountain said that the total cumulative effects would be significant for the Edmonton Terminal for some of the compounds that exceed the applicable ambient air quality objectives (e.g., benzene, xylene, and hydrogen sulphide). Health Canada expressed concerns regarding Trans Mountain's assessment of these contaminants' health risks. These are discussed in Chapter 11.

With respect to the Edmonton Terminal, Trans Mountain said that it is technically possible to include fixed roofs and odour control systems in its tank designs. It said that internal floating roofs with tank vapour adsorption units may provide an incremental benefit (approximately 3 to 9 per cent) in annual emissions reduction for benzene, xylene, and hydrogen sulphides for the proposed tanks. Nevertheless, it said that installing fixed roofs and odour control systems in addition to floating roofs does not provide any material value given that the terminal is in an industrial location.

Trans Mountain said that there is an existing Strathcona Industrial Association East Edmonton monitoring station in the vicinity and it does not see the need to develop an air emissions management plan for the Edmonton Terminal.

51 Fugitive emissions refer to emissions from all non-combustion sources, such as leaks from equipment (flanges, control valves, pump seals), vapours or gases that escape from storage tanks and during tanker loading, and suspended dust from vehicular traffic and equipment. Fugitive emissions are comprised of certain criteria air contaminants, greenhouse gas emissions and volatile organic compounds.

Air emissions from the Westridge Marine Terminal (WMT) and the Burnaby Terminal

Trans Mountain said that the ambient background concentrations for particulate matter 2.5 microns or less in diameter ($PM_{2.5}$) and nitrogen dioxide are generally high in the area around the WMT and the Burnaby Terminal due to the existing activities. It said that the largest contributor to predicted $PM_{2.5}$ concentrations is the existing vapour combustion unit at the WMT, from which all soot was conservatively assumed to be $PM_{2.5}$. Trans Mountain said that the proposed vapour combustion unit would be used during peak periods when three tankers are being loaded simultaneously. Otherwise, it would act as a back-up or standby unit.

Metro Vancouver said that it is concerned about particulate matter emissions from the proposed vapour combustion unit at the WMT. Metro Vancouver said that the emission factors Trans Mountain used to estimate the vapour combustion unit's particulate matter emissions are not representative. It recommended monitoring to verify these emissions during operation.

Participants, including North Shore No Pipeline Expansion, Burnaby Residents Opposing Kinder Morgan Expansion and Ms. Erika Plettner, expressed concerns that the Project would increase air emissions from loading and processing at the WMT and from the Burnaby Terminal. The City of Burnaby said that the assumptions Trans Mountain used in its air dispersion modelling may be incorrect, and that it omitted key air pollutants (such as diesel particulate matter, 1,3-butadiene) in the models. As a result, air emission concentrations may be under-estimated at the receptor level within the area of impact.

Metro Vancouver said that the potential effect of benzene emissions from the WMT on ambient air quality has been under-estimated due to the assumed near-perfect VOC collection efficiency of 99.9999 per cent during ship loading.

Simon Fraser University said that there are strong seasonal variations in atmospheric circulation and stability over the Burnaby-Simon Fraser University area that will have a significant influence on the dispersion of any toxic chemicals released into the atmosphere at different times of the year. It said that Trans Mountain did not demonstrate how it carried out simulations using a series of chemical releases with different buoyancy characteristics under different meteorological circulations and stability conditions.

ECCC said that Trans Mountain excluded tanker boiler emissions in its estimation of Project related marine air emissions, which leads to multiple uncertainties in regards to pollutants such as nitrogen oxides and $PM_{2.5}$. In response, Trans Mountain performed additional dispersion modelling for the combined effects of emissions from the Burnaby Terminal, the WMT, and all marine transportation traffic, including boiler emissions from tankers at berth. It then compared the results with boiler emissions excluded and concluded that the effect of boiler emissions from tankers at berth is negligible.

ECCC said that it found several uncertainties in the Project emission estimates of $PM_{2.5}$ and nitrogen dioxide that increased the uncertainty about the modelled air quality impacts. ECCE recommended that Trans Mountain establish a program to monitor air contaminants, including nitrogen dioxide and $PM_{2.5}$ at or adjacent to Tsleil-Waututh Nation's Burrard Inlet No.3 reserve.

Fraser Valley Regional District said that the predicted increase in VOC emissions from the Project would undermine its efforts to reduce VOC emissions and ozone concentrations in the Fraser Valley Regional District. ECCC said that it examined Trans Mountain's photochemical modelling and found several aspects of analysis were uncertain which reduced confidence in findings related to the magnitude of ozone, $PM_{2.5}$, and reduced visibility.

Metro Vancouver and ECCC pointed to numerous deficiencies in Trans Mountain's photochemical modelling of the formation of secondary particulate matter and ozone. They said that Trans Mountain should work with the Lower Fraser Valley Air Quality Coordination Committee (LFVAQCC) in establishing the scope, methodology, and meteorological and emissions scenarios for carrying out the modelling. Trans Mountain said that it submitted its draft work plan for the updated modelling to that committee for its review, but the committee declined to provide any comments. Nevertheless, Trans Mountain filed the results of its revised photochemical modelling and said that it addressed most of the issues raised by ECCC and Metro Vancouver. Metro Vancouver said that a letter written on behalf of ECCC, Fraser Valley Regional District, Port Metro Vancouver and Metro Vancouver identifies the LFVAQCC's concerns respecting the insufficient amount of time to develop and review the modelling plan and establish emission scenarios and cumulative cases.

With respect to ECCC's specific recommendation for follow-up modelling using 2009 meteorological data, Trans Mountain said that it does not see the need to update the modelling a third time. It said that none of ECCC's concerns are expected to materially affect the updated photochemical modelling results.

Trans Mountain said that, although it agrees that Project emissions would result in an increase in concentrations near the WMT and the Burnaby Terminal, it is committed to meeting the applicable ambient air quality objectives and other regulatory requirements for these terminals. Trans Mountain said that it is in the process of evolving and refining the vapour control designs with the goal of ensuring sufficient recovery and destruction efficiencies to meet the applicable ambient air quality objectives at the WMT. Trans Mountain said that it is committed to working with various provincial and federal agencies with responsibilities related to air emissions from the Project.

Fugitive emissions

Trans Mountain said that, in its modelling, it assumed the worst-case scenario of loading three tankers at once, although this is expected to occur for less than 5 per cent of the total loading time in a year. It said that the marine terminal would have two new vapour recovery units. Trans Mountain said that proposed carbon beds upstream of the new vapour combustion and recovery units are expected to remove 99.9 per cent of hydrogen sulphide and mercaptans before entering the units.

Metro Vancouver said that the collection efficiency of 99.9999 per cent used to estimate volatile organic compound fugitive emissions during tanker loading is too high. After further testing, Trans Mountain estimated these fugitive emission rates assuming the more conservative collection efficiency of 99.5 per cent instead of 99.99 per cent and compared them to the relevant ambient air quality objectives. It found that all maximum predicted concentrations using the conservative efficiency were below the relevant ambient air quality guidelines.

Trans Mountain committed to undertaking surveys aboard randomly sampled tankers at the WMT to check cargo tank covers and associated seals for leaks of real-time total hydrocarbon or total volatile organic compounds using a portable monitor. The Loading Master would undertake four such surveys per year (one per season).

Trans Mountain said that fugitive emissions of volatile organic compounds and greenhouse gas emissions could escape from the proposed additional storage tanks at the Edmonton, Sumas, and Burnaby Terminals through working and storage losses. Trans Mountain said that it would install tank vapour activation units on all proposed tanks at the Burnaby and Sumas Terminals to minimize fugitive volatile organic compound losses.

The Fraser Valley Regional District asked questions about an air emissions management plan for the WMT, specifically regarding dust emissions. Trans Mountain said that it would engage the District in developing a Dust Management Plan for the WMT, Sumas Terminal, and pump stations located within the district.

Trans Mountain said that Burnaby Mountain tunnel construction could be expected to generate air emissions, including fugitive and suspended dust emissions. It said that it is committed to implementing air emission and dust control mitigation measures at, and on access to and from, the work site.

Views of the Board

Several intervenors raised concerns about the ambient air quality measurements and noted uncertainties in Trans Mountain's air dispersion modelling. Notwithstanding that there are some limitations and uncertainties in Trans Mountain's air quality assessment and in intervenors' submissions, the Board is of the view that air dispersion modelling is a complex process and, as with any predictive modelling, uncertainties and limitations are inherent.

The Board acknowledges intervenors' interest related to monitoring air emissions from the tank terminals and Westridge Marine Terminal (WMT). In the Board's view, air emissions monitoring is paramount and serves as a valuable tool in verifying and validating the results of any air dispersion modelling. Ambient air quality monitoring provides a realistic assessment of potential impacts of air emissions from Project operations, and precludes any uncertainties or limitations associated with the predictive modelling. To this end, the Board would impose Conditions 52 and 79, requiring Trans Mountain to develop and implement air emissions management plans that are intended to protect

both the environment and human health. The Board considered a number of comments from the participants on these conditions with regard to Air Emissions Management Plans. The Board requires Trans Mountain to include, with the filed plans, a summary of its consultations with appropriate government authorities, and any potentially affected Aboriginal groups and landowners/tenants.

In their comments on the Board's draft conditions, some intervenors (e.g., Metro Vancouver), requested that the Board require Trans Mountain to provide a description of how data will be made available in real time to support public air quality advisories and public access to air quality information. Conditions 52 and 79 require Trans Mountain to provide reporting details, including a description of how the air quality monitoring data will be made available to the public.

ECCC, in its final argument, emphasized the importance of establishing the local, pre operation baseline for new monitoring sites in order to quantify the magnitude of the impacts attributable to the Project. The Board concurs with ECCC and requires Trans Mountain, as part of the Air Emissions Management Plan for the WMT (Condition 52), to monitor ambient air quality for at least one year prior to commencing operations, with the intent of establishing robust baseline data.

In regard to the Air Emissions Management Plans for the Edmonton, Sumas, and Burnaby Terminals, the Board requires Trans Mountain to establish baseline data as informed by relevant modelling results and using recent existing representative monitoring data (Condition 79). The Board also requires Trans Mountain to include details on the locations of air monitoring sites, including the rationale for the locations selected.

Certain ambient concentrations around the Edmonton Terminal already exceed the applicable ambient air quality objectives. This is likely due to the existing heavy industrial activity in the area. Given that the existing cumulative effects at the Edmonton Terminal are already above the applicable guidelines, the Board finds that any incremental contribution from Project operations could potentially increase the burden on the existing air quality, regardless of how small that contribution would be. Consequently, the Board would impose Condition 137 requiring Trans Mountain to install steel pontoon internal floating roofs and fixed roofs with odour control systems for all proposed new tanks at the Edmonton Terminal. While generally the existing tanks at the Edmonton Terminal were outside the scope of this hearing, the Board nevertheless encourages Trans Mountain to consider employing these types of roofs on their existing tanks or any future expansions.

The Board is not persuaded by Trans Mountain's reasoning that ambient air quality monitoring is not required for the Edmonton Terminal since the contaminants are already being measured by the Strathcona Industrial Association Edmonton East monitoring station. In the Board's view, monitoring air emissions from the Edmonton Terminal would enable Trans Mountain to delineate the source of emissions and be able to mitigate the emissions effectively with the intent of protecting the environment and public health. Therefore, the Board would impose Condition 79 requiring Trans Mountain to develop and implement an Air Emissions Management Plan for the Edmonton Terminal's proposed operations.

As Trans Mountain acknowledged, fugitive emissions of volatile organic compounds and greenhouse gas emissions could escape from the proposed additional storage tanks at the Edmonton, Sumas, and Burnaby Terminals through working and storage losses. In order to confirm that there are minimal fugitive losses from Project construction and operations, and Trans Mountain effectively implements measures to reduce any adverse effects of these fugitive emissions, the Board would impose Conditions 53, 54 and 55 requiring Trans Mountain to develop Fugitive Emissions Management Plans for pump stations, terminals, and the WMT. The Board notes the varying opinions between Trans Mountain and Metro Vancouver regarding the emissions factors and vapour collection efficiency used in estimating fugitive emissions at the WMT. To this end, the Board would impose a condition requiring Trans Mountain to provide the procedures for verifying, tracking and reporting on collection, removal and combustion efficiencies of its equipment (Condition 53).

The Board heard concerns expressed by Fraser Valley Regional District that the predicted increase in volatile organic compound (VOC) emissions from the Project would undermine its efforts to reduce VOC emissions and ozone concentrations in the Fraser Valley Regional District. The Board is aware that ambient background concentrations for $PM_{2.5}$ and nitrogen dioxide are generally high in the area around the WMT and the Burnaby Terminal due to the existing activities.

In their evidence, Metro Vancouver and ECCC identified numerous deficiencies in Trans Mountain's photochemical modelling and requested follow-up modelling using 2009 meteorological data. The Board accepts that there are deficiencies in Trans Mountain's photochemical modelling. However, the Board finds that a number of concerns noted were around monitoring of fugitive VOC emissions during the loading of tankers using real time observations of speciated VOC concentrations at the WMT. Given that the Board would require Trans Mountain to develop and implement an Air Emissions Management Plan for the WMT (Condition 52) and a Fugitive Emissions Management Plan for the WMT (Condition 53), the Board is not persuaded to require Trans Mountain to update the photochemical modelling. These conditions would include requirements for monitoring and managing contaminants, including volatile organic compounds, oxides of nitrogen, ozone and reduced visibility, and a plan to manage fugitive emissions from the WMT.

With respect to boiler emissions from tankers at berth, Transport Canada said that the North American Emission Control Area puts in place the most stringent air emissions requirements for tankers. Under these standards, all tankers must either burn fuel with 0.10 per cent sulphur content or use alternative technology that results in equivalent emissions. The Board agrees with Transport Canada's statement that the implementation of either of these would significantly reduce all sources of sulphur oxide emissions from tankers. As well, as required by North American Emission Control Area (under MARPOL), engines fitted onto tankers after 1 January 2016 will need to meet Tier III nitrogen oxide standards for a reduction of nitrogen oxide emissions of up to 80 per cent.

The Board acknowledges and shares the general concerns raised by several intervenors, including the Métis Nation British Columbia, about the cumulative impacts on air quality, particularly in areas where contaminant levels are already exceeding the applicable ambient air quality objectives. The Board also concurs with Trans Mountain that its proposed mitigation measures for the Project would reduce the severity of Project-related cumulative air emissions. However, to further minimize the cumulative air emissions, the Board would impose Conditions 79 and 137 requiring Trans Mountain to implement measures (e.g., new roof types, a local monitoring station) above and beyond those that it proposed to reduce Project-related impacts around the Edmonton Terminal.

The Board finds that air emissions from construction activities are expected to be intermittent, of limited duration, localized, and reversible in less than a year. Hence, in the Board's view, construction-related air emissions from the Project are not likely to cause significant adverse effects.

Chapter 11 provides a significance evaluation of health effects of air emissions.

Significance evaluation: increase in ambient air emissions during operations at the Edmonton Terminal

	Criteria	**Rating**	**Description**
Project effects	*Temporal extent*	*Long-term*	*Emissions from the terminal (primarily fugitive emissions from tanks) would continue throughout the operations phase.*
	Reversibility	*Permanent*	*Emissions from the terminals may only be reversible if and when their operations cease in several decades.*
	Geographic extent	*Regional Study Area*	*Emissions from the terminal are expected to dissipate in the Regional Study Area and would vary with changes in operational management and meteorological conditions.*
	Magnitude	*Low*	*Emissions from the terminal are expected to be below regulatory thresholds or guidelines, taking into account the conditions the Board would impose requiring an Air Emissions Management Plan, Fugitive Emissions Management Plan, and the installation of steel pontoon internal floating roofs and fixed roofs with odour control systems for all proposed new tanks.*
Cumulative effects	*Existing local ambient air quality concentrations for benzene, xylene, and hydrogen sulphide already exceed the applicable ambient air quality objectives due to the existing industrial activities in the Regional Study Area. With the conditions the Board would impose around air quality, including measures above and beyond those proposed by the company, the Project's contribution to total cumulative effects is expected to be inconsequential.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

Significance evaluation: increase in air emissions during operations at the Burnaby Terminal and the Westridge Marine Terminal (WMT) (assessed within the same study area)

	Criteria	Rating	Description
Project effects	*Temporal extent*	*Long-term*	*Emissions from the terminals (fugitive emissions from storage tanks and during tanker loading exhaust from tankers at berth and service and maintenance vehicles and equipment) would continue throughout the operations phase.*
	Reversibility	*Permanent*	*Emissions from the terminals may only be reversible if and when their operations cease in several decades.*
	Geographic extent	*Regional Study Area to Lower Fraser Valley*	*Emissions from the terminals are expected to dissipate in the Regional Study Area and would vary with changes in operational management and meteorological conditions.*
	Magnitude	*Low*	*Emissions from the terminals are expected to be below regulatory thresholds or guidelines, taking into account the conditions the Board would impose requiring Air Emissions Management Plans and Fugitive Emissions Management Plans.*
Cumulative effects	*Existing ambient air quality concentrations for $PM_{2.5}$ and NO_2 are generally high around the Burnaby Terminal and the WMT due to the existing industrial activities. The modelling predictions indicate that ozone and $PM_{2.5}$ could also exceed the applicable objectives in the Lower Fraser Valley as a result of existing activities. With the conditions the Board would impose around air quality, including measures above and beyond those proposed by the company, the Project's contribution to total cumulative effects is expected to be inconsequential.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

10.2.2 Greenhouse gas emissions

Trans Mountain said that Project construction would generate approximately 1,020,000 tonnes of greenhouse gas emissions (carbon dioxide equivalent (CO_{2e})), of which 899,500 tonnes CO_{2e} would be from land-clearing alone. Trans Mountain said that Project operations would generate approximately 407,000 tonnes CO2e of indirect emissions annually associated with electricity use. Section 10.2.1 provides a discussion on fugitive emissions generated during the operation of the Project.

It said that land-clearing includes removing vegetative waste and preparing sites along the pipeline right-of way and at facility locations, such as at terminals and pump stations. Trans Mountain assumes that it would burn the majority of vegetative waste. Therefore, emissions from land-clearing during construction would account for over 90 per cent of the Project's total greenhouse gas emissions.

Trans Mountain said that it is not possible to estimate how much timber would be salvaged and that it would develop a Timber Salvage Management Plan in accordance with the relevant provincial regulations. In the Lower Fraser Valley, where air quality is an issue, Trans Mountain said that it would avoid burning slash. Instead, it would mulch in-place or transport slash to an approved disposal location.

Trans Mountain said that installing the proposed tanks, associated terminal work, site preparation, vehicle and equipment operation and other construction activities would also result in greenhouse gas emissions.

Trans Mountain estimated the changes in provincial and Canadian annual greenhouse gas emission totals caused by Project operations. These are described in Table 8 below.

Table 8: Total greenhouse gas emissions generated by Project construction and annual operations for British Columbia and Alberta (in tonnes CO_{2e})

Province	Total Project construction emissions	Annual Project operation emissions	Annual provincial and Canadian emission totals (2012)	Percentage change in annual provincial and Canadian emissions totals due to Project operations
Alberta	177,000	407,000[1]	249,000,000	0.164
B.C.	844,000	-323[2]	60,100,000	-0.001
Total	1,020,000	407,000	699,000,000	0.058

1 – Indirect emissions associated with electricity use
2 – Emissions expected to decrease due to change of the vapour combustion unit to standby mode

Trans Mountain committed to continuously identifying and integrating design changes over the life of the Project to improve operating efficiency, while reducing greenhouse gas and other emissions. Trans Mountain said that emissions management is embedded in the design of the Project (e.g., replacement of the existing Vapour Combustion Unit with two new Vapour Recovery Units at the WMT, selection of energy-efficient equipment).

Trans Mountain proposed standard mitigation to reduce greenhouse gas emissions from the pipeline and associated facilities. It said that construction greenhouse gas emissions are not required to be reported in either B.C. or Alberta. It committed to common energy pipeline industry practices to minimize direct greenhouse gas emissions during Project construction and operations. Trans Mountain said that it expects the greenhouse gas emissions at all of its facilities to fall below the federal or provincial greenhouse gas reporting thresholds, with the exception of the WMT, which is considered a "Reporting Facility" as it generates greenhouse gas emissions above B.C.'s reporting threshold (i.e., 10,000 tonnes of CO_{2e} annually).

Several participants expressed concerns with respect to the increase in greenhouse gas emissions as a result of the Project. They said that the Project would have a significant impact on the global climate. A number of participants filed evidence about greenhouse gas emissions and climate change concerns from upstream or downstream sources other than marine shipping.

Views of the Board

The Board has focused its assessment on the direct greenhouse gas emissions generated from Project construction and operations, as opposed to assessing the global climate effects of the greenhouse gas emissions (e.g., increased flooding). The Board did not consider greenhouse gas emissions associated with upstream (e.g., oil production) and downstream activities (e.g., end use of the oil) for the reasons explained in the Board's Ruling No. 25 and discussed above in this chapter. In instances where intervenors filed evidence on greenhouse gas emissions associated with upstream and downstream activities other than marine shipping (despite Ruling No. 25), the Board did not consider that evidence.

In the Board's view, attempting to determine and assess the eventual climate change effects of greenhouse gas emissions generated by the Project is not practical in terms of meaningfully informing an environmental assessment recommendation on this Project. The potential effects associated with climate change have been well documented and are serious, but they are a cumulative effect. Although the Project's estimated contribution to increased rainfall, yield reduction in crops etc., can be calculated, these by themselves can appear to be minor and they do not necessarily assist in evaluating significance. Their ultimate effects are also difficult to attribute to any particular project.

Greenhouse gas emissions are a concern because of their long-term accumulation in the global atmosphere. Therefore, the Board focused its assessment on the amount of greenhouse gas emissions from the Project, and considered whether regulatory conditions were required as mitigation beyond existing federal or provincial regulatory requirements.

Construction-related greenhouse gas emissions are not reportable under any federal greenhouse gas regulations. Nonetheless, given the substantial amount of anticipated direct emissions that would be generated by Project construction, the Board would impose Condition 142 requiring Trans Mountain to develop an offset plan for the Project's entire direct construction-related greenhouse gas emissions determined post-construction. The intent of the offset plan would be to confirm that there are no net

greenhouse gas emissions from Project construction. The Board expects Trans Mountain to confirm that its selected offset option is registered under the approved quantification protocols and that it has been verified by an accredited "verification body." The condition would also require Trans Mountain to provide an accounting of offsets to confirm that the no-net emissions goal is realized. The Board expects that offset measures should be above and beyond the mitigation measures implemented for the Project.

The Board recognizes that Project construction would result in a substantial amount of direct greenhouse gas emissions, primarily from land-clearing, and that Trans Mountain is not able to definitively quantify the final amount because it is not able to determine how much timber would be salvaged during construction. The Board would impose Condition 140 requiring Trans Mountain to quantify the total direct greenhouse gas emissions after all construction activities are complete, to provide a more accurate estimate of the direct greenhouse gas emissions that are required to be offset.

A number of participants requested that the Board's draft conditions on greenhouse gas emissions should require Trans Mountain to assess and offset greenhouse gas emissions from Project operations in addition to greenhouse gas emissions from Project construction. The evidence indicates that greenhouse gas emissions during Project operations are expected to be relatively low compared to construction-related emissions, and are guided by the applicable provincial and national regulations. In addition, operational emissions fall below the applicable reporting thresholds, except for the Westridge Marine Terminal (WMT) where Trans Mountain committed to report in accordance with applicable reporting regulations. The Board is aware that fugitive emissions escaping from facility and pipeline leaks also include greenhouse gas emissions. In order to confirm that greenhouse gas fugitive emissions are also minimized as much as possible, the Board requires Trans Mountain to consider greenhouse gas emissions in its Fugitive Emissions Management Plans for all pump stations, tank terminals and the WMT (Conditions 53, 54 and 55).

In the Board's view, the direct greenhouse gas emissions from Project construction, without any additional Board imposed mitigation conditions, would have been of substantial magnitude. However, considering Condition 142, that the Board would impose, requiring Trans Mountain to develop and implement a Greenhouse Gas Emissions Offset Plan to achieve no net emissions, emissions from construction are expected to be fully offset and therefore of low magnitude and not significant. Emissions anticipated during operations would be below national reporting thresholds and therefore not considered significant.

10.2.3 Surface water quality and quantity

Trans Mountain identified a number of potential residual effects on surface water quality and quantity that could result from the construction and operation of the pipeline (e.g., reduced water quality due to suspended sediments during construction activities).

Trans Mountain committed to developing Environmental Protection Plans that include a variety of management plans, contingency plans, reclamation plans, and mitigation measures designed to address the potential residual effects. Trans Mountain said that, with the implementation of the general and site-specific mitigation, monitoring, and reclamation measures, any adverse effects on surface water quality or quantity from construction activities can be reduced to acceptable levels or avoided.

Trans Mountain identified numerous watersheds[52] crossed by the proposed pipeline corridor, for which the adverse effects could be considered potentially significant for total cumulative effects.[53] Intervenors expressed similar concerns, indicating that past industrial and urban development has reduced the quality and quantity of surface water.

Participants, including Metro Vancouver, the Yorkson Watershed Stewardship Committee, and Cowichan Tribes, raised various concerns related to adverse effects on surface water quality and quantity from

52 Sturgeon River, Lower and Upper North Saskatchewan River, Pembina River, Lower McLeod River, Athabasca River, Lower North Thompson River, Thompson River, South Thompson River, Lower Nicola River, and Similkameen watersheds.

53 Trans Mountain considered total cumulative effects as potentially significant for watersheds where the proposed aquatic disturbance threshold was crossed (i.e., if >18 per cent long-term or permanent riparian habitat disturbance existed).

construction and operation of the Project. One of the key issues raised by participants regarding surface water was the alteration or loss of riparian habitat that would result from the construction and operation of the Project. Metro Vancouver and the City of New Westminster said that riparian habitat provides important ecological services to aquatic ecosystems and that degradation of these areas can have a variety of consequences. Metro Vancouver and the City of New Westminster recommended that the pipeline be re-routed to avoid riparian buffers of fish-bearing watercourses, and that Trans Mountain commit to using trenchless crossing techniques, with entry and exit points outside of riparian areas.

Trans Mountain acknowledged that construction and operation of the pipeline would result in temporary alteration and disturbance of riparian habitat, and estimated that the maximum riparian area that may be disturbed as 334.6 ha, or 0.05 per cent of the total riparian habitat within the Regional Study Area (RSA). Appendix 11 provides a description of the spatial boundaries. Trans Mountain said that disturbance to riparian areas, if not managed appropriately, could potentially result in adverse effects to water quality. Trans Mountain proposed various mitigation measures aimed at reducing impacts on riparian habitat, including limiting riparian vegetation clearing to trenched areas and any required workspace within the proposed pipeline corridor. Trans Mountain said that it would adhere to the Forest Practice Code, Riparian Management Area Guidebook in B.C. during clearing activities, and would adopt riparian buffer setbacks for temporary work spaces based on provincial and federal guidelines. Trans Mountain also committed to revegetating any disturbed riparian habitat and to monitoring these areas upon completion of construction to ensure that they return to similar pre-construction functionality. Trans Mountain further acknowledged that woody vegetation would be allowed to grow back over the right of way, with the exception of 3 m on either side of the pipeline, which it indicated would be required for safety considerations and to provide access to the watercourses for operations crews, if required. Trans Mountain also stated that National Energy Board safe operational guidelines require that pipelines are kept clear of large woody vegetation directly over the pipeline.

Salmon River Enhancement Society raised concerns that Project construction will include the destruction of mature forests in riparian areas which they say is part of important habitat for fish, and that once destroyed, cannot be mitigated in a reasonable or timely manner. It also said that there is a need and a requirement to undertake an inventory of riparian habitat that will be destroyed, or otherwise negatively affected in order to determine compensation. Salmon River Enhancement Society indicated that the riparian damage, if viewed collectively for each watercourse crossing in B.C., would comprise a footprint of approximately 700,000 m^2.

Trans Mountain said that its estimate of riparian disturbance was conservative for a variety of reasons and despite the obvious overestimation, Trans Mountain maintains that the Project's maximum potential disturbance would only affect < 0.05 per cent of riparian habitat within the Project's RSA.

Cowichan Tribes said that the construction and operation of the pipeline is likely to contribute only a small amount to cumulative effects to fish and fish habitats. It said that the hectares of disturbance to riparian and instream habitat caused by the Project is generally small relative to existing disturbances in the B.C. watersheds.

Views of the Board

The Board acknowledges the concerns raised by participants about the effects that Project construction and operation would have on surface water. The Board is of the view that the proposed Environmental Protection Plans would effectively reduce the extent of any effects on surface water quality and quantity. The Board would impose Conditions 72 and 78 requiring Trans Mountain to provide to the Board finalized Environmental Protection Plans prior to construction, and provide the results of post-construction environmental monitoring, including any adaptive management measures that were implemented to address unforeseen issues (Condition 151). The Board would also require Trans Mountain to include with the filed Environmental Protection Plans a summary of its consultations with appropriate government authorities and any potentially affected Aboriginal groups (Conditions 72 and 78).

The Board is of the view that Project construction and operation would result in adverse effects on riparian habitat. The Board recognizes that clearing of riparian vegetation will be required for watercourses crossed using trenched methods. The Board acknowledges that a small area

(approximately 3 m on either side of the pipeline) will be kept free of large woody vegetation at the majority of watercourses crossed by the pipeline. Generally, the Board considers adverse effects on riparian habitat as temporary, since disturbed riparian habitat is likely to return to a similar pre-construction functionality during the life of the Project. However, in certain situations, such as when mature riparian habitat is removed, adverse effects on riparian habitat would be considered permanent such that riparian habitat may not return to pre-construction conditions within the life of the Project.

The Board recognizes the importance of riparian habitat and given the concerns and recommendations provided by participants, the Board would impose Condition 71 requiring Trans Mountain to develop a Riparian Habitat Management Plan. The condition would require Trans Mountain to conduct pre-construction assessments and quantification of any riparian habitat to be impacted by the Project at all defined watercourse crossings, planting plans for these areas, and monitoring of these areas to confirm they return or are returning to pre-construction functionality. The Board would also require Trans Mountain to provide goals and targets that clearly demonstrate how, over the course of five full growing seasons, riparian habitat has returned, or is trending towards sufficient pre construction functionality.

The Board would also impose Condition 154 requiring Trans Mountain to develop a Riparian Habitat Reclamation Evaluation Report and Offset Plan. The report would include an evaluation of the effectiveness and success of Trans Mountain's Riparian Habitat Management Plan. The report would also identify, after the fifth full growing season, any riparian habitat that has trended, not or is not trending, towards pre construction functionality, and the corrective actions that Trans Mountain will undertake to ensure riparian habitat returns to pre-construction functionality. The Riparian Offset Plan would apply to all defined watercourse crossings located in watersheds identified during the proceeding as being above the riparian habitat disturbance threshold (>18 per cent of riparian habitat disturbed in the watershed), or classified as High sensitive fish-bearing, and where after the fifth complete growing season, riparian habitat has not returned, or is not trending towards sufficient pre construction functionality.

The goal of these conditions is to minimize adverse effects on riparian habitat and ensure that areas that are disturbed return to pre-construction functionality. The Plans are also designed to ensure that a no-net loss of riparian habitat will occur at High sensitive fish-bearing watercourses and at watercourses within watersheds that have already surpassed environmental regulatory thresholds. The Board would also require Trans Mountain to consult with Aboriginal groups, landowners, and appropriate government authorities, and provide a discussion of how they have addressed any outstanding issues as part of the riparian habitat conditions (Conditions 71 and 154).

Significance evaluation: adverse effects on surface water quality and quantity

	Criteria	Rating	Description
Project effects	*Temporal extent*	*Short-term to long- term*	*Effects on surface water quality and quantity are expected to be mostly short-term (e.g., small sediment plume from instream crossing activities, water withdrawal for hydrostatic testing). Some project interactions, such as the removal of mature riparian vegetation, would result in long-term effects.*
	Reversibility	*Reversible to permanent*	*Effects on surface water quality and quantity are expected to be reversible. Once construction activities cease, surface water quality and quantity is expected to return to pre-construction conditions. However, in certain situations, such as when mature riparian habitat is removed, effects are expected to be permanent, as riparian habitat may not return to pre-construction conditions within the life of the Project.*
	Geographic extent	*Footprint to Local Study Area*	*Effects are expected to be limited to directly disturbed areas and the Local Study Area*
	Magnitude	*Low to moderate*	*Effects from construction and operation activities would generally be of low to moderate magnitude taking into account the mitigation, reclamation activities, and post-construction environmental monitoring.*
Cumulative effects	*Existing cumulative effects vary by watershed and could be considered substantial or above environmental thresholds in certain watersheds. Urban and industrial development has resulted in various degrees of decreased surface water quality and quantity in watersheds crossed by the proposed pipeline corridor. Taking into account the implementation of Trans Mountain's mitigation measures, and conditions the Board would impose, the Project's contribution to the total cumulative effects on surface water quality and quantity is considered inconsequential.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

10.2.4 Groundwater quality and quantity

In identifying the potential residual effects of Project construction and operation on groundwater quality and quantity, Trans Mountain identified the aquifers along the proposed pipeline corridor, facilities overlying mapped aquifers, horizontal directionally drilled crossings with potential artesian conditions and areas where potential groundwater quantity effects were identified.

Several participants raised issues related to the Project's potential effects on groundwater quality and quantity. Coldwater Indian Band said that it relies on groundwater from local aquifers to meet all domestic and fire-protection needs. It noted its long-standing concerns about the water source's vulnerability to the existing pipeline. Chapter 11 discusses concerns raised by Coldwater Indian Band along with the Board's views.

A number of Aboriginal groups, municipal and provincial governments, and federal authorities raised concerns about the potential impacts of the project on groundwater quality and availability, including potential impacts related to a spill or accident.

Other participants expressed concerns regarding protecting groundwater from existing and future contamination at facilities. Trans Mountain said that it has established groundwater monitoring programs at selected facilities, including the Burnaby Terminal and the WMT, to identify impacts on groundwater. It said that, should a release from the pipeline or a facility occur and groundwater impacts were suspected, it would undertake a hydrogeological investigation to assess site conditions and the magnitude and extent of any impacts.

Participants raised concerns about protecting groundwater from potential storage tank and/or pipeline leaks, and about remediation and groundwater quality monitoring. Trans Mountain said that groundwater is protected through tank design, level transmitters (to prevent overfill), a leak detection system under each tank, secondary containment and hydrocarbon detection within the secondary containment.

Peters Band submitted a report that discusses the site-specific conditions for its reserve lands, and the potential groundwater impacts from a pipeline leak on those lands. The report recommended several mitigation measures that can be incorporated to minimize the risk and extent of contamination. Trans Mountain said that it applies a risk-based design approach through which it would identify areas of higher risk that it would give higher priority for implementing additional risk mitigation measures.

Natural Resources Canada expressed concerns about the potential for groundwater seepage into the proposed tunnel through Burnaby Mountain. It said that accurate seepage estimates are needed to determine the amount of seepage water that would be pumped, treated, and disposed of, and to assess any effects on the local water table (i.e., lowering). Trans Mountain committed to have a qualified engineer and/or hydrogeologist onsite during construction to sample and analyze the water being extracted during the tunneling process.

Trans Mountain proposed mitigation measures to address the Project's potential effects on groundwater quality and quantity. Trans Mountain said that it followed recommendations from several industry and provincial and federal regulatory guidelines in designing construction activities to avoid diversion and unnatural retention of water along the right-of-way.

In conducting its cumulative effects assessment, Trans Mountain said it considered existing activities and reasonably foreseeable developments that could act in combination with the Project. It said that the Project's potential contribution to the total cumulative effects on groundwater quality is attributable to blasting activities or, during horizontal directional drilling, a drilling mud release or overlapping aquifers mixing. Trans Mountain said that the Project's contribution to cumulative changes in groundwater quantity would occur over the construction phase or associated with maintenance activities within one year during the operations phase.

Views of the Board

The Board recognizes the participants' concerns regarding the protection of vulnerable aquifers that may be present along the pipeline route. The Board accepts Trans Mountain's commitments to identify areas of high risk and to implement additional risk mitigation measures where needed. The Board would impose Condition 130 requiring Trans Mountain to develop a groundwater monitoring program for any vulnerable aquifers that may be present along the pipeline route. This would allow the Board to verify that measures to prevent impacts on groundwater quality are adequately implemented.

Metro Vancouver, in providing comments on the Board's draft condition, noted that the groundwater monitoring program should also be required for all municipal and Metro Vancouver owned or operated infrastructure, in addition to Trans Mountain facilities. It said that the groundwater monitoring program condition should also include baseline groundwater data for all sites. The Board is of the view that requiring Trans Mountain to collect baseline data and monitor groundwater for all municipal and Metro Vancouver owned or operated infrastructure is not reasonable since Trans Mountain does not own that infrastructure.

With respect to protecting groundwater from leaks at facilities, the Board acknowledges that Trans Mountain has proposed a leak detection system under each tank, and hydrocarbon detection along with secondary containment for each tank. In order to anticipate, prevent and manage conditions that could affect groundwater, the Board would impose Condition 130 requiring Trans Mountain to implement a groundwater monitoring program at all proposed facilities (pump stations, tank terminals, and Westridge Marine Terminal.

The Board shares Natural Resources Canada's concerns about groundwater seepage into the proposed tunnel and the Board would impose Condition 87 requiring Trans Mountain to develop a groundwater seepage management plan that it would implement during tunnel construction. In the Board's view, this would reduce or minimize any potential effects of groundwater seepage on the local water table.

Signification evaluation: adverse effects on groundwater quality and quantity

	Criteria	Rating	Description
Project effects	*Temporal extent*	*Short-term to long- term*	*Effects on groundwater quality (e.g., elevated groundwater turbidity, aquifer mixing, contamination from smaller spills) and quantity (e.g., effects of blasting and trench dewatering) are primarily expected to be short-term during the Project construction phase (in the order of days to months). Similar effects arising from maintenance activities would also persist in the order of days to months for each activity. However, maintenance will occur sporadically throughout the operations phase and, therefore, such effects can be considered long-term.*
	Reversibility	*Reversible*	*Effects on groundwater quality and quantity are expected to be reversible within the lifetime of the Project.*
	Geographic extent	*Local Study Area*	*Effects could extend beyond the Project footprint into the Local Study Area.*
	Magnitude	*Low to moderate*	*Taking into account Trans Mountain's proposed mitigation and the conditions the Board would impose requiring a groundwater monitoring program at all facilities, and protective measures for vulnerable aquifers along the pipeline route, the effects due to Project construction and routine operations activities are generally expected to be of low to moderate magnitude.*
Cumulative effects	*The existing cumulative effects on groundwater quality and quantity are generally not likely to be significant along most of the pipeline corridor. However, effects could be significant in areas where vulnerable aquifers are present or where more concentrated agricultural, municipal and industrial activities result in higher groundwater usage and demand. Taking into account the implementation of Trans Mountain's mitigation measures and the conditions the Board would impose, the Project's contribution to the total cumulative effects on groundwater quality and quantity is expected to be relatively minor.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

10.2.5 Freshwater fish and fish habitat

Trans Mountain said that approximately 1,163 watercourses have been identified along the proposed pipeline corridor (256 in Alberta, 907 in B.C.), through four major drainage basins and twenty-one different watersheds (Figure 18 and Figure 19).

Participants identified numerous species of conservation and management concern inhabiting watercourses crossed by the proposed pipeline corridor. Trans Mountain identified five SARA listed fish species (Table 9) that inhabit watercourses crossed by the proposed pipeline corridor.

Table 9: Aquatic species listed under Schedule 1 of the Species at Risk Act potentially found within the pipeline corridor

Species	Regulatory Status under SARA
Nooksack dace	Endangered
Salish sucker	Endangered
White sturgeon (Upper Fraser population)	Endangered
Green sturgeon	Special Concern
Westslope cutthroat trout[54] (B.C. population)	Special Concern

54 Trans Mountain said that Westslope cutthroat trout are introduced in the Lower Mainland and are therefore not considered a conservation concern in the Regional Study Area and Local Study Area.

Figure 18: Aquatics Regional Study Area for Alberta

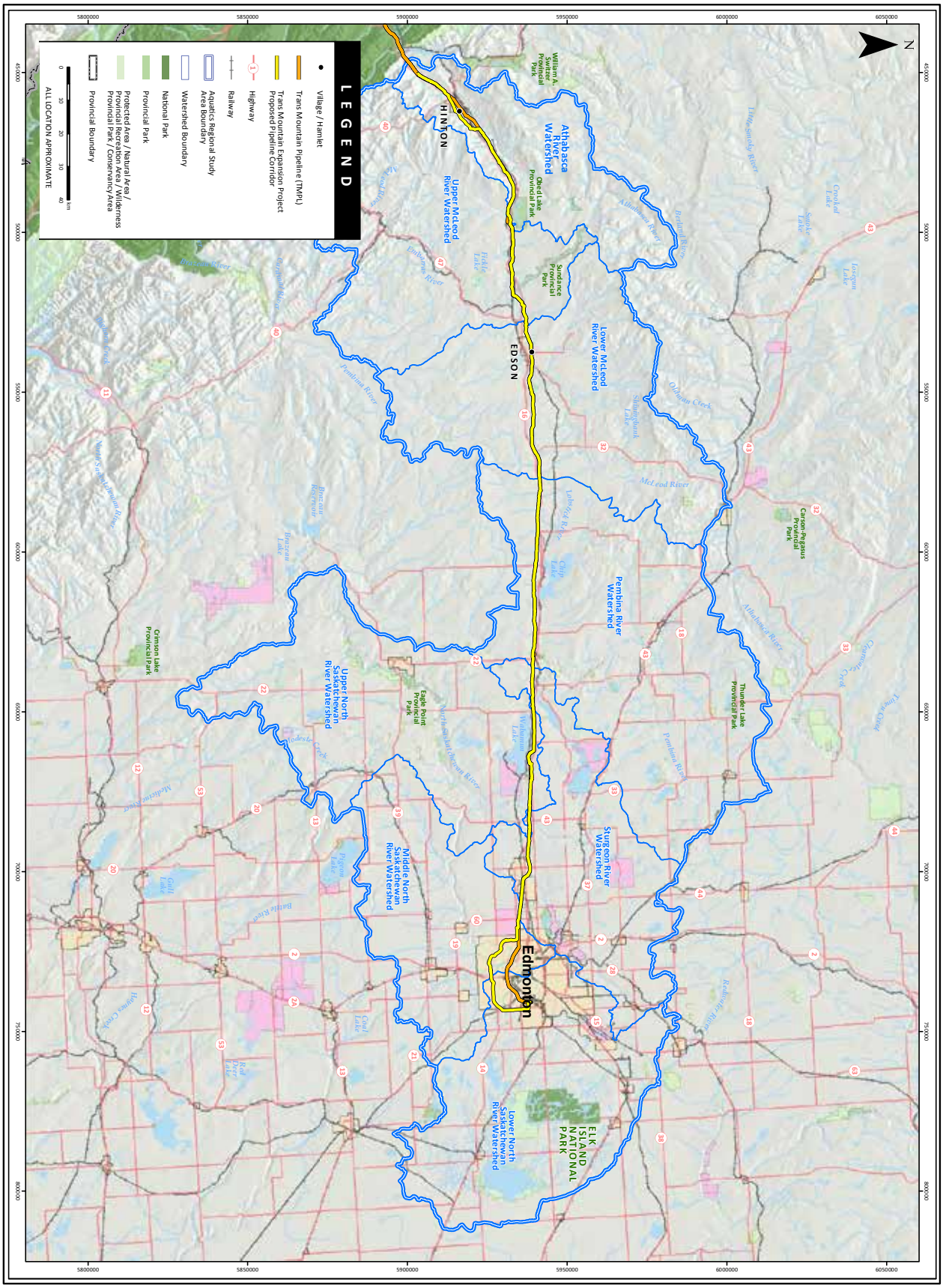
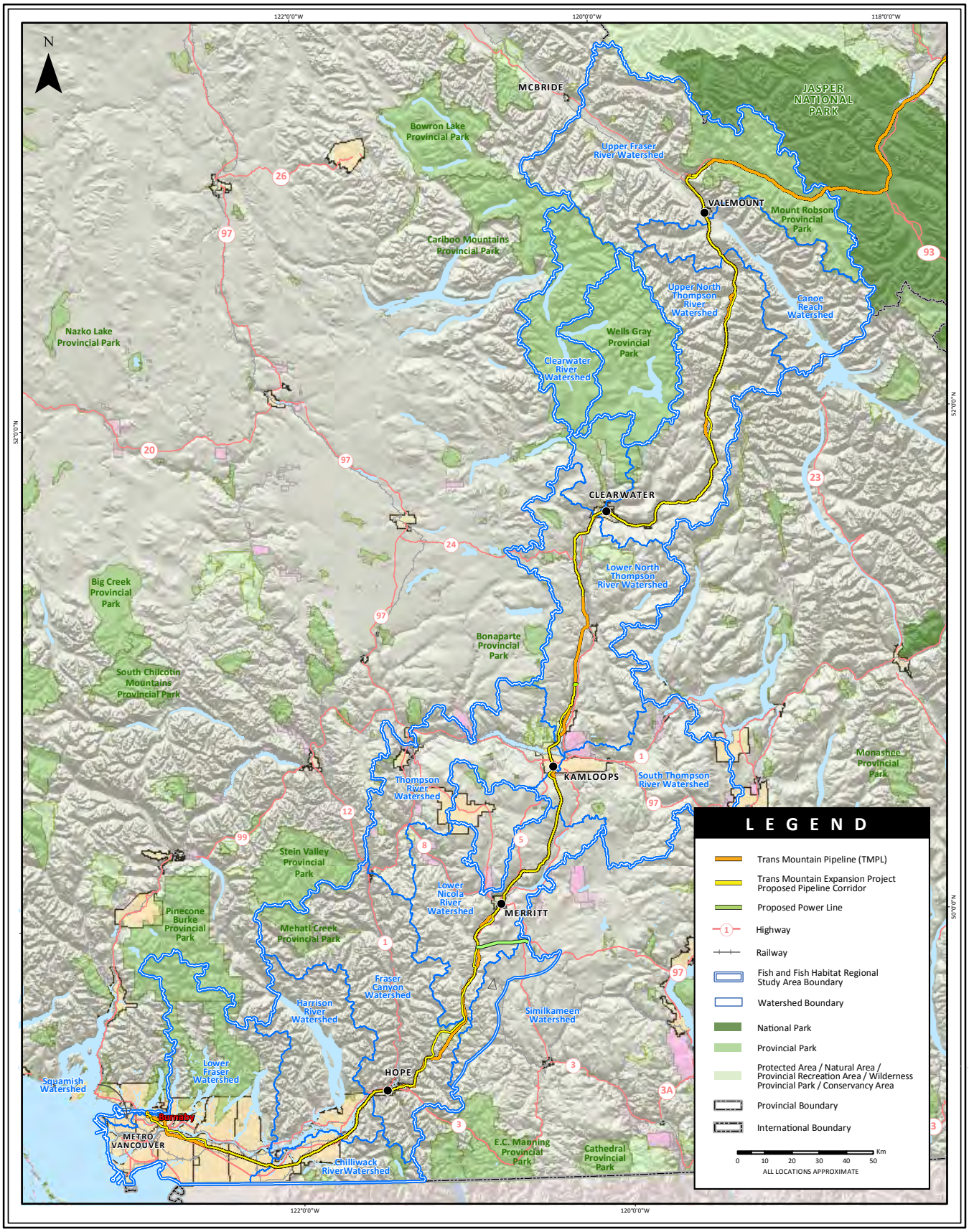


Figure 19: Aquatics Regional Study Area for British Columbia



Trans Mountain identified Pacific salmon[55] as being economically and ecologically important. Trans Mountain said that the Fraser River is considered the largest single salmon producing system in the world and accounts for, on average, approximately 50 per cent of salmon production in B.C. Several participants said that the Fraser River and its tributaries are vital habitat for Pacific salmon on the west coast of Canada. They identified other ecologically and environmentally sensitive areas, such as the Brunette River Conservation Area and Surrey Bend Regional Park, as sensitive fish habitat and home to species of conservation concern.

Participants raised a range of issues related to adverse effects on fish and fish habitat from the construction and operation of the Project. This section focuses on the following key issues:

- watercourse crossings methods, mitigation, and post-construction environmental monitoring;
- *Fisheries Act* authorizations;
- cumulative effects; and
- species at risk.

Watercourse crossing methods, mitigation, and post-construction environmental monitoring

Trans Mountain said that it selected appropriate watercourse crossing methods in consideration of the size and the environmental sensitivities of the watercourse (inclusive of traditional ecological knowledge), as well as timing of construction. It proposed trenchless crossing methods for larger, fish-bearing watercourses (e.g., Fraser River, Nicola River and Pembina River). Isolated trenched crossings were proposed for all other high sensitivity watercourse crossings, with priority given to working within least-risk biological windows.[56] Trans Mountain said that, in some instances, working in the least-risk biological windows was not possible (e.g., due to high flow). In these instances, priority was given to isolated trenched crossings outside of the least-risk window, as opposed to wet trenched crossings where excavation is conducted in flowing water.

Trans Mountain proposed to implement numerous mitigation measures to address potential impacts on fish and fish habitat. These include:

- DFO's Measures to Avoid Harm to Fish and Fish Habitat;
- hydraulic isolation will be implemented for any small to medium sized streams that are hydraulically connected to fish habitat, regardless of whether there are fishes or fish habitat at the crossing location, unless flow volumes exceed threshold limits for open-cut with flow isolation methodologies or site conditions preclude the ability to isolate the watercourse;
- Qualified Aquatic Environmental Specialist in Alberta or the Qualified Environmental Professional (QAES/QEP) led fish salvages at each isolated trenched crossing and at all fish-bearing crossings;
- water quality monitoring for suspended sediment during trenchless and isolated trenched crossings of watercourses with high sensitivity fish habitat, or open-cut crossing construction activities where flow is present;
- working within the least-risk biological windows when trenched methods are to be completed, where practicable;
- completing spawning surveys before and during construction (when spawning activity is confirmed or suspected, Trans Mountain committed to implementing measures to deter fish from spawning within the isolated section of the channel or within the immediate zone-of-influence when work is proposed outside of the least risk window);
- species-specific mitigation for Nooksack dace and Salish sucker; and
- measures to facilitate fish migrations in instances where isolated trenched pipeline construction methods are proposed to occur outside the least-risk biological window and channel spanning isolation measures are expected to be in place for more than three consecutive days.

55 Pacific salmon is meant to include five salmon species (i.e., Chinook, Coho, Pink, Sockeye, and Chum).

56 Provincial windows of least risk or Restricted Activity Periods are species and region specific and are established to protect sensitive life history stages of species of management concern including their eggs, juveniles, spawning adults and/or the organisms upon which they feed.

Trans Mountain committed to reclaiming all disturbed riparian habitat and instream habitat to, or trending towards, pre-construction functionality. Trans Mountain said that it is committed to monitoring these areas, post-construction, to evaluate the effectiveness of reclamation based on a comparison of post-construction conditions to pre-construction conditions.

Participants raised concerns or made recommendations regarding Trans Mountain's proposed watercourse crossing methods, mitigation measures, reclamation, and post-construction monitoring. Salmon River Enhancement Society indicated that the best way to mitigate impacts on fish and fish habitat from Project construction is to implement trenchless crossing methods. It further noted that the B.C. Oil and Gas Commission recommends trenchless methods as a means of protecting watercourses of high fish value.

Fisheries Act authorizations

In order to identify which crossings could result in serious harm and may likely require authorization under paragraph 35(2)(b) of the *Fisheries Act*, Trans Mountain conducted a self-assessment of the potential for serious harm to fish[57] which evaluated the risk from proposed watercourse construction activities. The results of Trans Mountain's self-assessment indicated that numerous proposed primary (26) and contingency watercourse crossings (46), predominately timed to occur outside of least-risk windows, were of high risk for serious harm. It committed to obtaining *Fisheries Act* authorizations when they are required, which would include measures to offset any residual serious harm, as well as potential specific monitoring requirements. Trans Mountain indicated that the types of offset measures would include habitat restoration and/or enhancement, habitat creation, biological or chemical manipulations, and/or complementary measures, including research-based projects, as defined in DFO's hierarchy of preferences. It noted that any Fish and Fish Habitat Offset Plan would be designed in consultation with regulators, fisheries managers, Aboriginal groups and other stakeholders, and with specific consideration for the guiding principles outlined in *DFO's Fisheries Productivity Investment Policy: A Proponents Guide to Offsetting*.

DFO indicated that the *Applications for Authorization under Paragraph 35(2)(b) of the Fisheries Act Regulations* establishes the time limits, totalling 150 days, within which the Minister of Fisheries, Oceans and the Canadian Coast Guard must decide whether to issue a paragraph 35(2)(b) authorization, or refuse to do so. DFO also said that when considering the potential issuance of a *Fisheries Act* authorization for a work(s), undertaking(s) or activity(ies) which may adversely affect asserted or established Aboriginal or Treaty rights, DFO would undertake consultation with potentially affected Aboriginal groups.

Salmon River Enhancement Society said that Trans Mountain's self-assessment failed to quantify the extent of serious harm to fish and fish habitat properly, and also questioned the adequacy of the information used to support the self-assessment, including a lack of site-specific crossing locations and mitigation. Participants also raised concerns about Trans Mountain's self assessment of potential serious harm in reference to riparian habitat, and said that Trans Mountain had not properly considered riparian habitat under the *Fisheries Act*. Trans Mountain said that removal of riparian vegetation may constitute serious harm if it has a limiting effect on the productive capacity of the watercourse, and if its removal or disturbance represents a potential influence on fish communities. Trans Mountain said that its understanding is based on precedent (i.e., previous DFO determinations on similar projects) and a professional working understanding of the *Fisheries Act* and the associated policies and processes.

Trans Mountain used both field and desktop exercises to determine fish and fish habitat at proposed crossing locations. Trans Mountain said that 95 per cent of the potential watercourses crossings identified along the pipeline corridor had been investigated by a qualified fish biologist, with many sites receiving multiple seasons of sampling. PIPE UP critiqued the watercourse crossing assessments by Trans Mountain, identified information gaps, and proposed a fish sampling program. Trans Mountain said that the fish and fish habitat data collection is more than adequate to support an environmental assessment and permitting for pipeline construction and operation, as per provincial and federal regulatory requirements and industry standards.

57 For the purposes of the *Fisheries Act*, serious harm to fish is defined as the death of fish or any permanent alteration to, or destruction of, fish habitat.

Cumulative Effects

Participants, including Kwantlen First Nation, Upper Nicola Band and Lower Nicola Band, expressed concerns that existing cumulative effects, from industrial and urban development, have resulted in decreased fish abundance and health, and that Project construction would contribute to the total cumulative effects. Trans Mountain said that the total cumulative effects for indicator species were potentially significant in watersheds where the aquatic disturbance threshold was exceeded.[58] Trans Mountain said that existing activities that have disturbed riparian and instream habitat include agriculture, rural and urban residential and commercial development, transportation and infrastructure development, utility activities, forestry, mineral resource exploration and development, ongoing recreational activities, and oil and gas exploration and development. Trans Mountain indicated that the Project, in combination with reasonably foreseeable developments, would increase cumulative effects in all watersheds. Trans Mountain said that the Project may contribute < 0.01 to 0.15 per cent, or an average of 0.05 per cent, to total riparian habitat disturbance in RSA (See description of the spatial boundaries in Appendix 11). Trans Mountain also said that the Project's overall contribution to combined instream habitat disturbance would be < 0.01 per cent in Alberta and 0.02 per cent in B.C.

Participants, including Metro Vancouver and Yarrow Ecovillage, said that substantial restoration activities have occurred in watercourses crossed by the proposed pipeline and that Project construction could potentially compromise the progress of habitat enhancement measures. The City of New Westminster said that habitat enhancements in the upper reaches of the Brunette River, and associated off-channels, have resulted in marked improvement in fish habitat quality. It said that the Project alignment adds risk to the ongoing successful improvements and the positive trajectory of this recovering system as fish habitat. The City of Coquitlam recommended that Trans Mountain avoid any disturbance to streams in Coquitlam, or alternatively, to provide additional habitat compensation to enhance stream habitat. Trans Mountain acknowledged the implementation of habitat enhancement measures completed by local stakeholders and municipalities. Trans Mountain said that existing compensation areas within watercourses will be avoided or minimized during construction and that any disturbance to compensation areas will be re-established during the construction and reclamation phases. Trans Mountain also committed to implement additional enhancement measures (e.g., boulder clusters, large woody debris) at watercourse crossings deemed high risk by the self-assessment, and, in the event a *Fisheries Act* authorization is required, would implement offset measures to compensate for the serious harm.

Species at risk

Trans Mountain indicated that seven proposed watercourse crossing locations are within the proposed critical habitat for Nooksack dace and Salish sucker. Trans Mountain proposed to cross six of these crossings using an isolated trenched watercourse crossing method. Trans Mountain said that it had not studied the possibility of trenchless crossings within critical habitat for these species. Trans Mountain said that the proposed species-specific mitigation and construction timing would limit the potential for serious harm to Nooksack dace and Salish sucker. Trans Mountain committed to obtaining the necessary permits under SARA for the salvage of all relevant freshwater fishes.

DFO said that the proposed mitigation measures may effectively mitigate potential localized effects on Nooksack dace and Salish sucker, but that trenchless crossings are preferred methods for reducing impacts on fish and fish habitat. DFO said that the enhancement of the specific habitat features and functions that benefit the Nooksack dace and Salish sucker may assist in furthering the recovery of these species. Metro Vancouver recommended that Trans Mountain commit to using trenchless crossings within areas of critical habitat, or re-route the pipeline to avoid impacts on critical habitat.

Trans Mountain indicated that no other fish species at risk have critical habitat identified within the pipeline corridor and that, with the implementation of mitigation measures and appropriate watercourse crossing methods, effects on fish species at risk are anticipated to be low. Trans Mountain said that Athabasca rainbow trout was recently uplisted by the Committee on the Status of Endangered Wildlife in Canada to Endangered and that the publication of the *Alberta Athabasca Rainbow Trout Recovery Plan 2014-2019* suggests that Athabasca rainbow trout could likely be listed under the SARA before Project construction.

58 Sturgeon River, Lower and Upper North Saskatchewan River, Pembina River, Lower McLeod River, Athabasca River, Lower North Thompson River, Thompson River, South Thompson River, Lower Nicola River, and Similkameen watersheds.

Views of the Board

The Board acknowledges the concerns raised by participants in regards to fish and fish habitat and more specifically, Pacific salmon. The Board is of the view that proposed watercourse crossings designs, mitigation measures, reclamation activities, and post construction environmental monitoring, as proposed by Trans Mountain, are appropriate and would effectively reduce the extent of effects on fish and fish habitat. The Board is also of the view that the baseline data, including collection methods, used by Trans Mountain to support their environmental assessment was appropriate for the scope of the Application. The Board finds that the assessment methods used by Trans Mountain are based on proven industry standards and are commonly applied approaches used in pipeline assessments. The Board is of the view that watercourse crossings are fairly standardized with ample guidance from industry as well as federal and provincial regulators, and when completed according to such guidance, are generally considered low risk.

The Board concurs with Trans Mountain's self-assessment of the potential for serious harm, in that the majority of proposed watercourse crossings are not going to constitute serious harm under the Fisheries Act. The Board acknowledges that some proposed watercourse crossings, because of timing or environmental conditions, are considered higher risk and have a higher potential for serious harm.

The Board agrees with participants that finalized, site-specific information is needed to make an accurate serious harm determination for higher risk crossings. In order to fulfill the responsibilities of the National Energy Board under the Memorandum of Understanding with DFO, the Board would impose Condition 43 requiring Trans Mountain to file site-specific information with the Board, prior to construction. The Board will use this information to conduct a site-specific review of each of the proposed watercourse crossings where Trans Mountain cannot meet all of Fisheries and Oceans Canada's Measures to Avoid Causing Harm to Fish and Fish Habitat, and to verify the results of Trans Mountain's self-assessment of the potential for serious harm. The Board would refer to DFO any watercourse crossing activities that may likely require authorization under the Fisheries Act. DFO would then be responsible for issuing any authorizations. The Board would impose Condition 110 that requires Trans Mountain, in the event it requires a Fisheries Act authorization(s), to file any finalized authorizations with the Board prior to construction. The Board notes that if any Fisheries Act authorization(s) are required for the Project, DFO has acknowledged it will undertake consultation with potentially affected Aboriginal groups. Trans Mountain also committed to developing any Fish and Fish Offset Plans in consultation with regulators, fisheries managers, Aboriginal groups and other stakeholders.

The Board understands participants' concerns regarding the consideration of riparian habitat as part of serious harm determination. The Board generally agrees with Trans Mountain's assertion that removal of riparian vegetation may require a Fisheries Act authorization if it has a limiting effect on the productive capacity of the watercourse, and if its removal or disturbance represents a potential influence on fish communities. The Board would impose Condition 43 requiring Trans Mountain to provide site-specific riparian habitat information prior to construction. The Board will then consider the riparian habitat information as part of its site-specific review. The Board would also impose conditions requiring Trans Mountain to develop a Riparian Habitat Management Plan and Riparian Habitat Reclamation Evaluation Report and Offset Plan aimed at reducing the impacts of construction on riparian habitat (Conditions 71 and 154). A detailed discussion on these conditions is provided in the surface water quality and quantity section (section 10.2.3).

The Board recognizes the concerns of participants related to cumulative effects on fish and fish habitat in watersheds crossed by the proposed pipeline corridor. The Board acknowledges Trans Mountain's voluntary commitment to develop an Environment Stewardship Program as part of the Community Benefit Program, where Trans Mountain would seek opportunities, alone or in partnership, to restore, secure, or enhance elements of aquatic ecosystems above and beyond regulatory requirements. The Board recognizes the local knowledge held by Aboriginal groups and the local community, including species experts and expects Trans Mountain to consult with these groups as it develops the Environmental Stewardship Program. The Board is of the view that voluntary programs, such as the Environmental Stewardship Program, are essential in addressing total cumulative effects and in promoting recovery of impacted species and habitats.

The Board recognizes that the proposed trenched crossing methods would result in adverse effects on riparian habitat within Nooksack dace and Salish sucker critical habitat. The Board recognizes that Recovery Strategies for both Nooksack dace and Salish sucker state that failure to maintain adequate riparian reserves as part of critical habitat is likely to cause population level impacts. As such, the Board would impose Condition 75 requiring Trans Mountain to use trenchless methods when working in the critical habitat of these species, with entry and exit points located outside of riparian habitat, when feasible. The Board is mindful that there are constraints associated with trenchless crossings and acknowledges that trenchless crossings may not be practicable at all crossings locations within critical habitat of these species. In the event trenchless crossings are not feasible, the Board would require a clear rationale as to why a trenchless crossing is not feasible, as well as the updated watercourse crossing method, any proposed site-specific mitigation, species-specific enhancement measures, reclamation measures, and post-construction monitoring (Condition 75). The Board shares DFO's view's, that the proposed isolated crossings, including mitigation, reclamation, post-construction monitoring, and species specific enhancement measures, if implemented appropriately, would likely mitigate localized residual effects on the Nooksack dace and Salish sucker and potentially aid in the recovery of these species. However, given the sensitive nature of Nooksack dace and Salish sucker populations, the Board is of the view that avoidance of any adverse effects is preferable to mitigating effects.

The Board also recognizes that Athabasca rainbow trout may be listed under the Species at Risk Act (SARA), prior to construction but after the permitting stage. The Board would impose Condition 92 requiring Trans Mountain to provide to the Board updates on any changes to species listings under Schedule 1 of the SARA and their Recovery Strategies, Action Plans or Management Plans. The condition would require Trans Mountain to design construction methods and develop mitigation that align with these strategies and plans, and eliminate or minimize any potential effects.

Signification evaluation: adverse effects on groundwater quality and quantity

	Criteria	**Rating**	**Description**
Project effects	*Temporal extent*	*Short-term to long-term*	*Effects are generally considered short-term; however, in some situations, effects would be expected to be of longer duration. For example, removal of mature riparian vegetation could result in effects that last in the order of years to decades, and as such, would be considered a long-term effect.*
	Reversibility	*Reversible to permanent*	*Effects are mostly expected to be reversible, allowing for disturbed areas to recover to pre-construction conditions within the life of the Project. In certain situations, such as when mature riparian habitat is removed, effects could be permanent, as riparian habitat may not return to pre-construction conditions within the life of the Project.*
	Geographic extent	*Local Study Area*	*Effects are expected to be localized to the Project footprint and the Local Study Area.*
	Magnitude	*Low to moderate*	*Effects from construction and operation of the Project are expected to be of low magnitude taking into account Trans Mountain's proposed mitigation, reclamation activities and post-construction environmental monitoring. Some individual watercourse crossings do have the potential to result in serious harm; however, in these situations, offset measures would be required to compensate for any residual serious harm, and therefore the effects are expected to be of moderate magnitude.*
Cumulative effects	*Existing cumulative effects differ in the various watersheds crossed by the proposed pipeline corridor. Numerous current and historical activities have reduced the abundance and health of fish species and the quality of habitat within the pipeline corridor. For some species and watersheds, existing cumulative effects could be considered substantial or above environmental regulatory thresholds. Taking into account the implementation of Trans Mountain's mitigation measures, and the conditions the Board would impose, the Project's contribution to the total cumulative effects on fish and fish habitat is expected to be relatively minor.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

10.2.6 Soil and soil productivity

The primary issues related to soil and soil productivity raised during the hearing were:

- soil degradation and decrease in soil productivity;
- disturbance of pre-existing soil contamination; and
- soil contamination from construction.

Soil degradation and decrease in soil productivity

Trans Mountain said that potential effects from construction and from maintenance activities include:

- decreased soil productivity due to mixing of topsoil or root zone material with subsoil, or mixing undesirable lower subsoils with upper subsoil horizons;
- degradation of soil structure due to compaction and rutting; and
- loss of topsoil or root zone material due to wind and water erosion.

Trans Mountain conducted a soil survey on lands with agricultural capability, documenting soil characteristics at approximately 2,000 sites along the proposed corridor. It proposed mitigation measures which include salvage of topsoil or of root zone material, three-lift soil separation at areas with identified poorer quality lower subsoils, traffic restrictions when soils are wet, and protection of soil windrows from erosion.

Trans Mountain said that there will be on-site inspection and monitoring by a Professional Agrologist on all farms in the Fraser Valley during construction to ensure that appropriate soil handling protocols are implemented. It said that landowner or lessee requests, such as for additional soil sampling or alternative soil handling techniques, would be reviewed by a Professional Agrologist, and that it would accommodate landowner and Crown land authority topsoil/root zone material salvage requests, if feasible. Trans Mountain said that if a landowner or lessee, or the Agrologist, has concerns about potential soil compaction, soil compaction testing would take place and if soil compaction is found to be greater than in adjacent undisturbed areas, decompaction processes will be initiated.

Trans Mountain said that its post-construction environmental monitoring program would assess the success of soil mitigation measures, and, where soil productivity appears to be impaired, soils would be tested if warranted and appropriate remedial measures identified and implemented. It said that it anticipates that the extent and severity of soil mixing, compaction, rutting and erosion would be minor, and said that past projects have shown residual effects can generally be resolved within two to three years post-construction. Trans Mountain said that it may take longer than five years to alleviate some effects, such as mixing of unexpected, undesirable, lower subsoils with upper subsoil horizons, and that reversibility would be longer term where topsoil is stored in berms for long-term facilities such as at access roads and terminals.

Yarrow Ecovillage said that, even if soil is removed in layers, the Project would disturb the subsurface and surface soil organisms and structure they depend on, thus reducing soil quality and hence its fertility and ability to provide biocontrol against pests and pathogens, with potential loss in whole or in part of organic certification.

Trans Mountain said that, while soil handling during construction may affect soil organisms, studies show that soil biology of stockpiled topsoil bounces back relatively quickly once replaced. Trans Mountain's Pipeline Environmental Protection Plan includes some mitigation measures for organic farms and farms transitioning to organic status, such as cleaning equipment to minimize the spread of weeds, salvaging topsoil from the entire construction right-of-way, and prohibiting the use of herbicides. Trans Mountain committed to develop additional mitigation at Yarrow Ecovillage in cooperation with the landowners and users and their organic certification boards, and to work with owners, users and boards on all organic farms to ensure that soil handling procedures do not affect organic certification.

Metro Vancouver and the Grasslands Conservation Council of British Columbia said that soil disturbance and erosion could be increased if the right-of-way becomes adopted for human recreational uses. Trans Mountain said that its Traffic and Access Control Management Plan is intended to control disturbance from increased access during and following pipeline construction, in particular in areas of high soil erosion hazard and where increased access could disturb reclamation efforts on sensitive terrain.

Disturbance of pre-existing soil contamination

Trans Mountain said that there have been five historical spills along the existing Trans Mountain pipeline right-of-way, and that they were remediated to the applicable standards at the time. Trans Mountain confirmed that soil testing at these sites would occur prior to soil disturbance. It said that it conducted a cursory inventory of potential third party contaminated sites to identify potential sources of contamination that could impact the Project. Trans Mountain said that, if contamination is suspected or if previously unknown contamination were discovered during construction, it would implement mitigation measures in its Contamination Discovery Contingency Plan and Waste Management Program.

Metro Vancouver and the City of New Westminster said that Trans Mountain's contamination discovery program is likely insufficient to detect many important chemicals that may not be seen or smelled, and that such contaminants, once disturbed, can re-enter the environment and waterways, increasing the exposure of biota to toxins. They suggested that Trans Mountain should conduct contaminated sites investigations prior to construction, especially in areas of historic industrial activity along the right-of-way. In response, Trans Mountain said that, based on the final route, it would update the preliminary inventory and re-assess potentially contaminated areas prior to construction. Trans Mountain said that, if contamination is confirmed on the right-of-way, site-specific mitigation, remediation, and monitoring measures would be developed, when warranted.

Soil contamination from construction

Trans Mountain described mitigation and contingency measures to avoid contamination from spot spills, inadvertent release of drilling mud, and release of hydrostatic test water. Trans Mountain said that no residual effects of pipeline construction and maintenance were identified for soil contamination.

Yarrow Ecovillage referenced a study that found increased presence of heavy metals in soils in pipeline construction areas. Trans Mountain said that the study, which found elevated metals in the working space and right-of-way of two recently installed Chinese pipelines, suggested the potential sources of these metals are incomplete cleanup after welding, burning of oil on the pipeline, and mechanical wear of tires and brakes, each of which would be avoided or mitigated by different construction practices in Canada or by Project mitigation. Trans Mountain concluded that there is very little risk of heavy metal contamination from construction of the Project, but committed to a statistically valid sampling and testing of soils prior to construction and before re-spreading topsoil at Yarrow Ecovillage to ensure there has been no metal contamination of the soil.

Cumulative effects

Trans Mountain said that a broad range of existing activities and land uses have already disturbed approximately 39 per cent of the soils in the LSA, which increases to approximately 41 per cent with the Project and reasonably foreseeable developments, of which the Project contributes 2 per cent.

Views of the Board

The Board is of the view that the effects of pipeline construction on soil and soil productivity are generally well understood. Trans Mountain has committed to a suite of mitigation measures to reduce such effects, and these measures have proved effective on past projects.

The Board would impose conditions requiring Trans Mountain to include updated mitigation measures in the Environmental Protection Plans (EPPs) to be filed prior to construction (Conditions 72, 78 and 81). These EPPs must also include updated management and contingency plans, a number of which (such as the Wet/Thawed Soils Contingency Plan) are relevant to soil and soil productivity. The Board would also impose conditions requiring Trans Mountain to address the potential for soil erosion due to increased access in the Access Management Plan, and to include soil issues in the post construction environmental monitoring reports, including in the final report identification of any outstanding soil issues that require ongoing action or assessment (Conditions 47 and 151). The Board would impose general conditions that require Trans Mountain to implement all commitments it has made during this hearing, and to file updated commitments tracking tables before, during and after construction (Conditions 2 and 6).

The Collaborative Group of Landowners Affected by Pipelines (CGLAP) recommended the Board impose additional conditions with regard to appropriate tires and tire pressures for Project vehicles on agricultural lands; to make three-lift soil separation, de-compaction and soil core sampling mandatory on all agricultural lands in the Fraser Valley; and to require Trans Mountain to file, and make publicly available, a study on pipeline temperature effects of the existing Trans Mountain pipeline being conducted by the University of the Fraser Valley and underwritten by Trans Mountain.

Given Trans Mountain's commitments related to soil handling and wet weather conditions, including those describing how it will respond to landowner requests in relation to soil sampling or soil handling techniques and to landowner concerns about potential soil compaction, the Board is not persuaded of the need for the additional conditions proposed by CGLAP. Further, the Board is not privy to the agreement between the University of the Fraser Valley and Trans Mountain with regard to the temperature effects study, and declines to impose a condition requiring it to be filed. The Board would impose Condition 99 requiring Trans Mountain to maintain and file its landowner consultation records, which must include a summary of the issues or concerns raised by landowners together with the actions, or explanation for no actions, taken in response.

The Board is satisfied with Trans Mountain's response to Yarrow Ecovillage's concerns about disturbance to organic farm soils, which includes commitments to develop additional mitigation in cooperation with landowners, users and organic certification boards to ensure that soil handling procedures do not affect organic certification. The Board would also require Trans Mountain to address potential adverse effects of treatment measures for weeds, such as contamination of organic lands by prohibited substances, in the Weed and Vegetation Management Plan (Condition 45).

The evidence indicates that Trans Mountain has conducted only a cursory inventory of potential third party contaminated sites to-date, but has committed to a more comprehensive review of such pre-existing contamination prior to construction, including site assessments and remediation measures where appropriate. The Board would impose Condition 46 requiring Trans Mountain to file a Contamination Identification and Assessment Plan prior to construction, to demonstrate the adequacy of the identification and assessment procedures that were and are being used.

With regard to the study submitted by Yarrow Ecovillage concerning the potential for pipeline construction to result in heavy metal contamination of soils, the Board is satisfied with Trans Mountain's risk assessment, which takes Canadian construction practices and Project mitigation into account, and with its proposed soil sampling to be undertaken at Yarrow Ecovillage.

Significance evaluation: adverse effects on soil and soil productivity

	Criteria	**Rating**	**Description**
Project effects	*Temporal extent*	*Medium- to long- term*	*Effects are expected to be mostly medium-term, but long- term in the case of facilities and if mix unanticipated poor lower subsoils with upper subsoils.*
	Reversibility	*Reversible to permanent*	*Medium-term effects are reversible in the post-construction phase, whereas long-term effects at facilities would continue until post-abandonment.*
	Geographic extent	*Footprint to Local Study Area*	*Effects expected to be limited generally to directly disturbed areas, although unanticipated contamination if disturbed could migrate off-footprint.*
	Magnitude	*Low to moderate*	*Residual effects could include reduction in soil productivity, although proposed mitigation, reclamation and monitoring measures are expected to limit the severity of such effects.*
Cumulative effects	*Although a relatively high percentage (approximately 39 per cent) of soils in the LSA are already disturbed, given Trans Mountain's mitigation and reclamation measures and the Board's conditions, the Project's contribution to total cumulative effects is expected to be relatively minor.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

10.2.7 Rare plants and lichens, and vegetation communities of concern

The primary issues raised during the hearing regarding rare plants and lichens, and vegetation communities of concern (including wetlands of concern) were related to federally-listed (i.e., under the SARA) and provincially-listed plant and lichen species at risk, provincially-identified rare ecological communities, and grassland communities in the interior of B.C.

Trans Mountain said that construction and operation of the proposed pipeline would disturb or alter about 2,231 ha of native vegetation, and, although such areas would revegetate with appropriate native species, species composition would be altered. It said that vegetation within at least 3 m on either side of the pipeline centreline would be maintained to not exceed 1 m in height to allow for aerial reconnaissance and access for operational maintenance. Trans Mountain said that long-term loss of native vegetation may occur at long-term facilities, and that vegetation communities and populations adjacent to disturbed areas may also be indirectly affected by edge effects, changes in surface drainage patterns, soil erosion, and dust deposition.

Survey methods

Trans Mountain said that it conducted vegetation surveys on lands where access was available, at locations that were representative of the different vegetation types in the area and at locations with a high potential to support rare plants and lichens, or vegetation communities of concern. It said that there are eight federally-listed plant and lichen species with historical occurrences within the RSA (see Appendix 11 for a description of the spatial boundaries), and 13 others with high or moderate potential to occur along the pipeline corridor. Trans Mountain said numerous provincially listed plant and lichen species and rare ecological communities are listed as encountered or were observed within the pipeline corridor.

A number of participants, including ECCC, questioned the adequacy of Trans Mountain's vegetation surveys. Trans Mountain responded that its rare plant survey methodology was based on the Alberta Native Plant Council Guidelines for Rare Plant Surveys and the British Columbia Protocols for Rare Plant Surveys. It said that surveys were conducted during biologically appropriate times for the species with potential to occur in the area, and that experienced, professional biologists conducted the surveys. Trans Mountain said that once the Project footprint has been determined, supplemental surveys would further delineate or verify rare plants and communities where necessary and inform site-specific mitigation.

Mitigation

Trans Mountain said general measures to mitigate effects on native vegetation include paralleling existing linear disturbances, utilizing workspace on adjacent existing rights-of-way, and siting temporary facilities (such as work camps and stock piles) on existing disturbances to the extent practical. It said that detailed reclamation strategies would be finalized before construction and described in the Reclamation Management Plan.

Trans Mountain detailed potential mitigation measures for rare plants and lichens and vegetation communities of concern, together with circumstances where each mitigation would be used, the expected level of success and measurable goals to determine success. Trans Mountain said that site-specific mitigation measures are dependent on the finalization of the Project footprint, but in general:

- complete avoidance would be adopted for rare plants, lichens, and communities ranked S1 or S1S2[59] and for species or critical habitat that are protected under provincial or federal legislation, subject to factors such as construction and workers' safety;
- disturbance reduction could include measures such as placement of protective structures over plants of concern, and restricting use of herbicide near vegetation communities or sub-populations; and
- where avoidance and disturbance reduction are not feasible, alternative reclamation techniques would be used, such as propagating and transplanting to suitable receiving sites, and stripping the upper 15 cm of topsoil separately where feasible to make use of the existing seed bank.

Trans Mountain said that offsets for rare plants, lichens and communities are unnecessary because other technical mitigation options are available which would sufficiently mitigate potential impacts. It said that

59 S1 means critically imperilled in a province, S1S2 is critically imperilled to imperilled, while S2 is imperilled.

not all non-standard restoration measures would be effective, practical, or economically feasible at all locations. In its comments on the Board's draft conditions, Shackan Indian Band emphasized the importance of avoidance in cases where the effectiveness of mitigation and offsets is unproven.

For rare plants and lichens and vegetation communities of concern that are disturbed, Trans Mountain said that some species can recolonize or re-establish in one growing season if the seed bank and habitat is available, whereas effects to others (such as mature trees) would reverse over the long term. Trans Mountain said that due to potential connectivity among populations, alteration of occurrences of rare plants or lichens may affect the viability of other populations in the RSA.

Post-construction monitoring

Trans Mountain said that post-construction environmental monitoring would use baseline vegetation data from surveys on and off the right-of-way; that reclamation of native vegetation would be deemed successful when vegetation growth on and off the right-of-way are comparable; and that if reclamation measures are unsuccessful, remedial measures would be implemented as soon as feasible.

Trans Mountain said that where warranted, a rare plant specialist would revisit the locations of previously documented rare plants and lichens and vegetation communities of concern one full growing season after cleanup to determine the effectiveness of mitigation measures. Where a rare plant population is determined to have returned to a state of overall health and vigour comparable to, or better than, the status documented pre-construction, the issue would be considered resolved; otherwise, additional monitoring and corrective measures may be recommended.

In response to an Adams Lake Indian Band information request, Trans Mountain described post-construction monitoring results from 2012 for a previous expansion of the Trans Mountain pipeline (the TMX Anchor Loop project), for which 69 per cent of rare vascular and 72 per cent of rare non-vascular plant sites were successfully mitigated, and 31 per cent and 28 per cent respectively were unsuccessfully mitigated.

SARA-listed species with critical habitat

ECCC said that it considers activities that would adversely impact the survival or recovery of a SARA-listed species, or any activity likely to destroy critical habitat under SARA, to have caused significant adverse effects. ECCC said that avoidance is often the only known means to ensure the critical habitat of plant species would not be destroyed, and that a number of Trans Mountain's proposed mitigation measures have risks and uncertainties, such as time lags and risk of failure with habitat restoration. In particular, ECCC cautioned against concluding that offsets are likely to be effective in the context of critical habitat for plant species at risk, and that offsets cannot compensate for the loss of irreplaceable habitat. ECCC said it continues to identify critical habitat for species, and so encourages the use of the most up-to-date information regarding recovery planning.

In addition to the mitigation described above, Trans Mountain described the further mitigation it would implement with regard to SARA-listed plant species that have critical habitat overlapping the pipeline corridor (see Table 10). Trans Mountain said that additional surveys for SARA listed toothcup, whitebark pine and relevant vegetation species of concern would continue in summer 2016, and that it would prepare appropriate mitigation measures if such species or their critical habitats were encountered within the Project footprint. It said that the potential for Project mitigation to be unsuccessful is very low for SARA-listed plant and lichen species.

Table 10: Proposed further mitigation for SARA-listed plant species with critical habitat that overlaps the pipeline corridor

SARA-listed plant species	Mitigation
Toothcup (Endangered)	Critical habitat for toothcup is crossed by the proposed pipeline corridor at Mission Flats near Kamloops. Shoreline disturbance in proximity to known toothcup populations would be avoided by implementing horizontal directional drilling (HDD) at the North Thompson River crossing, and the small portion of temporary workspace that overlaps the critical habitat polygon does not contain attributes of toothcup critical habitat. In the unlikely event the HDD is unsuccessful, critical habitat destruction can still be avoided by positioning the construction footprint in areas of existing disturbance to the greatest extent practical, and by applying mitigation such as narrowing the construction right-of-way, retaining the seedbed, and employing appropriate salvage, propagation and transplant techniques.
Whitebark pine (Endangered)	Five candidate critical habitat regeneration areas intersect the proposed pipeline corridor. The proposed route parallels pre-disturbed rights-of-way and mainly follows low elevation forested valleys well below the treeline, whereas whitebark pine habitat is high elevation, upper subalpine habitat. The intersected candidate areas are mostly covered by dense canopy forests that do not provide the attributes for a shade-intolerant species such as whitebark pine, and rare plant surveys within the proposed pipeline corridor did not identify the presence of whitebark pine in these areas.
Haller's apple moss (Threatened) and Mexican mosquito fern (Threatened)	Critical habitat for Haller's apple moss and early draft critical habitat for Mexican mosquito fern overlap a 1 km buffer centered on the reactivation segments (as does candidate critical habitat for whitebark pine). Upon determination of areas requiring work, field surveys would be completed as needed to inform the development of site-specific mitigation measures. The potential for interaction is expected to be low given the disturbance footprints of reactivation activities are relatively small and mostly within the existing Trans Mountain pipeline right-of-way and pump stations, and given the proximity of existing disturbances.
Roell's brotherella moss (Endangered, though not yet SARA listed)	Environment and Climate Change Canada suggested early draft critical habitat (which is based on occurrence) could overlap the proposed pipeline corridor. However, Trans Mountain said an occurrence of *Roell's brotherella* originally located within the Burnaby Terminal was determined to be a location error, and therefore no existing occurrences are located within the proposed pipeline corridor.

Trans Mountain said that if its resource specialists consider recovery to be unacceptable or habitat loss to be beyond predicted effects during the Post-Construction Environmental Monitoring program, additional mitigation measures would be implemented which could include transplants, seed collection, appropriate salvage, propagation and habitat improvements.

Grasslands

A number of participants noted particular concerns with disturbance to grasslands in the B.C. interior. The Grasslands Conservation Council of British Columbia, for example, said that such grasslands are a rare ecotype in B.C., occupying less than one per cent of the land base, are critical to one-third of the province's threatened or endangered species for some portion of their annual lifecycles, can take 50 years or more to recover from significant disturbance, and that B.C. has already lost over 20 per cent of its original grasslands to forest ingrowth, land conversion and invasive plants. Dr. Lauchlan Fraser said that grasslands are notoriously difficult to restore due to the characteristic low annual precipitation and relatively low productivity of the ecosystem.

Trans Mountain said that the Bunchgrass biogeoclimatic zone is intersected by the proposed pipeline corridor for a total of approximately 35 km and that approximately 158 ha is predicted to be directly disturbed or altered by the footprint. Trans Mountain described the mitigation it could implement in native grasslands, such as retaining sod and using the vegetative mat if a competent sod layer exists, and said that the preferred reclamation method is seeding a native seed mix. Trans Mountain committed to additional mitigation and offsets within the Lac du Bois Grasslands Protected Area, which intersects the preferred routing for approximately 10 km. (see section 10.2.12).

Trans Mountain said that establishing a cover of native grassland species (or a cover crop species) would occur over the medium-term (i.e., 1 to 10 years), that greater species diversity may take longer than 10 years, and that revegetation to habitat function equivalent to areas adjacent to the right-of-way is expected within the operational life of the Project. It said that cryptogamic crust (a thin layer of living organisms such as fungi and lichens on the soil surface) may take on the order of decades to centuries to return to pre-construction conditions, and that such crusts are highly susceptible to trampling. Trans Mountain said that it would salvage, store, and redistribute topsoil after construction, and that this has been effective for rehabilitation of the cryptogamic crust.

Cumulative effects

Trans Mountain said that a broad range of existing activities and land uses have already disturbed native vegetation in the RSA. It said areas of existing disturbance have previously been converted to non-native cover types that provide little to no habitat value for rare plants and rare lichens, and where rare ecological communities are unlikely to persist.

Trans Mountain applied a habitat disturbance threshold of 40 per cent based on literature that indicates risk is highest when total habitat loss measured at the landscape (regional) scale exceeds 50 per cent. Trans Mountain said that this disturbance threshold is already exceeded by existing land conversion and disturbance at the RSA scale in Alberta and in the B.C. Georgia Depression ecoprovince/lower mainland development area, and thus total cumulative effects on native vegetation and on rare plants and lichens and vegetation communities of concern is potentially significant in these areas. Trans Mountain said that total cumulative effects for SARA-listed plant and lichen species are also significant in some areas because of disturbance from existing activities. Trans Mountain said that, in the Bunchgrass biogeoclimatic grassland zone, total cumulative effects would constitute approximately 34 per cent disturbance with the Project contributing four per cent.

Views of the Board

The Board is of the view that the effects of pipeline construction on native vegetation, and the effectiveness of related mitigation and remediation, are generally well understood.

The Board would impose Conditions 72 and 78 requiring Trans Mountain to file, before construction, updated Environmental Protection Plans, which include the Reclamation Management Plan and Rare Ecological Communities or Rare Plant Species Discovery Contingency Plan. The Board would require the Post-Construction Environmental Monitoring Reports to address rare plants, lichens and ecosystems, and the Access Management Plan to address the potential for adverse effects on vegetation due to increased access along the right-of-way (Conditions 47 and 151). The Board would also require Trans Mountain to consider relevant updates for plants and lichens listed under Species at Risk Act (SARA), and consequences for Project mitigation and monitoring, prior to construction and throughout the Project lifetime (Condition 92).

The Board would impose Condition 40 requiring specific mitigation and monitoring measures to be updated and included in a Rare Ecological Community and Rare Plant Population Management Plan to be filed prior to construction. This condition would also require Trans Mountain to demonstrate the overall adequacy of surveys for rare ecological communities and rare plants and lichens. In the Board's view, a single year of monitoring to determine the effectiveness of alternative reclamation techniques, such as transplantation, as suggested by Trans Mountain, may not be sufficient, and so the Rare Ecological Community and Rare Plant Population Management Plan would be required to address the appropriate monitoring duration for each type of mitigation measure.

Although Trans Mountain said it does not see the need for offsets, the Board notes that monitoring of previous projects (such as the TMX Anchor Loop) has shown that mitigation for rare plants is not always successful. The Rare Ecological Community and Rare Plant Population Mitigation Evaluation Report and Offset Plan would therefore require an overall evaluation, five years post-construction, of the success of mitigation and of the need for offsets where ongoing effects remain, as well as the need for further corrective actions and monitoring on-site (Condition 155).

The Board finds that offsets may not be feasible or effective for some rare ecological communities or rare plants and lichens, and so reiterates the primary importance of avoidance and mitigation to

avoid and reduce adverse effects. Offsets should generally be used only as a last resort and when they have a reasonable chance of success. In the Board's conditions, Trans Mountain would therefore be required to justify any use of offsets, to explain why avoidance and mitigation cannot feasibly avoid residual effects, and to discuss any limitations on the potential effectiveness of offsets for the particular community or species. For SARA-listed plant species in particular, the Board finds that Trans Mountain's proposed avoidance and mitigation measures are expected to avoid adverse effects on these species and their critical habitat, and so offsets are not expected to be required.

The Grasslands Conservation Council of British Columbia recommended that the Board's conditions related to rare plant and ecosystem mitigation include species of concern listed S2 (imperilled) or higher in addition to those that are federally listed under SARA, given that federal listing is a coarse filter at the national scale and so can miss the variability and status of species and ecosystems at the provincial scale. The Board agrees that species and communities at risk at the provincial level with a status of S2 (imperilled) or higher should receive special attention, similar to species at risk at the national level. Consequently, the Board would include in the Conditions 40 and 155 related to rare ecological communities and rare plants a requirement for Trans Mountain to address S1, S1S2 and S2 species, including an evaluation of the potential need for and feasibility of offsets.

The Grasslands Conservation Council of British Columbia also recommended that the Board impose specific conditions to oversee the mitigation and reclamation of grasslands given their sensitivity to disturbance. It said that post-construction monitoring should be for 30 years given that the standard five years post-construction monitoring would only indicate if interim cover is re-establishing itself. It said that offsets should be required to compensate for lost productivity due to invasive plants, and that Trans Mountain should be required to manage and control access in such rare and ecologically sensitive areas for the lifetime of the pipeline.

With regard to grasslands in the B.C. interior, the Board agrees with participants' views that special attention should be focused on mitigation, reclamation and monitoring in these areas, given the importance, rarity and sensitivity of these grasslands, and the long duration and potential difficulties in successfully reclaiming them. The Board would therefore impose Conditions 42 and 157 that require a Grasslands Survey and Mitigation Plan prior to construction, and a Grasslands Reclamation Evaluation Report and Offset Plan to evaluate reclamation success after ten years, and to determine the need for offsets and for ongoing monitoring and corrective actions on-site.

Significance evaluation: adverse effects on rare plants and lichens and vegetation communities of concern

	Criteria	Rating	Description
Project effects	*Temporal extent*	*Medium- to long- term*	*Effects are expected to be mostly medium-term, but can be long-term at facilities along the right-of-way due to vegetation maintenance, for certain communities such as mature trees and grasslands, and if mitigation is unsuccessful.*
	Reversibility	*Reversible to permanent*	*Medium-term effects are reversible during the post-construction phase, but long-term effects might extend beyond the lifetime of the Project.*
	Geographic extent	*Footprint to Local Study Area*	*Effects are expected to be mostly restricted to the Project footprint, although some effects, such as edge effects and dust and effects on local populations, can extend off the footprint.*
	Magnitude	*Low*	*With surveys, avoidance, mitigation and offsets (as a last resort), net effects are expected to be mostly of low magnitude, although there is potential for loss of rare plant or community occurrences if undetected or if mitigation is unsuccessful.*
Cumulative effects	*Existing cumulative effects to native vegetation are already substantial in the Vegetation Regional Study Area in Alberta and in the lower mainland of British Columbia. Furthermore, the reason that rare plants, lichens and vegetation communities are at risk is often because existing cumulative effects have already exceeded a sustainability threshold for the species or community. Despite substantial existing cumulative effects on native vegetation, given Trans Mountain's mitigation and reclamation measures and the Board's conditions, the Project's contribution to total cumulative effects is expected to be relatively minor. For species or communities that are imperilled or critically-imperilled at the provincial level, given the additional measures required in the Board's conditions (which include offsets as a last resort under the mitigation hierarchy), the Project's net contribution to total cumulative effects is expected to be inconsequential. For SARA-listed species, given the additional measures committed to by Trans Mountain and as required in the Board's conditions, the Project's contribution to total cumulative effects is expected to be inconsequential and offsets are not expected to be required.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

10.2.8 Forests

The primary issues raised during the hearing regarding forests were related to old growth forests in B.C., the potential degradation of forest health, and the loss of urban trees. With regard to forests generally, Trans Mountain said that construction of the proposed pipeline, facilities and associated power lines would create new forest clearing, increase the existing corridor width where existing linear disturbances are paralleled, and create indirect edge effects in adjacent forest. Trans Mountain said temporary workspaces would be planted with timber tree species in forested areas, although effects to mature trees would take decades to reverse and the right-of-way would be maintained free of high vegetation throughout the Project's lifetime.

Old Growth Management Areas

Trans Mountain said that Old Growth Management Areas (OGMAs) in B.C. originated under the B.C. Forest Practices Code as a key element of biodiversity planning, and a key goal of OGMAs is ensuring relatively undisturbed ecosystems are represented on the landscape. A number of participants raised concerns about effects on OGMAs. For example, the Stó:lō Collective said that right-of-way clearing width within OGMAs should be minimized and actual effects should be monitored and compared to predicted effects.

Trans Mountain said that 66 OGMAs are crossed by the pipeline corridor, and that two are crossed by the Kingsvale power line. It said that avoidance of OGMAs is the top priority where possible, followed by minimization of impact and use of existing linear features to the extent practical. It said that, as the Project footprint continues to be refined, it would work with the British Columbia Ministry of Forest, Lands and Natural Resource Operations to reduce unavoidable effects, and it committed to reviewing replacement options if unavoidable effects would result. Trans Mountain said that post-construction environmental monitoring would include identifying where actual effects on OGMAs deviate from anticipated effects,

documenting changes to newly created edges in OGMAs, and identifying if further mitigation is required should windthrow levels exceed natural levels.

Forest health

Trans Mountain said that construction activities have the potential to exacerbate forest health related damage. For example, timber clearing could result in an accumulation of excess woody debris that could in turn lead to increased bark beetle populations, and damage to residual trees could compromise tree health and increase susceptibility to other forest health factors such as pathogens.

Trans Mountain said that mitigation would include minimizing coarse woody debris left on the right-of-way and damage to trees at the edge of the right-of-way; obtaining local beetle flight data to determine the appropriate tree clearing period; and following applicable legislation, regulations, and guidelines with respect to the movement of construction debris. Trans Mountain concluded that no residual effect on forest health due to construction is anticipated.

Urban trees

A number of participants noted the importance of urban forests and trees. Calvin Taplay, for example, noted the valuable ecological services that trees provide in an urban context and Sandra Martin expressed concern about the loss of mature trees and the length of time it would take for trees to grow to replace them.

Trans Mountain committed to engage a qualified arborist to develop a Tree Plan specific to municipal lands within the City of Abbotsford, including a survey identifying the species and number of trees to be removed, and to plant new trees, either on the construction right-of-way or on other City-owned property. Trans Mountain said that it would extend the same or equivalent commitment to other municipalities.

Views of the Board

The evidence indicates that some mature trees and old growth forest would be lost as a result of the Project, and regrowth of trees back to similar size would take decades. The Board acknowledges the importance of Old Growth Management Areas given the cumulative effects on old growth forests in parts of B.C. The Board would therefore impose Condition 76 requiring Trans Mountain to file, prior to construction, an Old Growth Management Areas Mitigation and Replacement Plan with the aim of no-net-loss to old growth forests within Old Growth Management Areas overall. The Board agrees with participants about the importance of minimizing effects within Old Growth Management Areas, and so requires the mitigation hierarchy, in which avoidance and mitigation are favoured over offsets, to be followed.

The Board is satisfied with Trans Mountain's commitments related to forest health and urban trees.

Significance evaluation: adverse effects on forests

	Criteria	Rating	Description
Project effects	*Temporal extent*	*Long-term*	*The right-of-way would be cleared of high vegetation for the lifetime of the Project, and replanted trees often take decades to mature.*
	Reversibility	*Reversible to permanent*	*Some replanted areas are expected to resemble pre-construction conditions within the lifetime of the Project, whereas other areas would take longer to mature (e.g., old growth) and the right-of-way would remain cleared of high vegetation for the lifetime of the Project.*
	Geographic extent	*Footprint to Local Study Area*	*Direct effects would generally be limited to the Project footprint, whereas indirect edge effects would extend off the footprint, as could the exacerbation of forest pests.*
	Magnitude	*Moderate*	*Forests would be cleared and maintained as low height vegetation along the entire right-of-way.*
Cumulative effects	*Existing cumulative effects on old growth and mature forests in British Columbia are already substantial in some areas. There has also been substantial forest health related damage in some areas, such as from mountain pine beetle. Despite such substantial cumulative effects, given Trans Mountain's mitigation and the Board's conditions for Old Growth Management Areas (which would, as a last resort under the mitigation hierarchy, require replacement or other offsets), and given Trans Mountain's mitigation measures related to forest health and urban trees, the Project's contribution to total cumulative effects is expected to be relatively minor.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

10.2.9 Wetlands

Trans Mountain said that 538 wetlands are potentially crossed by the proposed pipeline corridor, and that 23 are crossed by the proposed Kingsvale power line corridor. It said that not all of these wetlands would be disturbed because the pipeline right-of-way would be routed within the corridor to avoid wetlands to the extent practical, and power structures are typically placed outside of areas of water. Trans Mountain said that potential effects to wetlands include loss or alteration of hydrological function, biogeochemistry function, and habitat function.

A number of participants expressed concerns related to effects on wetlands. The City of Surrey said that bog ecosystems (such as at Surrey Bend Regional Park) develop very slowly and are highly sensitive to changing hydrological and nutrient regimes, and that disturbance could result in the eventual replacement of bog habitat with swamp or fen ecosystems. The Salmon River Enhancement Society said that bogs are typically very difficult to restore once damaged and that bogs are some of the more increasingly rare ecological communities in the southeastern portion of B.C.

Surveys and mitigation

Trans Mountain said that it reviewed aerial surveys and satellite imagery of the wetlands encountered by the Project, and that it has ground surveyed 413 of the 538 wetlands crossed (77 per cent) during the pre-construction field programs. It said that it aims to conduct ground surveys at all remaining wetlands encountered by the Project prior to construction unless unable to obtain landowner access permission.

Trans Mountain said that the proposed pipeline corridor has been routed to avoid wetlands and to follow existing linear infrastructure where feasible. It said that mitigation would include:

- *hydrological function*: standard pipeline construction and operational activities to avoid the diversion or natural flow impedance of water, reclamation to pre-construction profiles, and re-establishment of surface drainage patterns;
- *biogeochemistry function*: salvage of surface material in unsaturated wetlands, and erosion and sediment control measures where warranted; and
- habitat function: minimal disturbance construction techniques such as the use of matting or compacted snow or ice over vegetation, salvaging and replanting woody species in areas of particular sensitivity where warranted, and re-establishment of wetland substrate to allow natural recovery using the native seedbank.

Trans Mountain said that past studies and monitoring following past projects have shown the proposed mitigation measures, along with supplemental remedial measures where warranted and with the passage of time, have proven to be successful, and that wetland habitat function generally returns successfully within two to three years. It said that many of the wetlands crossed by the pipeline corridor are also either crossed by, or are adjacent to, the existing right-of-way, which speaks to wetland resiliency and recovery following temporary disturbance.

Trans Mountain said that tree re-growth in treed wetlands can take longer than 10 years, that tree growth would be restricted along the right-of-way for the duration of the Project's lifetime, that permanent disturbance may occur at facilities, and that wetlands of low functional condition are unlikely to recover to their type and class and may not recover as functional wetlands.

Post-construction monitoring

To measure the effectiveness of mitigation and reclamation measures, and the need for remedial measures, Trans Mountain said that ground-based surveys would be conducted at all wetlands disturbed during construction and that their condition would be compared to their pre-construction state and to wetlands located adjacent to the right-of-way. It said that wetland functions are being evaluated pre-construction based on the ground-survey field work, with each wetland assigned to one of four functional condition categories (high, high-moderate, low-moderate, or low) based on a weighted sum of individually evaluated functions. It said that the goal is to return all wetlands to the same functional condition category post-construction. Trans Mountain said that, if a wetland recovers to the same functional condition category but at a lower score, additional remedial measures may be recommended to ensure the wetland reaches its full recovery potential within the category.

ECCC said that the Federal Policy on Wetland Conservation goal of no net loss of wetland functions applies to all wetland functions, individually, and that Trans Mountain's approach of assigning each wetland a functional condition category based on a sum of individual function scores could allow for the loss of an individual function. Trans Mountain said that its assessment is intended to inform a wetlands' overall functional condition, and that each functional condition category represents a range of scores to accommodate the seasonal and annual variation and dynamic nature of wetlands, and to allow for some subjectivity inherent in these types of assessments.

No net loss and compensation

ECCC said that the Federal Policy on Wetland Conservation's goal of no net loss of wetland functions applies:

i) on federal lands and waters,

ii) in areas affected by the implementation of federal programs where the continuing loss or degradation of wetlands has reached critical levels; and

iii) where federal activities affect wetlands designated as ecologically or socio-economically important to a region.

ECCC identified the areas for (ii) as including the lower mainland/Fraser valley region of B.C. and the 'White Area' (or settled areas) of Alberta, and for (iii) as including all eelgrass beds and red- and blue-listed wetland ecological communities in B.C. and environmentally significant areas in Alberta. It emphasized the mitigation hierarchy under which compensation should only be used as a last resort, and said that where wetland losses have been severe, no further loss of any remaining wetland area may be deemed essential, such as in the 'White Area' of Alberta.

The British Columbia Wildlife Federation recommended that Trans Mountain go beyond no net loss and adopt a net-gain strategy for all wetlands impacted by the pipeline expansion.

Trans Mountain said that no net loss of function applies to all wetlands disturbed by the Project. It said that, if at the end of the last year of monitoring (i.e., year five after construction), should any wetland not be on a trajectory to recovering its pre-construction functional condition, and additional remedial measures are not determined to be appropriate, then compensation would be considered following consultation with regulatory authorities. Trans Mountain provided a Preliminary Wetland Compensation Plan, and said that the type of compensation and approach to be taken would be determined through consultation with ECCC, and that Trans Mountain would ensure all of ECCC's requirements are met.

ECCC said that the no-net-loss goal in the Federal Policy on Wetland Conservation also applies to the temporary loss of wetland function, noting that such temporary loss can affect migratory birds and species at risk that are dependent on wetland habitats for part or all of their lifecycle, potentially jeopardizing the survival and recovery of species. ECCC recommended that measures be implemented so that the temporary loss of wetland functions is reduced to the extent possible. In its comments on the Board's draft conditions, the Katzie First Nation said that both temporary and permanent wetland losses could impact traditional use of lands and resources, and so supported a requirement for offsets for both, as did the B.C. Wildlife Federation, which noted a temporary loss of wetlands could have long-term impacts on wildlife populations. Trans Mountain said that temporary alterations would be noted as wetlands recover over time, but that it is not reasonable to implement offsets for temporary losses because pipeline construction would cause temporary alteration of wetland function but wetlands are still anticipated to function overall with the implementation of appropriate mitigation measures.

Cumulative effects

Trans Mountain said that a broad range of existing land uses have already disturbed wetlands in the RSA (see Appendix 11 for a description of the spatial boundaries). Trans Mountain said that total cumulative effects are significant within the City of Edmonton and lower mainland developed area in B.C. where permanent loss or alteration of many wetlands has likely occurred. Trans Mountain assumed that regulatory standards (i.e., the goals in the Federal Policy on Wetland Conservation and the Alberta Wetland Policy to protect and restore wetlands) have been exceeded because long-term or permanent wetland loss and alteration has occurred.

Views of the Board

The Board is of the view that the effects of pipeline and power line construction on wetlands, and of the effectiveness of related mitigation and remediation, are generally well understood. Trans Mountain has provided a suite of mitigation, reclamation and monitoring measures for wetlands, and has avoided numerous wetlands via routing decisions. The Board would impose Conditions 41 and 156 requiring Trans Mountain to provide an update on such measures prior to construction in the Wetland Survey and Mitigation Plan, and an evaluation of reclamation success five years post-construction in the Wetland Reclamation Evaluation Report and Offset Plan.

Trans Mountain committed to no net loss of function at all wetlands. Trans Mountain proposed a method for determining the need for offsets based on an evaluation of overall wetland functionality by summing the scores of individual wetland functions. Environment and Climate Change Canada (ECCC), in contrast, said that no net loss in the Federal Policy on Wetland Conservation applies to each wetland function individually, and that using a sum of scores could result in the loss of individual function. The Board notes that areas to which the Federal Policy on Wetland Conservation applies include areas where wetland losses have already reached critical levels as well as wetlands designated as ecologically or socio-economically important to a region, highlighting the importance of maintaining each individual function in such areas. The Board finds ECCC's approach to be persuasive for areas to which the Federal Policy on Wetland Conservation applies, and so the wetlands conditions would require no net loss for each individual function in such areas, while allowing for reasonable natural variation.

Trans Mountain proposed determining whether wetland compensation is required after the last year of Post-Construction Environmental Monitoring, based on whether wetland function is on a trajectory to returning to its pre-construction functional category and on whether additional remedial measures are appropriate. ECCC, in contrast, said that no net loss in the Federal Policy on Wetland Conservation also applies to the temporary loss of wetland function and, together with other participants, noted the potential importance of such losses to migratory birds and species at risk. The Board is of the view that Trans Mountain's approach to no-net-loss could result in losses to wetland function of up to a decade or more, given the construction period, the five years of post-construction environmental monitoring, the potential for further remedial actions, the additional time for a wetland on a trajectory to achieving its pre-construction function to actually achieve it, and the potential additional time for offset sites to develop the desired compensatory functions. The Board finds ECCC's approach to be persuasive for areas to which the Federal Policy on Wetland

Conservation applies, and so the wetlands conditions would require no net loss to include the temporary loss of wetland functions in such areas.

In summary, the Board's wetland conditions would require offsets to be implemented for any temporary or ongoing loss in any individual wetland function for wetlands in areas to which the Federal Policy on Wetland Conservation applies. In all other areas, the conditions would require offsets for any ongoing loss to overall wetland function still evident at the end of the five-year post-construction monitoring program. An evaluation of the potential for further actions on-site would also be required. Given these requirements to ensure no net loss for all wetlands, with stricter requirements where existing cumulative effects are already critical and where wetlands are designated as ecologically or socio economically important to the region, the Board is not persuaded to require a net gain strategy, as suggested by the British Columbia Wildlife Federation. Finally, the Board reiterates the importance of the mitigation hierarchy, in which avoidance and mitigation to avoid and reduce adverse effects are generally favoured over offsets, and this is reflected in the wetlands conditions.

Significance evaluation: adverse effects on wetlands

	Criteria	**Rating**	**Description**
Project effects	*Temporal extent*	*Medium-term to long-term*	*Effects are expected to be mostly medium-term given reclamation measures, although some effects (such as at facilities, or due to vegetation maintenance along the right-of-way at treed wetlands) would remain for the lifetime of the Project.*
	Reversibility	*Reversible to permanent*	*Medium-term effects are reversible during the post-construction phase, but long-term effects might extend beyond the lifetime of the Project.*
	Geographic extent	*Footprint to Local Study Area*	*Effects are expected to be mostly limited to the Project footprint, although changes in wetland functions (such as hydrology and biogeochemistry) could affect adjacent wetlands and nearby surface waters.*
	Magnitude	*Low to moderate*	*Disturbed wetlands would generally suffer some loss or alteration of function until successfully reclaimed, although some function would generally continue during that time.*
Cumulative effects	*Given the Board's conditions concerning mitigation and, as a last resort under the mitigation hierarchy, offsets to achieve no-net-loss of overall wetland function by the end of the Post-Construction Environmental Monitoring Program, the Project's contribution to total cumulative effects is expected to be relatively minor. In areas to which the Federal Policy on Wetland Conservation applies, which includes areas that have already reached critical levels of cumulative loss or degradation, given the additional measures required by the Board's conditions (which includes no-net-loss in such cases to also address temporary losses and losses to individual wetland functions), the Project's contribution to total cumulative effects is expected to be inconsequential.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

10.2.10 Weeds

Trans Mountain said that pipeline construction is expected to cause some weed introduction and spread, and that this may extend beyond the footprint and LSA to the RSA (see description of the spatial boundaries in Appendix 11). Trans Mountain said that non-native and invasive species introduced or spread by the Project can exert competitive pressure on, and alter, native vegetation, and can out compete crops and forage grasses.

A number of participants expressed concerns related to weeds. The Upper Nicola Band raised concerns about the introduction of non-native invasive weeds and the use of herbicides. Metro Vancouver and the City of New Westminster said that clearing of native vegetation, exposure of bare soils, and increased access can all raise the risk of invasive species spreading and establishing. It said that many invasive plants have low habitat value for endemic and native organisms, which may be displaced as a result, and that removal of invasive species can have adverse impacts such as potential accidental mortality to wildlife and their nests from mowing. The City of Chilliwack emphasized the need for a comprehensive weed

management plan that clearly identifies how invasive plants would be managed throughout the lifetime of the Project, and that Trans Mountain should be required to demonstrate how it has developed the plan with input from local governments.

Surveys, mitigation and monitoring

Trans Mountain said that it would conduct pre-construction weed surveys to document any problem vegetation infestations on and immediately adjacent to, the construction right-of-way and at each facility. It said that survey results would be used to inform the need for pre-construction treatments and for heightened mitigation during construction.

Trans Mountain provided a preliminary Weed and Vegetation Management Plan which describes prevention, monitoring, and remedial measures to control non-native weed species, and post treatment inspections and evaluation. Trans Mountain said that the objective is to manage provincially- and regionally-designated weed species to a level, by density and distribution, equivalent to, or less than, levels on adjacent lands with equivalent or similar land use and land management.

Trans Mountain said that it would manage problem vegetation using an integrated vegetation management approach that combines non-chemical (mechanical/manual), cultural (seeding), and chemical (herbicide) treatment options tailored to the plant species and conditions at the site. It said that it would adhere to all provincial regulations related to designated noxious and invasive plants, and to all applicable regional and municipal by-laws pertaining to the use of pesticides, such as pesticide-free zones and buffers at water bodies.

Trans Mountain said that it consults with all landowners or Crown land managers regarding the control of problem vegetation on their land, and that it only uses pest control methods they approve. It said that it would contact each municipality and/or regional invasive plant council to determine additional species of concern and any specific mitigation recommended for the applicable areas. Trans Mountain said that its proposed mitigation measures are effective industry standard measures and that past experience has shown that mitigation resulted in limited weed issues, although it may take up to 10 years to reverse residual effects in certain circumstances.

Cumulative effects

Trans Mountain said that existing cumulative effects range from "not significant" to "significant," given that weeds typically establish in previously disturbed areas and that existing disturbance within the RSA is comparatively high in settled areas of western Alberta, in the City of Edmonton, and in the lower mainland development area of B.C.

Views of the Board

Project construction and ongoing operations and maintenance activities have the potential to introduce and spread invasive plants off the right-of-way and it could take years to bring them under control. There was agreement between Trans Mountain and intervenors about the importance of controlling invasive plants that could result from the Project. The Board is satisfied that Trans Mountain has proposed a suite of mitigation measures to control such introduction and spread, and that such measures have proved to be effective in the past.

The Board would impose Condition 45 requiring Trans Mountain to file, prior to construction, an updated Weed and Vegetation Management Plan including a summary of weed survey results, mitigation and monitoring that would be undertaken during and after construction and throughout the operational life of the Project, and consideration of the potential adverse effects of treatment measures. In addition, the Board would impose Condition 47 requiring Trans Mountain to address, in the Access Management Plan, the potential for adverse effects on vegetation due to increased access along the right-of-way.

Significance evaluation: adverse effects of weeds

	Criteria	Rating	Description
Project effects	*Temporal extent*	*Short-term to medium-term*	*Where weeds are introduced or spread despite prevention measures, it may take less than a year or up to 10 years to reverse residual effects.*
	Reversibility	*Reversible*	*Control measures are expected to reverse any introduction or spread of weeds within the lifecycle of the Project.*
	Geographic extent	*Footprint to Regional Study Area*	*Weeds that are introduced or spread have the potential to spread off the right-of-way.*
	Magnitude	*Low to moderate*	*With prevention, monitoring and remedial measures, the introduction and spread of weeds is expected to be kept under control, limiting the magnitude of adverse effects.*
Cumulative effects	*The presence of weeds and resulting adverse effects is already substantial in some areas with high existing disturbance. Despite such substantial existing cumulative effects, given Trans Mountain's prevention, monitoring and remedial measures, and the Board's conditions, the introduction and spread of weeds is expected to be reduced to relatively minor levels.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

10.2.11 Terrestrial wildlife and wildlife habitat

Trans Mountain said that the following are potential Project effects on wildlife, including migratory birds, and their habitat:

- change in habitat from vegetation clearing and sensory disturbance;
- change in movement from reduced habitat connectivity and creation of barriers or filters to movement; and
- increased mortality risk resulting from collisions with vehicles or equipment, loss or disruption of habitat features, or sensory disturbance.

Trans Mountain said that the Project rights-of-way would be periodically maintained to early seral stage forest habitat (herb and shrub stages). Trans Mountain said that wildlife mortality risk could result from maintenance of early seral vegetation on linear corridors that would lead to increased predator efficiency and improved access for trapping, hunting, and poaching of wildlife.

Various participants raised concerns about Project effects on wildlife, including terrestrial migratory birds and their habitat. For example, the City of New Westminster raised concerns about adverse effects of construction noise on wildlife. It said that the impacts would depend on which species are in the area and what life history stage they are in when encountering the disturbance. Trans Mountain committed to mitigation, such as avoiding construction during sensitive timing windows for wildlife, to the extent feasible.

ECCC said that the Project would adversely affect migratory birds through the removal and fragmentation of existing habitat, through sensory disturbance, and through increased human and predator access. It recommended that Trans Mountain apply timing windows and buffers to reduce effects on migratory birds and that Trans Mountain take additional measures to avoid and minimize impacts on habitats for all migratory birds where biodiversity hotspots are identified from survey work.

ECCC said that the Project crosses a number of priority habitat areas for migratory birds and species at risk, including wetlands, riparian areas, grasslands, protected areas, parks and Important Bird Areas. ECCC recommended that Trans Mountain:

- identify biodiversity hotspots and consider additional mitigation measures for those areas;
- avoid impacts during key sensitive periods of use by migratory birds and minimize the frequency of Project maintenance clearing/vegetation management to the extent feasible;
- complete pre- and post-construction surveys within priority habitat areas for migratory birds in order to:
    - establish a robust baseline to predict potential Project impacts in priority habitat areas; and
    - verify the accuracy of the predicted effects, manage potential cumulative effects, and apply the

results in support of a monitoring and mitigation strategy;

- undertake habitat restoration and enhancement and consider conservation offsets for impacts on migratory bird habitat in priority habitat areas, such as Important Bird Areas; and
- complete specific surveys for swifts and swallows prior to clearing activity in areas of high suitability habitat for these species.

Trans Mountain said that it would review areas with high suitability for swifts and swallows to identify active colonies that may be affected by construction activities to ensure the appropriate mitigation is implemented. Trans Mountain said that it continues to review the results of field surveys and other migratory bird data sources and would consider this information in Project routing and mitigation planning. Trans Mountain said that this information would be detailed in updated Environmental Protection Plans and Environmental Alignment sheets. Trans Mountain committed to implementing ECCC's recommendations related to avoidance of habitat and/or sensitive periods of use by migratory birds through micro-routing, timing windows, and protective buffers. Trans Mountain said that it would incorporate select surveys for migratory birds and bird habitat features into the post-construction environmental monitoring program. Trans Mountain said that the results of post-construction migratory bird surveys would inform the need for, location of, and type of adaptive management measures to facilitate the success of mitigation and reclamation measures.

Trans Mountain said that it would not propose conservation offsets to address the Project's residual or cumulative effect on migratory birds since the Project's predicted residual effects would range from low to medium magnitude, they are reversible in the long term, and the Project's contribution to cumulative effects would range from negligible to medium magnitude. Trans Mountain did, however, propose to restore the construction right-of-way to natural vegetation communities in grassland areas, along with monitoring of the reclaimed grassland areas during the post-construction monitoring program. It said that it would discuss the installation of nesting and roosting structures in that priority habitat areas with ECCC and the British Columbia Ministry of Forests, Lands, and Natural Resource Operations. Trans Mountain also provided a Preliminary Wetland Compensation Plan, as discussed in section 10.2.9.

The Upper Nicola Indian Band raised concerns about avian collisions with power lines at the proposed Kingsvale pump station. Trans Mountain said that it would develop an Avian Protection Plan using information and best practices outlined by the Avian Power Line Interaction Committee (2006, 2012).

Trans Mountain proposed standard mitigation for Project effects on wildlife and wildlife habitat. It said that it would outline detailed mitigation in environmental protection plans.

Cumulative effects

Trans Mountain said that the Project was likely to interact with existing and reasonably foreseeable disturbances to contribute to cumulative effects on wildlife. A discussion, including Board views, on Project contribution to cumulative effects on grizzly bear, caribou, and other terrestrial wildlife species at risk, is found later in this section.

Monitoring and follow-up

Trans Mountain committed to a post-construction environmental monitoring program over a five year period to determine the effectiveness of mitigation, and identify the need for further monitoring and adaptive measures. Trans Mountain said that it would use pre-construction baseline data in monitoring wildlife and wildlife habitat as a basis to compare construction and post-construction monitoring data.

Trans Mountain said that follow-up programs, which could extend beyond five years, would be developed for select wildlife indicator species. It said that, upon completion of the post-construction environmental monitoring program, monitoring by Trans Mountain personnel would occur regularly throughout the life of the Project to assess any issues raised by stakeholders including regulatory authorities, and that it would implement warranted mitigation measures in a timely basis.

Views of the Board

The Board acknowledges that the Project has the potential to adversely affect wildlife and wildlife habitat including migratory birds and their habitat. The Board finds that Trans Mountain's proposed

mitigation is reasonable and would address the majority of the potential impacts on wildlife and wildlife habitat, including migratory birds and their habitat.

Environment and Climate Change Canada (ECCC) recommended that Trans Mountain be required to consider conservation offsets for impacts on migratory bird habitat in priority habitat areas. ECCC defined priority habitats as riparian areas, wetlands, grasslands, protected areas, parks and Important Bird Areas. The Board would impose conditions requiring Trans Mountain to file a Wetland Survey and Mitigation Plan and a Wetland Reclamation Evaluation and Offset Plan (Conditions 41 and 156). Trans Mountain would be required to mitigate effects on wetlands and to implement offsets for any temporary or permanent loss in any individual wetland function for wetlands in areas to which the Federal Policy on Wetland Conservation applies (see section 10.2.9.).

In addition, the Board would impose conditions requiring Trans Mountain to file a Riparian Habitat Management Plan, Grasslands Survey and Mitigation Plan, Riparian Habitat Reclamation Evaluation Report and Offset Plan, and Grasslands Reclamation Evaluation Report and Offset Plan (Conditions 71, 42, 154 and 157). (See sections 10.2.5 and 10.2.7 subsection on Grasslands for more details on these topics.) These conditions would require Trans Mountain to implement and monitor appropriate mitigation, restoration, and offset measures for riparian, wetland, and grassland habitats that could be used by migratory birds, and other wildlife. The conditions would also require corrective actions, if needed, based on monitoring results. The Board is of the view that these plans would mitigate and offset effects on migratory birds, through their habitat, and is not persuaded that a separate condition is required for conservation offsets specific to migratory birds.

ECCC also recommended that Trans Mountain be required to file a plan that would include a summary of surveys conducted for swifts and swallows, identification of biodiversity hotspot locations and a description of additional measures, other than those committed to in the Environmental Protection Plans, to avoid and minimize impacts on habitats in biodiversity hotspots for all migratory birds.

Trans Mountain has committed to review areas with high suitability for swifts and swallows, and to ensure that appropriate mitigation is applied. Trans Mountain has also committed to consider the results of field surveys and other migratory bird data sources in Project routing and mitigation planning. Given that the Board would impose conditions requiring Trans Mountain to file updated environmental protection plans for facilities, pipeline and Westridge Marine Terminal, including updated management plans, that could include an Avian Protection Plan (Conditions 78, 72 and 81), and to file post-construction environmental monitoring reports (Condition 151), the Board is not persuaded that a separate condition for swifts and swallows, priority habitat locations and additional mitigation measures is warranted.

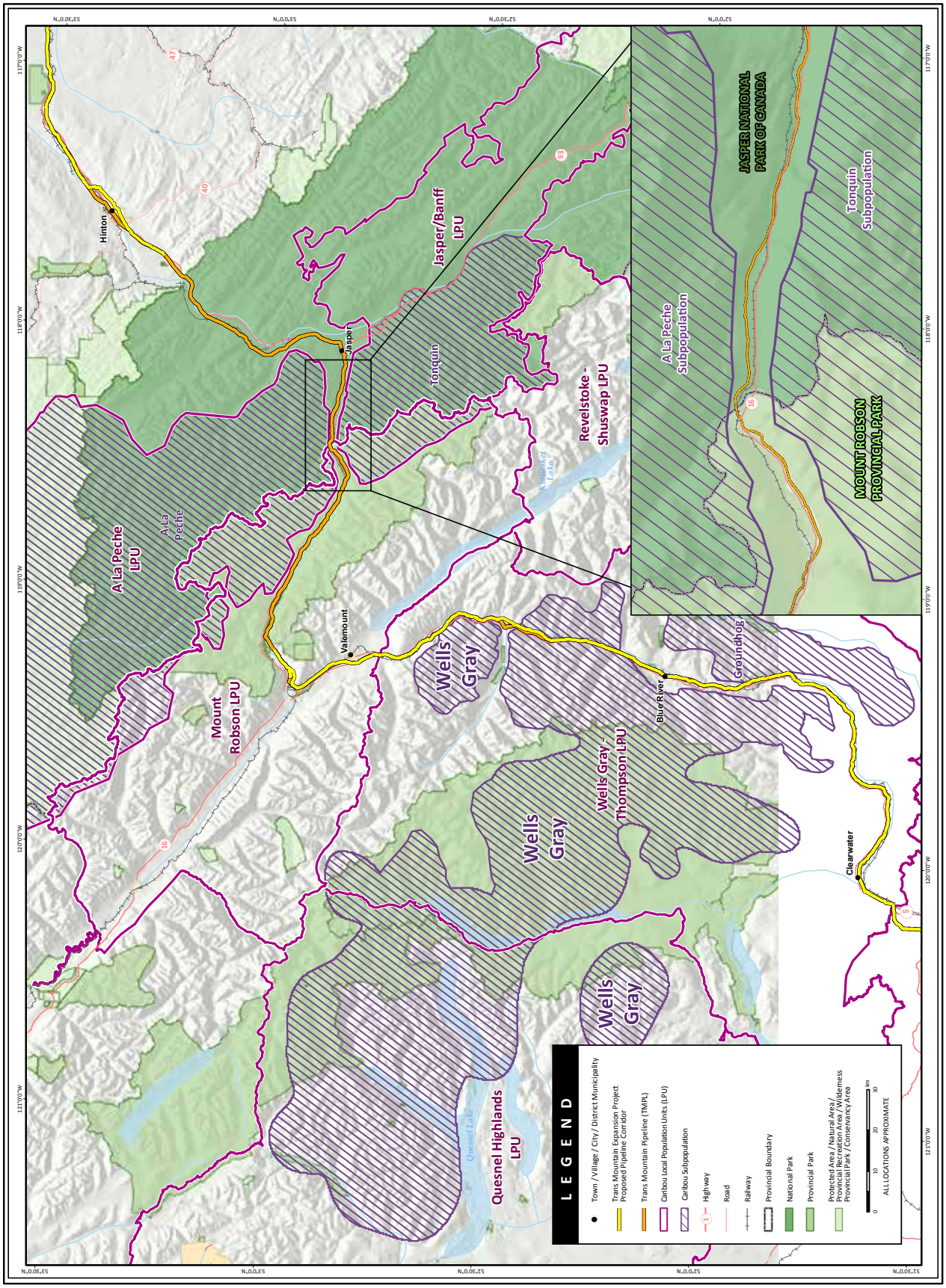
In general, the Board finds that, taking into account mitigation proposed by Trans Mountain and the conditions the Board would impose, the Project is not likely to cause significant adverse environmental effects on wildlife and wildlife habitat. Significance evaluations for each of caribou, grizzly bear, species at risk, and marine birds are provided in sections 10.2.11 and 10.2.16.

Woodland caribou

The southern mountain population of woodland caribou is listed as Threatened under Schedule 1 of the Species at Risk Act. The proposed Project would cross each of the Wells Gray and Groundhog subpopulations and the Mount Robson local population of southern mountain caribou (map provided in Figure 20). The proposed Hinton to Hargreaves pipeline reactivation segment would cross the South Jasper caribou range. Trans Mountain said that the Groundhog herd is small and extremely isolated from other southern mountain caribou populations and has a high probability of extinction within 30 years. Participants, including B.C. Nature and Nature Canada and ECCC, raised concerns about Project effects on southern mountain caribou and its critical habitat. ECCC said that there is high potential that some portion of southern mountain caribou critical habitat would be destroyed by the Project, and surveys of biophysical attributes[60] of critical habitat would need to be completed in the area of overlap between critical habitat and the Project footprint, once the footprint is delineated. ECCC said that destruction of biophysical

60 habitat characteristics required to carry out life processes

Figure 20: Caribou ranges crossed by the Project



attributes within critical habitat constitutes critical habitat destruction, regardless of its proximity to other disturbances.

ECCC recommended that destruction of the biophysical attributes of critical habitat as described in the Southern Mountain Caribou Recovery Strategy, be avoided. ECCC stated that avoidance of critical habitat is the only known means to ensure critical habitat will not be destroyed, since a number of mitigation measures and approaches proposed by Trans Mountain have risks and uncertainties associated with them. ECCC said that reclamation of southern mountain caribou habitat is not only uncertain, but the time scale required for habitat restoration is longer term and may not meet the immediate recovery needs of the impacted southern mountain caribou herds.

ECCC asked Trans Mountain for an assessment of alternative approaches that would reduce impact of the project on southern mountain caribou. Trans Mountain said that pipeline corridor and site selection was one of the primary mechanisms to avoid or reduce Project effects on wildlife, and it would use existing access to facilitate Project construction in caribou range to avoid additional disturbance. Trans Mountain said that the revised corridor proposed in the Froth Creek to Finn Creek area is approximately 4.9 km shorter in the Groundhog caribou range than the previously proposed corridor. Trans Mountain said that the pipeline corridor is proposed adjacent to existing linear disturbance for approximately 71.7 per cent of its length through Wells Gray caribou range, and would parallel the existing Trans Mountain pipeline right-of-way for the entire length in the Groundhog caribou range. Trans Mountain said that alternate routes to fully avoid the Groundhog caribou range would result in creation of a new linear corridor in close proximity to the North Thompson River. Trans Mountain noted that since the Project parallels existing disturbances within the Wells Gray and Groundhog caribou ranges, incremental disturbance within the Wells Gray and Groundhog caribou ranges as a result of the Project is minimal (i.e., less than 0.01 per cent change from existing conditions).

Trans Mountain committed to avoiding critical habitat for species designated as Endangered or Threatened under the SARA to the extent feasible. It further committed to consult with ECCC where avoidance cannot be accomplished, to develop mitigation measures that would ensure that the residual effect is within regulatory tolerance. Trans Mountain said that the location and extent of critical habitat for southern mountain caribou is under review and being updated by ECCC. Trans Mountain said that it would complete additional field work to review the location of critical habitat, including biophysical attributes, and this information would be used to inform route refinement and mitigation measures.

Trans Mountain said that it would consider extending the length of trenchless crossings within caribou ranges to leave a vegetated screen for line-of-sight and to reduce access by both humans and predators along the pipeline right-of-way following construction. Trans Mountain said that the project effects on ungulate winter range is minimized by paralleling the proposed pipeline corridor with the existing Trans Mountain Pipeline right-of-way, thereby reducing the amount of new cut and minimizing fragmentation. Trans Mountain said that re-routing the right-of-way around the ungulate winter range would result in a new linear corridor that is not contiguous with existing disturbance, and additional clearing of forested land.

ECCC said that if avoidance of critical habitat is not possible, then a detailed mitigation and monitoring plan should be developed that would aim to support the survival and recovery of southern mountain caribou in the context of the recovery strategy. ECCC recommended that the mitigation and monitoring plan be developed in consultation with provincial and other qualified species experts.

ECCC said that Trans Mountain should demonstrate that all technically and economically feasible measures have been taken to first, avoid, and then minimize adverse impacts on critical habitat, such as conducting activities on the right-of-way that leaves critical habitat intact to the full extent possible. ECCC recommended that the mitigation and monitoring plan provide for monitoring of mitigation effectiveness and incorporate adaptive management where monitoring demonstrates inadequacies and concerns in the mitigation measures employed.

In addition to general mitigation measures, Trans Mountain committed to file a mitigation plan for southern mountain caribou that would be prepared in consultation with the appropriate regulatory authorities.

ECCC said that the Project would result in conditions that would favour other prey species and a consequent increase in predator density in critical habitat, if not effectively mitigated. It said that the primary threat for most southern mountain caribou populations is unnaturally high predation rates as a result of human-

caused and natural habitat loss, degradation and fragmentation. Trans Mountain noted that the cumulative effects of habitat alteration and resultant increased predation have led to declining numbers of southern mountain caribou. It said that the Project would interact with existing and reasonably foreseeable disturbance to increase the area of early seral habitat in the Wells Gray and Groundhog caribou ranges. Trans Mountain said that since the Project parallels existing disturbances within the Wells Gray and Groundhog caribou ranges, the Project's contribution to cumulative fragmentation would be reduced and creation of new access in caribou range would be avoided.

Trans Mountain committed to prepare and file a Traffic and Access Control Management Plan to mitigate environmental effects associated with increased access and subsequent increased concentration of hunting and increased predation of wildlife. Trans Mountain said that, along segments of the construction right-of-way where mitigation measures are implemented to control human access (in particular, motorized access), the effectiveness of access control would be determined by visually assessing evidence of human access (e.g., disturbance to vegetation establishment and cover, soil erosion, and disturbance of access control measures). The results would then be used to identify areas that require additional measures to prevent access along the right-of-way.

Views of the Board

Key issues raised with respect to effects on the southern mountain population of woodland caribou are the potential for loss of critical habitat and potential for increased mortality risk.

In reaching its views regarding the significance of adverse environmental effects on the southern mountain population of woodland caribou, the Board considered Project effects, including effects on critical habitat as identified in the Southern Mountain Caribou Recovery Strategy and in evidence provided by Environment and Climate Change Canada (ECCC). The Board also considered whether Trans Mountain's proposed mitigation for southern mountain caribou is consistent with the Southern Mountain Caribou Recovery Strategy.

The Board agrees with ECCC's preference that destruction of critical habitat be avoided. The Board expects Trans Mountain to demonstrate that it has avoided critical habitat for southern mountain caribou, including biophysical attributes of critical habitat, to the fullest extent possible. Nevertheless, the Board realizes that habitat avoidance is not possible in all instances, or it is possible, but with resulting impact elsewhere.

The Board acknowledges that Trans Mountain has proposed to avoid some habitat for southern mountain caribou through corridor alignment, and where habitat avoidance was not possible, Trans Mountain proposed to align the corridor adjacent to existing disturbances to reduce Project effects on southern mountain caribou and its habitat. The Board finds that paralleling the existing right-of-way will avoid or reduce new cut and fragmentation. Trans Mountain has committed to conduct additional field work to locate particular biophysical attributes of critical habitat in order to inform route placement. The Board considers Trans Mountain's attempts to reduce effects on southern mountain caribou habitat, through direct avoidance and by routing adjacent to existing disturbances, to be reasonable.

To confirm that Trans Mountain reports on the extent of caribou habitat that may be affected, directly and indirectly, by the proposed pipeline route, the Board would impose Condition 36 requiring Trans Mountain to file a Pre-Construction Caribou Habitat Assessment for each caribou range potentially affected by the Project that would describe the type of habitat characterized by biophysical attributes of critical habitat, as defined in the Southern Mountain Caribou Recovery Strategy.

The Board is of the view that after attempts are made to avoid critical habitat through route placement, mitigation and restoration of caribou habitat are necessary to reduce Project effects on critical habitat. To confirm there is no-net-loss of caribou habitat, the Board would impose Condition 37 requiring Trans Mountain to file a Caribou Habitat Restoration Plan. The objective of the Plan is to restore as much habitat as possible and assist in identifying and quantifying the extent of any unavoidable and residual habitat loss that remain. The Board would also require an Offset Measures Plan for Residual Effects on Caribou Habitat (Condition 128) for each caribou range potentially affected by the Project to offset for such unavoidable and residual effects. Trans Mountain would be

required to take into account temporal loss of habitat and the literature on conservation offsets for caribou in the development of the Offset Measures Plan. The Board is of the view that offsets are a last resort and should only be applied after habitat avoidance, mitigation and habitat restoration are implemented. The Board would also require Trans Mountain to provide details in the Caribou Habitat Restoration Plan of how proposed mitigation and restoration measures for these species are consistent with the Recovery Strategy for the Woodland Caribou, Southern Mountain Population in Canada (2014).

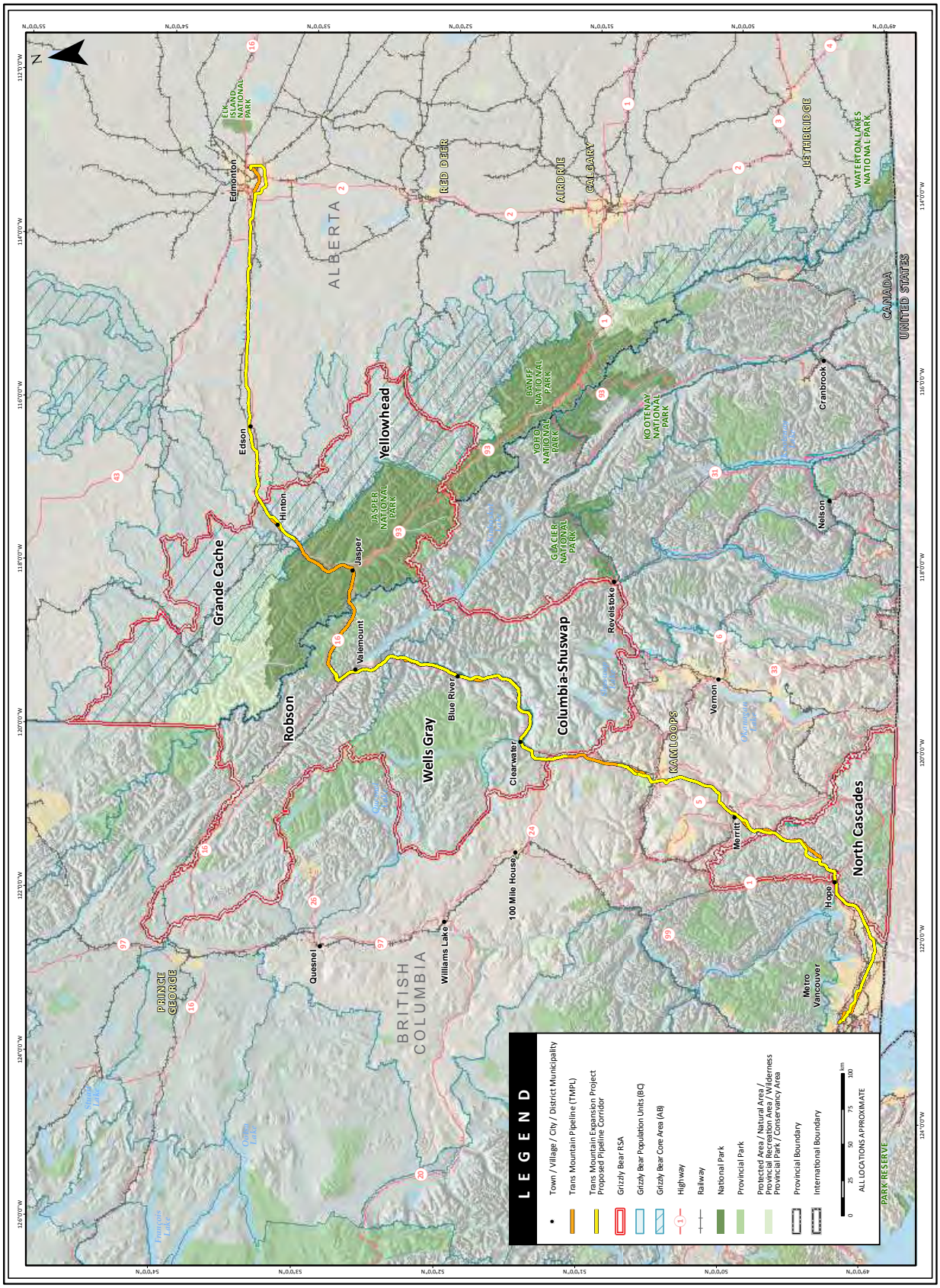
The Board acknowledges ECCC's view that reclamation of southern mountain caribou habitat is uncertain. Given this uncertainty, the Board recognize the need for monitoring and verifying the effectiveness of caribou habitat restoration and offset measures, and the need for corrective measures should monitoring determine that reclamation and offset measures are not effective. The Board would therefore impose Condition 149 requiring Trans Mountain to file a Caribou Habitat Restoration and Offset Measures Monitoring Program to monitor and verify effectiveness of caribou habitat restoration and offset measures, and to identify protocols for how those measures would be adapted, as required, based on monitoring results. The Board would further impose Condition 150 requiring Trans Mountain to report monitoring results in Caribou Habitat Restoration and Offset Measures Monitoring Reports.

The Board finds that with mitigation, including human and predator access control, the potential for the Project to measurably affect predator-prey dynamics and, therefore, mortality risk for caribou, as a result of incidental predation, is low. To verify that Trans Mountain designs an effective access management plan that would control and monitor human and predator access into new disturbance areas in affected caribou ranges, the Board would impose Condition 47 requiring Trans Mountain to file an Access Management Plan that would include monitoring for effectiveness of access control measures and adaptive management measures, if needed, based on monitoring results.

Significance evaluation: adverse effects on Woodland caribou

	Criteria	**Rating**	**Description**
Project effects	*Temporal extent*	*Short-term to long-term*	*Effects on habitat along the new right-of-way are expected to be long-term, as the right-of-way is maintained in a semi-cleared state. Effects on right-of-way contiguous to existing right-of-way are not expected to be temporally additive. All effects are long-term within the ranges but are expected to be offset within the medium-term.* *Effects on mortality risk are expected to be short-term as access measures are implemented.*
	Reversibility	*Reversible*	*Effects on habitat and mortality risk during the Project life are expected to be reversible, since offsets would be applied to mitigate effects of maintaining the right-of-way in a semi-cleared state through Project operations. There is likely a lag time between project effects and when offsets are implemented and become effective. Effects on increased mortality risk are expected to be reversible as access control measures are implemented during the life of the Project.*
	Geographic extent	*Local Study Area to Regional Study Area*	*Weeds that are introduced or spread have the potential to spread off the right-of-way.*
	Magnitude	*Moderate*	*Effects are expected to be moderate given that the right-of-way would be maintained in early seral vegetation state for the life of the Project.*
Cumulative effects	*Existing cumulative effects on Woodland caribou are already substantial. The reason that Woodland caribou are at risk is because existing cumulative effects have already exceeded a sustainability threshold for the species. Taking into account Trans Mountain's mitigation measures, and the conditions the Board would impose to confirm there is no-net-loss of caribou habitat, the Project's contribution to total cumulative effects on Woodland caribou is expected to be inconsequential.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

Figure 21: Grizzly bear Regional Study Area



Grizzly bear

The proposed Project would intersect two Bear Management Areas (Grande Cache and Yellowhead) in Alberta, three viable Grizzly Bear Population Units in B.C. (Columbia-Shuswap, Wells Gray, and Robson), and the threatened North Cascades Grizzly Bear Population Unit in B.C. (map provided in Figure 21). Trans Mountain said that the proposed pipeline reactivation segment from Hinton to Hargreaves would cross grizzly bear secondary habitat and grizzly bear core habitat, although it does not expect the reactivation segments to have a measureable effect on wildlife and wildlife habitat.

Grizzly bears are blue-listed in B.C., designated as "At Risk" in Alberta, and listed as Threatened under the *Alberta Wildlife Act and Wildlife Regulation*. The western population of grizzly bear is federally listed as a species of Special Concern according to the Committee on the Status of Endangered Wildlife in Canada. Trans Mountain said that the North Cascades grizzly bear population is at risk of extirpation. It said that hunting is allowed for the Columbia Shuswap, Wells Gray, and Robson population units in B.C., while it is not allowed for the North Cascades population unit in B.C., or the Grande Cache and Yellowhead Grizzly Bear Management Units in Alberta.

Trans Mountain attempted to reduce Project effects in the grizzly bear population units through avoidance and by aligning the proposed Project with existing disturbance to the extent feasible. It said that routing to avoid the North Cascades Grizzly Bear Population Unit would require new cut across mountainous terrain in areas with limited access and would cross through the Threatened Stein-Nahatlatch Grizzly Bear Population Unit, which would otherwise not be affected by the Project. Trans Mountain said that the entire length of the proposed pipeline corridor within the North Cascades Grizzly Bear Population Unit is located within an existing transportation corridor that is largely restricted to the Coquihalla River Valley, and is parallel to existing Trans Mountain Pipeline (TMPL) right-of-way for 82 per cent of its length.

Intervenors, including Canadian Parks and Wilderness Society – B.C. Chapter and Lower Nicola Indian Band, asked about Project effects on grizzly bear and their habitat, including effectiveness of grizzly bear habitat after commencement of construction and cumulative effects of mortality risk. In response to issues raised by the Lower Nicola Indian Band regarding effectiveness of grizzly bear habitat, Trans Mountain said that, despite the potential increase in available forage that can be expected from vegetation clearing for Project construction and operations, effective habitat for grizzly bear is predicted to decrease within the Local Study Area (LSA) due to increased mortality associated with cleared areas where human access is possible. Trans Mountain said that it would implement access management mitigation measures to reduce access along the right-of-way following construction, and attraction of wildlife to the right-of-way during operations would be reduced by avoiding attractive forage species in seed mixes used for reclamation.

Trans Mountain said that cumulative effects of human development are identified as the greatest threat to grizzly bear. Trans Mountain said that the Alberta Grizzly Bear Recovery Plan identified objectives that would limit the rate of human caused mortality per Bear Management Areas by maintaining open road densities at or below 0.6km/km^2 for Grizzly Bear Priority Areas and at or below 1.2km/km^2 in all remaining grizzly bear range. Trans Mountain said that hunting is a major factor for grizzly bear mortalities in B.C. and that, in addition to hunting pressure, human access increases the risk of human-bear conflicts that can result in bears being relocated or destroyed.

Trans Mountain said that the existing average motorized access density in the Columbia-Shuswap, Wells Gray, Robson and North Cascades Grizzly Bear Population Units currently exceeds the threshold of 0.6 km/km^2, suggesting a high risk of grizzly bear mortality and displacement under current conditions. It said that the predicted contribution of the Project and reasonably foreseeable developments to motorized access density would not cause the average density to exceed 0.6 km/km^2 at the regional scale for the Grande Cache and Yellowhead Grizzly Bear Population Units that are below this threshold under current conditions. It also said that the average motorized access density at the grizzly bear population unit scale would not change substantially as a result of the Project. Trans Mountain said, however, that the proposed pipeline corridor and reasonably foreseeable disturbances are predicted to have a localised effect on the motorized access density within each grizzly bear population unit intersected by the Project, which would cause localized increases from baseline conditions below 0.6 km/km^2 to levels that exceed the threshold.

Trans Mountain said that mitigation proposed is expected to adequately address the Project's contribution to cumulative effects on mortality risk, with one exception. Trans Mountain said that the Project would

contribute to grizzly bear mortality risk in the Northern Cascades Grizzly Bear Population Unit, causing an incremental effect on mortality risk for a threatened population.

In response to Adams Lake Indian Band's concerns related to cumulative effects on grizzly bear mortality risk, Trans Mountain committed to develop and implement a mitigation strategy for the North Cascades, Grande Cache, and Yellowhead Grizzly Bear Population Units. Trans Mountain said that the grizzly bear mitigation strategy would include objectives consistent with current regulatory guidelines and would be developed in consultation with the appropriate regulatory authorities.

In addition to standard mitigation, Trans Mountain proposed to coordinate access and new clearing requirements with other industrial users in the area to minimize human activity in grizzly bear habitat and to control access where access cannot be avoided. Trans Mountain said that it expects the implementation of the Wildlife Conflict Management Plan as part of the environmental protection plans would prevent any direct bear mortalities associated with Project construction and operations.

Trans Mountain committed to prepare and file a Traffic and Access Control Management Plan to mitigate environmental effects associated with increased access and subsequent increased concentration of hunting at previously inaccessible locations. It said, where mitigation measures are implemented to control human access (in particular, motorized access), it would determine the effectiveness of access control by visually assessing evidence of human access (*e.g.*, disturbance to vegetation establishment and cover, soil erosion, and disturbance of access control measures). The results would be used to identify areas that require additional measures to prevent access along the right-of-way. Trans Mountain said that it would monitor the success of access control measures implemented along segments of the construction right-of-way as part of the post-construction environment monitoring program.

Views of the Board

Key issues raised by participants relate to Project effects on grizzly bear habitat, and the Project's contribution to increased cumulative mortality risk.

The Board recognizes that, while habitat avoidance is preferred, habitat avoidance is not possible in all instances, and may involve trade-offs with other important habitat types. The Board acknowledges Trans Mountain's efforts to route the Project adjacent to existing disturbance in each of the potentially affected grizzly bear population units. The Board notes that Trans Mountain's proposed pipeline corridor does not avoid the North Cascades Grizzly Bear Population Unit due to potential effects on another threatened grizzly bear population unit. Nevertheless, the Board accepts Trans Mountain's intent to route adjacent to existing disturbance for most of the pipeline corridor length in the North Cascades Grizzly Bear Population Unit.

The Board recognizes that, although vegetation clearing would result in some forage opportunities for grizzly bear along the right-of-way, the benefit of increased forage habitat would be tempered by an increase in mortality risk due to potential human access along the cleared areas.

The Board acknowledges Trans Mountain's proposed mitigation strategy for the North Cascades, Yellowhead and Grande Cache Grizzly Bear Population Units. In order to confirm that direct and indirect effects of Project activities on grizzly bear populations with an elevated conservation status are mitigated in a measurable way and reported on, the Board would impose Condition 56 requiring Trans Mountain to file Grizzly Bear Mitigation Plans for each vulnerable grizzly bear population unit/ grizzly bear management area. As part of these plans, Trans Mountain would be required to monitor the effectiveness of mitigation measures, apply corrective measures as needed, and report on monitoring results in post-construction monitoring reports. Trans Mountain would also need to justify if a mitigation plan is not provided for a vulnerable grizzly bear population unit or a particular grizzly bear management area.

The Board is of the view that access restriction measures at the cleared Project right-of-way would assist in reducing Project-related grizzly bear mortality risk. To verify that Trans Mountain designs an effective access management plan that would control and monitor access into new disturbance areas in grizzly bear local population units and management areas, the Board would impose Condition 47 requiring Trans Mountain to file an Access Management Plan that would include monitoring for effectiveness of access control measures and adaptive management measures, if needed, based on monitoring results.

Significance Evaluation: adverse effects on Grizzly bear

	Criteria	Rating	Description
Project effects	*Temporal extent*	*Long-term*	*Effects on habitat loss from vegetation clearing and operational maintenance to an early seral vegetation stage would be expected to persist through the life of the Project. Effects on mortality risk are expected to be long-term, as some access could be possible, even with implementation of access control measures.*
	Reversibility	*Reversible*	*Effects on each of grizzly bear habitat and mortality risk are expected to be reversible since vegetation would be allowed to regrow to an extent after construction, and because human access on the right-of-way would be limited after the Project is decommissioned or abandoned.*
	Geographic extent	*Local Study Area to Regional Study Area*	*Effects of Project construction on grizzly bear habitat are limited to the wildlife Local Study Area. However, potential for increased mortality risk from Project construction and operations would contribute to cumulative effects in the Regional Study Area.*
	Magnitude	*Low to moderate*	*Early seral vegetation would be maintained along the pipeline right-of-way and could provide foraging habitat, though habitat effectiveness would be lessened by increased mortality risk from human access along the right-of-way. Though human access to the new right-of-way would be limited by access control measures, an increase in mortality risk from some amount of human access along the right-of-way could occur.*
Cumulative effects	*Existing cumulative effects on mortality risk is considered substantial for each of the Columbia-Shuswap, Wells Gray, Robson and North Cascades Grizzly bear population units due to existing regional exceedances of the generally accepted linear disturbance threshold in these population units. Existing cumulative effects on mortality risk for the Grande Cache and Yellowhead Grizzly bear management areas are not considered substantial as the threshold would not be exceeded at the regional level for these population units, though it is noted that hunting is closed for those two bear management areas. Taking into account the implementation of Trans Mountain's mitigation measures, and the conditions the Board would impose, the Project's contribution to the total cumulative effects on grizzly bear is expected to be inconsequential for each of the Columbia-Shuswap, Wells Gray, Robson and North Cascades Grizzly bear population units. Taking into account the implementation of Trans Mountain's mitigation measures, and the conditions the Board would impose, the Project's contribution to the total cumulative effects on grizzly bear is expected to be relatively minor for the Grande Cache and Yellowhead Grizzly bear population units.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

Other terrestrial wildlife species at risk

Trans Mountain said that the Project has the potential to affect various SARA-listed terrestrial wildlife species, as outlined in Appendix 13. Trans Mountain said that the Project could affect species at risk through habitat loss, change in movement, and increase in mortality risk. Trans Mountain and ECCC said that the Project has the potential to cross critical habitat for a number of species at risk, including woodland caribou which is assessed earlier in this section. Trans Mountain said that the Project would cross the Sowaqua Spotted Owl Wildlife Habitat Area, which is classified as a Long-Term Owl Habitat Area, and for which a provincial no-net-loss policy is in place.

Participants raised concerns about Project effects on species at risk and their habitat, including:

- project effects on habitat and Trans Mountain's efforts to avoid critical habitat for species at risk; and
- Trans Mountain's proposed mitigation if critical habitat cannot be avoided and potential effectiveness of mitigation measures for species at risk.

The Métis Nation of British Columbia raised specific concerns about Project effects on bat species, and said that Trans Mountain did not propose mitigation measures to limit impacts on bats during rearing, or during feeding after hibernation. The Métis Nation of British Columbia also raised concerns about effects of blasting on bats. ECCC said that little brown myotis and northern myotis are listed as Endangered under Schedule 1 of the SARA because their populations are experiencing unprecedented declines. ECCC recommended that Trans Mountain conduct additional field studies on bats and consider that information during Project micro-routing, and when

finalizing specific mitigation measures in the Project environmental protection plans. Trans Mountain agreed to conduct surveys for bats to identify habitat features, and to implement mitigation to reduce effects on bats and their habitat.

ECCC said that there is potential for species that could be impacted by the Project, and that are not currently listed as Threatened or Endangered under Schedule 1 of the SARA, to be listed as such within a time frame that overlaps with Project construction and operation. ECCC specifically said that this potential is high for barn owl, and said that listing would require critical habitat identification to the extent possible.

ECCC said that there is potential for the Project to result in destruction of critical habitat for several species listed as Endangered or Threatened under Schedule 1 of the SARA. ECCC said that it considers activities that would adversely impact the survival or recovery of a SARA-listed species, or any activity likely to destroy critical habitat, to be a significant adverse effect. ECCC recommended that Trans Mountain avoid activities with the potential to destroy critical habitat of SARA-listed species. ECCC said that, in the event that avoidance of critical habitat is not fully incorporated into the Project, a detailed species-specific mitigation and monitoring plan be developed before Project decisions are made.

ECCC stated that avoidance of critical habitat is the only known means to ensure critical habitat will not be destroyed since a number of mitigation measures and approaches proposed by Trans Mountain, as well as other mitigation approaches, have risks and uncertainties associated with them. ECCC said that alternative pipeline installation methods such as trenchless methods, as well as avoiding barriers to dispersal, seasonal avoidance, den and hibernacula avoidance and micro-routing around biophysical features have the potential to avoid destruction of critical habitat for some species. ECCC noted that additional survey work to determine the precise distribution of critical habitat (i.e., the locations that possess the biophysical attributes within critical habitat) would aid Trans Mountain in determining how the destruction of critical habitat could be avoided.

In its comments on conditions, ECCC recommended a change in the Offset Measures Plan for Residual Effects on Caribou Critical Habitat that would allow for offsets for all species at risk whose final, proposed, candidate and early draft critical habitat is directly or indirectly affected by the Project. ECCC noted that a biodiversity offset is only appropriate where it is intended to address the residual adverse impacts that remain after Trans Mountain has considered and adopted the best technically and economically feasible alternative project design or location that would avoid the impacts of the project and measures to minimize the impacts of the project.

ECCC stated that a biodiversity offset may include various activities such as restoration, enhancement, or creation of species' habitat or measures that reduce threats to the provision of ecological services or to a species. ECCC further stated, in final argument, that there are limits to what can be offset. ECCC said that offsets cannot compensate for the loss of irreplaceable habitat and offsets may not be appropriate where there is a high probability of the offset failing or where the impacts of failure would be significant. ECCC reiterated in final argument that it recommends avoidance of the destruction of critical habitat.

The Shackan Indian Band, in response to proposed conditions to be imposed by the Board, said that it considers creation of habitat unproven, and the proper approach under these circumstances is avoidance.

Trans Mountain said that offsets should only be implemented as the last stage of the mitigation hierarchy if all the measures to avoid, minimize and restore on-site will not alleviate residuals effects to insignificant levels. Trans Mountain said it would follow regulatory guidance in the development of avoidance, minimization, and restoration measures to avoid the need for offsets. Trans Mountain also said that, should offsets for species at risk be determined necessary by the provincial authorities with responsibility to manage the populations and their habitat, in consideration of the mitigation and habitat restoration plans, it would work with the provincial authorities to determine the most appropriate offset approach.

Trans Mountain committed to avoiding critical habitat for species designated as Endangered or Threatened under the SARA to the extent feasible. It further committed to consult with ECCC where avoidance cannot be accomplished, to develop mitigation measures that would ensure that the residual effect is within regulatory tolerance.

In response to questions from the Board, Trans Mountain said that methods to avoid critical habitat that would be implemented include reducing the right-of-way width where feasible, micro-routing (avoidance of

specific features within the Project footprint), and Project scheduling to avoid sensitive periods for wildlife. Trans Mountain said that it continues to conduct wildlife field work to identify the biophysical attributes of critical habitat, and to review pipeline installation methods to avoid or reduce disturbance to critical habitat.

Trans Mountain said that information from ECCC and provincial regulatory authorities regarding refined critical habitat mapping, along with its field survey information would be used to determine overlap of the Project footprint with critical habitat and allow for design modifications, such as micro-routing, to avoid or reduce Project impacts on critical habitat.

Trans Mountain committed to develop mitigation plans for each wildlife species whose draft, candidate, proposed or final critical habitat is directly or indirectly affected by the Project. It said that the mitigation plans would consider timing of Project activities and would include measures to minimize disturbance and to restore or enhance habitat. Trans Mountain also committed to review and evaluate offset options for Sowaqua spotted owl habitat.

Views of the Board

In reaching its views regarding the significance of adverse environmental effects on terrestrial wildlife species at risk, the Board considered Project effects on SARA-listed species, as well as effects on critical habitat of these species as identified in a Recovery Strategy and in evidence provided by Environment and Climate Change Canada (ECCC). The Board also considered whether Trans Mountain's proposed mitigation is consistent with applicable recovery strategies.

The Board acknowledges ECCC's view that destruction of critical habitat would be a significant adverse effect. The Board is of the view that restoration of critical habitat, including biophysical features that cannot be avoided by the Project, is necessary to reduce Project effects on species at risk.

The Board acknowledges the Shackan Indian Band's preference for habitat avoidance. Subject to further consideration at the detailed route stage, the Board is satisfied with efforts made by Trans Mountain to avoid critical habitat, and finds that, where avoidance was not possible, Trans Mountain aligned the proposed corridor adjacent to existing disturbances to reduce effects on critical habitat. The Board is of the view that further avoidance of critical habitat may be possible during detailed route alignment, once surveys for biophysical attributes of critical habitat are completed to allow for identification and location of critical habitat in relation to the Project pipeline and facilities. The Board acknowledges that Trans Mountain would implement measures, such as reducing the right of way width where feasible, micro-routing (avoidance of specific features within the Project footprint), and Project scheduling to avoid and reduce effects on critical habitat. The Board encourages Trans Mountain to consider further reasonable alternative Project activities affecting critical habitat of wildlife species at risk, such as trenchless pipeline installation methods, avoiding barriers to dispersal, and avoiding dens and hibernacula, as recommended by ECCC.

The Board considered ECCC's recommendation that Trans Mountain be required to provide offsets for species at risk whose final, proposed, early draft and candidate critical habitat would be affected by the Project. ECCC defines offsets as restoration, enhancement or creation of a species' habitat, or measures that reduce threats to the provision of ecological services or to a species. Trans Mountain has committed to develop and implement mitigation plans for each wildlife species whose draft, candidate, proposed or final critical habitat is directly or indirectly affected by the Project. The Board acknowledges that Trans Mountain's mitigation plans would include measures to minimize disturbance to habitat, and to restore or enhance habitat. Trans Mountain said it would work with provincial authorities to determine the most appropriate offset approach, should those authorities deem offsets to be necessary for provincially managed species at risk, in consideration of the mitigation and habitat restoration plans. The Board would impose Condition 44 requiring Trans Mountain to file Wildlife Species at Risk Mitigation and Habitat Restoration Plans for each species whose draft, candidate, proposed or final critical habitat is directly or indirectly affected by the Project, and that such plans include details of post-construction monitoring of the mitigation and habitat restoration measures proposed.

Trans Mountain would also be required to provide details, in the Mitigation and Habitat Restoration Plans, of how proposed mitigation and restoration measures for these species are consistent with

applicable recovery strategies and action plans. The Board would require Trans Mountain to consult with appropriate government authorities and any species experts on the mitigation and habitat restoration plans. The Board would also require Trans Mountain to provide a description of and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan. In the Board's view, the plans would adequately address ECCC's recommendation on offsets, as offsets are defined by ECCC.

The Board would also impose Condition 38 requiring Trans Mountain to file a Sowaqua Spotted Owl Mitigation Plan to ensure that mitigation and offset measures are implemented in the Sowaqua Long-Term Spotted Owl Habitat Area potentially affected by the Project.

The Board shares ECCC's concern that Project construction and operations could potentially impact wildlife species that are not yet listed as Endangered or Threatened under Schedule 1 of the SARA, but that would be so listed within a time frame that overlaps with Project construction and operation. To address this concern, the Board would impose Condition 92 requiring Trans Mountain to file a summary of any relevant updates, including new Schedule 1 listings, or new or amended Recovery Strategies, Management Plans or Action Plans including identification of critical habitat, identification of avoidance measures, as well as mitigation and monitoring measures.

In general, the Board finds that, taking into account mitigation proposed by Trans Mountain and imposed conditions, Project construction and operation are not likely to cause significant adverse environmental effects on wildlife species at risk. The Board expects that Project effects on federal at-risk small mammals, birds, amphibians, reptiles, and invertebrates would be limited to the Local Study Area. The Board expects that, in general, Project effects on species at risk would be of short- to long-term temporal extent, depending on the species affected, and reversible given implementation of mitigation including plans for restoration or enhancement of habitat as part of formalized mitigation plans during Project construction and operation. The Board expects that effects on species at risk would be of moderate magnitude, given Trans Mountain's efforts to avoid habitat for species at risk or to align adjacent to existing disturbance, and to implement mitigation, including that outlined in formalized mitigation plans.

The Board recognizes that the reason wildlife species are at risk is often because existing cumulative effects have already exceeded a sustainability threshold for the species. The Board is of the view that, despite substantial existing cumulative effects on SARA-listed wildlife species, with Trans Mountain's measures and the imposed conditions, the Project's contribution to the total cumulative effects is expected to be inconsequential.

10.2.12 Parks and protected areas

Provincial and municipal parks, and protected and sensitive areas

Trans Mountain said that the Project would cross four parks and protected areas in B.C.: Finn Creek Provincial Park, North Thompson River Provincial Park, Lac Du Bois Grasslands Protected Area and Bridal Veil Falls Provincial Park. Trans Mountain said that the Project would strive to produce a net benefit to native biodiversity and ecological integrity in those regions. Alternatives considered by Trans Mountain to avoid or reduce effects on parks and protected areas in B.C. are discussed in Chapter 11.

Trans Mountain said that it would work with B.C. parks to develop offset projects that align with each of the parks' management objectives, and that it would provide to the Board a summary of the proposed offset projects once they are defined, and the necessary approvals to construct and operate in the parks have been granted.

Trans Mountain proposed to identify and undertake an offset project, or a 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. It said that projects that are selected for the purpose of offsetting loss of native biodiversity and ecological integrity would be monitored following construction to assess whether targets have been met and performance measures have been achieved.

Several participants asked about opportunities for enhancements that might be provided for regional parks and sensitive areas along the route of the Project. Trans Mountain said that community benefit agreements continue to be executed, and that some would focus on sensitive ecosystems and municipal parks while

others would focus on environmental and socio-economic matters relevant to their communities.

Participants, including Lisa Craig and the City of Burnaby, raised concerns and asked questions about the potential impacts (disruption, destabilisation) of proposed tunnelling through an environmentally sensitive area, the Burnaby Mountain Conservation Area. Trans Mountain said that proposed tunneling to route the pipeline expansion through Burnaby Mountain would be completed entirely from portals located within the Burnaby and WMT facilities. Trans Mountain said that there would be no impact on the Burnaby Mountain Conservation Area lands through clearing or any other construction activities. It said that the tunnel would be backfilled to prevent the development of a conduit for groundwater flow.

The City of Burnaby raised concerns that the alternative route from the Burrard Terminal to the WMT would pass through the Burrard Inlet Conservation Area, potentially resulting in loss of trees, including those that may support great blue heron. In response to questions from the City of Burnaby, Trans Mountain said that the Burnaby Streets Alternative Alignment pipeline route is an alternative route, with the tunnel option through Burnaby Mountain as the preferred route. Trans Mountain said that during a survey in 2014 no active great blue heron colonies were found. Trans Mountain said that if the alternative route through the conservation area is selected for construction, a search for heron nests would be completed. If active or inactive heron nests are found, Trans Mountain said it would contact the appropriate regulatory authority. Trans Mountain outlined mitigation measures for great blue heron nesting colonies including implementation of setback buffers and least risk timing windows. A detailed discussion on Project effects on forests and urban trees including Board views is provided in section 10.2.8. A detailed discussion on alternative routes from the Burnaby Terminal to the WMT, including Board views can be found in Chapter 11.

Jasper National Park

Parks Canada Agency (Parks Canada) recommended a number of conditions related to proposed pipeline reactivation works in Jasper National Park, including a request for an updated Project specific environmental protection plan and restoration plan, a DFO compensation plan (if serious harm is expected and offsetting is deemed necessary by DFO), a post-reactivation monitoring program, a pre- and post-reactivation follow-up program for wetland function, and a remediation program for previously unidentified contaminated sites. Trans Mountain agreed with the requests and agreed to work with Parks Canada to develop a set of Management Objectives/Desired End Results with appropriate and applicable monitoring and performance criteria for the proposed reactivation activities.

Parks Canada said that, with the implementation of Trans Mountain's environmental protection and mitigation measures, along with any site-specific conditions required by Parks Canada, and if Management Objectives / Desired End Results are accomplished, it is unlikely that the Project would cause significant adverse effects to the ecological integrity of Jasper National Park.

Views of the Board

The Board recognizes Trans Mountain intent to establish net benefit proposals in B.C. parks related to native biodiversity and ecological integrity.

The Board finds that the tunneling of Burnaby Mountain to place the Westridge delivery lines would not result in any environmental effects on the Burnaby Mountain Conservation Area because the tunnel portals would be located within the Burnaby and Westridge Marine Terminal (WMT) facilities. The Board views on geotechnical issues related to the proposed tunnel through Burnaby Mountain are found in Chapter 6.

Trans Mountain maintains the Burnaby Mountain tunnel option as its preferred option.[61] In the event that the tunnel construction method through Burnaby Mountain is not feasible, Trans Mountain proposes to use an alternate route, which is a trenched pipeline construction following Burnaby streets and the Canadian Pacific rail line from the Burnaby Terminal to the WMT. The Board heard concerns raised by participants about the alternative 'streets' option from the Burnaby Terminal to the WMT potentially affecting the Burrard Inlet Conservation Area, including great blue heron that may nest in the conservation area. The Board finds Trans Mountain's proposed mitigation for potential effects on great blue heron in the conservation area to be reasonable and acceptable.

61 Alternative corridors are discussion in Chapter 11, section 11.1.2.

The Board would impose conditions requiring Trans Mountain to develop and file, environmental protection plans (Conditions 72, 78 and 81), habitat offset and restoration plans (Conditions 40, 41, 155 and 156), and a contamination identification and assessment plan (Condition 46) for the Project that are also expected to reduce environmental impact of reactivation activities within Jasper National Park. The Board is of the view that these conditions would adequately address Parks Canada's recommendations specific to pipeline reactivation at Jasper National Park.

Effects of the Project on valued environmental components within the parks are considered in Project effects assessment sections for fish habitat, vegetation and wildlife (sections 10.2.5, 10.2.7 and 10.2.11).

10.2.13 Marine sediment and water quality

The Board considered Trans Mountain's effects assessment and all related evidence from participants, including evidence regarding construction-related effects and the potential for contaminant releases during WMT operations.

In this section, the Board focuses on:

- marine sediment sampling;
- dredging and Disposal at Sea Permit; and
- mitigation and monitoring.

Marine sediment sampling

Trans Mountain said that historical reports for the existing berth at the WMT indicate elevated levels of certain contaminants (such as polycyclic aromatic hydrocarbons, cadmium, and mercury) in subtidal sediment. Mr. A.G. Lewis said that the existing and proposed docking facilities are in an area noted for chronic oil contamination and that there are historic sources of polycyclic aromatic hydrocarbons. He said that the existing sediments survey should be expanded to characterize the extent and chemical nature of oiled sediments. Mr. Lewis was of the view that sediment disturbance will affect both the distribution and abundance of organisms in the area and will introduce sediment into the water column, thus increasing the risk of biological damage.

Trans Mountain conducted further sediment sampling in 2013 that showed exceedances of some metals, polycyclic aromatic hydrocarbons, and polychlorinated biphenyl in the top 0.5 m of the sediment layer in some locations. Trans Mountain said that further sediment sampling would aid in better delineation of areas that would require land disposal for sediments dredged during construction.

ECCC said that, based on the current chemical and physical information, it would not consider the top 0.5 m of the sediment layer suitable for disposal at sea, and would require further sampling and testing, including biological testing.

Dredging and Disposal at Sea Permit

Based on preliminary engineering and design plans, Trans Mountain estimates that it would dredge approximately 150 000 m^3 from the intertidal and nearshore subtidal zones. It said that it is committed to reduce the amount of dredging required at the WMT to the extent feasible by identifying feasible alternative engineering options and construction methods.

ECCC recommended that Trans Mountain demonstrate how it considered various engineering options and construction methods that could reduce or eliminate the dredge footprint and volume of material proposed for disposal at sea. Trans Mountain said that it is investigating construction and sediment management methods with this aim in mind. Trans Mountain committed to provide details on alternative options and methods in its Disposal at Sea Permit application, should dredging and disposal at sea become its preferred option.

Trans Mountain said that, if it applies for a permit, it would follow all requirements and timelines of the permitting process, including submitting a waste prevention audit after submitting its permit application. It added that it will not seek a Disposal at Sea Permit for any blasted or excavated material.

Mitigation and monitoring

Trans Mountain committed to the following measures to manage and reduce potential Project effects on marine sediment and water quality during construction:

- design the expanded terminal in a way that minimizes the dredge footprint or avoids dredging altogether;
- use clamshell dredge and silt curtains to limit sediment release and dispersal during dredging;
- monitor turbidity and total suspended solids during in-water construction activities; and
- follow erosion and sediment control measures on land to limit sediment releases to water.

Trans Mountain said that its primary mitigation during WMT operations would be to treat stormwater from hydrocarbon storage and handling areas to remove hydrocarbons prior to discharging it into Burrard Inlet. It said that surface water from the dock's loading area and the process areas of the foreshore would be directed to the oil/water separator and discharged through the existing outfall to Burrard Inlet. Run-off from the dock roadway and all other areas outside of the process areas would continue to drain directly into Burrard Inlet.

Trans Mountain said that it will monitor the surface water discharged to the marine environment to ensure compliance with the conditions of the British Columbia Ministry of Environment's discharge permit.

Views of the Board

The Board recognizes that the marine sediment and water quality surrounding the Westridge Marine Terminal (WMT) have been affected by historical and existing terminal activities. Trans Mountain's most recent sampling showed exceedances of certain contaminants and finds that additional marine sediment sampling is necessary to delineate areas that, if dredged, would require sediment disposal on land.

With respect to dredging methods, Trans Mountain has committed to reduce the amount of dredging required at the WMT by identifying feasible alternative engineering options and construction methods. In the event that Trans Mountain seeks a Disposal at Sea Permit from Environment and Climate Change Canada (ECCC), Trans Mountain has committed to follow all requirements and timelines of that permitting process. The Board accepts ECCC's comment that any proposed disposal at sea will only be considered for approval under the Canadian Environmental Protection Act, 1999 if it is demonstrated to be the most technically and environmentally preferable option. Therefore, the Board has revised Condition 35 on Marine Sediment Management Plan accordingly.

Trans Mountain said that it would treat stormwater and surface water from the dock's loading area at the existing stormwater treatment facility before discharging it into Burrard Inlet. The Board understands that this treatment facility is operated under a British Columbia Ministry of Environment discharge permit and that it will be expanded to accommodate the increased stormwater discharge from the terminal expansion.

In light of the above, the Board has imposed Condition 35 requiring Trans Mountain to develop a marine sediment management plan that would be included within the Environmental Protection Plan for the WMT. The plan would include the results of supplemental marine sediment surveys, a volume quantification of sediment to be dredged and disposal options. The plan would also include monitoring details for the terminal's construction and operations phases, for both biotic and non-biotic parameters. The Board requires Trans Mountain to include a summary of its consultations with appropriate government authorities and potentially affected Aboriginal groups, into the plan.

Significance evaluation: adverse effects on marine sediment and water quality

	Criteria	Rating	Description
Project effects	*Temporal extent*	*Short-term to long-term*	*During construction, effects are expected to be limited to the period when dredging occurs. Effects from stormwater discharges are expected to occur sporadically throughout the operations phase.*
	Reversibility	*Reversible*	*Effects from dredging are expected to be reversible once that activity is complete. Effects from stormwater discharges are expected to be reversible once terminal operations cease.*
	Geographic extent	*Local Study Area*	*Effects are expected to be limited to the Local Study Area during both construction and operations.*
	Magnitude	*Low*	*Effects from dredging and stormwater discharges are expected to be within the applicable criteria.*
Cumulative effects	*The Board finds that some contaminants are present at levels higher than the applicable criteria due to historical and existing terminal activities. Taking into account the implementation of Trans Mountain's proposed mitigation, and the condition the Board has imposed aimed at protecting marine sediment and water quality, the Project's contribution to the total cumulative effects is expected to be inconsequential.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

10.2.14 Marine fish and fish habitat

Trans Mountain defined Burrard Inlet as a productive marine environment, supporting a diverse assemblage of algae, invertebrates, and marine fish, including three SARA-listed marine fish species of Special Concern: Bluntnose sixgill shark, Green sturgeon, and Yelloweye rockfish (inside waters population). Trans Mountain indicated that Burrard Inlet, or portions of it, are considered DFO Important Areas for Dungeness crab and Pacific salmon. Trans Mountain said that one DFO Important Area for Dungeness crab overlaps with the LSA (Appendix 11 provides a description of the spatial boundaries). Trans Mountain said that Pacific salmon are known to use numerous different streams within Burrard Inlet for important life stages. Trans Mountain said that Pacific salmon likely use the LSA to some extent, but it is not considered high quality habitat. Trans Mountain also indicated that three Rockfish Conservation Areas (RCA) are located within the RSA, including the Eastern Burrard Inlet RCA, located within the LSA.

Trans Mountain, DFO, and Tsleil-Waututh identified that Burrard Inlet has been cumulatively impacted by industrial and urban development. Tsleil-Waututh said that Burrard Inlet was historically one of Canada's most productive marine fish habitats. Trans Mountain said that urban and recreational development has resulted in a large percentage of intertidal habitat being modified, resulting in a range of total cumulative effects both on habitat and species that utilize such habitat, and that cumulative effects are expected to persist with or without the Project.

Several concerns were raised by participants about impacts on marine fish and fish habitat from the construction activities associated with the expansion of WMT. In this section, the Board focuses on:

- alteration or loss of marine fish habitat;
- mortality or injury to marine fish; and
- mitigation and offsets.

A discussion of the introduction of aquatic invasive species from Project-related marine vessel ballast water, and underwater noise produced from Project-related marine vessels on marine fish, is provided in the marine fish and fish habitat assessment in Chapter 14, section 14.3.1, see subsection on Marine fish and fish habitat.

Alteration or loss of marine fish habitat

Trans Mountain acknowledged that the expansion of WMT would result in loss and alteration of marine fish[62] habitat. Trans Mountain estimated the amount of habitat to be lost or altered from the expansion of WMT based on preliminary engineering designs (Table 11).

Table 11: Approximate area of marine fish habitat to be destroyed or permanently altered

Habitat	Area to be lost (m^2)
marine riparian habitat	2,252
intertidal habitat	4,323
subtidal habitat	13,002
Total	19,577

Trans Mountain said that subtidal and intertidal habitats that are lost or permanently altered will be partially offset by new rip-rap habitat along the outer face of the fill area. It said that the intertidal area would retain the general physical characteristics that are currently present. It acknowledged that habitat loss may result in a temporary decrease of the productive capacity of surrounding habitats.

The Village of Belcarra suggested that Trans Mountain should be required to create additional eelgrass habitat within Central Burrard Inlet as compensation for the increased footprint of the WMT. Trans Mountain said that construction of the WMT would not adversely affect any eelgrass habitat, and that the environmental conditions in the area may not be suitable for eelgrass establishment, so eelgrass habitat creation is not a suitable offsetting measure.

Injury or mortality

Trans Mountain said that some marine organisms would likely be injured or killed from pile driving, infilling, and potential dredging activities. It said that sessile organisms such as marine invertebrates would be at highest risk of harm, whereas mobile species, such as marine fish, would likely disperse from the area, avoiding impacts. It acknowledged that pile driving could result in injury or potentially death of marine fish from high pressure energy waves. Trans Mountain said that mortality or injury from high pressure sound waves would be unlikely, as sound pressure waves capable of causing injury or mortality would be in the immediate vicinity (i.e., within several metres) of pile driving, and that marine fish are most likely to disperse from the area when preparatory activities commence.

DFO said that Trans Mountain's proposed mitigation would minimize injury and mortality to marine fish and invertebrates, but that some minor fish mortality may still occur. Trans Mountain said that, if some mortality of marine fish and invertebrates occurred, it would not affect the viability of localized populations.

Trans Mountain said that residual effects of construction and operations of the WMT on SARA-listed marine fish are considered unlikely due to the low abundance of these species within the RSA.

Mitigation and offsets

Trans Mountain has proposed numerous mitigation measures that it submits are consistent with federal regulatory guidelines, industry best management practices, and align with *Best Management Practices for Pile Driving and Related Operations* developed by the B.C. Marine and Pile Driving Contractors Association. These include:

- conducting all infilling and any potential dredging within least-risk biological windows to avoid sensitive life stages of marine fish;
- hydrophone monitoring when installing piles, whether an impact hammer or hydraulic drive is used;
- using bubble curtains when an impact hammer will be used to install piles (type and usage of bubble curtains will be discussed with Fisheries and Oceans Canada);

62 The term marine fish is meant to include all marine organisms (e.g., fish, invertebrates, eggs).

- a crab salvage program within the dredge and fill footprint; and
- water quality monitoring during marine construction activities (i.e., dredging of the marine environment from onshore and/or the marine environment, marine drilling, pile installation, infilling, etc.) in order to assess the effectiveness of mitigation measures in place to reduce potential effects to water quality and sediment quality during construction.

Trans Mountain identified that the construction activities associated with the expansion of WMT would likely result in serious harm and could require Authorization under paragraph 35(2) (b) of the *Fisheries Act*. Trans Mountain provided a preliminary marine fish offsetting plan that proposed the construction of rock reefs with the purpose of providing high value marine fish habitat to offset any residual serious harm resulting from the expansion of WMT. Trans Mountain said that, in the event a *Fisheries Act* authorization would be required, a finalized marine fish habitat offsetting plan would be developed that would include detailed offsetting measures, as well as compliance and effectiveness monitoring to confirm that offsetting habitat was constructed as planned and functioning as intended. Trans Mountain also acknowledged that the offsetting measures presented in their preliminary marine fish habitat offsetting plan were conceptual and would be refined through further discussions with DFO, participating Aboriginal groups, and other interested parties.

DFO said that a detailed review of the Project in regards to serious harm would only occur during the permitting phase. DFO indicated in its final argument that when considering the potential issuance of a *Fisheries Act* authorization for a work(s), undertaking(s) or activity(ies) which may adversely affect asserted or established Aboriginal or Treaty rights, DFO will undertake consultation with potentially affected Aboriginal groups. DFO further recommended that the Proponent develop a follow-up monitoring program to assess the effectiveness and adequacy of mitigation measures implemented during and post-construction.

Views of the Board

The Board is of the view that construction activities associated with the expansion of the Westridge Marine Terminal (WMT) are expected to result in the loss and alteration of marine fish habitat and some mortality or injury of marine fish. The Board recognizes that Burrard Inlet, and portions of the Local Study Area, are considered important habitat for some marine fish species (e.g., DFO Important Area for Pacific salmon). However, the Board is of the view that the proposed mitigation measures would effectively mitigate the extent of the effects on marine fish and fish habitat.

The Board is mindful of DFO's recommendation that Trans Mountain develop a follow-up monitoring program to assess the effectiveness and adequacy of mitigation measures. The Board would impose Condition 151 requiring Trans Mountain to conduct a post construction monitoring program of marine fish and fish habitat for the expansion of the WMT and file the results with the Board.

Trans Mountain has acknowledged that the construction activities associated with the expansion of the WMT would likely require a Fisheries Act authorization. As the Memorandum of Understanding between DFO and NEB does not apply to marine terminals, the responsibility for reviewing the effects on marine fisheries from the expansion of the WMT under the Fisheries Act is the responsibility of DFO. The Board would impose Condition 109 requiring Trans Mountain to provide a finalized copy of the Fisheries Act authorization with the Board, prior to construction, in the event DFO determines one is required for the expansion of the WMT. If DFO determines a Fisheries Act authorization is required for the expansion of the WMT, Trans Mountain would be required to offset any residual serious harm as part of the authorization. The Board acknowledges the recommendation of the Village of Belcarra, but is of the view that any requirements for offsets related to the expansion of the WMT are best addressed by DFO. The Board acknowledges that should a Fisheries Act authorization be required, Trans Mountain has committed to developing a finalized marine fish habitat offsetting plan that would be refined through further discussions with DFO, participating Aboriginal groups, and other interested parties. The Board recognizes DFO has indicated that, when considering the potential issuance of a Fisheries Act authorization for a work(s), undertaking(s) or activity(ies) which may adversely affect asserted or established Aboriginal or Treaty rights, DFO will undertake consultation with potentially affected Aboriginal groups.

The Board would require Trans Mountain to file a finalized Environmental Protection Plan for the WMT (Condition 81). The Board requires Trans Mountain to include with the filed plan, a summary of its consultations with appropriate government authorities and any potentially affected Aboriginal groups. In its summary, Trans Mountain must also provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plans.

The Board recognizes that there is potential for SARA-listed species at risk to be present in the Regional Study Area (RSA) during construction activities, but given the proposed mitigation and the rare occurrences of these species in the RSA, the Board is of the view that impacts on these species are unlikely.

Significance evaluation: adverse effects on marine fish and fish habitat

	Criteria	**Rating**	**Description**
Project effects	*Temporal extent*	*Medium-term*	*Effects from various construction activities (e.g., infilling, pile driving and potential dredging) are expected to occur intermittently throughout the expansion of the Westridge Marine Terminal (taking months to years) resulting in effects on marine fish and fish habitat (e.g., mortality, alteration or loss of habitat).*
	Reversibility	*Reversible to permanent*	*Marine resources are generally expected to resemble pre-construction conditions within the life of the Project, ultimately making the effects reversible. Some effects could be considered permanent (i.e., mortality of an individual marine fish); however, they are not expected to result in noticeable changes to marine fish abundance.*
	Geographic extent	*Footprint to Local Study Area*	*Effects are expected to be localized to the Project footprint and the Local Study Area.*
	Magnitude	*Low to moderate*	*Effects from the construction of the Project would be limited to a few or many individuals. Generally speaking, the Local Study Area is not considered high quality marine fish habitat. However, for some species, the Local Study Area has been designated as a DFO Important Area and would be considered valuable habitat. Mitigation measures, reclamation activities, post-construction environmental monitoring and potential offsets through a Fisheries Act authorization are expected to reduce the magnitude of effects and would therefore considered to range from low to moderate magnitude.*
Cumulative effects	*Existing cumulative effects could be considered substantial and above environmental regulatory thresholds within the Regional and Local Study Area. Burrard Inlet has been altered by urban and industrial development that has resulted in a loss of habitat and a decrease in marine fish abundance. Taking into account the implementation of Trans Mountain's mitigation measures, the conditions the Board would impose, and a potential Fisheries Act authorization, the Project's contribution to the total cumulative effects on marine fish and fish habitat is expected to be inconsequential.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

10.2.15 Marine mammals

Trans Mountain indicated that five SARA-listed marine mammal species, including two ecotypes of killer whales, could potentially occur in the RSA; namely Grey whale (Special Concern), Stellar sea lion (Special Concern), Harbour porpoise (Special Concern); North Pacific humpback whale (Threatened), Bigg's killer whale (Threatened); and Southern resident killer whale (Endangered). No critical habitat for SARA-listed marine mammal species has been identified in the RSA (Appendix 11 provides a description of the spatial boundaries).

Trans Mountain said the Harbour seal is the most common marine mammal found within Burrard Inlet, and that sightings of other marine mammals are considered rare. DFO acknowledged that

Trans Mountain accurately characterized existing marine mammal resources within the RSA for the proposed WMT Expansion.

Tsleil-Waututh identified that Burrard Inlet has been cumulatively impacted by industrial and urban development. Tsleil-Waututh said that Burrard Inlet was historically one of Canada's most productive marine fish and wildlife habitats.

Participants expressed concerns related to adverse effects on marine mammals from the expansion and operation of WMT. In this section, the Board focuses on:

- permanent or temporary auditory injury;
- sensory disturbance; and
- mitigation

A discussion of the effects of Project-related marine shipping on marine mammals is provided in Chapter 14, section 14.3.1, see subsection on Marine mammals.

Permanent (PTS[63]) and temporary auditory injury (TTS[64])

Trans Mountain said that, based on its comparative study of underwater noise levels from similar projects against the proposed thresholds, as well as the effectiveness of proposed mitigation measures, it is unlikely that permanent auditory injury to marine mammals would occur. Trans Mountain said that temporary auditory injury could occur to marine mammals, but would be localized to marine mammals found within several metres of pile driving, and is therefore unlikely. DFO shared a similar view as Trans Mountain, stating that the residual effects of temporary auditory injury resulting from the expansion of the WMT will likely be low risk.

Sensory disturbance

Trans Mountain said that, within the LSA and, potentially portions of the RSA, underwater noise levels produced from construction activities would be capable of causing sensory disturbance to marine mammals. Trans Mountain said that effects associated with sensory disturbance can range from physiological responses (e.g., increased stress hormones) to behavioral responses (e.g., startles responses, avoidance behaviors). It said that the extent of sensory disturbance depends on a number of factors, including: the source level, frequency and duration of the underwater noise; and the context and the species in question.

Trans Mountain said that the intermittent nature of pile driving would allow for the behavior of some marine mammals to return to normal after sound production ceases, and that it is possible that some marine mammals may habituate to construction activities. Trans Mountain said that effects could be more pronounced for more sensitive species, such as the harbour porpoise, and could result in temporary avoidance of construction areas for these species. Trans Mountain said that SARA-listed species are unlikely to be affected from residual effects of construction and operation of the WMT due to the low abundance of these species within the RSA.

DFO said that sensory disturbance to marine mammals would likely be intermittent in nature and likely result in some avoidance behaviors, but ultimately the residual effects of sensory disturbance will likely be low risk to marine mammals.

Mitigation

Trans Mountain committed to developing a Marine Mammal Protection Program which includes mitigation measures aimed at protecting marine mammals during construction activities associated with the expansion of the WMT. It said that the mitigation measures are aligned with *Best Management Practices for Pile Driving and Related Operations* developed by the B.C. Marine and Pile Driving Contractors Association, and includes:

- a marine mammal survey prior to any marine activities to determine the presence of

63 permanent threshold shifts

64 temporary threshold shifts

cetaceans or species at risk in the exclusion zone (in the event a cetacean or species at risk is encountered in the exclusion zone or in close proximity, all marine operations will be temporarily suspended until the mammal has left the area or does not appear for 30 minutes);

- pile driving only during daylight hours to ensure marine mammals can be seen (in the event, pile driving would have to occur outside of daylight hours, Trans Mountain will consult with DFO to develop mitigation appropriately); using a vibratory driver, rather than an impact hammer, when possible, to install piles (vibratory drivers do not produce the high impulse signatures of impact pile driving);
- bubble curtains would be used in conjunction with an impact hammer (type and usage of bubble curtains will be discussed with Fisheries and Oceans Canada); and
- using a hydrophone to confirm the assumptions, at the onset of pile-driving, concerning source levels, potential exceedances of marine mammal auditory injury levels, and effectiveness of mitigation measures (sound levels will be monitored both onshore and in-water during loud underwater construction activities, in order to allow for adjustments of exclusion zone based on changes in field conditions; monitoring will take place for 30 minutes prior to and during marine construction activities).

DFO said that the mitigation measures proposed by Trans Mountain are standard measures that are technically feasible and have been successfully implemented in past projects, and will largely mitigate the residual effects on marine mammals from the construction activities associated with the expansion of WMT. DFO said the Marine Mammal Protection Program framework is preliminary in nature and is lacking detailed information on construction mitigation and monitoring programs; however, it does provide a good overview of measures aimed at mitigating impacts of pile installation, which is anticipated to result in the greatest effect on marine mammals residing in or migrating through the LSA.

Views of the Board

The Board is of the view that the proposed mitigation measures would reduce the extent of adverse effects on marine mammals. The Board agrees with DFO's assessment and would impose Condition 81 that requires Trans Mountain to develop a Westridge Marine Terminal (WMT) Environmental Protection Plan, which will include finalized mitigation and monitoring plans associated with the expansion of the WMT. The Board would expect Trans Mountain to finalize the plan in consultation with DFO, as well as potentially affected Aboriginal groups. The Board would also impose Condition 151 requiring Trans Mountain to conduct a post-construction monitoring program for marine mammals from the expansion of the WMT and file the results with the Board.

The Board is of the view that construction activities associated with the expansion of WMT are unlikely to result in permanent or temporary auditory injury to marine mammals, and considers such effects to be low risk. The Board acknowledges that construction activities associated with the expansion of WMT has the potential to result in sensory disturbance to marine mammals. The Board is of the view that sensory disturbance would be limited to a few individuals due to the limited abundance of marine mammals in Burrard Inlet. The Board recognizes that there is potential for SARA-listed species to be present in the RSA during construction activities, but given the proposed mitigation and the rare occurrences of these species in the RSA, the Board is of the view that impacts on these species are low risk.

Significance evaluation: adverse effects on marine mammals.

	Criteria	Rating	Description
Project effects	*Temporal extent*	*Medium-term*	*Sensory disturbance of marine mammals is expected to occur from pile driving associated with the expansion of the Westridge Marine Terminal. Pile driving is expected to occur intermittently for the duration of construction activities. Therefore, effects are expected to last in the order of months to years.*
	Reversibility	*Reversible*	*Marine mammal behaviour is expected to return to normal once construction activities (i.e., pile driving) cease.*
	Geographic extent	*Local Study Area to Regional Study Area*	*Effects are expected within the Local Study Area; however there remains the possibility that sensory disturbance could occur at the Regional Study Area.*
	Magnitude	*Low*	*Marine mammal habitat within the Regional and Local Study Area is not considered high quality habitat. Effects from construction activities associated with the expansion of the Westridge Marine Terminal are expected to be limited to a few individual marine mammals and unlikely to impact marine mammal resources as a whole.*
Cumulative effects	*The Regional and Local Study Areas were historically considered high quality habitat for marine mammals; however, industrial and urban development have since substantially altered these areas, limiting the quality and availability of marine mammal habitat. Existing cumulative effects could be considered substantial or above environmental regulatory thresholds for Burrard Inlet. Taking into account the implementation of Trans Mountain's mitigation measures and the conditions the Board would impose, the Project's contribution to the total cumulative effects on marine mammals is expected to be inconsequential.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

10.2.16 Marine birds

The Westridge Marine terminal is located at the edge of the English Bay and Burrard Inlet Important Bird Area which attracts tens of thousands of migratory birds along the Pacific Flyway and is globally important habitat for western grebes, Barrow's goldeneye and surf scoter. The area is also nationally important habitat for great blue herons. Trans Mountain said that bird abundance in the inlet has been recorded at more than 24,000 birds during peak spring months, and the marine areas of the Central Harbour have the greatest abundance of waterbirds.

Trans Mountain said that three marine bird species listed under Schedule 1 of the SARA, which may be observed using habitats within Burrard Inlet, are: great blue heron, long-billed curlew (special concern), and marbled murrelet (threatened). Trans Mountain said that critical habitat has not been identified for any of the three species.

Participants, including B.C. Nature and Nature Canada, Mr. A.G. Lewis and ECCC, raised concerns about the effect of WMT construction and operation on marine bird mortality caused by collisions with infrastructure, and behavioural alterations caused by sensory disturbance. Trans Mountain said that bird collisions with the WMT or vessel infrastructure would be rare. When they occur, it would be primarily due to disorientation caused by night lighting of the terminal, or lack of visibility during weather events. Trans Mountain committed to implement mitigation measures to reduce the potential for light-induced collisions, such as using low level or low intensity lighting, and informing Project related vessel operators of the hazards regarding bird strikes occurring at night. Trans Mountain said that the risk of mortality could be further minimized by monitoring and recording marine bird collisions and adapting management goals to eliminate the potential for recurring fatal collisions.

ECCC recommended that Trans Mountain implement an Avian Mitigation and Monitoring Plan to assess the effectiveness of proposed mitigation measures to avoid harm to migratory birds that could arise from activities related to the WMT facility. ECCC said that this monitoring should include post-construction monitoring at the WMT, including berthed vessels.

Trans Mountain said that bird strikes and collisions would be reported to Trans Mountain's Lead Activity Inspector and the Environmental Inspector or Kinder Morgan Canada's Operations Supervisor. Trans

Mountain said it would report the date, time, location, environmental conditions, and the species and number of individuals involved, as well as recommended follow up actions and communications.

Trans Mountain said that information regarding mortality and collision events would be compiled by the Environmental Monitor and included, as applicable, in post-construction monitoring reports for the WMT.

Views of the Board

Trans Mountain has committed to various mitigation measures to reduce effects of construction and operation of the Westridge Marine Terminal (WMT) on marine birds. In addition, Trans Mountain has committed to compile information regarding mortality and collision events and to include that information in post-construction monitoring reports. The Board expects Trans Mountain to include this information in the post-construction monitoring reports related to the Project.

Given the mitigation measures and reporting committed to by Trans Mountain, in Board's view a separate condition for an Avian Monitoring Plan, as requested by ECCC, is not required.

Significance evaluation: adverse effects on marine birds - Westridge Marine Terminal construction and operation

	Criteria	**Rating**	**Description**
Project effects	*Temporal extent*	*Long-term*	*Sensory disturbance and potential for collisions would be expected to persist through the life of the Project.*
	Reversibility	*Reversible*	*Sensory disturbance effects would be expected to be reversible at the population level.*
	Geographic extent	*Local Study Area*	*Effects would be expected at the Westridge Marine Terminal.*
	Magnitude	*Low*	*Effects would be expected to be minimal at the population level.*
Cumulative effects	*Existing cumulative effects are not considered to be substantial. Taking into account the implementation of Trans Mountain's mitigation measures, the Project's contribution to the total cumulative effect on marine birds is expected to be relatively minor.*		
Recommendation	*Not likely to cause significant adverse environmental effects.*		

10.2.17 Accidents and malfunctions

Chapter 9 discussed Trans Mountain's ability to anticipate, prevent, and respond to Project accidents and malfunctions. This section discusses the potential environmental effects of a spill that might result from such accidents and malfunctions involving the Project, such as a spill from the pipeline, from the tank terminals, or from WMT. Chapter 11 discusses the potential socio-economic effects of such spills.

The section of the current chapter is focused on potential spills from the Project, rather than potential spills from marine shipping associated with the Project. However, oil spilled from the pipeline or facilities can enter the marine and estuarine environment and affect valued components in the vicinity of the spill, which are discussed in this chapter.

Chapter 14 discusses the prevention, preparedness, and response measures related to potential spills from the increase in marine shipping associated with the Project, as well as the potential environmental and socio-economic effects of such spills. Some of the information in Chapter 14, section 14.6 on the potential effects of a tanker spill on certain valued environmental components may also be relevant here if oil spilled from the pipeline or from a terminal reaches such components.

Ecological risk assessment methods

Trans Mountain conducted a qualitative ecological risk assessment to evaluate the potential environmental effects to the ecological receptors resulting from exposure to crude oil releases from the pipeline. It selected case studies of oil spills from environments similar to the Project, based on a literature review.

To assess the effects of a pipeline spill, Trans Mountain selected the following four hypothetical oil spill locations:

- in proximity to the Athabasca River near Hinton, Alberta;

- the North Thompson River near Darfield, B.C.;
- the Fraser River near Hope, B.C.; and
- the Fraser River near the Port Mann Bridge in greater Vancouver.

Table 12 describes the pipeline spill scenarios considered for the assessment.

Trans Mountain said that it considered winter, summer, and spring/fall seasons in evaluating the interactions between spilled oil and ecological receptor groups. It considered Cold Lake Winter Blend (CLWB) as a conservative choice due to the higher risk associated with inhalation of volatiles and/or exposures to volatile hydrocarbons. For each river, season and ecological receptor type, Trans Mountain evaluated the expected spatial extent, magnitude, duration, and reversibility of negative environmental effects.

Trans Mountain estimated the potential recovery times of the freshwater and terrestrial environment. Several issues raised by participants related to the potential recovery are discussed below.

Trans Mountain said that the spatial extent of environmental effects would vary, depending upon the season and river characteristics, and that the magnitude of environmental effects was often rated "high", at least locally. It said that the duration of the effects, taking into consideration oil spill response and restoration activities, were typically less than five years, and often 12 to 24 months. All rated negative environmental effects were considered to be "reversible."

Table 12: Pipeline spill scenarios

Pipeline location (reference kilometre post)	Credible worst case spill volume (m^3)	Smaller spill volume (65 per cent of credible worst case) (m^3)	Description
309.0	2,700	1755	Athabasca River Scenario Location: approximately 10 km east of Hinton at a forest site approximately 200 m from the Athabasca River.
766.0	1,400	910	North Thompson River Scenario Location: approximately 3 km north of Darfield at partially cleared lands approximately 100 m from the North Thompson River.
1,072.8	1,300	845	Fraser River Near Hope Scenario Location: forested stream crossing site in west Chilliwack upstream from Trans-Canada Highway approximately 600 m from Vedder Canal, a Fraser River tributary.
1,167.5	1,250	812.5	Fraser River and Delta Near Port Mann Bridge Scenario Location: approximately 500 m west of Port Mann Bridge at an industrial site on the south bank approximately 400 m from the Fraser River.

Trans Mountain conducted a Preliminary Quantitative Ecological Risk Assessment for the WMT to assess the potential environmental effects to marine ecological receptors resulting from potential spills during product loading.

Spatial boundaries for this assessment included the geographic extent where potential effects are expected to be measurable and considered the oil spill footprint, as well as the RSA defined as the area of English Bay, Vancouver Harbour, and Burrard Inlet east of the First Narrows, including Indian Arm and Port Moody Arm.

Trans Mountain evaluated two hypothetical oil spill scenarios as part of this assessment. This included scenarios representing two crude oil spill volumes:

- a spill of 160 m^3 due to a large break in a loading arm (with assumption that 80 per cent is retained by a boom placed around the vessel being loaded); and
- a smaller volume of 10 m^3 (which remains within the containment boom).

Trans Mountain evaluated each hypothetical spill scenario using stochastic fate and transport modelling under a range of environmental conditions, including winter, spring, summer and fall. Trans Mountain said that it selected the CLWB as the representative crude oil because it is already transported by Trans Mountain, and is expected to remain a major product transported by the new line.

Trans Mountain considered the summer season as the credible worst case because increased hydrocarbon concentrations in water and air would increase exposure to people and organisms relative to colder ambient conditions.

Trans Mountain also conducted a detailed quantitative risk assessment that builds on the results of the preliminary qualitative risk assessment. It said that the detailed assessment focuses on changes in the health of the ecological receptors from exposures associated with hypothetical spills resulting from a loading accident at the WMT.

Trans Mountain said that the potential risks of negative environmental effects from crude oil exposure from each spill scenario were evaluated for four main ecological receptor group/habitat combinations as follows:

- shoreline and near shore habitats;
- marine fish and supporting habitat;
- marine birds and supporting habitat; and
- marine mammals and supporting habitat.

Trans Mountain said that each of the four ecological receptor groups contain a variety of habitats and/or individual receptor types that have differing sensitivity to crude oil exposure (ranked on a scale of low to very high). In defining the potential ecological consequence of crude oil exposure at any given location, Trans Mountain considered the overlap of the likelihood of crude oil presence, and the sensitivity of ecological habitat or receptors that may be present at that location

Trans Mountain said that the observed effects and distribution of oil from the 2007 Westridge delivery line spill in Burnaby are similar to the predictions made in the WMT detailed ecological risk assessment. For example,

- the observed effects of surface oiling on fish and wildlife after the 2007 spill are consistent with, and similar to those predicted by the detailed quantitative ecological risk assessment (i.e., no fish kill, and limited effects from direct oiling on birds and marine mammals);
- the predictions of the assessment for the extent and intensity of shoreline oiling are very similar to the effects observed after the spill in 2007; and
- the observed recovery of shoreline biota is consistent with predictions provided in the assessment (i.e., less than 2 years in lightly oiled areas, and 2-5 years in more heavily oiled areas).

Potential effects on valued environmental components

Spilled oil, depending on factors such as its trajectory and weathering, can affect a valued environmental component in a similar way, regardless of whether it is spilled from the pipeline or from a storage or marine terminal. This section therefore considers the potential effects of spills on valued components without always distinguishing the particular source where it is unnecessary to do so.

Freshwater and aquatic biota

Trans Mountain said that biological effects of oil spills to freshwater environments vary widely in relation to the characteristics of spilled oil, the physical dimensions and other characteristics of the receiving waterbodies, season, and other factors. Trans Mountain said that if relatively fresh oil reaches water, oil spreads over the water surface forming an oil slick. Volatile hydrocarbons quickly evaporate into the atmosphere, and some of the lighter water-soluble components that would otherwise evaporate may dissolve in the water, resulting in concentrations that may be toxic to aquatic organisms. As oil is transported downstream, it can become stranded on shorelines and riparian vegetation, retained in the

water column as droplets, or retained within coarse bed substrates. The rate of spreading, dissolution and dispersion of hydrocarbons would be slower in the low-turbulence environments of ponds and lakes compared to the Burrard Inlet or an estuary setting, but faster in highly turbulent rivers, where the hydrocarbon would also move downstream and spread laterally.

Trans Mountain said that evidence shows that hydrocarbon concentrations in affected waterbodies are often high immediately following a spill and that water quality typically recovers within days to weeks following an oil spill into inland waters. Trans Mountain indicated that after some historical oil spills (e.g., Kalamazoo River, Wabamun Lake) hydrocarbon concentrations in surface water were generally reduced below aquatic thresholds or guidelines within weeks to months of the spill.

Trans Mountain indicated that hydrocarbons may have lethal and non-lethal effects on aquatic biota, depending on the sensitivity of the species or life stage exposed, and the degree and duration of exposure. Trans Mountain said that hydrocarbons have the potential to effect fish and fish habitat by: altering essential habitat; physically smothering organisms; and exposing fish to acute or chronic toxicity. Trans Mountain said that the primary mechanisms of toxicity identified for fish and fish eggs exposed to hydrocarbons, are: non-polar narcosis and Blue sac disease.

Intervenors raised concern over spilled oil resulting in phototoxicity to fish. Living Oceans Society said that Trans Mountain's application failed to consider any consequences that may result from photo-enhanced toxicity. Trans Mountain said that phototoxicity remains an incompletely understood mechanism of hydrocarbon toxicity, particularly with respect to the phototoxic activity of individual polycyclic aromatic hydrocarbon (PAH) molecules, and exposure to both the PAHs and relevant wavelengths of ultra violet light. Trans Mountain said it agrees with intervenors that phototoxicity is a recognized mechanism of hydrocarbon toxicity to juvenile fish. Beyond this however, Trans Mountain said it believes that phototoxicity is not the primary mechanism of toxicity likely to be responsible for environmental effects in the event of a crude oil spill. Trans Mountain said that the ecological relevance of PAH phototoxicity remains questionable, and that it should not be used for environmental management decisions unless its ecological relevance is firmly established.

Trans Mountain said that case study evidence shows that effects on fish, fish eggs and larvae are limited to the period of a few days to a few years after a release, depending on a variety of factors. Trans Mountain said that water concentrations are likely to decrease below effects thresholds within days to weeks after a spill and that relatively little oil appears to become entrained into riverbed gravels where it would remain subject to weathering so that recovery would likely occur over a period of weeks to months. Trans Mountain said that oil could persist for long periods of time in silty sediments when deposited in slow-moving areas of water. It further said that although the uneven distribution of hydrocarbons in sediment could result in some areas where effects on developing fish eggs could occur, it is equally likely that areas with lower deposition would remain unaffected. Trans Mountain indicated that, depending upon the type of oil spilled and the characteristics of the receiving environment, a portion of the reproductive capacity of a single year-class of fish could be lost, and that recovery would occur in subsequent years.

Trans Mountain said that floating aquatic plants would be killed if it came in contact with an oil slick. It said that submerged aquatic plants would be less vulnerable, as they would be exposed primarily to dissolved hydrocarbons and are not considered likely to fall within the most sensitive groups of aquatic biota to such exposure. Trans Mountain said that emergent aquatic plants would generally be quite tolerant of moderate exposure to floating oil (such that a portion of the stem was oiled). Trans Mountain said that aquatic plants are not expected to be an important part of the ecological structure of most of the larger rivers crossed or paralleled by the proposed pipeline corridor, as the rivers draining in mountainous areas of western Canada have high water levels and flow rate, as well as high turbidity level, that would limit the quality of habitat for aquatic vegetation.

Trans Mountain said that shoreline and riparian vegetation are expected to be affected only in cases where rivers are in flood condition at the time of an oil spill such that the riparian areas are overwashed by oil. Trans Mountain said that areas subject to heavy oiling, such as the initial overland flow path from a spill site to the aquatic environment, may require aggressive remedial actions so that all habitat is initially destroyed, then reconstructed and seeded with appropriate native seed mixes. It said that annual plant communities typically recover from moderate oiling within one or two years.

Trans Mountain said that aquatic invertebrates exhibit a broad range of sensitivity to hydrocarbon exposure. Sensitive species such as stoneflies, mayflies and caddisflies would be expected to respond to dissolved

hydrocarbon exposure at levels similar to sensitive fish species, while other invertebrates are expected to be more tolerant. It said that case studies show that although benthic invertebrate community biomass and diversity are affected by oil spills, they recover quickly.

Participants provided evidence that described the various effects, both acute and chronic, from exposure of aquatic biota to spilled oil. Of particular concern was potential for spilled oil to enter the Fraser River and estuary, and the corresponding impacts on important commercial, recreational, and cultural fisheries, such as Pacific salmon. Raincoast Conservation Foundation said that 42 species of fish use the Lower Fraser River and estuary for a part or all of their lifecycles and specifically highlighted Pacific salmon. It said that due to the large diversity of populations and their variable life histories and use of the lower river, there is not time of year when salmon are not vulnerable to an oil spill. Raincoast Conservation Foundation indicated that Pacific salmon currently face numerous natural and anthropogenic stressors. It further indicated that cumulative effects and effects associated with historical oil spills worked in combination to negatively impact fish species. Raincoast Conservation Foundation said that a spill during peak migration of economically important or at risk species could be devastating to those populations.

Trans Mountain's qualitative ecological risk assessment for the Fraser River and Delta near the Port Man Bridge B.C. spill scenario indicated that the magnitude of an oil spill effect on the fish and fish eggs, and aquatic invertebrates aquatic receptors would be of low magnitude and have a short recovery period. Trans Mountain indicated for the aquatic vegetation receptor, the magnitude of oil spill effects would range from low to high, depending on the season, and that recovery would occur between 1 year and 18 months. Metro Vancouver said that Trans Mountain's qualitative risk assessment is largely subjective and poorly validated, and assumed an optimistically continuous window within which clean up and remediation was possible. Metro Vancouver said it anticipates that impacts of spill into the Fraser River or its connected tributaries, directly or via overland delivery, are anticipated to have much larger scale impacts that take much longer to remediate, if they can be remediated at all.

Trans Mountain recognized the biological importance and significant diversity of fish in the Fraser River and estuary. It said that a crude oil spill into the Fraser River could have substantial negative effects that could be long lasting if prompt and effective measures were not taken to mitigate the immediate effects by containment and recovery. Trans Mountain said that evidence from actual case studies showed that freshwater ecosystems recover from oil spills, often within relatively short periods of time.

Participants also raised concerns over the potential for spilled oil to submerge or sink. The City of New Westminster said that once dilbits sink to the bottom of a river, stream, or lake, hyporheic flows can introduce dissolved hydrocarbons from oil stranded in gravels into the surrounding water. It said that at low flow rates, hydrocarbon concentrations in interstitial waters of spawning shoals would likely achieve concentrations that would reduce embryo survival of fish and fisheries productivity and have ongoing impacts on benthic invertebrates. Trans Mountain indicated that in past spills, such as the Kalamazoo River, that crude oil deposition to sediments occurred primarily in quiescent, soft-bottom areas of the river (particularly within impoundments) and not in net-erosional areas of the river bed such as gravel or cobble bed sections. Trans Mountain said that it is unlikely that a large proportion of spilled crude oil in the Lower Fraser River would be deposited to sediment. It said that oil that might be deposited to sediment would not find a quiescent environment where it could be trapped, as it did in the Morrow Lake head pond in the Kalamazoo River. Trans Mountain said that gravel and sand river bed materials would continue to be dispersed and moved down-river by natural process in the river bed. These processes would tend to break the oil up and further admix it with sand and silt particles, which would also help to facilitate biodegradation of the oil.

Metro Vancouver said that since oil in freshwater environments is more likely to sink, clean up efforts aimed at rehabilitating freshwater systems are expected to be more physically damaging to the habitat. It said that dredging and removal of contaminated substrates and vegetation may be required after dilbit settles, and that if this is required within a major salmon migration corridor such as the Fraser River, the stirring up of sediments and presence of humans and equipment could further impede successful migration and spawning success. Metro Vancouver said that the cleanup for the Kalamazoo dilbit spill has proven extremely difficult for these reasons, and despite experimenting with many different cleanup techniques, no highly effective methods appeared to emerge that dealt with sunken dilbit and did not cause extensive harm to the environment.

Participants also raised concerns regarding oil spills having long-term consequences on aquatic species at risk. The City of New Westminster said that a spill in watercourses inhabited by Nooksack dace or other SARA-listed species would potentially have a significant impact on the recovery of these species.

Soil

Trans Mountain said that hydrocarbon in soil could adversely affect soil productivity and soil invertebrates. It said that emergency response activities could further affect soil by admixing, compaction, rutting, and erosion.

Trans Mountain said that remediation activities would result in restoration of soil quality to levels that would support the recovery of both plant and invertebrate life, and that prior land use could be restored in the short to medium term.

Terrestrial vegetation

Trans Mountain said that effects of spilled oil could include physical smothering, habitat modification and toxicity, resulting in the death of plants and of contacted foliage and that oiling could lead to ecosystem changes, including loss of overall diversity, rare species and rare ecological communities. Trans Mountain said that response and remediation activities could disrupt habitat and provide an opportunity for invasion by non-native or weedy species. It said that areas subject to heavy oiling may require aggressive remedial actions (likely requiring extensive excavation), meaning that all habitat is initially destroyed.

Trans Mountain said that annual plant communities typically recover from moderate oiling within one or two years, while forest communities could require longer than 10 years. Metro Vancouver said that plant species of conservation concern and sensitive plant communities would likely be lost permanently in locations affected by a terrestrial spill because it is difficult to remediate and re-establish conditions that replicate those that supported rare plant assemblages.

Wetlands

Trans Mountain said that potential effects of spilled oil include death of plants and die back of contacted foliage, alteration of habitat through changes in species composition, and that contaminated sediments can negatively affect rooted aquatic plants and re-contaminate the water if disturbed. It said that areas subject to heavy oiling may require aggressive remedial actions so that all habitat is initially destroyed. The National Oceanic Atmospheric Administration Shoreline Assessment Manual filed by Cowichan Tribes said that for marshes, natural removal rates are very slow and that thick oil on vegetation is usually removed when the vegetation dies back and sloughs off.

Trans Mountain said that recovery of wetlands generally begins about 12 months after the spill and is effectively complete after five years. It said that much aquatic vegetation regenerates from buried root systems, in which case recovery is essentially complete in the year following the spill. It said that oil spilled in wetlands tends to have a long residence time, can cause interior oiling and pooling, may result in a slow rate of recovery in some wetlands, and that there have been instances where wetlands can take upwards of 20 years to naturally recover from a spill. Trans Mountain said that it is committed to achieving the goal of no-net-loss of wetland function in the case of a spill, and that it would use the wetland baseline information collected pre-construction for comparison with post-spill reclamation.

The City of Surrey and Metro Vancouver said that a spill in bogs and fens (such as in Surrey Bend Regional Park) can be particularly problematic, given that oil would tend to saturate peat layers, and that this would necessitate the complete removal of the peat and other surface vegetation during spill cleanup. They said that restoration of bogs and fens is not straightforward because they develop over considerable periods of time with the slow accumulation of peat.

Wildlife

Trans Mountain said that exposure to oil in the freshwater environment from a pipeline spill could result in lethal and sub-lethal effects on mammals, birds, amphibians, and reptiles from various effects pathways (loss of waterproofing of fur or feathers, ingestion or inhalation of toxins, dermal exposure, reduced mobility, and decline in food availability).

B.C. Nature and Nature Canada raised concerns about the mortality of aquatic birds caused by a crude oil spill from the pipeline. In response to their concerns, Trans Mountain said that any mortality of birds caused

by a crude oil spill would be a significant adverse environmental effect, and no such mortality of birds is acceptable under any circumstances. Trans Mountain said that, while the ecological risk assessment did not directly consider exposure to lingering oil, such effects would be implicitly incorporated into estimates of recovery.

Based on the detailed quantitative risk assessment for the modelled credible worst-case 160 m^3 spill at the WMT, Trans Mountain concluded that mortality of terrestrial wildlife is not likely to result from minor exposure to crude oil. While there could be exposure of terrestrial wildlife to floating crude oil, Trans Mountain said that such exposure would affect only a small portion of overall wildlife habitat and the effects were likely to be minor.

Trans Mountain said that its Emergency Response Plan would include measures to protect wildlife and wildlife habitat, including species at risk and critical habitat, in the event of an oil spill.

Trans Mountain said that the population recovery of mammals and birds could take up to five years, depending upon the extent of the injuries, and the reproductive capacity of the affected population. Trans Mountain said that the recovery of amphibian populations would be fairly rapid (i.e., one or two breeding cycles) because of their high reproductive potential. Trans Mountain also said that turtles tend to be long lived and have lower reproductive potential so recovery from serious harm at the population level could take longer, potentially five years or more.

Marine sediment

Trans Mountain said that sedimentation of oil may occur when dispersed oil enters the water column if it combines with suspended particulate matter, and settles to the bottom. Trans Mountain said that the results of the oil spill modelling indicated that negligible amounts of oil would become suspended as droplets in the water column, due to the sheltered nature of Burrard Inlet and the relatively viscous characteristic of the oil. Therefore, it was unlikely that a smaller spill of CLWB would result in any high magnitude or long lasting negative effects in the sediment.

Marine vegetation

Numerous participants expressed concerns about the effects of oil spills on particularly productive and sensitive marine vegetation communities, such as the salt marshes at the Maplewood Conservation Area in Burrard Inlet and the brackish marshes of the Fraser River. ECCC said that, depending on the volume, location, time of year, and other factors, an oil spill could have serious, long-lasting effects on important habitats such as marshes. Trans Mountain said that marshes generally occupy the upper end of the intertidal zone where oil is more likely to become stranded and impacts can be severe, including conspicuous death of the aboveground or above-water vegetation. It said that plants can have high survival rates where the upper portion of the vegetation remains un-oiled, allowing for respiration and photosynthesis to continue.

Trans Mountain said that where there is heavy oiling, measures may be required to remove as much of the oil as needed to speed the overall rate of recovery. It said that intrusive remedial options, such as mechanical oil removal, vegetation cutting and removal, and sediment reworking/tilling, have the potential to cause additional adverse effects, such as damage to plant roots and/or mixing oil into the soils.

Potential effects on other marine vegetation communities, such as eelgrass and kelp beds, are discussed in Chapter 14, section 14.6.1.

Trans Mountain said that marshes generally recover on their own within one or two growing seasons after light to moderate oiling, and that plants that grow from rhizomes in the soil or sediment usually regenerate even if the aboveground portions exhibit die-back. It said that, with the implementation of appropriate oil spill response activities, recovery of oiled shoreline habitat within two to five years following a large spill is a reasonable expectation, and referenced studies from a number of previous spills.

Cowichan Tribes questioned the assertion of complete recovery within two to five years, and said that Trans Mountain did not discuss the potential for residual effects resulting from disruption of biological community structure. Cowichan Tribes said this process can, in turn, free up habitat space which can be utilized by opportunistic species that can slow or inhibit the recovery of the original community.

A number of participants said that there is potential for long-term retention of oil in marshes. Trans Mountain said that it does not dispute that small amounts of crude oil can become sequestered

and remain in brackish marshes and that small amounts of sequestered oil do get released, but said that there is no direct link between such low levels of exposure and biological effects at the individual or population level.

Tsawwassen First Nation filed a study of the Louisiana salt marshes following the BP-Deepwater Horizon oil spill. The results included a finding that marsh vegetation displays remarkable resilience to oil spills, and that the effects of the oil concentrate and are confined to the marsh edge, so that the marsh vegetation recovers fully in non-eroded areas after approximately one and a half years. However, the study also found that death of the stabilizing root matrix at the edge of marshes, characterized by erosive edges or cliffs, led to accelerated erosion and permanent marsh ecosystem loss.

Marine fish

Trans Mountain said that two major mechanisms of toxicity to fish are non-polar narcosis and Blue sac disease. Trans Mountain said that acute effects of hydrocarbon exposure on fish are generally caused by exposure to relatively soluble components of crude oil, and that these compounds also tend to be volatile and are rapidly lost to the atmosphere so the initial 24 to 48 hours following an oil spill represent the timeframe when acute toxicity is most likely to occur.

Trans Mountain said that the potential for toxicity to the marine fish community is greatest near the surface where more soluble hydrocarbons can dissolve from the floating fresh oil or form droplets that can be temporarily dispersed down in to the water column by wave action. Trans Mountain said that extensive formation and dispersion of oil droplets into the water column is unlikely to occur in the sheltered waters of Burrard Inlet. It said that the potential for acutely toxic concentrations of hydrocarbons to extend down into deep water is very low, due to the limited solubility of hydrocarbons and the dilution that would accompany mixing into deep water.

Trans Mountain said that its ecological risk assessment indicated that fish habitat would be affected by the WMT credible worst-case spill scenario. It said that due to the limited fetch in Burrard Inlet and the low potential for dissolved hydrocarbon concentrations in water to reach thresholds that would cause mortality of fish or other aquatic life, the potential for negative effects is generally low. Trans Mountain said the risk would be greatest in shallow water areas under weather conditions that caused spilled oil to be driven into shallow areas with wave action, leading to localized high concentrations of dissolved hydrocarbons in the water. Trans Mountain said that this could result in the death of fish, as a result of narcosis, or could cause abnormalities in developing embryos if spawn was present. Trans Mountain said that negative effects would be greatest if the spill occurred at a time when shallow water was being used as spawning or nursery areas for marine fish and invertebrates. Trans Mountain said that the area with the highest probability of effects is located near the confluence of Indian Arm and Burrard Inlet. It said that critical habitats and spawning areas, as well as developing eggs and embryos in shallow water habitat located in proximity to the WMT, would be most likely to be affected.

Living Oceans Society said that diluted bitumen entrained into the water column can be ingested directly by fish, and by numerous other species of jellyfish and other free-swimming suspension feeders. It said that free-swimming suspension feeders that accumulate submerged diluted bitumen provide an indirect route for contaminating their predators, which include juvenile, sub-adult and adult salmon species associated with the Fraser River watershed and also salmon hatcheries in Burrard Inlet. It said that contamination of these species, in turn, provides a pathway for secondary exposure for other species that consume them, such as marine mammals. In addition, suspension feeding organisms inhabiting shorelines are also vulnerable to oil exposure through ingestion of submerged oil droplets entrained in the water column.

Trans Mountain said that recovery of the marine fish community would occur in the short-term because of the limited spatial extent of potential effects of spilled oil on fish and fish habitat, and the generally low potential for the credible worst-case scenario to cause acute lethality to fish. Trans Mountain said that even under a worst-case outcome event where a localized fish kill might be observed, it is expected that the lost biological productivity would be compensated for by natural processes within one to two years. Tsleil-Waututh Nation indicated that an oil spill could result in the local extinction of culturally important species.

Trans Mountain said that the ecological risk assessment indicates that near shore and shoreline habitats would be affected by the WMT credible worst-case oil spill scenario. It said the area with the highest probability of oiling and negative effects is located near the confluence of Indian Arm and Burrard Inlet. Trans Mountain said that very little of the potentially affected shoreline habitat in Burrard Inlet is the type

that would tend to sequester spilled oil. It is expected that Shoreline Cleanup and Assessment Technique would be applied to the spilled oil that reached shorelines, and that most of this oil could be recovered. Trans Mountain said that biological recovery from spilled oil, where shoreline communities were contacted by and harmed by the oil or by subsequent cleanup efforts, would be expected to lead to recovery of the affected habitat within two to five years and that these conclusions are consistent with evidence from the Westridge delivery line release caused by third-party damage.

Living Oceans Society said that oil impinging on shorelines may kill organisms that respire aerobically by smothering them. It said that embryos of fish and other species that develop on the intertidal or shallow subtidal reaches of shorelines may die from toxic effects, and if mortalities of intertidal organisms are widespread and nearly complete, as is often the case when shorelines are smothered by oil or when cleanup operations are extensive and highly damaging, these communities may require years to recover. Living Oceans Society said that once incorporated beneath the surface of some beaches, diluted bitumen may persist for considerable periods in the absence of physical disturbance and that these lingering reservoirs of diluted bitumen pose long term threats to intertidal organisms.

Participants also raised concerns over the potential impacts from oil spill cleanup measures. Living Oceans Society indicated that shoreline cleanup methods could result in mortality of organisms. Musqueam Indian Band said that oil dispersants have been shown to increase the toxicity of petroleum oil to aquatic life, both experimentally and in the field. It said that research has also shown that dispersants alone can be toxic to fish in the absence of petroleum. Trans Mountain said that dispersant use is not pre-approved for use in Canada today and can only be undertaken on a case by case basis, which will involve a Net Environmental Benefit Analysis. Trans Mountain said that it is generally accepted practice that dispersants are precluded from use in the following conditions which are present in areas of Burrard Inlet: dispersants are not used in shallow water (depth less than 10 to 20 m) to avoid the dispersed oil from contacting the seabed; dispersants are not used in the presence of filter feeding organisms that could ingest the dispersed oil; and dispersants are unlikely to be used in fish spawning habitats or within the area of shallow water fisheries.

Trans Mountain said that the portion of the 2007 Westridge delivery line spill that ran into Burrard Inlet and its remediation resulted in intertidal habitat loss, mortality of intertidal fauna, such as starfish, barnacles and limpets, and limited and localized effects to subtidal organisms. Trans Mountain said that there was no evidence of direct effects on fin-fish species from the 2007 spill. Trans Mountain said that surface samples collected one and two weeks after the incident were below detection limits for extractable petroleum hydrocarbons. While concentrations of polycyclic aromatic hydrocarbons were above detection limits at a few locations, none exceeded water quality guidelines that are protective of the marine environment. The follow up monitoring and assessment report concluded that oil concentrations in the water column likely peaked soon after the release, and decreased to background levels within days.

Marine mammals

Trans Mountain said that aquatic mammals, such as sea otter, river otter and mink that rely upon fur for insulation in cold ocean water, are extremely sensitive to oiling with a high potential of oil ingestion if coastal habitat is oiled. It said that marine mammals that rely upon blubber for insulation are less sensitive to external oiling, although the potential for mortality cannot be ruled out due to other exposure pathways or mechanisms, and that oil ingestion remains a potentially important exposure pathway. Trans Mountain also noted that fouling of baleen plates can have adverse effects on baleen whales.

Trans Mountain said that its ecological risk assessment indicates that marine mammals and marine mammal habitat would be affected by the WMT credible worst-case oil spill scenario. It said that the area with the highest probability of oiling is located at the confluence of Indian Arm and Burrard Inlet. Trans Mountain said that the actual effects would depend upon the size of the oil spill, the efficacy of measures intended to promptly contain and recover spilled oil, the ability of oil spill responders to capture and treat oiled animals, and the intrinsic sensitivity of the animals to exposure. Trans Mountain said that animals like the otter would be most at risk, with lower potential for mortality of harbour porpoise and harbour seals. It said that exposure of other whales and pinnipeds was quite unlikely due to their low occupancy in Burrard Inlet and that at the population level, lost individuals would likely be compensated for by natural processes within one to two years. Trans Mountain said that following the 2007 Westridge delivery line spill, three dead harbour seal pups were found, but cause of death could not be determined and only one had signs of oiling. Trans Mountain said that no other effects on marine mammals, including otters, were reported in Burrard Inlet from the 2007 spill.

Living Oceans Society said that a major spill of diluted bitumen in Burrard Inlet or near the Fraser River estuary could inflict population-level mortalities on resident and migratory marine mammals. It said that oil spills are capable of causing extensive mortalities of marine mammals when present in large numbers and that an estimated 300 harbour seals and 2,800 sea otters died as a result of the Exxon Valdez oil spill. Living Oceans Society said that large-scale mortalities of birds and mammals could de-stabilize or permanently alter the food web of Burrard Inlet and the Fraser River estuary, and cause ecosystem-level effects there and beyond.

Marine birds

Trans Mountain evaluated potential environmental effects on marine birds from exposure to floating oil based on predicted thickness of oil on the surface of the water. Trans Mountain assumed that harm would result in any area where slick thickness is 10 micrometres or greater, but that mortality is not likely to occur in areas with lesser exposure to oil.

Several participants raised concerns about oiled birds. B.C. Nature and Nature Canada raised concerns about the methodology Trans Mountain used to determine effects on marine birds from oil spills from the WMT. B.C. Nature and Nature Canada said oil slick thickness thresholds used by Trans Mountain to evaluate effects of oil spills on marine birds may underestimate marine potential effects of a spill on marine birds.

Trans Mountain said that potential effects on marine birds and mammals exposed to crude oil on the water surface were evaluated using a commonly applied benchmark. Based on the detailed quantitative risk assessment for the modelled credible worst-case 160 m3 spill at WMT, Trans Mountain concluded that seabirds such as sea ducks, cormorants, gulls and other species could be exposed to crude oil in the event of a spill. However, in the context of the Burrard Inlet Important Bird Area, the area of effect is small, and population-level effects on birds were unlikely.

ECCC recommended that critical habitat in any section of the pipeline corridor and facility areas be considered in the development of Emergency Response Plans. Trans Mountain committed to consider species at risk and critical habitat in development of Emergency Response Plans.

Trans Mountain said that operational spills, should they occur at the WMT, would be mitigated through the use of protective booming at the terminal and around vessels being loaded. It said that small oil spills that remain confined in the protective boom and are quickly remediated would have very minor effects in terms of exposures to wildlife. It said that in the unlikely event of a credible worst-case spill and if some of the crude oil were to escape from the protective boom, greater environmental effects would result.

B.C. Nature and Nature Canada raised concerns about effects of chronic oil spills on marine birds. Trans Mountain said that the vessels calling on the WMT are required by law to follow the *Vessel Pollution and Dangerous Chemicals Regulations* made under the *Canada Shipping Act, 2001*. Trans Mountain said that it would provide reception facilities at the WMT to service the needs of the Project-related marine vessels. Trans Mountain would also screen the tankers calling on the WMT to check for malfunctions to pollution prevention equipment or history of non-adherence to provisions of the *Canada Shipping Act, 2001* and MARPOL.

Trans Mountain noted that taking into account the oil spill recovery and wildlife protection actions that would follow an accidental oil spill, it remains likely that seabirds would be harmed by an accidental spill at the WMT. However, at the population level, lost individuals would likely be compensated for by natural processes within one to two years.

Views of the Board

The Board acknowledges the concerns raised by participants in regards to Trans Mountain's ecological risk assessments, but is of the view that Trans Mountain's ecological risk assessments methods were appropriate. The Board disagrees with intervenors, such as Metro Vancouver who critiqued Trans Mountain's ecological risk assessment, stating it was largely subjective and poorly validated. The Board finds that Trans Mountain provided a comprehensive ecological risk assessment that provided the Board with an indication of the potential effects of an oil spill. The Board acknowledges that while the evidence filed by intervenors offered context to the discussion

of potential effects of an oil spill, it generally lacked any structured approach commonly applied in ecological risk assessments.

The Board is of the view that the effects of a spill from the pipeline, a storage terminal, or the WMT would be highly dependent on the particular circumstances, such as the amount and the type of product(s) spilled, location of the spill, response time, the effectiveness of containment and cleanup, the valued components that are impacted, and the weather and time of year of the spill.

For example, a small spill contained within the Project footprint on frozen ground could have relatively minor and non-significant effects. On the other hand, a credible worst-case spill and subsequent cleanup activities could impact numerous valued components, and effects on those components could be long-term, of regional geographic extent, and of high magnitude, as summarized by Trans Mountain and the participants. Although such effects would be expected to diminish over time with the implementation of cleanup activities and the process of natural degradation of the oil, if such an event occurred, its effects would probably be adverse and significant.

The Board is of the view that although impacts from a credible worst-case spill would probably be adverse and significant, natural recovery of the impacted areas and species would likely return most biological conditions to a state generally similar to pre-spill conditions. Such recovery may be as quick as a year or two for some valued components, or may take as long as a decade or more for others. Valuable environmental values and uses could be lost or diminished in the interim. For some valued components, including certain species listed under SARA, recovery to pre-spill conditions may not occur.

Therefore, the Board would require Trans Mountain to provide finalised Emergency Response Plans (Conditions 125 and 126). The Board would require Trans Mountain to identify High Consequence Areas, including species at risk critical habitat, and incorporate these considerations into the development of their Emergency Response Plans.

For the purposes of CEAA 2012, the Board finds that effects from a credible worst case spill would be adverse and significant. However, as discussed in Chapter 9 with regard to the likelihood of spills, the Board finds that such events are not likely. Therefore, the Board recommends that there are not likely significant adverse effects for the purposes of CEAA 2012.

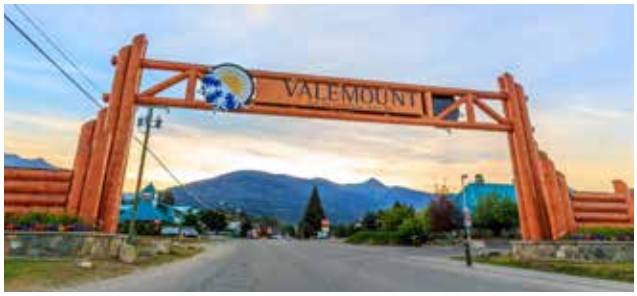
The Board has incorporated the potential environmental consequences of a spill outlined above into its discussion on spill risks in Chapter 1, and considered them in its overall weighing of the benefits and burdens of the Project in Chapter 2.





11.0





People, communities and lands

The Board's expectations regarding a company's evidence in relation to the potential socio economic effects caused by the existence of a project are set out in the Board's Filing Manual. The evidence is expected to identify and consider the effects a project may have on people and communities in the vicinity of the project right-of-way (RoW) and the project's facilities. The Board uses the information about these effects gained through the evidence filed by the company and by other participants in the hearing to help inform its public interest determination. This chapter discusses evidence related to the potential direct and indirect socio economic effects of the Trans Mountain Expansion Project, and the Board's views on these matters. The Board's approach to its assessment of the environmental and socio economic effects of the Project is outlined in Chapter 10. The Project's potential socio economic effects resulting from a Project related increase in marine shipping activities are discussed in Chapter 14.

11.1 Land requirements and routing

The Board requires applicants to provide a description and rationale for the proposed general route of the pipeline, the location of associated facilities, and the permanent and temporary lands required for the project. The Board also requires a description of the land rights to be acquired, as well as the land acquisition process and the status of land acquisition activities. This information allows the Board to assess the appropriateness of the proposed general route of the project, the proposed land requirements and the applicant's land acquisition program. The Board is also required to assess the alternate means of carrying out a project pursuant to section 19 of the *Canadian Environmental Assessment Act 2012* (CEAA 2012).

During the hearing, the Board considered the general route proposed for the Project, the potential environmental and socio-economic effects of the Project, as well as all evidence and commitments made by Trans Mountain regarding the design, construction and safe operation of the pipeline and associated facilities. The detailed route for the Project has not been finalized. If a certificate is issued, Trans Mountain is required to file its Plan, Profile and Book of Reference (PPBoR) with the Board, as set out in sections 33 through 39 of the *National Energy Board Act* (NEB Act). This will enable the Board to consider the best possible detailed route for the Project. It is during this detailed route approval process that landowners may submit any written objections they have to the proposed location of the pipeline on their property, and a detailed route hearing may be held to further consider the best possible detailed route at that location, or the most appropriate methods or timing of the construction of the pipeline.

11.1.1 Land rights and acquisition

Trans Mountain said that, in order to construct, operate and maintain the pipelines, facilities and Project infrastructure, land rights must be acquired from Crown and private landowners in both Alberta and B.C. It identified a 150 meter-wide corridor for the proposed pipeline route. Trans Mountain said that it made the decision early in the planning phase of the Project to study and apply for a pipeline corridor rather than the approximately 45 m RoW that would be required during construction. This would allow a certain amount of flexibility for minor alignment adjustments during the detailed engineering and design phase.

Trans Mountain said that the new pipeline would be adjacent to the existing Trans Mountain Pipeline (TMPL) easement for 73 per cent of the total length, and would parallel other existing RoWs 16 per cent of the total length. A new pipeline corridor would be required for 11 per cent of the total length of the proposed pipeline route.

The estimated requirements to construct, operate and maintain the pipeline, facilities and associated infrastructure are listed in Table 13. Trans Mountain said that the actual quantities would be determined at completion of engineering design and construction planning.

Table 13: Land area summary

Requirements	Land area required in Alberta (ha)	Land area required in B.C. (ha)	Other considerations
RoW	621.2	1,178.9	18.3 m wide combination of existing TMPL and new right-of-way (RoW). Proportion to be determined following engineering design.
Temporary workspace	906.2	1,726.8	Average 26.7 m wide.
Westridge marine terminal	--	1.4	The current dock extends 75 m into Burrard Inlet and the new dock is anticipated to extend approximately 250 m into Burrard Inlet. Maximum marine footprint of construction activities may be approximately 350 m into Burrard Inlet.
Black Pines pump station	--	2.25	Freehold forested land. New permanent access roads will be required for the new Black Pines Pump Station located less than 0.5 km from the nearby road and within a 15 to 20 m wide RoW.
Darfield pump station	--	0.07	Freehold agricultural land.
Hinton pump station	0.3	--	Freehold forested land.
Supplemental overhead power service:			
Edson pump station	To be determined	--	
Edmonton terminal	0.3	--	Approximately 100 m at 30 m wide RoW.
Kingsvale pump station	--	117.5	Approximately 24 km at 50 m wide.
Black Pines pump station	--	12.0	Approximately 2.4 km at 50 m wide.
Temporary construction lands:			
Construction camps	3 to 5	6 to 10	One site in Alberta, two sites in B.C.
New access	To be determined	To be determined	Access roads to the new pipeline construction RoW, where it is not contiguous with the existing pipeline alignment, will be from existing public and private access points and roads, controlled existing access, rights-of-way of others, and existing shoo-flies and trails. Where temporary access roads and shoo-flies are required, these will typically be 5 m wide to accommodate equipment and machinery.
Stockpile sites	23	44	Four sites in Alberta; eight sites in B.C.

Trans Mountain said that no additional permanent land is expected to be required at the Edmonton, Kamloops, Sumas and Burnaby terminals, although temporary offsite staging/parking areas could be required. This temporary requirement would be determined during construction planning.

Trans Mountain requested that the Board issue an order, pursuant to section 58 of the NEB Act, exempting it from the requirements of subsections 31(c), 31(d) and 33 of the NEB Act in relation to yet to be specified select temporary lands or infrastructure required for construction of the Project. In its Application, Trans Mountain provided a list of preliminary locations for camp sites, stockpile sites, and new temporary and permanent access roads.

The Stó:lō Collective raised concerns regarding Trans Mountain's plan to place a Project staging area on one of their important spiritual and burial sites called Lightening Rock.

Table 14 provides the geographic distribution and relative percentage of Crown and private lands traversed by the proposed pipeline corridor.

Table 14: Land ownership for proposed pipeline corridor

Breakdown of Crown and Private Tracts of Land	Alberta	B.C.	Total	Percentage
Total Crown Tracts	331	662	993	25.71
Total Private Tracts	682	2 157	2 839	73.50
Total Aboriginal Tracts	0	31	31	0.80
Total Unknown Tracts	0	6	6	0.01
Total Tracts	**1 013**	**2 856**	**3 869**	**--**

As described in Chapter 4, Trans Mountain said that it consulted with landowners and occupants within the applied-for 150 meter-wide pipeline corridor and alternate corridors, as well as those within 1.5 km of the pump station locations. In addition to the consultation it has already undertaken, Trans Mountain said that it would seek all necessary land rights and approvals for the new pipeline, Black Pines pump station site, additional land for expansion of the two existing Darfield and Hinton pump station, and for temporary workspace for the pipeline, power lines and cathodic systems, by negotiating for easement or statutory RoW agreements, temporary workspace agreements, lease agreements, and fee simple purchase agreements.

Trans Mountain said that the land acquisition process commenced in May 2014, and that all land would be acquired with strict adherence to, and in accordance with, the provisions of the NEB Act. As of 31 December 2014, Trans Mountain said that in Alberta, it had provided service of notices, pursuant to section 87 of the NEB Act, to approximately 50 per cent of landowners and had executed approximately 17 per cent of the total easement agreements required. In B.C., it had provided service of notices, pursuant to section 87 of the NEB Act, to approximately 14 per cent of landowners and had executed approximately 4 per cent of the total easement agreements required.

The Collaborative Group of Landowners Affected by Pipelines and Metro Vancouver expressed concern with the methodology Trans Mountain used for establishing market value for the purposes of determining the value of land rights acquired for the Project. In response to this concern, Trans Mountain said that, based on research undertaken by accredited appraisers, B.C. Assessment valuations had been used as a basis for residential properties but values included an uplift to address any undervaluation that existed. It said that for non-residential properties, such as park lands, appraisers took into consideration zoning and development restrictions, as well as market values for lands adjacent to, but without such zoning.

11.1.2 Alternative means of carrying out the Project

As required under the CEAA 2012, the Board considered alternative means of carrying out the Project. These alternatives represent various technically and economically feasible ways that an applied-for project can be carried out, and which are within Trans Mountain's scope and control.

Pipeline corridor selection process

Trans Mountain said that it selected its pipeline corridor route by applying the following hierarchy of routing criteria:

- siting the proposed corridor on, or adjacent to the existing TMPL or adjacent to easement or rights-of-way of other linear facilities;
- siting the proposed corridor in a new easement selected to balance a number of engineering, construction, environmental and socio-economic factors; and
- minimizing the length of any new easement before returning to the TMPL easement or other rights-of-way.

Several participants expressed concern that there was not adequate information on the detailed route of the pipeline and therefore, they were not able to fully assess the impacts that the Project could have on their respective interests. Metro Vancouver said that the final routes and maps were still in planning phases and it appeared that much of the environmental impact analysis had not been completed on the proposed and possible alternate routings. It said that it has not been provided with the exact pipeline routing, and this was a significant concern given that the routing affects many of the sensitive ecosystems, species at risk, regional parks and greenways, infrastructure, health and air quality, seismic hazard concerns, emergency response, regional planning and cumulative impacts. Metro Vancouver said that the iterations related to proposed and alternate routes had made it virtually impossible to assess the potential impacts that the pipeline construction and operations would have upon the Metro Vancouver environment, especially on sensitive ecosystems, riparian areas, geological environments, Regional Parks and infrastructure owned by Metro Vancouver.

Pipeline corridors in parks and protected areas

Various intervenors raised concerns about the Project routing through B.C. Provincial Parks and other protected areas. Issues raised included proposed routing through provincial parks (rather than avoiding them), concerns around park boundary adjustments, and the Project's potential effects on the biophysical nature of parks.

Trans Mountain said that, in consultation with the Ministry of Environment and B.C. Parks personnel, it determined that the proposed routing within provincial parks would require the temporary adjustment of park boundaries at each of Finn Creek Provincial Park, North Thompson River Provincial Park, Lac du Bois Grasslands Protected Area and Bridal Veil Falls Provincial Park, to facilitate construction within the park. Trans Mountain said that this could be achieved by submitting a Boundary Adjustment Request to B.C. Parks under the B.C. Park Act, and in accordance with the March 2010 Provincial Protected Area Boundary Adjustment Policy, Process and Guidelines.

Trans Mountain said that it considered alternative corridor locations to avoid or reduce Project effects on provincial parks as part of its Boundary Adjustment Proposal to B.C. Parks.

Lac du Bois Protected Area

B.C. Nature and Nature Canada, and the Grassland Conservation Council of British Columbia raised concerns about the pipeline corridor passing through the Lac du Bois Grassland Protected Area and suggested alternate routing options to avoid the protected area.

Trans Mountain said that the existing Trans Mountain RoW is effectively "full" and did not have space for the installation of another pipeline. It said that the Telus fiber-optic RoW through the protected area was a very suitable route for new pipeline construction and said that the City of Kamloops preferred the Lac du Bois routing in order to avoid disruption to the community of Westsyde.

A detailed discussion of Project effects on grasslands, including grasslands in Lac du Bois Protected Area, mitigation and offsets committed to by Trans Mountain, and the Board's views on these, is included in Chapter 10.

Colony Farm Regional Park

Various participants raised concerns about the use of Colony Farm Regional Park as a temporary staging area for the proposed trenchless crossing of the Fraser River, given its importance as a wildlife habitat. The City of Coquitlam said that CP Rail has lands or land rights immediately to the west of Colony Farm Regional Park that could be used as a construction staging area.

Trans Mountain said that it was undertaking a detailed construction study to determine if it is possible to remain outside of Colony Farm Regional Park by using the adjacent railway access road and CP Rail spurs. Trans Mountain said that it had not completed this study.

Brunette River Conservation Area

Some intervenors raised concerns about the proposed routing through the Brunette River Conservation Area.

Trans Mountain said that it preferred the Brunette River Conservation Area option because it would result in fewer impacts to residential and commercial properties as well as urban infrastructure. The corridor that follows the existing pipeline RoW outside of the Brunette River Conservation Area was unsuitable due to dense residential and urban development immediately on, or adjacent to, the existing pipeline RoW. Trans Mountain said that it would use trenchless construction technology in the conservation area.

Coldwater Indian Reserve 1

The Coldwater Indian Band raised concerns about Trans Mountain's preferred pipeline corridor outside of the east boundary of the Coldwater Indian Reserve 1. The Coldwater Indian Band said that its members have a high level of anxiety because of potential added impacts to its drinking water and the Coldwater River. The Coldwater Indian Band said that Trans Mountain did not consult them about the removal of the various corridor options from consideration. The Coldwater Indian Band said that its preliminary assessment of the corridor options suggested that the West Alternative could be a better option based on the potential effects to its aquifer, its rights and its overall quality of life and sense of well-being.

Trans Mountain said that consultation with the Coldwater Indian Band on the corridor options occurred as early as May 2013 and that it had continued to update the Coldwater Indian Band since the Application was filed with the Board. Trans Mountain maintained that the proposed preferred pipeline corridor was selected following consultation with affected stakeholders and assessment of the route options against the routing criteria established for the Project.

Westridge Marine Terminal (WMT)

Trans Mountain said that it considered potential alternative marine terminal locations based on feasibility of coincident marine and pipeline access, and it screened the alternative locations based on technical, economic and environmental considerations.

Trans Mountain said that it considered each of a northern-leg and a southern-leg option for the Project. In its assessment of a northern leg option, it considered marine terminal locations at Kitimat and Prince Rupert. 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.

Trans Mountain said that, relative to the southern expansion of the existing system, the northern leg option would involve a 250 km longer pipeline, higher capital costs, greater technical challenges, including routing through high alpine areas of the Coast Mountains or extensive tunneling, and fewer opportunities to benefit from existing operations and infrastructure, such as use of the existing Trans Mountain RoW and facilities. Trans Mountain determined that expansion along the existing TMPL route was more favourable.

Trans Mountain said that although use of existing facilities was favoured by best practices, it considered potential southern terminal alternatives. It considered feasibility of requisite pipeline access and the location of storage facilities, as well as marine access by tanker.

Trans Mountain considered six alternative southern terminal locations including Howe Sound, Vancouver Harbour, Sturgeon Bank, Washington State, Boundary Bay and Roberts Bank. Trans Mountain determined that Howe Sound and Vancouver Harbour had no feasible pipeline access, and that Howe Sound, Vancouver

Harbour and Sturgeon Bank had no feasible land in close proximity for storage. Trans Mountain further determined that Boundary Bay had insufficient water depth for a marine terminal, and a terminal location at Washington State would require a longer pipeline, depending on terminus location.

Trans Mountain conducted a screening level assessment to assess the Roberts Bank alternative location further. The assessment was conducted based on desktop studies of technical, economic, and environmental considerations for marine access, storage facilities, and pipeline routes to a terminal at that location.

Trans Mountain said that the potential sites in the Lower Mainland and the estuary of the Fraser River delta represent complex environmental values, multiple stakeholders, regulatory regimes, and Aboriginal interests. For the purposes of the screening assessment, Aboriginal concerns and interests for the Roberts Bank alternative 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.

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. The Roberts Bank alternative would require a land area of approximately 100 acres for 20 storage tanks, as well as ancillary equipment and buildings, a larger dock structures with a 7 km trestle, and a 14 km longer pipeline that diverges further from the existing pipeline corridor. This alternative would result in an estimated $1.2 billion higher capital cost and assumed higher operating costs.

Trans Mountain said that while both the Westridge and Roberts Bank terminal alternatives have positive and negative attributes, the WMT was selected as the preferred alternative.

Participants, including the City of North Vancouver, raised concerns about the proposed expansion of the existing WMT and assessment of alternative marine terminal locations.

The City of Burnaby said that Trans Mountain did not provide an assessment of the risks, impacts, and effects of the alternate locations proposed for the marine terminal at Kitimat, B.C., or Roberts Bank in Delta, B.C. The City of Burnaby noted that both the alternate locations are more remote than the WMT and are likely to pose significantly fewer risks to tankers than the WMT, and have significantly fewer impacts to densely populated areas.

Applied-for alternative pipeline corridor placements

Trans Mountain said that, while it has finalized a preferred pipeline corridor, it identified technically feasible alternative corridors in a limited number of specific areas in response to issues raised during Aboriginal, stakeholder and landowner engagement. Trans Mountain said that these alternative corridors provide the flexibility to address remaining Aboriginal, landowner or stakeholder issues. Table 15 identifies the alternate corridors for which Trans Mountain is seeking approval.

Table 15: Alternate pipeline corridors

Alternate corridor name	Rationale for applying for alternate corridor
Westridge Delivery Lines (using conventional pipeline construction)	Trans Mountain said that in response to feedback from residents and stakeholders in Burnaby requesting that the Project routing minimize disruption to their residential and developed areas, Trans Mountain revised its preferred pipeline corridor for the Westridge Delivery Pipelines to a trenchless installation by tunneling through Burnaby Mountain and underneath Barnet Marine Park. In the event that the tunnel construction method through Burnaby Mountain and under Barnet Marine Park is not feasible, Trans Mountain proposes to use an alternate corridor, which is a trenched pipeline construction following Burnaby streets and the Canadian Pacific rail line from the Burnaby Terminal to the WMT.
River Crossing Contingencies: 1. Pembina River Crossing Contingency Alternate 2. Raft River Crossing Contingency Alternate	In the event of a potential failure of the proposed horizontal directional drilling (HDD) installation, an alternate is required at separate locations to meet the technical requirements of conventional installation methods
B.C. Provincial Parks: 1. Finn Creek Provincial Park 2. North Thompson Provincial Park 3. Lac du Bois Protected Area	The preferred pipeline corridors are subject to the approval of Boundary Amendment application to B.C. Parks. In the event the Boundary Amendment is not approved, an alternate corridor is required outside of the Park boundaries

Route re-alignments outside of proposed preferred pipeline corridor

Trans Mountain said that, as of the close of the evidentiary record for the hearing, it was still investigating several alternate pipeline corridors outside of the proposed preferred pipeline corridor it had presented in its Application. These are in proximity to:

- Edmonton Lewis Estates community;
- Ohamil Indian Reserve 1;
- Tzeachten Indian Reserve 13;
- Surrey Bend Regional Park; and
- Coquitlam between Hartley Avenue and United Boulevard or Brigantine Drive.

In order to accommodate these potential alternate corridors, Trans Mountain requested approval from the Board for the preferred pipeline corridor with a condition that, concurrent with the filing of the PPBoR pursuant to section 33 of the NEB Act, Trans Mountain would file with the Board a description of, and supporting information for, any proposed detailed route re alignments located outside of Trans Mountain's preferred corridor.

Edmonton – Whitemud Drive / Lewis Estates

Trans Mountain identified its preferred corridor route as aligning within the Edmonton Transportation/Utility Corridor, including Whitemud Drive, because the original pipeline, which bypassed the city boundaries when first built, was now located within the city boundaries.

The City of Edmonton objected to Trans Mountain's use of Whitemud Drive due to the negative impact it would have on the adjacent landowners. The City of Edmonton objected to how the proposed pipeline would increase the City's cost of operating and maintaining the affected portions of Whitemud Drive, and interfere with plans to expand the roadway. It said that it supported an alternate route traversing the Lewis Estates community.

Trans Mountain said that it would work with the City of Edmonton to mitigate conflicts related to the physical alignment and design of the pipeline and the future Whitemud Drive expansion. It committed to further investigate the Lewis Estates alternate route which could impact numerous additional residences.

Ohamil Indian Reserve 1

Trans Mountain proposed a preferred pipeline corridor that avoided crossing the Ohamil Indian Reserve 1 and is located within the Trans-Canada Highway easement. Trans Mountain said that, due to uncertainty regarding the process of acquiring sufficient legal rights and whether the pipeline can be located within the Trans-Canada Highway easement, it was investigating an alternate pipeline corridor that would cross the Ohamil Indian Reserve 1.

Tzeachten Indian Reserve 13

Trans Mountain said that it and Tzeachten Indian Band entered into an Agreement in Principle that would allow its preferred pipeline corridor to traverse Tzeachten Indian Reserve 13 and be located adjacent to the existing TMPL RoW. Trans Mountain said that discussions were ongoing and that route options, both on and off Tzeachten Indian Reserve 13, remain under consideration.

Surrey Bend Regional Park

Several intervenors raised concerns about proposed alignment of the pipeline corridor through the Surrey Bend Regional Park with concerns raised about potential effects on the bog ecosystem in the park. The City of Surrey and Metro Vancouver submitted an assessment in support of two alternative routes that would avoid the Surrey Bend Regional Park. Trans Mountain said that, unless the B.C. Ministry of Transportation and Infrastructure were to grant Trans Mountain a variance and share their RoW, neither of the alternative options presented were possible.

Trans Mountain said that a custom construction methodology would be used to limit intrusion into park land, which Trans Mountain would completely rehabilitate. It said that the concerns about the proposed corridor through the park are manageable and can be mitigated to provide a no-net-loss solution. Trans Mountain said that it is nonetheless committed to continue to pursue and investigate options with the B.C. Ministry of Transportation and Infrastructure to share its RoW and avoid the park.

A detailed discussion of Project effects on wetlands (including bogs), the mitigation and compensation committed to by Trans Mountain, and the Board's views on these, is included in Chapter 10.

Coquitlam - Schooner Street

Trans Mountain proposed that the pipeline follow the existing Trans Mountain pipeline RoW in Coquitlam at Schooner Street until it reaches a residential area on Schooner Street, where it would divert away from the existing RoW.

The City of Coquitlam requested that Trans Mountain revise the proposed corridor to avoid impacts to prominent businesses, industrial vacancies and proximity of City utilities within Schooner Street. It proposed a re-route away from Schooner Street along an alignment between Hartley Avenue and United Boulevard. Trans Mountain said that this re-alignment has the potential to impact new businesses.

Views of the Board

The Board finds that Trans Mountain's route selection process, route selection criteria, and level of detail for its alternative means assessment are appropriate. The Board further finds that aligning the majority of the proposed pipeline route alongside, and contiguous to, existing linear disturbances is reasonable, as this would minimize the environmental and socio-economic impacts of the Project.

The Board acknowledges the concern raised by the City of Burnaby that Trans Mountain did not provide an assessment of the risks, impacts and effects of the alternate marine terminal locations at Kitimat, B.C., or Roberts Bank in Delta, B.C. The Board finds that Trans Mountain has provided an adequate assessment, including consideration of technical, socio-economic and environmental effects, of technically and economically feasible alternative marine terminal locations.

With respect to the route deviations, the rationale for most deviations was to reduce the potential for land use conflicts. Therefore, the Board finds the proposed deviations and supporting criteria to be appropriate.

The Board recognizes that some parties have concerns about the many route changes proposed since the Project was announced. While route changes may have been confusing for some, a number of the changes were the result of input from Aboriginal groups, landowners and communities along the right-of-way (RoW), as well as government stakeholders. The Board acknowledges that several intervenors did not agree with the route selection process and that it may not have produced desired or acceptable route selection outcomes for some participants. The Board notes that the detailed route for the Project has not been finalized, and that this hearing assessed the general route for the Project, the potential environmental and socio-economic effects of the Project, as well as all evidence and commitments made by Trans Mountain regarding the design, construction and safe operation of the pipeline and associated facilities. While finalizing the detailed pipeline route, the Board expects Trans Mountain to continue engaging with affected people and communities, and to continue to be responsive to, and address to the extent possible, any concerns raised.

The proposed Project would cross four parks and protected areas that would require the temporary adjustment of those park boundaries. The Board notes the existing process under the B.C. Park Act, and the Provincial Protected Area Boundary Adjustment Policy, Process and Guidelines for provincial park boundary adjustments, to facilitate construction within a park. This required Trans Mountain to submit an assessment to B.C. Parks to outline alternatives that would avoid the use of protected lands and the reasons those alternatives are not considered feasible.

The Board understands Trans Mountain's preference for flexibility at this stage of the Project with respect to part of the routing. Specifically, Trans Mountain is seeking approval from the Board for six alternative corridors, so that it can make a decision at a later stage regarding which of the corridors would form the final route. It is the Board's view that sufficient information has been provided to consider all corridors, including these six alternatives. Trans Mountain must subsequently select one corridor prior to filing its Plan, Profile and Book of Reference (PPBoR) with the Board. Until the final corridor is selected, the Board directs Trans Mountain to consider and include both preferred and alternate corridor information when filing any follow-up reports or fulfilling any conditions (to the extent that the reports or conditions apply to each corridor).

The Board is of the view that the opportunity exists for detailed route alignments that may further minimize impacts to those directly affected. The Board acknowledges the consideration by Trans Mountain, in consultation with Shxw'ōwhámel First Nation, Tzeachten First Nation, and the B.C. Ministry of Transportation and Infrastructure, of three route re alignments that extend beyond the applied-for corridor width of Trans Mountain's preferred route, in proximity to Ohamil Indian Reserve 1, Tzeachten Indian Reserve 13, and Surrey Bend Regional Park, respectively.

If the Project is approved, Trans Mountain will be required to prepare a PPBoR that depicts the proposed detailed route of the Project. The Board would impose Condition 7 requiring Trans Mountain to file, with its PPBoR, an environmental and socio-economic assessment of each proposed route re alignment, including an update on its consultation with all appropriate government authorities, potentially affected Aboriginal groups and affected landowners and tenants.

With respect to Trans Mountain's request for approval of the proposed route re alignments in proximity to the Lewis Estates community in Edmonton, AB, and United Boulevard and Hartley Avenue in Coquitlam, B.C., these re-alignments extend beyond the applied-for RoW width of Trans Mountain's preferred route and were not filed with the Board until late in the regulatory process. Given the late filing and the insufficient evidence to assess Trans Mountain's consultation, and the potential socio-economic and environmental effects associated with these proposed route re-alignments, the Board denies Trans Mountain's request, without prejudice to Trans Mountain filing an application for a variance under section 21 of the NEB Act. The Board notes Trans Mountain's commitment that all land acquisition would comply with the provisions of the National Energy Board Act. The Board has reviewed Trans Mountain's anticipated requirements for permanent and temporary land rights and finds these to be appropriate. The Board also finds that, based on the evidence before the Board at this time, Trans Mountain's process for the acquisition of land rights is appropriate.

With respect to Trans Mountain's request that the Board issue an order, pursuant to section 58 of the NEB Act, exempting Trans Mountain from the requirements of subsections 31(c), 31(d)

and 33 of the NEB Act in relation to yet to be specified, select temporary lands or infrastructure required for construction of the Project, the Board grants this exemption order. However, given the preliminary nature of the locations of temporary lands filed with the Application, and concerns expressed by potentially affected parties, the Board would impose Condition 60 requiring Trans Mountain to file a finalized list of locations for all temporary lands to be used, and an environmental and socio-economic assessment of each location including an update on its consultation with all appropriate government authorities, potentially affected Aboriginal groups, and affected landowners and tenants.

This section 58 Order would only come into effect if the Governor in Council directs the Board to issue a Certificate in respect of the Project, and when such a Certificate, if directed, is issued.

11.2 Occupancy and resource use

Trans Mountain said that the Alberta portion of the proposed pipeline corridor crosses trapping areas and land used for agricultural, commercial, industrial, oil and gas, recreational, and rural and urban residential purposes. The B.C. portion of the proposed pipeline corridor crosses trapping areas and land used for agricultural, commercial, forestry, industrial, mining, recreational, rural and urban residential, guide-outfitting and tourism purposes. Trans Mountain said that the Project has the potential to affect local communities, Aboriginal groups and other stakeholders engaging in these types of activities.

11.2.1 Forestry

Trans Mountain identified numerous forest tenures or land dispositions related to forestry along the proposed pipeline corridor, including timber management areas, Crown tenures, other forestry-related tenures and in B.C., Old Growth Management Areas.

Trans Mountain said that, as a result of clearing necessary for pipeline construction, there will be a loss of forestry resources and a reduction of land base for timber harvest during construction and operations. It said that exact short- or long-term loss of forestry resources would be determined once the RoW has been finalized.

Trans Mountain said that it planned to use existing linear disturbances (including the existing TMPL RoW) and existing temporary workspace in order to reduce the disturbance of forestry and timber resources, and maximize the land available for future timber production. It said that it would notify and consult with all affected licensees or permit holders, and compensate timber tenure holders where economic loss is proven and necessary.

Aboriginal groups, including Alexander First Nation, Alexis Nakota Sioux Nation, Enoch Cree Nation, Ermineskin Cree Nation, Montana First Nation and Samson Cree Nation, expressed concerns about the loss of merchantable timber along the RoW and how timber would be salvaged. Trans Mountain said that prior to clearing, a scope of work would be drafted for clearing activities, including a Timber Salvage Management Plan. In addition, Trans Mountain said that it would schedule meetings with Aboriginal groups to gain feedback and explore opportunities for clearing and timber harvest.

11.2.2 Aggregate, mineral, and oil and gas resource activities

Trans Mountain said that land in certain areas along the proposed pipeline corridor and throughout the Project study area, specifically in the rural Alberta and Fraser-Fort George/Thompson-Nicola regions, is used for mineral, aggregate, and oil and gas resource development and infrastructure.

Trans Mountain said there would be some reduction in land base for subsurface activities, including oil and gas activities, and mineral and aggregate extraction, as a result of construction of the Project. It said that the reduction in land base would occur primarily in the limited areas where the proposed pipeline corridor deviates from the existing TMPL RoW and affects new land. Trans Mountain said that, where the proposed pipeline corridor already follows the existing TMPL RoW and other linear disturbances, future subsurface and extraction potential has already been limited.

Trans Mountain said that its proposed mitigation measures include advanced notification and consultation about the construction schedule to coordinate planned activities, and secure agreements with Crown subsurface rights holders, where required.

11.2.3 Trapping, hunting, and recreational fishing

Trans Mountain said that trapping, hunting, fishing and outfitting activities occur along the proposed pipeline corridor and throughout the Project study area. Trans Mountain said that construction activities will overlap with hunting seasons and trapping activities. These may cause disruption to resource users in the immediate vicinity of construction activities, including disruption of livelihood or use patterns for individuals that use land and resources for outfitting, trapping, hunting and fishing.

Trans Mountain said that it planned a variety of measures to mitigate the construction-related effects, including:

- providing advanced notification of construction schedules;
- direct notification to affected tenure holders; and
- compensation to affected trappers according to established industry and provincial protocols, if reduced fur harvest and lost revenue is proven.

Trans Mountain said that in the event of a spill, recreational fishing, hunting and trapping activities could be disrupted due to restricted or prohibited access at the source site and response area. For recreational fishing, these restrictions would typically apply during the active cleanup period, but could extend until affected resources are stable or recovered. Trans Mountain said noise and traffic associated with emergency response activities could cause further disturbance to trapping activities in the areas immediately around response sites, and this could result in reduced trapping success.

11.2.4 Use of designated recreational areas, protected areas and non-consumptive areas

Trans Mountain identified a number of parks and protected areas with known human uses that are crossed by the proposed pipeline corridor, and that could be disturbed during construction activities and during periods of site-specific maintenance. It said that it considered outdoor recreation stakeholders and their activities in these areas, including camping, snowmobiling, skiing, ATVing, mountain biking, mountaineering and hiking, wildlife viewing and rafting groups.

Trans Mountain said that the overall Project-related effects on parks and protected areas are associated with the potential construction-related physical disturbance to natural and built features that may have intrinsic, interpretive and recreational value. It said this could result in a change in access and use patterns to certain recreational areas within parks as people divert to other areas to avoid construction-related sensory effects, including nuisance air emissions, noise and visual effects. Trans Mountain said that the effects may also result in an overall decrease in the quality of the outdoor experience of Aboriginal and non-Aboriginal users during construction and, at times, during site-specific maintenance.

Trans Mountain said that a pipeline spill could affect the tourism and recreation industry both by directly disrupting the activities of tourists and recreationalists and by causing economic effects to recreation or tourism-based businesses. In the event of a spill, boating and camping may be restricted or prohibited at the source site and downstream. These restrictions would typically apply during the active cleanup period, but could extend until affected resources are stable or recovered.

Several participants, including the Hinton Mountain Bike Association and Calvin Taplay, provided descriptions of the many recreational activities that are available to users along the RoW. They said that interruption to these activities during construction and operation, or as a result of spills, could affect their ability to enjoy these recreational areas.

Participants expressed concern that the proposed pipeline route across parks and trail systems could result in a reduction in undisturbed nature, and provide additional access points for individuals to use the trails for purposes other than their designated use. Metro Vancouver said that it would be detrimental for the proposed pipeline to traverse through environmentally sensitive ecosystems where installation is challenging, maintenance and monitoring is difficult, and where a pipeline breach and spill could have catastrophic consequences that would be difficult or impossible to fully address.

The Parks Canada Agency said that reactivation of the existing pipeline in Jasper National Park has the potential to impact the local tourism industry. It recommended requiring Trans Mountain to schedule reactivation activities outside of the summer peak tourist season to minimize the conflicts between potential tourist use and pipeline reactivation traffic along existing access routes.

Trans Mountain said that it would implement a number of mitigation measures to reduce disturbance to valued natural or built features, including:

- minimizing disturbance to recreational trails and use areas;
- providing advanced notification and consultation with appropriate authorities and land users prior to construction;
- reducing sensory disturbance (e.g., through noise and dust abatement); and
- working with potentially affected stakeholders when completing the final design for Traffic and Access Control Management Plans.

Trans Mountain said that even with mitigation measures, certain natural features with intrinsic values could be disrupted depending on the final RoW selection and that residual sensory disturbance would occur.

11.2.5 Residential land use

Trans Mountain said there are a number of residential use areas, including playgrounds, schools and housing that are crossed by the proposed pipeline corridor. In order to reduce or avoid more densely populated residential areas, Trans Mountain said that it made several routing decisions, such as:

- following the proposed new Highway 16 to avoid a number of residential properties in the Town of Hinton, Alberta;
- revising the preferred pipeline corridor in the City of Chilliwack, B.C. area to follow a B.C. Hydro RoW to avoid Watson Elementary School playground, several rural properties and three high density residential subdivisions; and
- diverting from the existing TMPL RoW in the Township of Langley and the City of Surrey, B.C. to minimize encroachment on urban areas.

Trans Mountain said that, despite these alternations to the route, construction could disturb features such as yards, fences, storage sheds, garages, or other features on residential properties, and community use areas, such as schools, playgrounds and other public facilities. Trans Mountain said that aesthetic disturbances and access restrictions would result from construction activities. Potential socio-economic effects of large spills will vary depending on the exact location and nature of the incident; however, pipeline spills may potentially damage homes resulting in costs for individuals.

Several participants, including Geoffrey Senichenko and the Simon Fraser Student and Graduate Student Societies at Simon Fraser University, expressed concern regarding the impact the Project would have on residences and quality of life. They said that the Project is unsuitable for large urban areas, particularly in the Lower Mainland region, due to the proximity to residences and schools. They say that these factors increase public safety issues.

Intervenors raised concerns regarding the level of disruption to fully developed residential neighborhoods during construction, and a lack of comprehensive traffic mitigation and noise management plans. They were also concerned about the impact a spill, accident or malfunction would have on their daily lives. Burnaby Residents Opposing Kinder Morgan Expansion (BROKE) described the impact and damage caused by the 2007 Burnaby rupture as an example of potential impacts on residential property and quality of life.

Trans Mountain said that it has developed a Socio-Economic Management Plan (SEMP) that will reduce effects on the human environment, with a number of measures focused on managing and reducing effects in an urban environment. It committed to develop and implement an issues tracking process to monitor and respond to Project-related socio-economic issues and opportunities that emerge during construction and reclamation. Trans Mountain committed to:

- avoiding the disturbance of built features to the greatest extent practical;
- consulting with governments and residents regarding specific construction activities and schedules in residential areas; and
- providing compensation to private land and property owners, according to established industry protocols, where losses or damages are proven.

11.2.6 Westridge Marine Terminal (WMT)

Trans Mountain said that the WMT is located near residential, commercial, recreational and industrial land uses. The nearest residences to the facility are approximately 75 m south of the WMT property boundaries. There is a range of marine vessel traffic, commercial fishing activity and recreational use in the area of Burrard Inlet around the WMT.

Trans Mountain said that construction-related activities at the WMT will result in numerous barge deliveries to the site, as well as other construction-related traffic around the new dock area. These activities could result in disruption to marine access and use patterns for all marine users, Aboriginal traditional users, commercial, recreational and tourism users, as people divert to other areas to avoid construction activities. Commercial users could experience minimal delays when accessing marine terminals in Port Moody Inlet during construction. Trans Mountain said that a decrease in quality of the experience of Aboriginal and non-Aboriginal marine commercial, recreation and tourism users could occur and result in a temporary change in business practices for tourism operators.

In order to lessen potential negative effects, Trans Mountain committed to communicating construction activities and schedules to the marine community in Burrard Inlet to allow users to consider alternate movement patterns during construction. This would include advanced announcements in local newspapers and the placement of warning signs offshore and onshore near the construction activities.

Trans Mountain said that the presence of the expanded dock complex at the WMT during operations could cause disruption to recreational and traditional marine users due to marine traffic congestion. This effect could be more prominent when tankers are berthed at the terminal. It said that the area available for fishing could be permanently reduced as a result of the dock expansion and increased presence of tankers.

Trans Mountain said the existing WMT is visible from numerous points on and near the south and north shore of Burrard Inlet in the Metro Vancouver Region. While the new docks will extend further into Burrard Inlet, the current design has explicitly reduced the potential incremental visual impact, particularly for nearby residential areas on the south shore of Burrard Inlet.

Trans Mountain said nuisance air and noise emissions will occur during operations and periodic site-specific maintenance activities as a result of pumps, ship loading, ship berthing (including anchor chains) and support equipment located on the site. It said that the types of sounds would be similar to those already generated on the site; however, sounds related to ship loading and berthing could occur more frequently.

Several participants described their regular activities in the area of Burrard Inlet around the WMT and identified issues, including increased noise and light, which are of concern to residents and marine users.

Tsleil-Waututh Nation said that certain direct effects of Project-related activity at the WMT could result in loss of quiet and privacy for its members carrying out cultural obligations.

The North Shore No Pipeline Expansion (NS NOPE) estimated that the WMT expansion would leave only 800 m of passage between docked tankers and the lighthouse at Cates Park. It said this would create a bottleneck for boat traffic, which could lead to an increase in collisions. NS NOPE said the Project is incompatible with current and future residential and recreational uses, that the WMT and the anchorages currently used already negatively affect residents and users of Cates Park, and that the proposed expansion will increase these impacts.

Trans Mountain said that it worked extensively with Port Metro Vancouver (PMV), the Pacific Pilotage Authority (PPA) and the B.C. Coast Pilots to determine a preferred dock layout at the WMT. It also incorporated feedback from the City of Burnaby and from community discussions into the Environmental and Socio-economic Assessment (ESA). Trans Mountain said that it considered approximately 20 layouts during the evaluation and study process, and would design the dock to reduce visual effects on nearby residential areas, minimize interference with existing anchorages, and reduce its footprint on Burrard Inlet.

Trans Mountain said that noise levels from tankers at anchorage would occur, but that noise levels at the nearest homes would be in compliance with *B.C. Oil and Gas Commission Noise Control Guidelines (2009)*. A predictive noise modelling study would be done and the results used to determine if any noise reduction measures are required. Trans Mountain committed to adhere to all applicable federal and provincial guidelines, regulations and legislation for noise management. It also committed to conducting an area lighting study on impacts to the surrounding communities.

11.2.7 Agricultural land use

Trans Mountain said that land use along approximately 49 per cent of the new pipeline ROW is agricultural, including pasture and grazing, field crops, organic and specialty crops, and livestock and poultry facilities.

Trans Mountain said that, during specific periods of construction and site-specific maintenance, agricultural land use patterns could be disrupted or restricted, resulting in an inability to use land for crops and lost productivity. Other potential effects include noise and vibration, potential weed infestations, and interference with watering systems.

Trans Mountain said that a spill could cause negative economic effects on agricultural land use due to the restriction of movement of livestock and planting or harvesting in the affected area, as well as loss of vegetation and soil productivity as a result of soil contamination. Contamination of water sources may require farmers to bring water in from out of the area to irrigate crops or to water livestock. The extent of these effects would depend on several factors, including volume, product and length of exposure. In the event of effects on businesses or landowners, Trans Mountain said it will make initial mitigation efforts to contain the hydrocarbon release, followed by clean up and restoration of the site. Landowners and businesses will be compensated for impacts directly resulting from a hydrocarbon release.

Yarrow Ecovillage expressed concern with respect to impacts of pipeline construction on its physical assets, including a waste water treatment system, irrigation, and hothouse operation. Trans Mountain said that current routing of the RoW and temporary workspace (TWS) alleviates most of the physical asset impact issues. It committed to placing the proposed pipeline within the existing 18 m TMPL RoW, ensuring the waste water ponds and marsh located north of the RoW and TWS will not be impacted by construction, developing a strategy that ensures that adequate temporary irrigation lines are installed and that permanent irrigation lines are re-established as quickly as possible after construction, and maintaining access to the south portion of the Yarrow Ecovillage property at all times during construction.

The Collaborative Group of Landowners Affected by Pipelines expressed concern that the proposed pipeline will cause problems related to crop productivity after construction due to depth of cover and soil compaction issues. It requested that the Board impose several conditions that it said would ensure landowners are properly compensated for damage resulting from construction, ongoing inspection, maintenance or repair, and that it suggested would address what it believes are areas of vagueness in the NEB Act regarding compensation matters.

To mitigate these and other Project-related effects, Trans Mountain committed to, among other measures:

- developing a Land Program Execution Plan that incorporates all specific commitments made to individual landowners during the construction planning process, and consult the Land Program Execution Plan throughout the pipeline construction activity phases for identification of specialized land uses and any unique, specialized construction practices;
- ensuring that a professional Agrologist is onsite during construction activities on all farms in the Lower Mainland of B.C.;
- ensuring general and farm-specific agricultural biosecurity protocols are adhered to;
- consulting with landowners regarding notification preference and construction schedule; and
- compensating for disturbance activities resulting in productivity loss, if necessary.

11.2.8 Industrial and commercial use areas

Trans Mountain said that the proposed pipeline corridor would cross a number of industrial and commercial areas, and that some businesses may be physically disturbed or experience disruptions related to noise and dust from construction activities. Where municipal roads are being used for construction, nearby businesses could experience disrupted access, resulting in reduced visits to these business during construction. Trans Mountain said that pipeline spills could potentially damage business and commercial establishments, resulting in lost income for affected neighbourhood businesses.

The City of Coquitlam said that the proposed pipeline alignment along Hartley Avenue, Schooner Street and United Boulevard would be located near significant commercial businesses, which are largely dependent on motorist traffic. It said that prolonged construction could result in business loss and contribute to high industrial vacancy rates.

Trans Mountain committed to a number of mitigation measures to decrease Project-related effects, including:

- consulting with affected stakeholders;
- avoiding key use areas to the greatest extent possible;
- using urban pipeline construction practices to reduce nuisance emissions;
- providing alternate access routes for local businesses, where practical; and
- providing compensation agreements to address any direct economic loss.

11.2.9 Municipal land use and bylaws

Trans Mountain said that numerous areas of land use and development plans are crossed by the proposed pipeline corridor. These include areas zoned or otherwise noted for a range of uses or protection, including environmental significance, residential, commercial and industrial use, parks and natural areas, trail systems, resource/mineral potential and community watersheds.

Several municipalities expressed concern that the proposed Project may contravene existing municipal bylaws. Several noted that approval of permits and variances to bylaws may be required. The City of Burnaby provided a summary of 13 bylaws with which the Project could conflict. The City of Burnaby said that it strictly enforces its bylaws, in accordance with its duty to its citizens, and that it intends to maintain this practice with regard to the Project, should it be approved. As such, in many cases where its City bylaws require permits, the City of Burnaby said it may choose not to facilitate the construction of the Project, and such permits may be denied. Absent any explanation by Trans Mountain that the proposed activities could be completed in compliance with Burnaby bylaws, the City of Burnaby said that the proposed activities must be considered unlawful.

Several municipalities expressed concern that the proposed Project may conflict with existing and future land use plans, particularly in areas of dense urbanization. The City of Edmonton expressed concern that the proposed Project would impact the City's future land use planning along Whitemud Drive. It said that it plans to make significant improvements to Whitemud Drive in the next 20 years, particularly at 207 Street, 215 Street and 231 Street, and having the Project pipeline in the Whitemud Corridor would restrict the City's ability to optimize the design of its future infrastructure for the area and would substantially increase the cost of realizing the planned expansion. The City of Edmonton also said that the proposed Project would severely restrict the City's ability to implement a naturalization plan for the affected portions of Whitemud Drive.

The City of New Westminster expressed concern that pipeline construction may limit the ability of New Westminster to meet its local and regional land use planning objectives for residential park and trail development, as well as restoration and enhancement plans as outlined in the several city policies, official community plans, as well as in Metro Vancouver's Ecological Health Action Plan. Specific areas of concern which may be impacted included developing a recreational greenway in the Brunette Valley corridor, the planned Sapperton Green development, and a pedestrian crossing over the Brunette River to connect the cities of New Westminster and Coquitlam to form part of the local/regional greenway.

Trans Mountain said that it anticipates engaging with municipal representatives, through the formation of technical working groups, to ensure that goals are respected and adhered to for long-term land development. Trans Mountain said it would apply for, or seek variance from, all permits and authorizations that are required by law, and would continue to work with all municipalities to understand the applicability of bylaws and standards related to the construction and operation of the Project.

11.2.10 Navigation and navigation safety

The NEB Act requires the Board, when making its recommendation, to take into account the effects that the issuance of a certificate in respect of a pipeline that passes in, on, over, under, through or across navigable waters, might have on navigation, including safety of navigation. Jurisdiction over shipping safety remains with Transport Canada.

The Board has considered the potential of the pipeline crossings, marine terminal, and ancillary works related to the project to adversely affect navigation and navigation safety at navigable waters.

Trans Mountain said that the proposed pipeline corridor would cross four watercourses considered navigable, 34 watercourses considered potentially navigable and 92 potentially navigable wetlands in Alberta. In B.C., the proposed pipeline corridor would cross 49 watercourses considered navigable, 70 watercourses considered potentially navigable and 84 potentially navigable wetlands. Activities associated with reactivated segments of the existing TMPL are not proposed to be located in, on, under, over, through or across a navigable watercourse or wetland.

Potential for one navigable wetland was identified by Trans Mountain at the Blackpool Pump Station; however, Trans Mountain said that the wetland would not be affected by construction work at the facility.

Trans Mountain said that the power line associated with the Black Pines Pump Station is proposed to cross the North Thompson River, while the power line associated with the Kingsvale Pump Station is proposed to cross nine potentially navigable wetlands.

Trans Mountain said that the existing WMT is located in Burrard Inlet, which is a key navigable waterway. Trans Mountain said that commercial traffic in Burrard Inlet includes cargo ships, oil tankers, cruise ships and container ships. Burrard Inlet is also used intensively for recreational navigation.

Trans Mountain said that, during the construction phase for the WMT, marine users could inadvertently enter the construction zone at the marine terminal, which may have implications for the safety of commercial, recreational, tourism and Aboriginal users of Burrard Inlet who typically travel in the vicinity of the marine terminal. Trans Mountain said that some minor disruption to marine access and use patterns could occur during operations related to the presence of the expanded dock at the marine terminal and its increased footprint in the Burrard Inlet.

Trans Mountain said that navigation and navigation safety are not considered to interact with the construction and operation at the Edmonton, Burnaby or Sumas terminals since the proposed work at these facilities would not be located a near a navigable waterway.

Trans Mountain said that potential offsets for serious harm to marine fish would involve construction of subtidal rock reefs within the Eastern Burrard Inlet Rockfish Conservation Area. It said that it would need to locate the rock reefs to ensure safe navigation of vessels is not affected. Trans Mountain said that the top of the reefs would be no less than 4 m below chart datum, ensuring that the constructed reefs do not pose a hazard to navigation.

The City of Burnaby asked Trans Mountain to describe how the WMT would impact marine navigation in Burrard Inlet, including use by recreational marine vessels. The City of Burnaby asked Trans Mountain how it would amend its application either to ensure that there would be no impact to marine navigation, or to select a different terminus.

Trans Mountain said that the potential effects of the expansion of the WMT on navigation in Burrard Inlet, including on recreational marine users, are primarily considered to be related to access through the eastern portions of Burrard Inlet during Project construction. With respect to operations of the expanded terminal and facilities, marine users are anticipated to adapt to the presence of the expanded dock over the long term, such that movement patterns would resume. To ensure optimal navigation safety, Trans Mountain designed the dock to specifically not interfere with existing anchorages and to minimize its footprint in Burrard Inlet.

Trans Mountain committed to a number of mitigation measures to minimize the impact of the Project on navigation and navigation safety, including marine navigation and navigation safety in the Burrard Inlet related to the expanded WMT. Trans Mountain committed to standard mitigation as part of its SEMP and EPP to reduce Project effects on navigation and navigation safety in the freshwater and marine environments.

11.2.11 Visual and aesthetic resources

Trans Mountain said that the visual quality of the landscape adjacent to the RoW or other construction areas could be adversely affected by the Project over the short-term due to land disturbance and activities during periods of construction and site-specific maintenance. There could also be periods of night lighting around construction sites.

Trans Mountain committed to a number of mitigation measures to reduce the short-term visual effects of construction, including narrowing the RoW to reduce the number of trees to be removed, installing trees and shrubs at potential access points and viewsheds, and ensuring that lighting for all construction activities is directed downward, where feasible.

Trans Mountain said that, in certain areas, the Project is anticipated to have longer-term visual effects related to the presence of the new pipeline RoW and new or expanded above ground structures. It said this may, for some land and resource users, affect their visual experience, and that this effect would be considered a nuisance or inconvenience.

A number of intervenors raised concerns related to permanent tree loss and replacement within urban areas along either the preferred or the alternative routes. Many said that trees could potentially be removed, affecting the quality of life for residents, as well as the ecological services these trees provide in an urban context.

Trans Mountain said that the potential long-term visual effects would be reduced by paralleling an existing linear disturbance for a majority of the route, maintaining existing vegetation buffers, re-seeding of disturbed land in accordance with the Pipeline Reclamation Management Plan, and engaging a qualified arborist to develop a Tree Plan specific to municipal lands in consultation with the municipality and landowners.

The Province of British Columbia requested the Board impose a condition requiring Trans Mountain to conduct additional visual modelling of select locations, identified in consultation with stakeholders including the Province of British Columbia, where the proposed pipeline corridor deviates from the existing TMPL system RoW. The condition would require Trans Mountain to share the modelling results and, through consultations, identify any additional site-specific mitigation. Trans Mountain said that although it has already made such commitments, it would accept such a condition.

Trans Mountain said that the proposed new tanks at the Edmonton, Sumas and Burnaby terminals would be situated in existing disturbed industrial areas, which would minimize their visual and aesthetic effects.

Trans Mountain said that the visual impacts of the Black Pines Pump Station are considered minimal to substantial, depending on the observer viewpoint, and committed to landscape the station to limit visual impacts. No notable change in visual quality is anticipated for the remaining pump stations.

Views of the Board

The Board acknowledges that the Project would pass through areas of importance to many groups and stakeholders, including Aboriginal groups, landowners, communities, tourists and recreational users. The proposed pipeline corridor traverses parks and other areas, including Jasper National Park, Surrey Bend Regional Park and Colony Farm Regional Park, used for a variety of recreational pursuits. In the case of residential, agricultural and industrial land use, the Board notes that Trans Mountain's preferred corridor alignment attempts to maximize the use of existing rights-of-way (RoWs) and provide for greater pipeline routing flexibility, where possible.

The Board notes that Trans Mountain has committed to notifying and consulting with current land users and landowners. Trans Mountain has also developed a socio-economic management plan, which outlines measures that would be implemented to mitigate potential adverse effects on the many land users that could be affected by the Project. As discussed further in Sections 11.3 and 11.4, the Board would impose Condition 13 requiring Trans Mountain to file with the Board a plan for monitoring the potential adverse socio-economic effects resulting from construction activities.

The Board finds Trans Mountain's approach to consult with relevant authorities and affected stakeholder groups to develop plans that will reduce disturbance within parks and recreational areas is appropriate. The Board also finds Trans Mountain's programs for working with potentially affected landowners and land users to identify and address site specific land-use interests in its detailed route design and pipeline land agreements, where possible, appropriate for reducing potential disruptions and Project effects. The Board is of the view that Trans Mountain's proposed mitigation measures and commitments can effectively address the Project's potential effects on land use and land users.

Regarding the concerns expressed about compensation for damages from the construction and operation of the proposed pipeline, section 75 of the National Energy Board Act (NEB Act) requires

companies to do as little damage as possible and make full compensation for all damages sustained by persons as a result of the companies' exercise of their powers under the NEB Act. Sections 88 – 103 of the NEB Act set out processes for negotiation and arbitration to settle compensation matters, and these matters are the responsibility of the federal Minister of Natural Resources.

The Board acknowledges the many concerns expressed about the proposed tunnel for the pipeline through Burnaby Mountain. The Board considered these concerns, and all evidence on the record with respect to the proposed tunnel. The Board finds that, although both the preferred and alternate corridor routes for the Westridge Delivery Lines are acceptable, the proposed route through Burnaby Mountain is the preferable route because it avoids residential areas and urban infrastructure, reduces environmental effects during construction and operation, and minimizes risk during operation.

Generally speaking, companies are expected to obtain any federal, provincial or municipal permits or authorizations required by those jurisdictions, and Trans Mountain has committed to comply with, or seek variance from, all municipal bylaws, including those involving noise. To ensure that noise impacts associated with the construction of the Project will be addressed, the Board would impose Conditions 74, 80 and 86 requiring Trans Mountain to file noise management plans prior to construction for work involving the tunnel construction for Burnaby Mountain, horizontal directional drilling, and pump stations, tank terminals and the WMT. To ensure that noise impacts associated with the operation of the Project will be addressed, the Board would also impose Condition 141 requiring Trans Mountain to submit to the Board the results of post-construction noise surveys conducted at both the Sumas and Burnaby Terminals, and the WMT, demonstrating compliance with the B.C. Oil and Gas Commission's B.C. Noise Control Best Practices Guideline (2009).

The Board acknowledges the concerns raised by municipalities along the pipeline corridor that the proposed Project may limited their ability to meet existing and future land use planning objectives. As discussed in section 11.3, the Board recognizes the need for effective communication between Trans Mountain and potentially affected municipalities in the design phase of the Project to ensure local and regional land use plans are considered and properly addressed to minimize any impact to municipalities. As set out in Chapter 4, the Board would impose Conditions 14 and 49 requiring Trans Mountain to file with the Board terms of reference for the technical working groups, as well as reports of the meetings of the technical working groups.

The Board notes that several participants raised concerns regarding the expansion of the WMT, including disruption to movements of recreational and traditional marine vessels, and impacts from light emissions. The Board is of the view that Trans Mountain's commitment to design the WMT expansion to reduce its footprint in Burrard Inlet and minimize interference with existing anchorages can effectively reduce the impacts of expansion on residents and marine users. To address potential light impacts associated with the operation of the WMT, the Board would impose Condition 82 requiring Trans Mountain to file a light emissions management plan for the WMT. This plan would require that Trans Mountain employ industry best practices to minimize extraneous light pollution, and limit any nuisance lighting disturbances for nearby residents and marine users, to the extent possible.

The NEB Act amendments that came into force on 3 July 2013 require the Board to take into account the effects that issuance of a certificate in respect of a pipeline that passes in, on, over, under, through or across navigable waters might have on navigation, including safety of navigation, when making its recommendation.

Construction of pipeline crossings, the marine terminal, and ancillary works associated with the Project could affect navigation and navigation safety without the application of appropriate mitigation measures. Trans Mountain must abide by design criteria for power line crossings of waterways under the Canadian Standards Association standards for overhead systems (CSA C22.3). Trans Mountain has committed to limit Project impediments to navigation, to inform user groups on a regular basis, and to mark hazards to navigation. The Board considers the mitigation proposed by Trans Mountain to reduce Project effects on navigation and navigation safety in the freshwater environment and marine environment at the WMT to be acceptable.

The Board would impose Condition 48 requiring Trans Mountain to submit to the Board for approval, prior to construction, a listing of navigable waterways proposed to be crossed by the pipeline or

affected by fish habitat offset works, or any ancillary components proposed to support the Project. Trans Mountain is also required to provide an assessment of Project effects, including effects of fish habitat offsets on navigation and navigation safety (outside of marine shipping), and proposed mitigation measures. This assessment would contain a listing of any issues raised by waterway users and Aboriginal groups regarding navigation use, how issues have been addressed, and proposed mitigation measures to address project effects on navigation and navigation safety for each navigable waterway.

The Georgia Strait Alliance, the Pacheedaht First Nation and the Tsawwassen First Nation recommended that the condition be expanded to include marine waterways and shipping lanes. The Board notes that jurisdiction over shipping safety in marine waterways remains with Transport Canada.

The Board accepts Trans Mountain's rationale to parallel existing linear disturbances for the majority of the route as a way to reduce long-term visual effects. Trans Mountain has committed to work with municipalities and landowners to develop specific plans to reduce the potential long-term impacts related to the presence of the new pipeline RoW. To ensure that visual impacts will be addressed in areas where the proposed pipeline corridor deviates from the existing Trans Mountain Pipeline system RoW and are highly visible to the public, the Board would impose a Condition 95 requiring Trans Mountain to submit to the Board a visual impact plan prior to construction. In the Board's views, this plan would ensure that Trans Mountain, in consultation with all appropriate government authorities, potentially affected Aboriginal groups, and affected landowners and tenants, identify and implement measures that minimize visual disturbances for nearby residents and land users, to the extent possible.

11.3 Infrastructure and services

11.3.1 Utilities and infrastructure

Trans Mountain said there will be an increase in Project-related vehicle traffic on highways and access roads during construction, including vehicles used for the transportation of equipment, supplies and workers to various locations along the proposed pipeline corridor. Various physical restrictions, such as steep side slopes, rivers, railways, and pipelines, require that the proposed pipeline parallels roads within highway rights-of-way.

Trans Mountain said that limitations to future municipal linear infrastructure planning and maintenance to existing sub-surface facilities may occur because of the necessity to obtain permits or permission to construct or install new facilities across, on, along or under an existing pipeline RoW. It said there are also limitations with regard to mechanically excavating within 30 m of the RoW.

Trans Mountain said that the Project is expected to cause a temporary increase in demand for water during construction due to direct water needs of the Project, such as for hydrostatic testing and dust suppression, and indirect potable water needs of the construction workforce. There is also expected be a temporary increase in solid and liquid waste flow and water services due to waste from temporary facilities and the increased population associated with temporary workers during construction.

Trans Mountain said that pipeline spills could potentially damage infrastructure, causing municipalities to incur infrastructure repair and replacement costs.

Several municipal intervenors said that municipalities and others whose utilities are impacted and who have jurisdiction over highways would incur present and future costs as a consequence of the proposed pipeline impacting their utilities, and as a consequence of the proposed pipeline occupying or crossing highways. They expressed concerns that Trans Mountain's Application did not identify the burden of the proposed Project on municipalities whose highways and utility corridors constitute a significant portion of the proposed pipeline route.

The City of Edmonton said that approximately $12,000,000 in municipal infrastructure mitigation costs are anticipated should the proposed pipeline be installed along Whitemud Drive. Having the proposed pipeline located along Whitemud Drive would restrict the City's ability to maintain and repair the affected portions of Whitemud Drive, limit the City's opportunity for optimization and innovation for the future expansion of Whitemud Drive, and severely restrict the City's ability to implement its Naturalization Plan for the affected

portions of Whitemud Drive. The City argued that should the Board recommend approval of the preferred route along Whitemud Drive, conditions should be imposed requiring Trans Mountain to financially compensate the City for all costs associated with having the pipeline along Whitemud Drive, including all costs that arise during the Whitemud Drive expansion.

The Cities of Surrey, Burnaby, Coquitlam, Abbotsford and the Township of Langley collectively commissioned a study to assess the additional costs incurred by each municipality to operate, maintain and construct municipal infrastructure impacted by the existing pipeline and proposed Project. The study concluded that the projected additional costs these municipalities would incur over 50 years as a result of the proposed Project would exceed a total $93,000,000, including administrative and replacement costs for municipal infrastructure.

Trans Mountain said that the study submitted by the Lower Mainland municipalities was based upon a number of unsubstantiated assumptions or incomplete information, and provided only a partial analysis of the additional costs the five municipalities would face should the Project be approved. It said the study ignored taxes, fees and land rights payments received by municipalities for the existing pipeline and those projected for the Project, omitted consideration of the routing, design and construction practices adopted by Trans Mountain, and was silent on consultation with municipalities to identify, mitigate and minimize social and economic impacts on communities.

Collectively, the municipalities of Abbotsford, Burnaby, Coquitlam, Langley and Surrey requested the Board impose several conditions on Trans Mountain. They said were designed to ensure minimal impairment of the municipalities' property and regulatory rights in respect of their highways and other utility infrastructure, and ensure municipalities and their taxpayers were not subsidizing the private business interests of Trans Mountain. They said that other regulators at both the federal and provincial level have recognized that it is not for municipalities or the province to pay these costs and subsidize the shareholders of private entities. The City of Coquitlam said that federal telecommunications companies subject to the *Telecommunications Act*, federal railways subject to the *Railways Act*, provincial pipelines subject to B.C.'s *Oil and Gas Activities Act*, and provincial electrical utilities subject to B.C.'s *Utilities Commission Act* are all subject to various forms of cost recovery or cost allocation regulating their interactions with, and the liability of, host municipalities. They said that the inclusion of their proposed conditions is necessary for Trans Mountain to effectively discharge its obligations under section 75 of the NEB Act to make full compensation to persons suffering damages as a result of its exercise of its rights under the NEB Act. Furthermore, they said that these conditions would provide a practical approach to prevent the Board from being called upon to repeatedly adjudicate access and compensation disputes in each municipality through which the Project is proposed to be constructed. The City of Surrey said that the NEB has jurisdiction to impose conditions related to impacted utilities including highway occupation and highway crossing uses pursuant to section 108 of the NEB Act.

Several intervenors expressed concerns regarding what they suggested would be substantial impairment to a municipality's ability to maintain or alter an existing roadway crossed by a federally regulated pipeline, because of section 112 of the NEB Act and the *NEB's Pipeline Crossing Regulations*. The City of Burnaby said that the existing practice requires the municipality or utility owner to obtain written permission from Trans Mountain prior to its repair or construction activities, and in practice, to accept any conditions imposed by the pipeline company. It further said that in most cases work is carried out under the supervision of Trans Mountain, and puts the pipeline company in a position to insist on compensation for its additional costs. The municipalities of Abbotsford, Burnaby, Coquitlam, Langley and Surrey requested the Board impose conditions on Trans Mountain that prohibit the company from including provisions in its crossing permits issued under the *NEB's Pipeline Crossing Regulations* that commit municipalities to terms and conditions, including indemnities to which they suggest they otherwise would not be subject.

In response to the municipalities of Abbotsford, Burnaby, Coquitlam, Langley and Surrey, Trans Mountain said that their proposed conditions should not be imposed by the Board because they are not within the Board's statutory mandate. Trans Mountain said that although the Board has broad jurisdiction to impose conditions on the issuance of a certificate pursuant to section 52 of the NEB Act, it does not have the authority to alter the substantive provisions of the NEB Act through the imposition of conditions. Further, the conditions are unnecessary in light of Trans Mountain commitments and the alternative remedies available under the NEB Act. It said that existing statutory remedies, such as section 75 of the NEB Act, are designed to address specific land use conflicts and compensation matters as they arise from

the construction and operation of an interprovincial pipeline, and the NEB Act does not provide for blanket compensation or crossing orders in relation to speculative future conflicts or works. Trans Mountain said that by requesting that the Board impose conditions that Trans Mountain be required to grant unconditional consent regarding all future roadworks above the pipeline, the municipalities are asking the Board to go beyond its statutory mandate under section 112 of the NEB Act and the *NEB's Pipeline Crossing Regulations*, and deviate from the legislative scheme established to address such crossings.

Trans Mountain said it believes that historical practice provides a reasonable approach respecting cost sharing and cost recovery for past, current and future infrastructure development and it is reasonable for Trans Mountain to reimburse municipalities for any modifications to their existing infrastructure required to accommodate the Project. In the planning and design of the Project, Trans Mountain said it is willing to work with municipalities to accommodate reasonably foreseeable plans for municipal infrastructure including roads and utilities in the design and placement of the pipeline. Once the Project is in place, any subsequent design and development of municipal infrastructure would be completed with the pipeline in place and should modifications or relocations of the pipeline be required to accommodate new municipal infrastructure, Trans Mountain would look to the municipality for reimbursement.

Trans Mountain committed to working cooperatively with municipalities in the development of the Project. This would include:

- minimizing potential impacts to existing municipal infrastructure;
- generating inventories of municipal sub-surface infrastructure crossings;
- paying for reasonable costs to inspect or relocate municipal infrastructure;
- developing traffic control plans; incorporating traffic-related requirements of B.C. Ministry of Transportation and Infrastructure, Alberta Transportation and other municipalities; and
- entering into water and waste use agreements

11.3.2 Housing, accommodations, and work camps

Trans Mountain said that existing commercial accommodations would house the Project workforces, to the extent practical, for the construction of the pipeline, pump stations and terminals. Temporary construction camps would be deployed to house workers on three construction spreads where local accommodation is not sufficient.

Trans Mountain said that while the use of local hotels and rental units would be considered positive by hotel and apartment owners, housing price inflation, even if short-term, could have negative effects for people on fixed incomes or not experiencing the income-related benefits associated with the Project. In smaller construction hubs, this could contribute to short-term increased demand for accommodations, such as hotels, motels, rental suites and campgrounds.

The Village of Valemount and Regional District of Fraser-Fort George expressed concern regarding the impact of temporary workers in the Valemount region, particularly with respect to the management of solid waste due to Valemount's solid waste transfer station being at maximum capacity, and impact on local housing costs.

Trans Mountain committed to develop and implement a worker accommodation strategy with contractors and local municipalities which would consider a range of potential issues, including local housing market development, accommodation capacity, transportation of workers, water supply capacity, waste management, camp security and preferences of host communities.

11.3.3 Protective and social services

Trans Mountain said that construction of the Project could increase demands on regional protective and social services due to direct Project activities, unforeseen or accidental events during construction, and the indirect demands of the temporary construction workforce. Trans Mountain identified several communities experiencing capacity constraints with regard to RCMP, fire and ambulance services.

Fraser Valley Regional District expressed concern that Trans Mountain defined a construction spread break in the middle of its Electorate Area D, and that this split would increase the workload imposed on it by having to work with two separate engineering consultants and construction contractors, as well as potential

discrepancies between engineering and construction standards. Trans Mountain confirmed that a single point of contact approach would be established and would remain consistent. It confirmed that all of Fraser Valley Regional District is currently envisioned to be undertaken by a single contractor.

Trans Mountain committed to a range of measures to reduce the potential indirect socio economic effects due to construction activities, including developing a Code of Conduct for employees and contractors, communicating with local protective and social service authorities on the timing and activities of the Project, and consulting with governments, municipalities, local/regional service providers and Aboriginal communities to develop and implement an issues tracking process to monitor Project-related socio-economic issues.

11.3.4 First responder services

Trans Mountain said that in the event of a large spill, demands are likely to be placed on local, municipal, regional and independent emergency responders (fire, police, ambulance and disaster agencies), hospitals, clinics, social service and relief organizations, and local, municipal, regional and federal government officials and staff. However, actual effects would depend on the size and nature of a spill, the number of people potentially affected and the availability of proper equipment and trained personnel.

Several intervenors and commenters raised concerns regarding the impact a spill would have on local, municipal and regional government staff and resources. The City of Vancouver cited its recent experience with the *MV/Marathassa* oil spill as demonstrating that a relatively small volume oil spill can place significant demands on municipal staff and resources.

The issue of emergency management and emergency response is covered in more detail in Chapter 9.

11.3.5 Cumulative effects

Trans Mountain said that the potential cumulative effects on transportation infrastructure, decrease in land available for future linear infrastructure planning, an increased demand on regional infrastructure and services may emerge as the Project acts in combination with existing activities and reasonably foreseeable developments. It noted the impact balance is both negative and positive, since the Project may contribute to increased pressure on and select disturbance of infrastructure and services, but it may also contribute to commercial opportunities for service provision.

Views of the Board

Portions of Trans Mountain's proposed corridor traverse congested urban environments that contain many constraints, including highways and other utility infrastructure. The Board acknowledges the concerns expressed by several municipalities regarding the additional burdens the proposed pipeline could have on their utilities, including the incurrence of additional costs as a consequence of future infrastructure development. A number of these intervenors requested that the Board impose specific conditions to address what they suggested are the impacts associated with having the pipeline interfere with and restrict their ability to accommodate future municipal infrastructure plans. Many of the proposed conditions related to ongoing communications between the intervenor and Trans Mountain, construction scheduling, crossing agreements and compensation for future costs.

Section 75 of the NEB Act requires companies to do as little damage as possible and make full compensation for all damages sustained by persons as a result of the companies' exercise of their powers under the NEB Act. Further, as described earlier in this chapter, sections 88 – 103 of the NEB Act set out processes for negotiation and arbitration to settle compensation matters, and these matters are handled by the federal Minister of Natural Resources. As set out in these sections, when a landowner and a pipeline company cannot agree on compensation for lands that the company has acquired or damaged, either party may apply to the Minister of Natural Resources to receive the services of a negotiator, or to have the dispute settled by arbitration.

With respect to highway crossings, the effect of section 112 of the NEB Act and the NEB's Pipeline Crossing Regulations outline the statutory and regulatory requirements for anyone planning to work, excavate or build on or near NEB-regulated pipeline rights of way. Activities within the RoW are governed by the NEB Act, the Pipeline Crossing Regulations, and agreements negotiated between the landowner and the pipeline company. The focus of these provisions is the safety of the public which is of paramount importance to the Board.

A party wishing to construct a facility across a pipeline either must obtain permission from the owner of the pipeline or may obtain leave of the Board. The Pipeline Crossing Regulations provide for timely response by pipeline companies to requests for leave applications should they be brought before the Board.[65]

It is the Board's view that both the company and people planning activities near pipelines have a role in preventing damage to pipelines. The company is responsible for the safety and security of the pipeline, the protection of the environment, and the safety of the people who live and work in the area around the pipeline. Landowners and persons living or working near pipelines also have an important role to ensure that their activities near pipelines are conducted safely. The Board also has a role of regulatory oversight to satisfy itself that companies it regulates, as well as individuals, follow the requirements of the NEB Act and regulations that are created to ensure the safe operation of the pipeline and safety of the public in relation to pipeline operations.

Several intervenors expressed concerns with what they perceived as limitations in the current compensation process as well as the crossings requirements. The Board notes that several municipalities questioned the adequacy of the NEB Act in dealing with compensation-related issues. The City of Surrey suggested that the NEB Act should be amended in a manner similar to what they say some other federal and provincial utility regulators have done. Compensation matters were not in scope in this hearing and the Board makes no assessment of the adequacy of the process to address compensation matters when the company and owner of lands cannot agree pursuant to sections 88-103 of the NEB Act. Such matters fall under the authority of the Minister of Natural Resources, and may be reviewed by the Minister if the Minister is of the view that the legislation requires amendment.

The Board is encouraged by Trans Mountain's commitment to continue its engagement with municipal representatives through the formation of technical working groups. The Board supports the creation of such groups as a potentially effective mechanism to collaboratively address issues of interest to the company and affected municipalities, including concerns relating to the pipeline's location and the potential impacts and future costs on a municipality's long-term plans. The Board is of the view that collaboration between municipalities and Trans Mountain in the design phase of the Project will help to ensure current and future municipal utility infrastructure is considered and properly addressed to minimize potential impacts to municipalities. As set out in Chapter 4, the Board would impose Conditions 14 and 49 requiring Trans Mountain to file with the Board terms of reference for the technical working groups, as well as reports of the meetings of the technical working groups.

Trans Mountain has committed to collaborate with potentially affected municipalities to consider each other's project plans through technical working groups. Trans Mountain has also committed to create a Community Benefit Program which would provide opportunity for municipalities to further offset potential future infrastructure or service costs. The Board is of the view that these factors, combined with the Project's likely positive economic effects, including increased tax revenues to the municipalities and regions the pipeline crosses, as further set out in section 11.5, adequately address the potential burdens that could result from the Project. Such outcomes, in the Board's view, may depend on the level of commitment from all parties to find mutually agreeable solutions.

The Board recognizes that issues can arise when underground infrastructure is located in close proximity to a pipeline. In order to facilitate the resolution of any potential conflicts, the Board would impose Condition 103 requiring Trans Mountain to file with the Board a list of all underground infrastructure utilities to be crossed by the Project, and to confirm that necessary agreements or crossing permits for those facilities to be crossed have been acquired or will be acquired prior to

65 The *Pipeline Safety Act*, which received royal assent on 18 June 2015, amends the NEB's regulation-making authority for damage prevention in the NEB Act, therefore requiring that new regulations be in place by 19 June 2016. The NEB's proposed regulations for the Pipeline Damage Prevention will replace the Board's *Pipeline Crossings Regulations*. The proposed regulations continue to prescribe the responsibilities of those wishing to conduct an activity near a pipeline, and the conditions they must meet, including that they must obtain company consent and must follow company safety measures and technical requirements. The proposed regulations also continue to have similar provisions to the current regulations respecting applications for authorizations, in that if consent cannot be obtained from the pipeline company, or conditions cannot be followed, application may be made to the Board. At the time of this Report, the new regulations are not yet in effect, and the final regulations may be revised from what was proposed.

construction. The Board is of the view that this would ensure that Trans Mountain has identified and finalized the exact location of all underground infrastructure that would be crossed by the Project.

With regard to intervenors' requests and concerns regarding information pertaining to construction scheduling, the Board notes that Trans Mountain has already made commitments with respect to these during the course of this hearing. Therefore, the Board is of the view that further specific conditions relating to construction scheduling are not required. Part of the Board's consideration of the Project includes the commitments made by Trans Mountain and how these address particular areas of concern. In order to facilitate a transparent and publically available record of the commitments made by Trans Mountain, the Board would impose Condition 6 requiring Trans Mountain to file with the Board a commitments tracking table listing all commitments made by Trans Mountain during hearing.

The Board recognizes that the Project would be constructed along numerous local highways and municipal roads. In order to ensure that impacts to local infrastructure, communities and emergency access is minimized, the Board would impose Condition 73 requiring Trans Mountain to submit its Traffic Control Plans to the Board prior to the start of construction, including evidence of consultation with all appropriate government authorities, potentially affected Aboriginal groups, and affected landowners and tenants.

The Board notes that Trans Mountain is still in discussion with local authorities for the development of an appropriate housing strategy for its Project construction workers, including locations where temporary closed construction camps would be used. To ensure potential effects that could result from the presence of construction workers for the Project are effectively addressed, the Board would impose Condition 59 requiring Trans Mountain to file its Worker Accommodation Strategy with the Board. The Board is of the view that Trans Mountain's commitments to use construction camps and to develop and enforce camp policies can effectively minimize the Project's potential negative effects on the infrastructure and services of local communities.

Trans Mountain has committed to liaise with local and regional social services, police and local governments, to identify and address issues related to the potential negative effects of the Project on housing, utilities, and the delivery of social services in local communities during construction within the Project area. In addition to the company's commitments, the Board would impose Condition 13 requiring Trans Mountain to file a Socio-Economic Effects Monitoring Plan. In the Board's view, this plan would ensure that potential adverse socio-economic effects resulting from construction activities are identified, and that measures to reduce or eliminate adverse effects are effectively implemented within the timeframes for which effects might occur.

The Board finds that Trans Mountain appropriately identified potential emergency and medical services issues that would result from a large spill from the Project, and has committed to work with external emergency response services in a pre-planning capacity. As discussed further in Chapter 9, the Board would impose several conditions to ensure Trans Mountain enhances the existing emergency management program and takes into account capacity limitations of local and regional first responders (Conditions 89, 90, 117, 118, 119, 120, 123, 124, 125, 126, 136 and 153). The Board finds that Trans Mountain's extensive evidence regarding emergency planning and response is credible and sufficient for this stage in the lifecycle of the regulatory process.

The Board is of the view that, with Trans Mountain's commitments and the Board's recommended conditions, the Project's potential adverse effects on the infrastructure and services of communities in proximity to the Project, including the Project's contribution to cumulative effects, can be effectively addressed.

11.4 Social and cultural well-being

Trans Mountain said that a sense of social and cultural well-being of a community or region is dynamic and influenced by multiple factors, and may be experienced differently by different people. Its assessment of Project effects on social and cultural well-being examined changes in population due to temporary workers, effects on community assets and values, changes in income patterns, and the potential for interactions between Project workers with local and Aboriginal communities.

Trans Mountain said that, although some positive indicators of wellness are used, including income and increased educational training, many of the indicators used in its assessment described undesirable social conditions. It said that issues identified by stakeholders included effects related to increased traffic and traffic safety, the presence of temporary workers in smaller communities, indirect social effects, pressures on infrastructure and services, as well as potential disruption to specific community assets and events.

11.4.1 Change in population and demographics

Trans Mountain estimated that the influx of temporary workers during construction would range from a low of approximately 515 construction workers in the Edmonton Region, to a high of approximately 2,900 construction workers in the Fraser-Fort George/Thompson-Nicola Region. Temporary population influx related to major projects can result in a number of issues for host communities, due to community-worker interactions and increased pressure on services and infrastructure.

Trans Mountain committed to a number of measures to maximize regional employment and procurement, and limit the effects of the Project on population change. These measures included:

- developing and implementing a program to enhance awareness of construction and operations jobs and career opportunities in cooperation with business, industry, community and education and training organizations; and
- creating an online employment communications tool where potential workers who are interested in employment can register to receive regular updates giving first consideration for employment opportunities to regional and Aboriginal residents with appropriate skills and qualifications, where possible.

Trans Mountain committed to the development of a Worker Accommodation Strategy to address a range of potential issues and identify opportunities and mitigation measures related to worker accommodation through ongoing engagement with local municipalities and stakeholders.

11.4.2 Changes in community life

Trans Mountain said that an increase in temporary workers during construction could have direct and indirect effects on community life. While the presence and influx of temporary workers most notably can result in substantial economic benefits for communities due to spending of income, some undesirable social outcomes may also occur. These include income spent on drugs, alcohol or gambling and the subsequent contributions to social problems in communities, as well as direct negative Project interactions with communities.

Trans Mountain identified a number of key community assets and events that have the potential to be negatively affected by the Project. Physical disturbance to community amenities, such as recreational facilities, golf courses, camping areas, cemeteries and community trails, may result in community members being unable to use them for specific periods of time, which could disrupt community life to some degree. Construction of the Project could negatively impact certain community events that coincide with construction.

Trans Mountain committed to implement a range of measures to reduce the Project's potential negative impacts on community life. These included:

- avoiding important community features and assets during RoW finalization by narrowing the RoW in select areas, where possible;
- scheduling construction to avoid important community events, where possible;
- ongoing consultation and engagement of construction schedules and plans with local and Aboriginal governments, as well as community officials;
- implementing a Code of Conduct for workers, including community awareness training in work orientation sessions;
- establishing a mechanism for communities to register construction-related complaints;
- developing a detailed Worker Accommodation Strategy that would consider camps in locations where local communities do not have adequate housing capacity; and

- providing recreational and leisure facilities for workers within the camps.

Trans Mountain committed to establishing a Community Benefit Program, which it said would create a positive net benefit for communities along the pipeline corridor. It said that these initiatives would be in addition to compensation for access and potential impacts to community lands, and in addition to any environmental mitigation for the Project. Trans Mountain said that priority areas for the Community Benefit Program would be identified through input from local governments and stakeholders, and could be environmental or socio-economic in nature. The Community Benefit Program could include local emergency management enhancements, improvements to community parks and infrastructure, as well as support for events and educational programs.

Trans Mountain said that potential socio-economic effects of large spills will vary depending on the exact location and nature of the incident, however, large hydrocarbon spills may adversely affect the sense of individual and community well-being by affecting cultural and heritage resources and psychological well-being. Trans Mountain said pipeline spills could also potentially damage homes resulting in costs for individuals.

Views of the Board

The Board acknowledges that the Project has the potential to impact the quality of life within affected communities, as well as the well-being of individuals as a result of potential changes in population and community life. The Board notes Trans Mountain's commitments to implement a Code of Conduct for workers, and to develop and implement an issues tracking process to monitor and respond to Project-related socio-economic issues and opportunities that emerge during construction and operation of the Project. In order to ensure that the potential negative socio-economic effects of Project construction can be effectively addressed by Trans Mountain, the Board would impose Condition 13 requiring Trans Mountain to file with the Board a plan for monitoring the potential adverse socio-economic effects resulting from construction activities. This would ensure that measures to reduce or eliminate adverse effects are effectively implemented within the timeframes for which effects might occur.

Trans Mountain has committed to create a Community Benefit Program. The Board finds that such as program would provide a positive net benefit for communities along the pipeline corridor. The Board encourages such initiatives, and views discussions with affected stakeholders as a positive mechanism for enhancing existing relationships and providing net benefits for communities. To inform the Board and all parties about the progress made toward the outcomes of the Community Benefit Program, the Board would impose Condition 145 requiring Trans Mountain to file with the Board progress reports on its Community Benefit Program for the first five years after commencing Project operations.

Based on Trans Mountain's commitments and the Board's recommended conditions, the Board is of the view that the Project's potential effects on the social and well-being of communities can be effectively addressed.

11.5 Employment and economy

Trans Mountain said that the Project will contribute substantially to economic growth. The effect would be long term since the economic effects are related to both construction and operations, and the Project is considered to have significant, positive residual socio-economic effects on provincial and national economies.

Trans Mountain said that it considered employment and economic effects related to provincial and national economies, regional employment, municipal economic benefits, training and capacity development, procurement and contracting, as well as the possibility of business or livelihood disruption. Trans Mountain's conclusions were outlined in a report prepared by the Conference Board of Canada quantifying four economic effects of the Project, including direct, indirect, induced and fiscal effects.

The capital cost of the Project is expected to be approximately $5.5 billion (2012 dollars), with the expenditures taking place over a seven-year period. The bulk of the spending activity is expected to take place during construction. Trans Mountain said this spending will generate direct impacts in the construction sector, supply chain impacts associated with the inputs needed to complete the Project, and induced effects, which occur when the wages that employees earn from the direct and supply chain effects are spent.

Trans Mountain estimated the construction phase would generate a total of $1.2 billion in federal ($646 million) and provincial ($568 million) government revenues. It said that the largest fiscal impacts associated with the construction phase are found in personal income taxes ($559 million), indirect taxes such as sales taxes ($335 million), and corporate income taxes ($184 million). B.C. ($394 million) and Ontario ($307 million) will experience the largest combined federal and provincial fiscal effects. Other regions of the country, such as Alberta ($239 million), Quebec ($166 million) and the Prairies ($58 million) will also experience fiscal benefits.

Trans Mountain said that the construction phase would support over 58 000 person-years of direct and indirect employment generated across Canada, with approximately 36 000 person years in B.C. and 15,000 in Alberta. Construction would require approximately 400-600 workers per spread and vary over the construction period. Construction at the tank terminals requires between 60 and 370 workers, and approximately 95 workers will be required for construction at the WMT.

Trans Mountain assessed the economic and fiscal benefits of the operational phase over its first 20 years of service. The operations phase is expected to generate $3.3 billion in combined federal and provincial revenues over this period, with B.C. experiencing the largest combined federal and provincial impact (34.8 per cent), followed by Ontario (24.3 per cent), Alberta (18.4 per cent), and Quebec (13.8 per cent).

Trans Mountain said that the municipalities, counties/regional districts, and First Nations Reserves crossed by the Project would accrue aggregate property tax increases of approximately $3.4 million annually in Alberta and approximately $23.2 million annually in B.C. It said that the total forecasted increase in municipal taxes across Alberta and B.C. would be over $26.5 million per year.

Trans Mountain said that the Project would directly support 443 jobs per year over the first 20 years of operations. The majority of these positions would be found in B.C., which accounts for 313 jobs per year (71 per cent of the total), with the rest being located in Alberta. In total, direct, supply chain and induced effect employment during operations would support 65 184 person-years during the first 20 years of operations, with 60 per cent of the jobs being created in B.C., 20 per cent in Alberta and the remainder in other regions of the country.

Trans Mountain said that it contributes to initiatives in communities where it operates and has initiated discussions with local governments and organizations to explore additional community benefit opportunities related to its priority areas of community investment, environment and ecological offsets, and education.

Trans Mountain said that, through its public engagement activities, concerns were raised about employment opportunities, as well as how Trans Mountain would work with trade schools on skill development. Numerous Aboriginal groups expressed an interest in employment and procurement opportunities, as well as assistance with training to provide the required skills.

Some Aboriginal groups said that they were concerned that substantial benefits were only being offered through mutual benefit agreements (MBAs), through which a First Nation consents to the Project and its impacts.

Metro Vancouver raised concerns about Trans Mountain's use of input-output models, and said that these models do not, in themselves, indicate the magnitude of the benefits and costs, or whether the Project is desirable from a public or social viewpoint. Metro Vancouver said that the Government of Canada, through the Treasury Board Secretariat, had released guidelines for regulatory appraisal that recommends cost-benefit analysis as the appropriate method of evaluation, and that maximizing net benefits to Canadian society as a whole should be the metric used. Tsawout First Nation Upper Nicola Band and Living Oceans Society said that the Conference Board of Canada report provided by Trans Mountain was deficient in a number of areas, including the benefit-cost analysis.

Catherine Douglas and the Pro Information Pro Environment United People (PIPE UP) Network submitted a study on the economic costs and benefits of the Project for B.C. and Metro Vancouver. They concluded that the benefits of the Project were very small and significantly overstated by Trans Mountain.

A number of intervenors raised concerns about the Project's potential impact on property values. NS NOPE said that a spill in the Burrard Inlet would affect property values of residences opposite the WMT. The City of New Westminster suggested that Trans Mountain conduct property value analyses for residential homes located near the pipeline, including an analysis of the economic impacts resulting from potential spills.

Unifor said that it opposed approval of the Project because it would undermine investment in a value-added, diversified and more stable oil and gas sector, and posed very serious risks to the B.C. commercial fishery and the livelihoods of those who depend upon it.

A number of participants expressed their support for the Project. B.C. Building Trades said that the Project was good for their members and good for B.C. The Edmonton Chamber of Commerce said that the contribution of the Project to Canada's long-term balance of trade and the wealth of its citizens was overwhelmingly positive.

To support employment and economic opportunities for the Project, Trans Mountain said that it would take active steps to maximize regional, Aboriginal, provincial and Canadian contracting and procurement, and give first consideration to qualified regional suppliers of goods and services. It said that regional employment clauses would be included in all Project contracts and General Contractors would be required to report the number of hires from Project area Aboriginal residents and other regional residents.

Trans Mountain said that its Employment and Training strategy would be informed by local and regional skill gaps for participation in employment opportunities for construction of the Project. Trans Mountain said that its targets for training and education initiatives include providing:

- support for Project-relevant training programs for Aboriginal participants for the construction of the pipeline;
- support for training in construction readiness, orientation, safety and certification, trades introduction and administrator training;
- support training to employment initiatives that focus on skills related to the construction of the pipeline and facilities;
- support Project-relevant training programs pre-certificate, such as trades orientation, foundations/life skills programs and short term training that provide immediate opportunities like camp cooks and surveying; and,
- training programs that enhance the Aboriginal communities' ability to participate in the contracting opportunities on the Project.

Trans Mountain said that it would maximize the hiring of on-reserve and off-reserve Aboriginal community members, and had developed a Training Policy for Aboriginal Peoples to create initiatives that increase the long-term capability for Aboriginal people to participate in the Project. Trans Mountain committed to collaborating with communities, educational and training institutions, industry and government to increase the opportunities available to communities, providing timely labour market information, and evaluating its training and employment initiatives on an ongoing basis to develop best practices for effective programs.

Trans Mountain said that it worked collectively with Aboriginal communities to provide procurement, employment, and workforce development opportunities, and to consider MBAs. It said that it was actively working to connect with Aboriginal businesses offering services or products relevant to Project construction or operation. As of 31 May 2015, it had worked with 32 Aboriginal groups to obtain capacity information and complete a workforce analysis. Where new investment in oil spill preparedness and response capacity was required, Trans Mountain said that it would seek to maximize the benefit to Aboriginal communities along the pipeline and marine corridor.

Trans Mountain said that it considered as many alternatives as it could to maximize benefits to the Aboriginal communities it affects, including the possibility of equity. It said that equity was ultimately ruled out as it required a substantial upfront investment by Aboriginal communities in return for uncertain returns as equity holders, and that many of the Aboriginal communities consulted prefer more certain economic benefits.

Trans Mountain said that property values are affected by numerous market forces, and there was no known or widely accepted cause and effect relationship between the presence of oil pipelines and property values in the Alberta and B.C. context. Trans Mountain said that proximity to an oil pipeline is not associated with lower transaction prices for single-family properties or for adjacent and nearby properties. It was not the presence of a pipeline easement that affected prices but the effect of the type of land use on which there is an easement.

Views of the Board

The Board acknowledges the potential benefits to local, regional and national economies associated with the Project. The Board considered the evidence provided by Trans Mountain and by intervenors, and is of the view that construction and operation of the Project would likely result in positive economic effects, including revenues to various levels of government, and employment for local, regional and Aboriginal individual and businesses. Positive economic effects are likely to continue for at least the 20 initial years of operation.

The Board notes the economic analysis provided by Trans Mountain, and the report filed by C. Douglas and PIPE UP Network questioning the benefits of the Project. The Board finds the methodology used by Trans Mountain to estimate the Project's potential economic effects to be based on generally accepted methodologies. The Board is of the view that the use of input-output models to estimate general economic effects can provide a general understanding of the potential economic effects that can result from the construction and operation of large infrastructure projects. The Board is the view such projections represent broad estimates only, and that the actual economic effects of the Project would only be apparent once the Project is constructed and brought into operation. The Board is of the view that while providing general projections, these methodologies are acceptable for estimating a project's potential economic effects.

The Board acknowledges Trans Mountain's commitments to provide local economic and educational opportunities, and to develop the capacity of local and Aboriginal individuals, businesses and groups. The Board is of the view that a company's activities and initiatives that can support the development of business and skill capacity are most effective when appropriately timed and initiated prior to commencement of Project construction. In order to facilitate the appropriate timing and further development and implementation of Trans Mountain's measures to support local and Aboriginal employment opportunities, the Board would impose Condition 11 requiring Trans Mountain to file with the Board an Aboriginal, local and regional skills and business capacity inventory at least six months prior to construction to report the results of its efforts to support business and skill development.

The Board views employment and training opportunities associated with the Project as key benefits at the local and regional levels, and as potentially providing particular benefits for Aboriginal individuals, communities and businesses. The Board therefore encourages Trans Mountain to continue to work with Aboriginal, local and regional communities to develop training, employment and procurement opportunities for the Project. In order to provide information to the Board, local communities and Aboriginal groups about the final development and implementation of such initiatives, the Board would impose Condition 12 requiring Trans Mountain to file with the Board a training and education monitoring plan, and to report on Aboriginal, local and regional training and education measures and opportunities for the Project (Condition 58). In addition, the Board would impose Condition 107 requiring Trans Mountain to file a report on Aboriginal, local and regional employment and business opportunities for the Project throughout the construction period.

11.6 Heritage resources

In reaching its recommendations regarding the potential environmental effects of the Project on heritage resources, including with respect to Aboriginal peoples, the Board considered all related evidence provided by Trans Mountain and hearing participants. With respect to the effects of the Project, including with respect to Aboriginal people, and consistent with the CEAA 2012, the Board considered the potential environmental effects of the Project on physical and cultural heritage, and on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. The Board's approach to its environmental assessment is described in Chapter 10.

Trans Mountain conducted heritage resources assessments to evaluate the potential Project effects on heritage resources related to the terrestrial components of the Project. The spatial and temporal boundaries used for the heritage resources are described in Appendix 11.

Trans Mountain said that heritage resources include historical, archaeological and palaeontological sites, In Alberta, heritage resources are administered under the *Alberta Historical Resources Act*, and palaeontological resources are recognized as a heritage resource. In B.C., archaeological resources are administered under the *British Columbia Heritage Conservation Act*, and there is no provincial legislation providing protection for palaeontological sites. Trans Mountain committed to meeting the legislative requirements of both provinces.

Trans Mountain said that it conducted a Historical Resources Impact Assessment for the Alberta portion of the proposed pipeline, and an Archaeological Impact Assessment for the B.C. portion of the proposed pipeline corridor. Trans Mountain said that fieldwork for both the Alberta Historical Resources Impact Assessment and the B.C. Archaeological Impact Assessment were ongoing through the 2015 fieldwork season. As of August 2015, Trans Mountain had identified 32 previously unknown archaeological sites and approximately 50 previously unknown historic sites in Alberta, and 55 previously unknown archaeological sites in B.C.

Trans Mountain said that the proposed pipeline corridor crosses 25 quarter-sections in Alberta that are listed as having high probability of palaeontological resources. In B.C., despite the proposed pipeline corridor crossing lands that have high potential for encountering palaeontological sites (including Valemount through the Monashee Mountains, the North Thompson River Valley to Kamloops, Kamloops to Hope, and Hope to Vancouver), a desktop overview assessment, helicopter overflight and a ground reconnaissance survey had not identified any previously designated or new palaeontological sites within the proposed pipeline corridor.

Trans Mountain said that potential effects to heritage resources from Project activities include disturbance to known or previously unidentified historical, archaeological and palaeontological sites during the Historical Resources Impact Assessment, Archaeological Impact Assessment, or construction-related activities. Once disturbed, the resource may be altered or lost.

Trans Mountain said that heritage resources could also be affected by a spill. Product released from the pipe, and associated cleanup activities, could interfere with the ability to interpret, date and analyze artefacts and preserved organic remains resulting in permanent loss of critical information.

Gunn Métis Local 55 expressed concerns about heritage and cultural sites around Lac Ste. Anne and Wabamun Lake, including burial sites and historical trails along the Edmonton to Hinton segment of the proposed pipeline corridor.

Samson Cree Nation's traditional land and resource use (TLRU) study identified sacred archaeological sites within the Project area. Samson Cree Nation expressed concern that, in additional to those identified, there would be unknown or secret burials and important historical resources in the study area due to historical use by their ancestors and transfer of intergenerational knowledge.

Upper Nicola Indian Band identified archaeological and cultural heritage sites, including burial sites and historical trail systems. They expressed concern that the Project would lead to erosion of these sites from construction and operations, as well as opening these areas up to others who do not respect these sites.

The Stó:lō Collective conducted a Cultural Heritage Overview Assessment of the Project, including the proposed pipeline corridor from KP 969-1147. In addition to archaeological sites protected under B.C.'s *Heritage Conservation Act*, it identified a number of cultural site types defined by the Stó:lō Collective but not recognized under this act, including:

- *lyoqthet* (transformation) sites;
- *Halq'eméylem* place names;
- *Sxwôxwiyádm /* cultural landscape features;
- *Xá:Xa* (sacred or taboo places) sites; and
- *Sxwó:yxwey* - places in the landscape related to the origin of the Sxwó:yxwey mask.

The Stó:lō Collective also raised concerns that one of their important spiritual and burial sites called Lightening Rock was in close proximity to a staging area Trans Mountain identified for the Project.

Trans Mountain said that it made opportunities available to potentially affected Aboriginal communities, based on their proximity to the Project or their assertion of traditional and cultural rights to the land, for participation in archaeological field studies conducted for the Project. The field program was designed to provide Aboriginal community members with the opportunity to provide Traditional Ecological Knowledge information to the ESA. Trans Mountain said that Aboriginal communities were engaged in identifying culturally modified tree sites through participation in Traditional Ecological Knowledge and TLRU studies. Pre- and post-1846 culturally modified tree sites were also identified by qualified archaeologists during the Historical Resources Impact Assessment and Archaeological Impact Assessment.

Trans Mountain said that the primary mitigation measure for protecting heritage and paleontological resources is avoidance, and secondarily, site-specific mitigation developed in consultation with appropriate provincial regulatory authorities, and approval by these authorities in fulfillment of permit obligations may also be used. Trans Mountain said that resource-specific mitigation measures have been identified for key areas of archaeological potential along the Project's proposed pipeline corridor. In the unlikely event that an archaeological, historical or palaeontological site is discovered during construction, the Heritage Resources Discovery Contingency Plan will be implemented, and construction activities may resume only with the permission of the provincial regulatory authority upon review and approval of any mitigation to compensate for the disturbance.

In addition, Trans Mountain committed to construction monitoring by a qualified archaeologist or palaeontologist in areas of high archaeological and palaeontological potential.

Views of the Board

Paragraphs 5(1)(c)(ii) and (iv), and 5(2) (b)(ii) and (iii) of the CEAA 2012 require consideration of the environmental effects that are likely to result from the designated project on physical and cultural heritage, or any structure, site or thing that is of historical, archaeological and paleontological or architectural significance, including with respect to Aboriginal people. In its evaluation, the Board has considered the effects of the Project on heritage resources to include all of the effects described in paragraph 5 of CEAA 2012. The Board also considered the effects of accidents and malfunctions that may occur in connection with the Project.

The Board recognizes the value of heritage resources preservation to Aboriginal communities, and acknowledges the information and knowledge shared by Aboriginal groups regarding historical, cultural, archaeological and paleontological sites that are of significance and value to them. This knowledge helps to ensure that potential environmental effects of the Project on heritage resources are identified, and that the final Project design and associated mitigation measures adequately protect identified and unidentified heritage resources that may be impacted by the Project.

The Board acknowledges the concerns raised by Aboriginal groups regarding the potential effects of the Project on physical and cultural heritage resources, as well as the recommendations made to the Board by a number of Aboriginal groups. These included, among other things, recommended requirements for collaboration, review or approval by Aboriginal groups related to heritage resource site identification, reporting and monitoring during construction.

The Board considered all of the evidence provided, and finds that the work that Trans Mountain has already completed, including the identification of potential sites of concern and its commitment to avoid all sites whenever possible, is sufficient at this point in the lifecycle of the regulatory process. The Board notes that the management of archaeological and heritage resources is the responsibility of provincial governments in the Project area. Before construction can begin, Trans Mountain must obtain clearances from the relevant provincial agencies with respect to archaeological and heritage resources. Any permits issued by the provinces may identify any conditions of approval or mitigation measures that Trans Mountain would be required to meet. The Board is therefore of the view that, given the limited number of sites identified through the impact assessments done by Trans Mountain, the measures and commitments made by Trans Mountain to avoid all sites where possible and to implement its Heritage Resources Discovery Contingency Plan in the event resources are encountered during construction, the evidence and traditional knowledge identifying potential sites of concern provided by Aboriginal groups, and the regulatory oversight of provincial authorities that issue final clearances for lands involved for the Project, the potential effects of the Project on physical and cultural heritage resources would be confined to the Project footprint and the Westridge Marine Terminal site boundary, would be short to long term, reversible to permanent, and of low to moderate magnitude.

To ensure that the Board and all parties, including affected Aboriginal groups, are aware of any approvals or conditions imposed by provincial authorities for the Project, the Board would impose Condition 100 requiring Trans Mountain to file confirmation that all archaeological and heritage resource permits and clearances have been obtained from the relevant provincial ministries prior to commencing construction. The Board also encourages Aboriginal groups to continue to share information with Trans Mountain, and to consider their potential participation in monitoring activities during construction. In order to facilitate the potential participation of Aboriginal groups interested in participating in construction monitoring, the Board would impose Condition 98 requiring Trans Mountain to file a plan to address the potential participation of Aboriginal communities in construction monitoring.

The Board finds that, with Trans Mountain's obligation to meet provincial requirements, its commitments and the Board's recommended conditions, the construction and operation of the pipeline facilities and the WMT are not likely to cause significant adverse environmental effects on heritage resources, including with respect to Aboriginal people.

The Board finds that in the event of a credible worst-case spill, environmental effects to heritage resources could be adverse and significant. However, as discussed in Chapter 9 the Board is the view that, should the Project be designed, constructed and operated according to the fulfillment of its certificate conditions and Trans Mountain's commitments, the probability of such an event is very low. Therefore, the Board recommends that there are not likely significant adverse effects for the purposes of CEAA 2012.

The Board has incorporated the potential consequences of a spill into its discussion on Spill Risks in Chapter 1 and considered them in its overall weighing of the benefits and burdens of the project in Chapter 2.

11.7 Traditional land and marine resource use

The Project route traverses land and water areas in Alberta and B.C. that Aboriginal groups use for traditional activities, uses and practices and for exercising various potential or established Aboriginal and treaty rights. Trans Mountain assessed the potential Project effects on traditional land and resource use (TLRU), traditional marine resource use (TMRU) as it relates directly to the WMT, and related interests. Trans Mountain said TLRU refers to the current use of lands by potentially affected Aboriginal communities for traditional purposes.

11.7.1 Trans Mountain's assessment of potential effects on traditional land and marine resource use

For the Project overall, Trans Mountain said that through the implementation of mitigation measures, Project construction and operations would not result in significant adverse effects on the ability of Aboriginal groups to continue to use lands, waters, or resources for traditional purposes. Trans Mountain also concluded that the residual effects of construction and operations activities of the WMT on TMRU indicators would not be significant.

11.7.2 Scope and methodology

The company said its assessment of TLRU examined anticipated effects related to the terrestrial components of the Project as a whole (e.g., pipeline, temporary facilities, pump stations, tanks and the WMT), since the communities and regions in which the Project occurs will experience Project-related activities in a combined manner. The spatial and temporal boundaries used for the TLRU assessment are described in Appendix 11.

The TLRU indicators and measurements used by Trans Mountain in its assessment were:

- subsistence activities and sites (including hunting, trapping, fishing, plant gathering, trails and travel ways, and habitation sites); and
- cultural sites (including gathering places and sacred areas).

For potential marine impacts associated with the WMT, Trans Mountain used TMRU (including subsistence activities and sites, and cultural sites) as its TLRU indicator and measurements. Trans Mountain said that TMRU is a unique indicator for the assessment of the effects for the WMT since the only marine interface related to the Project occurs at the WMT. The TMRU assessment also considered air emissions, acoustic environment, marine fish and fish habitat, marine mammals and marine birds. The potential effects of Project-related marine vessel traffic on TMRU are discussed in Chapter 14.

Trans Mountain said the indicators used for its assessment were selected based on feedback from Aboriginal communities and the professional experience of the assessment team, and were refined to reflect the components valued by traditional resource users that are often holistic in nature and span both the biophysical and social disciplines. Trans Mountain said potential Project-related effects on TLRU are linked to issues related to biophysical elements (including, fish and fish habitat, wetland loss or alteration, vegetation, and wildlife and wildlife habitat) and some socio-economic elements (such as, employment and economy through the effects of wage employment on traditional lifestyle, social and cultural well-being, navigation and navigation safety and community health).

As part of its assessment, Trans Mountain prepared and submitted an initial TLRU technical report. The report provides the results of the desktop analysis, literature review, and the results of engagement with Aboriginal community representatives and TLRU and TMRU studies conducted for the Project.

Trans Mountain also filed supplemental TLRU and TMRU reports incorporating information from traditional land and marine resource use reports and related evidence filed directly with the Board by Aboriginal intervenors, or that were provided directly to Trans Mountain subsequent to the completion of its earlier technical reports. Trans Mountain stated that the TLRU and TMRU results and concerns raised by these Aboriginal communities are summarized in these reports.

At the time of the submission of its evidence, Trans Mountain said that Project-specific studies were completed by 52 Aboriginal communities and that two non-Project specific TLRU studies were provided to Trans Mountain for baseline information. It said that Aboriginal communities participated in the Aboriginal field program that accompanied biophysical surveys. During studies for the Project, each participating Aboriginal community was asked to identify potential subsistence activities and sites including hunting, trapping, fishing, plant gathering, trails/travelways, habitation sites and cultural sites including gathering places and sacred areas. Aboriginal groups were also provided the opportunity to request mitigation for identified sites that would be affected by the Project.

Trans Mountain said that it reviewed all of the information and that the results from the studies were used to inform its assessment by identifying traditional land use sites and resources potentially affected by the Project. It said that the information also contributed to the development of mitigation measures to address these effects.

11.7.3 Baseline conditions

Trans Mountain described the existing baseline conditions for TLRU in relation to the Project.
Trans Mountain said existing conditions of TLRU encountered by the Project were determined through a review of publicly available harvest data, Aboriginal Traditional Knowledge and TLRU reports, the results of engagement with Aboriginal community representatives, the collection of Traditional Ecological Knowledge during biophysical field study participation and TLRU studies conducted with potentially affected Aboriginal communities for the Project.

Trans Mountain said existing baseline conditions represent the current use of lands and resources by Aboriginal peoples for traditional purposes prior to construction of the Project and provide a reference point against which future conditions are compared to assess Project-specific and cumulative effects.

11.7.4 Project effects - pipeline

Trans Mountain identified in its initial TLRU technical report the following TLRU sites within the proposed pipeline corridor requiring mitigation:

- 19 trails and travelways;
- 5 habitation sites;
- 43 plant gathering sites;
- 14 hunting sites;
- 7 fishing sites;
- 2 trapping sites;
- 5 gathering places; and
- 14 sacred areas.

Trans Mountain also filed supplemental TLRU reports incorporating information from TLRU reports and related evidence filed directly with the Board by Aboriginal intervenors, or that were provided directly to Trans Mountain subsequent to the completion of its earlier technical reports. Trans Mountain detailed the types of sites identified in each of the reports filed by Aboriginal intervenors, including trails and travel ways, habitation sites, plant gathering, hunting, fishing, trapping, gathering places, and sacred areas. These sites and associated activities were noted for each Aboriginal group that filed TLRU reports and related evidence directly with the Board, or provided these to Trans Mountain.

Based on its assessment, Trans Mountain identified the following potential residual socio economic effects on TLRU indicators associated with the construction and operations of the Project:

Disturbances of trails, travelways and habitation sites during construction and site-specific maintenance

This is anticipated to result from short-term physical disturbance of land and access limitations that may affect the practice of traditional activities by Aboriginal communities. Traditional land and resource users may be unable to use, or be deterred from using, certain areas at times during construction and periods of site-specific maintenance.

Trans Mountain stated these effects would be of short-term duration, periodic during construction and site-specific maintenance, reversible in the short-term, and of medium magnitude. Trans Mountain said the effects were determined to be not significant.

Alteration of subsistence resources

This effect could manifest itself through changes to local harvesting locales, behavioural alteration or sensory disturbance of environmental resources or increased public access to traditional harvesting areas and increased pressure on environmental resources. The operation of the proposed Project will affect subsistence resources primarily due to temporary disturbances related to maintenance activities. 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.

Trans Mountain stated these effects would be of short-term duration and periodic during construction and site-specific maintenance activities. Effects would be reversible in the long term as the effects of disturbance to traditionally harvested resources will be dependent on each target species' sensitivities and could extend greater than 10 years following decommissioning and abandonment. Trans Mountain stated the effects would be of medium magnitude, as the effects assessment results for fish and fish habitat, wildlife and wildlife habitat, vegetation, wetlands indicates that effects to traditionally harvested resources may be detectable and is dependent on each target species' sensitivities. Trans Mountain said the effects were determined to be not significant.

Disruption of subsistence activities during construction and site-specific maintenance

In the event that subsistence hunting, fishing, trapping and plant gathering activities are disrupted by the construction or operations of the Project, the interruption could mean that the traditional resource user misses the harvest opportunity or that their participation is curtailed. The company stated disruption of subsistence activities also refers to the possibility that traditional resource users could be prevented from accessing key harvesting areas resulting from limited access or increased public access to traditional harvesting areas. The operations of the proposed Project will affect subsistence activities primarily due to temporary disturbances related to site-specific maintenance.

Trans Mountain stated these effects would be of short-term duration and periodic during construction and site-specific maintenance activities. Effects would be reversible in the long term as changes to preferred harvesting locales could result in indirect effects such as harvesters having to spend more time and money to travel further for subsistence activities, and could extend greater than 10 years following decommissioning and abandonment. Trans Mountain stated the effects would be of medium magnitude. Trans Mountain said the effects were determined to be not significant.

Disturbance of gathering places and sacred areas during construction and site-specific maintenance

The disturbance of gathering places and sacred areas is a potential residual effect of interactions between traditional resource users with the short-term physical disturbance of land, and access limitations that may affect the practice of traditional activities by Aboriginal communities. Traditional land and resource users may be unable to use, or be deterred from using, certain areas at times during construction and periods of site-specific maintenance. Several gathering places and sacred areas were identified within the proposed pipeline corridor during the TLRU studies for the Project.

Trans Mountain stated these effects would be of short-term duration, periodic during construction and site-specific maintenance activities, reversible in the short-term, and of medium magnitude. Trans Mountain said the effects were determined to be not significant.

Combined effects on subsistence activities and sites

This considers those combined residual socio-economic effects that are likely to occur, including disturbance of trails and travelways, disturbance of habitation sites, alteration of subsistence resources, disruption of subsistence activities, sensory disturbance from nuisance air emissions and noise, and change in land use. Trans Mountain said the combined effect on the subsistence activities and sites indicator is considered to have a negative net impact balance. Although the spatial boundary of the interaction is likely to occur within the Project Footprint, indirect effects may be felt throughout the Regional Study Area (RSA).

Trans Mountain said the duration of the event is short-term, over the life of the Project, and the frequency is periodic. Trans Mountain stated the magnitude is medium. While the proposed pipeline corridor is located adjacent to existing disturbances for 89 per cent of the length, Aboriginal communities continue to practice traditional activities within and adjacent to the proposed pipeline corridor and on Crown lands along the existing TMPL and throughout the RSA. The effects to traditionally harvested resources may be detectable and are dependent on each target species' sensitivities. Trans Mountain said the effects were determined to be not significant.

Combined effects on cultural sites

This considers those combined residual socio-economic effects that are likely to occur, including disturbance of gathering places, disturbance of sacred areas, sensory disturbance from nuisance air emissions and noise, and change in land use patterns. The company said the combined effect on the cultural sites indicator is considered to have a negative net impact balance. Although the spatial boundary of the interaction is likely to occur within the Project Footprint, indirect effects may be felt throughout the TLRU RSA.

Trans Mountain said the duration of the event is short-term, limited to the construction phase or site-specific maintenance, and the frequency is periodic. Trans Mountain stated the magnitude is considered to be medium. While the proposed pipeline corridor is located adjacent to existing disturbances for 89 per cent of the length, Aboriginal communities continue to practice traditional activities within and adjacent to the proposed pipeline corridor and on Crown lands along the existing TMPL and throughout the RSA. Trans Mountain said the effects were determined to be not significant.

Trans Mountain concluded that there are no situations for TLRU indicators that would result in a significant residual socio-economic effect. Consequently, it said it concluded that the residual socio-economic effects of Project construction and operations on TLRU indicators will be not significant.

11.7.5 Project effects – WMT

Trans Mountain described the potential effects of the construction and operations of the WMT on marine-based traditional resource use. Trans Mountain said terrestrial (onshore) activities associated with the construction and operations of the WMT and its effect on TLRU is included in its assessment of effects on TLRU for the Project as a whole.

Trans Mountain stated that for the marine component of the WMT, the spatial boundary of the marine TLRU LSA encompasses and extends beyond the footprint to include the zones of influence of air emissions, acoustic environment, marine fish and fish habitat, marine mammals and marine birds since TLRU is dependent on these resources. The company said the marine TLRU LSA is the area where there is a reasonable potential for localized Project-related effects to affect existing uses of the land for traditional purposes. The potential effects of the Project are primarily assessed within the footprint and the marine TLRU LSA.

Trans Mountain said that subsistence activities, sites and supporting resources at the WMT would likely be physically disturbed during the construction phase of the Project at particular locations and specific times. Trans Mountain said potential residual effects of the WMT expansion include alteration of subsistence resources relating to marine mammals, marine birds, and marine fish. All existing activities and marine traffic, reasonably foreseeable development and future marine traffic in the WMT area, would interact with Project-related activities to contribute to the potential for cumulative changes on traditionally harvested resources during the construction phase of the Project.

Trans Mountain said the impact balance of this residual effect is considered negative. The spatial boundary ranges from permanent loss of marine fish habitat within the footprint to sensory disturbances that extend into the Marine TLRU RSA. Trans Mountain said the anticipated loss of marine fish and fish habitat will be offset through the construction of compensation/offset habitat. Specific compensation/offset measures will be determined in consultation with DFO, Aboriginal communities, local stewardship groups and other interested parties during the permitting phase of the Project. Trans Mountain said the duration of the event causing the effects to marine resources that support traditional harvesting activities are expected to extend throughout the operational life of the WMT.

Trans Mountain assessed the combined effects on TMRU, which considered Project-related marine effects on TMRU related to changes in marine access and use patterns, sensory disturbances and alterations of subsistence resources. The impact balance of the combined residual effect is considered negative. The company said the combined residual effect is considered to be reversible in the long term (as it will continue through the operations phase due to the extension of the dock and increased presence of moored tankers) and of low to medium magnitude given that the effects to traditionally harvested marine resources may be detectable and are dependent on each target species' sensitivities. The expanded dock complex will become a permanent feature of the inlet and long-term traditional resource use patterns will likely adapt over time.

Trans Mountain stated there are no situations for TLRU that would result in a significant residual socio-economic effect. Consequently, the company said it concluded that the residual socio-economic effects of construction and operations activities of the WMT on TLRU indicators will be not significant.

Spills

Trans Mountain said that accidental spills could affect traditional lands, culture, and practices by causing short- to medium-term disruption to trail systems, waterways, landmarks and gathering areas or sites within or downstream of the spill area. Credible worst-case and smaller spills could also result in mandated or voluntary interruption of subsistence trapping, hunting and gathering activities as a result of real or perceived changes in the quality of berries, medicinal plants, fish, and wildlife. A spill could also damage or affect use of spiritual and burial sites and sacred landscapes. Trans Mountain said that it did not adopt a more quantitative approach for predicting effects on traditional activities, since no widely accepted method exists for predicting oil spill effects on such indicators due to the inherent complexity resulting from the role of human interpretation and its influence on individuals' experiences of social effects and their ability, willingness and confidence to respond to change.

Mitigation

In each of its TLRU and TMRU technical reports, Trans Mountain provided detailed descriptions of mitigation measures that would be implemented to address the identified potential project effects for each of the indicators and site types. Trans Mountain also included in its technical reports detailed summaries of all of the mitigation requests made by participating Aboriginal groups, and the company's mitigation responses to each of the concerns or mitigation requests recorded.

Trans Mountain said that mitigation measures were principally developed in accordance with Trans Mountain standards, industry and provincial regulatory guidelines, current industry accepted best practices, engagement with Aboriginal communities, experience gained from other pipeline projects and professional judgment.

Trans Mountain said that the finalization of the footprint would avoid disturbance of known sacred areas to the greatest extent practical, and that the construction RoW would be narrowed at key locations to avoid known sacred areas. It said that the amount of land disturbed would be reduced by using previously disturbed areas, where possible. Trans Mountain said that in order to protect and avoid sensitive sacred sites, it would ensure that all personnel working on the construction of the Project were informed and sites clearly marked before the start of clearing. In the event that previously unidentified sacred sites were discovered during clearing or construction, measures from the Traditional Land Use Sites Discovery Contingency Plan or Heritage Resources Discovery Contingency Plan would be implemented.

Trans Mountain stated that sensitive resources identified in the Environmental Alignments Sheets and environmental tables within the immediate vicinity or the right-of-way will be clearly marked before

the start of clearing. The company stated that if additional TLRU sites are identified prior to Project construction, the sites will be assessed and appropriate mitigation measures will be determined and applied. Access will be managed, where required, along the Project where new temporary and permanent access is created for the construction and operation of the pipeline.

Trans Mountain said that it made extensive commitments regarding environmental compliance for the life of the Project. It said that it would implement a comprehensive suite of mitigation measures to reduce the effects of the Project on the environment and, in turn, on the use of those lands and resources for traditional purposes. EPPs and contingency plans have been developed to ensure disturbance is mitigated and minimized. Although some of the residual effects are long term, Trans Mountain said that this did not preclude Aboriginal groups from continuing to use lands, waters or resources for traditional subsistence purposes.

Trans Mountain said that it will implement a Reclamation Management Plan that includes construction reclamation measures to stabilize and revegetate affected lands that, in time, achieve land productivity along the RoW equivalent to the adjacent land use, and ensure the ability of the land to support various land uses. As part of its Traffic and Access Control Management Plan, Trans Mountain said that it would work with TLRU users to define locations where access control is necessary to mitigate environmental effects associated with increased access.

Trans Mountain described additional measures to reduce residual effects on TLRU, including notification regarding construction schedules and pipeline route maps, installing signage notifying of construction activities in the area, and working with Aboriginal communities to develop strategies to most effectively communicate the construction schedule and work areas to its members.

Trans Mountain committed to obtaining *Fisheries Act* authorizations when these are required, which would include measures to offset residual serious harm, as well as potential specific monitoring requirements. Trans Mountain noted that any Fish and Fish Habitat Offset Plans would be designed in consultation with regulators, fisheries managers, Aboriginal groups and other stakeholders.

Trans Mountain said that Aboriginal monitors will play a role in environmental compliance, and that the company would provide opportunities for Aboriginal monitors to work onsite through the construction to commissioning of the Project, providing traditional knowledge to ensure protection of the environment, traditional sites and resources, and to monitor mitigation success.

Trans Mountain committed to consulting with affected Aboriginal communities to identify mutually acceptable in-kind or replacement measures to replace or offset impacts directly related to and caused by a spill.

Cumulative effects

Trans Mountain said that the Project is likely to interact with existing and reasonably foreseeable developments causing cumulative effects on subsistence resources through habitat alteration and availability, changes to wildlife movement, and increased mortality risk. Most of the reasonably foreseeable developments occur outside the proposed pipeline corridor within the wider TLRU areas. These developments would not overlap spatially with the Project, but rather contribute to cumulative disturbances in traditional use areas and resources at a regional scale.

Trans Mountain said that the marine component of the cumulative effects assessment is specifically associated with the potential cumulative effects resulting from construction and operation of the WMT in combination with existing activities and reasonably foreseeable developments.

Trans Mountain assessed both the total cumulative effects and the Project contribution to these effects on TLRU and TMRU indicators. Trans Mountain said for potential effects on TLRU and TMRU indicators, the total cumulative effect significance ratings are estimated to range from low magnitude (within relatively intact areas) to high magnitude (in highly developed areas). Trans Mountain said existing cumulative effects risk is primarily associated with agriculture, forest harvest, roads and other transportation infrastructure, communities, quarries and mines, and oil and gas development. Trans Mountain stated these could be considered to range from not significant to significant. Trans Mountain stated that the application of best management practices to reasonably foreseeable developments would minimize their contribution to total cumulative effects on TLRU and TMRU indicators at the RSA scale.

Trans Mountain stated the strategy of paralleling and expanding existing facilities is the best approach to minimize the Project contribution to existing cumulative effects. Trans Mountain acknowledged the importance of continuing to work with Aboriginal communities to identify measures that avoid or minimize effects on TLRU and TMRU. Trans Mountain concluded the Project's contribution to total cumulative effects on TLRU and TMRU is rated as medium magnitude and not significant.

11.7.6 TLRU and TMRU interests and concerns provided by Aboriginal groups

Aboriginal intervenors that submitted written evidence in the hearing raised their use of lands, waters and resources for traditional purposes within their submissions to the Board. They stated that they continue to use the lands, waters and resources throughout their traditional territories in the exercise of their rights and their traditional activities. A total of 35 Aboriginal groups and individuals also provided oral traditional evidence (OTE) to the Board during the hearing. In their OTE, groups described aspects of their use of the lands, waters and resources, and provided views on how the Project could affect their ability to exercise their asserted and established rights relating to their traditional activities. Appendix 8 refers to information and evidence sources provided by Aboriginal groups that participated in the hearing. The Board notes that identifying and referring to specific passages within the record can lead to other direct and indirect references being overlooked. Therefore, anyone wishing to fully understand the context of the information and evidence provided by Aboriginal groups should familiarize themselves with the entire record of the hearing.

A number of concerns were raised by Aboriginal groups about the Project's potential effects on their continued use, for traditional purposes, of the lands, waters, and resources in the Project area. Specifically, concerns were raised about Trans Mountain's assessment methodology, the Project's potential effects on harvesting and cultural practices, the potential effects of spills, as well as the adequacy of mitigation measures and cumulative effects on TLRU and TMRU.

Assessment methods

Many Aboriginal groups raised concerns about the methodology used by Trans Mountain to assess the Project's potential effects on traditional use. Some said that a full assessment of adverse effects to environmental components of value specific to each group was required. A number of Aboriginal groups expressed concerns about the conclusions reached by Trans Mountain on the significance of potential effects. Some groups said that Trans Mountain had not comprehensively considered Aboriginal rights and title, and TLRU impacts to their territories.

The Stó:lō Collective said that Stó:lō technical and cultural experts were not involved in Project mitigation and EPP development, emergency response planning, or environmental survey work. The Stó:lō Collective was concerned that Trans Mountain was not committed to addressing issues and concerns raised in their Integrated Cultural Assessment.

Harvesting

Many Aboriginal groups said that they rely heavily on food gathered from the land and have a high consumption of subsistence foods in their traditional territories.

Some Aboriginal groups said that hunting activities continue to be impacted by development, and expressed concerns about the fragmentation of lands, loss of access to hunting and trapping areas, encroachment of developments, and loss of natural habitat. Some Aboriginal groups expressed concerns with the fragmentation of lands, loss of access to hunting and trapping areas, encroachment of developments and loss of natural habitat. Aboriginal groups said that although community members may not hunt as a basis for the survival of their family, it is still tied to tradition, bonding with their community, ancestors, and family, and creates a sense of place and rootedness.

A number of Aboriginal groups had concerns with increased access to traditional areas. Stk'emlupsemc te Secwepemc Nation said that they were concerned that increased access would threaten wildlife, increase fishing pressure and crowding, establish invasive plants, and increase waste. Some Aboriginal groups said that they were also concerned with increased competition for berry harvesting, as Project-related road construction would result in increased access to areas previously difficult to access.

Numerous Aboriginal groups expressed concerns with impacts to traditional fishing activities and fish and fish habitat for Project. Shxw'ow'hamel Indian Band is concerned that with construction occurring during the fishing season, and remediation impacts, there will be a loss of access to waterways, staging areas, and fishing sites, leading to a loss of fish. Matsqui First Nation said that while members still accrue substantial physical health benefits from harvesting and consuming Fraser River salmon, their ability to catch and preserve enough salmon to meet their dietary, ceremonial and social needs throughout the year has been severely affected by the devastation of fish stocks caused by commercial fishing practices and habitat destruction.

Aboriginal groups also said that harvesting, processing, and consuming wild foods, particularly salmon, also provide financial benefits. Fresh and canned salmon are staple sources of food, substantially offsetting the cost of purchasing groceries. Aboriginal groups said this economic benefit of wild foods is important to all but it is of critical importance to those who are poorer and who depend on wild food in order to live on limited income.

Many groups were concerned about their ability to continue to harvest plants, including medicinal plants, for traditional uses. Some Aboriginal groups said they had concerns with vegetation clearing, contamination of plants and loss or alteration of traditional use subsistence sites for plant gathering. Coldwater Indian Band said there are a lot of plants that help them through the year, and they gather berries, roots and plants to stay healthy. Neskonlith Indian Band said that some medicines can be harvested only in certain places throughout Secwepemcul'ecw, and that their members use a lot of the medicines directly and share knowledge of them with younger people. Samson Cree Nation said the land is their pharmacy, and Elders say that they cannot go pick medicine or do ceremonies as they once could. Michel First Nation said they use the land for their treaty rights. They also said that, in the location of their former reserve, they pick saskatoon berries, chokecherries, raspberries and blueberries.

Cultural impacts

Many Aboriginal groups said that the Project would accelerate a process by which youth and successive generations would lose their spiritual connection with the land. Sunchild First Nation described how lands in their traditional territory have historically been, and are presently used, as ceremonial and teaching grounds, and support hunting, fishing, trapping, and gathering of medicinal herbs. Matsqui First Nation, Shxw'ow'hamel First Nation, and other groups said that harvesting activities, consumption practices, rituals, and ceremony are important aspects of exercising and passing on to their children traditions, skills, and practices of their culture.

During TLRU studies, Aboriginal groups identified sacred sites, burial grounds, and places of cultural and spiritual significance where community gatherings can often take place. Aboriginal groups expressed concerns with regard to access to these areas, as well as disruption. Many Aboriginal groups expressed concerns with unmarked burial sites that could be impacted by construction.

The Stó:lō Collective raised specific concerns regarding Trans Mountain's plan to place a Project staging area on one of their important spiritual and burial sites called Lightening Rock. Stó:lō Collective strenuously objected to this plan.

Spills

Many Aboriginal groups expressed concerns about the potential for an oil spill and the adequacy of spill response procedures. Some groups said that a spill would have a catastrophic effect on the resources that they traditionally harvest, and were of the view that the low probability of a spill was not sufficient reason to determine the effects of a spill are not significant. Gunn Metis Local 55 said Lac Ste. Anne has hundreds of active harvesters, that the pipeline's proposed site is close to the waters of Lake Wabamun, and that their community members have many concerns about a potential spill.

Tsawwassen First Nation said that their primary concern was the potential for oil spills and subsequent effects on their constitutionally protected fishing and harvesting rights. Tsawwassen First Nation said that a TLRU study was not critical because Tsawwassen has established modern day treaty rights pursuant to the *Tsawwassen First Nation Final Agreement Act*. Tsawwassen First Nation said that their treaty right to fish and aquatic plants extends to all fish and aquatic plants for which there are harvesting opportunities within the Tsawwassen Fishing Area and Intertidal Bivalve Fishing Area.

A number of Aboriginal groups expressed concerns about potential impacts to the Fraser River. Tsleil-Waututh said that a spill in the Fraser River, or in the vicinity of the Fraser River estuary, would affect the ability to harvest sockeye and spring/chinook salmon, and that they would have no access to safe marine foods within their territory. Musqueam Indian Band said that their concerns about the Project were based on the many valued resources that originate from the Fraser River, which are fundamental to their society, culture, and subsistence.

Mitigation

Many Aboriginal groups said that they had concerns regarding mitigation measures proposed by Trans Mountain. Many said that they wanted to participate in monitoring activities, and that they wanted community members or Elders to be present during construction and involved in reclamation work, to ensure that mitigation measures are completed. Some Aboriginal groups expressed concerns about the reclamation of culturally important plants, watercourse crossings, and cultural heritage sites. The Lower Nicola Indian Band said that they are concerned with the alteration of culturally important and native vegetation species, and that proper and effective mitigation is required for their ability to practice Aboriginal rights. Many groups requested involvement in the development of mitigation measures and management plans to ensure that post-construction conditions can support their TLRU practices.

Cumulative effects

A number of Aboriginal groups expressed concerns about cumulative effects on TLRU and TMRU. During OTE presentations, groups shared their observations of changes to the land and waters in their traditional territories as a result of development. Aboriginal groups said that these changes have affected their ability to practice TLRU and TMRU activities, such as hunting, plant gathering, fishing, and trapping, as well as cultural ceremonies and gatherings. Some groups expressed concerns about the effects of existing development on the health of the ecosystems and resources harvested, as well as the effects on their cultural and spiritual well-being, and the potential effects of the Project in addition to these existing effects. Kwantlen First Nation said that they have concerns about the pressure the Fraser River is under and that Sockeye salmon, the most important of fish in their view, has been suffering a long decline.

Several Aboriginal groups raised concerns about how Trans Mountain conducted its cumulative effects assessment. Many groups felt that Trans Mountain's assessment was inadequate to assess the effects of the Project on their rights and interests. Many expressed the view that group specific cumulative effects assessments specific to them or their areas of interest should have been conducted.

Tsleil-Waututh Nation said that it conducted an effects assessment, according to the *Tsleil Waututh Stewardship Policy*, and concluded that the Project would add to negative cumulative effects, undermine Tsleil-Waututh Nation's ability to harvest, and eat safe marine foods from the Burrard Inlet, and prevent recovery of the subsistence economy.

In response to the concerns raised by Aboriginal groups, Trans Mountain stated that it reviewed the findings of the supplemental TLRU studies in the context of the ESA and determined that the significance conclusions with regard to TLRU remained unchanged for both Project related effects and the Project's contribution to cumulative effects.

Trans Mountain acknowledged that the Project may have potential adverse effects on opportunities to participate in traditional harvesting associated with direct Project effects on the land and wild food supplies (i.e., wildlife, fish, plants), and that subsistence activities may be disrupted by construction or operations of the Project and the interruption could mean that the traditional resource user misses the harvest opportunity or that their participation in the traditional activity is curtailed. Trans Mountain concluded that there will be no significant adverse impacts to the biophysical resources used by Aboriginal communities during construction and routine operations of the proposed pipeline and facilities (including the land based portion of the WMT).

With respect to effects on plants and reclamation activities, Trans Mountain said final reclamation measures, including opportunities to return culturally important plants to certain areas, and the Weed and Vegetation Management Plan, will be presented for discussion and input from Aboriginal groups at the EPP workshops.

Trans Mountain said it acknowledges the importance of the Fraser River and salmon to Aboriginal groups. Trans Mountain said it has developed a comprehensive suite of mitigation measures designed to protect the environment so that Aboriginal groups will be able to continue with their cultural practices and subsistence lifestyle. Trans Mountain said an entire suite of mitigation measures are found in the Pipeline EPP and the Westridge Marine Terminal EPP, and that with the implementation of these mitigation measures, the construction and operations of the proposed pipeline and facilities is not expected to have a significant effect on fish and fish habitat. The company said that while there will be temporary disruption to the ability of Aboriginal groups to access fishing locations during construction, the effect on fishing is expected to be short-term and therefore not significant.

With respect to cumulative effects, Trans Mountain said the methodology applied in the ESA is appropriate for considering the variability in total cumulative effects risk between regions, areas and 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. Trans Mountain said it applied a number of complementary approaches to balance the influences of setting and project specifics when conducting the cumulative effects assessment.

In response to the specific concerns of the Stó:lō Collective regarding Lightening Rock, Trans Mountain stated it adjusted the Project footprint at the proposed staging area, so activities are proposed to take place on the existing 18 metre-wide easement with an additional seven metres of temporary work space required for construction (reduced from the original 42 m width). However, Trans Mountain noted that no Project-specific archaeological work has been completed at the site and, as such, a field assessment is required in advance of Project construction to confirm the site boundary. Trans Mountain stated it is committed to working with the Stó:lō Collective during this field work and, if a conflict is confirmed, Trans Mountain stated it will aim to avoid the site through further localized reduction in temporary workspace, and work with Stó:lō on any necessary mitigation.

Views of the Board

Paragraphs 5(1)(c)(iii) and (iv), and 5(2) (b)(ii) and (iii) of the CEAA 2012 require consideration of the environmental effects that are likely to result from the designated project on the current use of lands and resources for traditional purpose, as well as physical and cultural heritage, or any structure, site or thing that is of historical, archaeological and paleontological or architectural significance with respect to Aboriginal people. In its evaluation, the Board has considered the effects of the Project to include all of the effects described in paragraph 5 of CEAA. The Board also considered the effects of accidents and malfunctions that may occur in connection with the Project.

The Board recognizes the importance that Aboriginal groups place on being able to continue their traditional uses and activities within the entire area of their traditional territories. In their written evidence and in their oral traditional evidence presented to the Board, Aboriginal groups explained how they continue to use the lands, waters and resources within their traditional territories for a range of activities, including hunting, trapping, fishing, gathering of resources on the land, and to continue to access sites and locations of cultural and spiritual importance. Groups also described the significant role that these activities and locations on the landscape have within their cultures and societies. They described how the transmission of cultural knowledge relies on the continued ability to access resources, sites and locations for traditional purposes. The Board acknowledges the strongly held views expressed by Aboriginal groups about the relationships between their use of the lands, waters, and resources and the importance of these within each Aboriginal society.

Some Aboriginal groups expressed concerns about Trans Mountain's approach to identifying the Project's potential effects on traditional land and resource use (TLRU), and the company's proposed mitigation measures. Concerns were expressed about how the Project's potential effects were assessed, the criteria used for determining the significance of these effects, and Trans Mountain's approach to assessing the Project's cumulative effects.

The Board has considered the evidence provided by Aboriginal groups and Trans Mountain about the nature and extent of the traditional land and marine use that is carried out by Aboriginal groups within the Project areas, and the potential effects of the Project on these traditional activities. The Board also considered all of the relevant information regarding potential Project effects on the

biophysical elements and the ecosystems that support these, including vegetation, wildlife, fish and fish habitat, and freshwater resources, which are addressed in Chapter 10. The Board notes that Trans Mountain's approach took into account all components of the biophysical environment that support the land base, the habitat conditions essential to the practice of traditional activities, and considered all the information that the company received from Aboriginal groups, to inform its assessment of resources potentially affected by the Project and the development of mitigation measures to address these effects.

The Board notes that Trans Mountain provided detailed responses to the information about TLRU and TMRU that was filed in evidence by Aboriginal intervenors who submitted reports on the Board's record. This included site-specific locations related to hunting, trapping, fishing, plant gathering, as well as areas of concern and interest relating to traditional use identified by these Aboriginal groups. Some groups were critical of Trans Mountain's assessment of the Project's potential effects on their ability to continue to use the lands, waters, and resources within the project area for traditional purposes, including the project's cumulative effects. The Board finds Trans Mountain's approach, including its methodology, for assessing the Project's potential effects on the current use of lands and resources for traditional purposes by potentially affected aboriginal groups was appropriate. The Board also finds that Trans Mountain adequately considered all the information provided on the record by Aboriginal groups regarding their traditional uses and activities. In the Board's view, Trans Mountain provided comprehensive responses and descriptions of mitigation for each of the specific sites and activities filed in the TLRU and TMRU reports on the record.

As noted in the section in this chapter regarding lands and land requirements for the Project, 89 per cent of the proposed right-of-way for the Project will be contiguous with existing disturbance. The Board is of the view that Trans Mountain's proposal to locate the Project to the greatest extent possible adjacent to existing disturbance greatly reduces the potential effects of the Project by reducing requirements for new disturbance.

The Board acknowledges that some Aboriginal groups have outstanding concerns about the potential effects of the Project on TLRU and TMRU. The Board notes that Trans Mountain has committed to continued engagement with all potentially affected Aboriginal groups to address issues and concerns. In order to inform the Board about any outstanding concerns, the Board would impose Conditions 96 and 146 requiring Trans Mountain to file with the Board reports on its ongoing consultations with potentially affected Aboriginal groups, including any issues and concerns raised, and any required mitigation measures both, during construction and the first five years of operations.

The Board views the final design of a project, including the finalization of mitigation measures and plans for environmental and socio-economic protection, to be an iterative process, and that these can be appropriately finalized after a final determination on the Project has been made. In this regard, the Board views the ongoing dialogue between Trans Mountain and potentially affected Aboriginal groups to be an important component in the finalization of those plans and measures. The Board expects that Trans Mountain will continue to consult with potentially affected Aboriginal groups, and encourages affected Aboriginal groups to engage in ongoing discussions with the company so that appropriate information can be incorporated into the Project design and follow-up programs. In order to inform the Board about the conclusions from this ongoing work, the Board would impose Condition 97 requiring Trans Mountain to file for approval, prior to construction, a report on outstanding TLRU and TMRU investigations.

Trans Mountain committed to provide Aboriginal groups with opportunities to be actively involved in monitoring activities during construction and reclamation. The Board encourages those Aboriginal groups that wish to have a role in monitoring the Project's potential effects during construction and reclamation to discuss such opportunities with Trans Mountain. To facilitate the participation of Aboriginal groups in construction monitoring, the Board would impose Condition 98 requiring Trans Mountain to file a plan for the participation by Aboriginal groups in construction monitoring. In addition, the Board would impose conditions requiring Trans Mountain to report to the Board on its consultations with Aboriginal groups for the development of the Project's environmental protection plans.

The Board acknowledges the significant concerns raised by the Stó:lō Collective regarding the Project's potential impacts on Lightening Rock. The Board accepts the views expressed by the Stó:lō Collective about the importance of Lightening Rock as a site of cultural significance. The Board acknowledges Trans Mountain's commitment to continue to work with the Stó:lō Collective to conduct further assessment at the site in order to define the site's boundaries more clearly and to identify and address any potential impacts the Project may have. In order to inform the Board of the outcomes of these further assessments, the Board would require Trans Mountain to file a report outlining the conclusions of a site assessment for Lightening Rock, including reporting on consultation with the Stó:lō Collective (Condition 77).

The Board acknowledges the concerns raised by Aboriginal groups about the potential effects of a spill on their continued use of lands, waters and resources. Trans Mountain has, in the event of a spill, committed to consulting with affected Aboriginal communities to identify mutually acceptable in-kind or replacement measures to replace or offset impacts directly related to, and caused by, the spill. The Board would require Trans Mountain to identify Aboriginal groups to be included in its consultation plan for review of the Project's Emergency Management Program. In the event of a spill from the pipeline or at the WMT, the Board finds that, depending on the extent and location of the spill, response time and the effectiveness of response measures, there could be significant adverse environmental effects to the use of lands, waters and resources for traditional purposes. However, the Board is the view that, should the Project be designed, constructed and operated according to the fulfillment of its certificate conditions and Trans Mountain's commitments, an accident or malfunction that could result in significant adverse environmental or socio economic effects is not a likely event.

The Board is of the view that the ability of Aboriginal groups to use the lands, waters and resources for traditional purposes would be temporarily impacted by construction and routine maintenance activities, and that some opportunities for certain activities such as harvesting or accessing sites or areas of TLRU will be temporarily interrupted. The Board is of the view that these impacts would be short term, as they would be limited to brief periods during construction and routine maintenance, and that these effects will be largely confined to the Project footprint for the pipeline, associated facilities and the on-shore portion of the WMT site. The Board finds that these effects would be reversible in the short to long term, and low in magnitude.

For the TMRU activities directly affected by the WMT, the Board finds that these effects would persist for the operational life of the Project, as TMRU activities would not occur within the expanded water lease boundaries for the WMT. The Board finds that while the effects would be long term in duration, these would be reversible in the long term. The Board notes that the anticipated loss of marine fish and fish habitat will be offset through compensation or offset habitat, and that specific compensation measures will be determined in consultation with DFO and affected Aboriginal communities. The Board acknowledges the concerns expressed by Aboriginal groups about the effects on harvesting and traditional user vessel movements in the vicinity of the WMT, but notes that the dock and associated vessel movement have been present for many years. Aboriginal groups would likely be able to adapt to the expanded water lease boundary. Therefore, the Board finds that for the WMT, the Project's effects on TMRU are low in magnitude.

With respect to the total cumulative effects on TLRU and TMRU, the Board finds existing cumulative effects associated with agriculture, forestry, transportation, roads and other infrastructure could be significant in certain areas of high development. Given Trans Mountain's suite of mitigation measures to address effects on the biophysical resources that support TLRU and TMRU activities, Trans Mountain's specific mitigation measures for addressing potential effects on TLRU and TMRU, the Boards finds that the Project's contribution to cumulative effects is not significant.

The Board is therefore of the view that during construction and routine operations, the Project is not likely to cause significant adverse environmental effects on the lands, waters or resources used for traditional purposes by Aboriginal groups, and is not likely to cause significant adverse effects on the ability of Aboriginal groups to utilize lands, waters or resources for traditional purposes.

The Board finds that in the event of a credible worst-case spill, environmental effects to the lands, waters or resources used for traditional purposes by Aboriginal groups would be adverse and

significant. However, as discussed in Chapter 9 the Board is the view that, should the Project be designed, constructed and operated according to the fulfillment of its certificate conditions and Trans Mountain's commitments, the probability of such an event is very low. Therefore, the Board recommends that there are not likely significant adverse effects for the purposes of CEAA 2012.

The Board has incorporated the potential consequences of a spill into its discussion on Spill Risks in Chapter 1 and considered them in its overall weighing of the benefits and burdens of the project in Chapter 2.

11.8 Human health

Trans Mountain undertook a variety of human health risk assessment (HHRA) studies that estimated the Project's potential effects on human health. It said that it followed a conventional risk assessment approach, focusing on the identification of the potential pathways by which people might be exposed to chemicals of potential concern (COPC), and quantifying the potential health effects. Trans Mountain completed screening level and qualitative risk assessments of the pipeline and marine terminal facilities, as well as detailed risk assessments for the WMT and for pipeline spill scenarios. It said construction-related health impacts were not included, due to the short-term nature of the emissions associated with construction activities. The Project's potential effects on human health associated with increased marine transportation are discussed in Chapter 14.

Trans Mountain identified the exposure pathways by which chemical emissions might 'travel' from the Project to the people living near the Project's facilities, to those who might frequent the area for recreation or other purposes, as well as how age, gender or health status may affect people's vulnerability to potential effects. Since the COPC would be emitted directly into the air, the primary exposure pathway is *via* inhalation (i.e., breathing in chemicals). Exposure through other pathways was also examined, including by ingestion of foods and direct skin exposure.

Trans Mountain said that specific consideration was given to Aboriginal peoples because of the unique opportunities for chemical exposures that might occur through traditional Aboriginal practices, including the consumption of traditional foods such as game meat, fish, beach food and wild plants. Trans Mountain said that it used exposure limits to assess the potential health effects that could result from short-term and long-term exposure to the various chemical emissions associated with the Project. Reliance was placed on exposure limits developed or recommended by regulatory authorities or reputable scientific authorities for the protection of human health. These included, among others, those available from Health Canada, the British Columbia Ministry of the Environment (B.C. MOE), the United States Environmental Protection Agency (US EPA), and the World Health Organization (WHO).

11.8.1 Pipelines and facilities

Pump stations

Trans Mountain said that all new pumps will be electrically driven and would not be a direct source of chemical emissions. Trans Mountain said overall, the opportunity for exposure to chemical emissions from the pump stations would be limited largely due to the low potential for pump station emissions to disperse off-site.

Edmonton, Sumas and Burnaby tank terminals

Trans Mountain said that for the Edmonton, Sumas and Burnaby tank terminals, the maximum predicted levels of exposure to COPCs (acting either singly or in combination) for both short term and chronic exposure remained below levels of exposure that would be expected to cause health effects. Adverse health effects would therefore not be expected among residents or area users from exposure to the emissions from the additional tanks at the Edmonton, Sumas and Burnaby tank terminals.

Pipeline spill scenarios

Trans Mountain assessed the potential health effects associated with simulated pipeline oil spill scenarios involving the spillage of oil onto land, within Metro Vancouver, as a result of third party damage to the pipeline. Trans Mountain assessed spilled oil volumes of 1 012 m^3 and 1 558 m^3, which took into consideration factors such as the expected response time for initiation and completion of valve closure, and the distance between valve locations.

Trans Mountain's assessment focused on short-term inhalation exposures during the early stages of an incident, as well as direct physical contact. Potentially affected people included members of the general public along the pipeline corridor within Metro Vancouver, as well as emergency responders. Trans Mountain acknowledged that people may be especially responsive to chemical exposures, and therefore reliance was placed on the use of health-based exposure limits developed by reputable scientific and regulatory authorities.

Trans Mountain said that, for both scenarios, exceedances of exposure limits were predicted for the aliphatic C1-C4 and C5-C8 groups, benzene and toluene. Average concentrations were predicted to exceed exposure limits at distances ranging from 50 m to approximately 1 km directly downwind from the surface of the pooled oil.

Trans Mountain said that, although the assessment revealed exceedances of the exposure limits, the interpretation of these exceedances required consideration of the conservative assumptions incorporated into the assessment. Trans Mountain said that the referenced guidelines used by Trans Mountain correspond to exposure levels that are well below those known to cause adverse health outcomes. An exceedance of an exposure limit does not necessarily indicate an imminent health risk, but implies some prospect for health effects to occur, and requires further analysis. Trans Mountain said that it also relied on the use of Acute Exposure Guideline Levels (AEGLs) and Emergency Response Planning Guidelines (ERPGs) in its assessment, since these were intended specifically for assessing the potential health effects that might occur from exposure to relatively high concentrations of chemicals for short duration under rare, accidental circumstances.

Trans Mountain concluded that the weight of evidence showed no obvious prospect for people's health to be seriously adversely affected during the early stages of the spill events, and that overall, people in the area would not be expected to experience health effects other than minor transient sensory or non-sensory effects. Examples of these effects include minor discomfort, mild irritation of the eyes, nose, or throat, mild cough, and symptoms such as mild headache, light headedness, minor vertigo, dizziness, or nausea. Odours may be apparent to some individuals.

Westridge Marine Terminal (WMT)

Trans Mountain said that, for short-term (acute) exposure, the maximum predicted air concentrations of chemicals resulting from the expansion of the WMT are lower than the corresponding exposure limits, with one exception – the combined exposures to the respiratory irritants mixture (composed primarily of NO2 and SO2). Trans Mountain said that this is largely produced by emissions from the existing tugs and main engines of the existing tankers. This was predicted to exceed the exposure limit for area users at one location within the perimeter of another industrial facility, where public access would be restricted. Trans Mountain said that predicted concentrations were otherwise below exposure limits for Aboriginal peoples, urban dwellers and area users and concluded the potential health risks were therefore negligible or low, and that adverse health effects would not be expected. Trans Mountain stated that exceedance for the respiratory irritants mixture is not predicted to change under the Application Case or Cumulative Case, and that this indicates that the incremental changes as a result of the Project and the reasonably foreseeable increases in all other marine vessel traffic are essentially negligible, and that the Project will have very little, if any, impact on the Base Case health risks associated with short-term exposure to the respiratory irritants mixture.

Trans Mountain said that for long-term (chronic) exposure risks, in all cases, the maximum predicted annual air concentrations of non-carcinogenic chemicals and for each carcinogenic COPC are lower than the corresponding exposure limits. Trans Mountain concluded that long-term health risks were therefore considered negligible or low, and that adverse health effects are not expected as a result of the WMT expansion.

Trans Mountain evaluated the potential health risks associated with short-term exposure to chemical emissions resulting from failures of the vapour combustion unit (VCU) and the vapour recovery units (VRUs) at the WMT. Trans Mountain stated that for the purpose of the assessment, the modelling incorporated a number of conservative assumptions corresponding to credible 'worst-case' conditions with a low probability of occurrence. Specifically, the VCU was assumed to fail during the simultaneous loading of three vessels, a loading scenario which is expected to occur less than 5 per cent of the time.

Also, it was assumed that 30 minutes would be required to identify a problem with the VCU or one of the VRUs, discontinue vessel loading, and isolate the vessel being loaded and the vapour recovery system. The company said it was assumed that each of the upset scenarios occurred despite the low probability and without regard for the numerous safety and monitoring measures that will be implemented as part of the Project.

Trans Mountain predicted exceedance of the acute inhalation exposure limit for benzene under both of these upset scenarios. These exceedances were predicted to occur within the terminal boundary, over water within the water lot lease boundary, and in the vacant lands to the southeast of the terminal. Trans Mountain said that the likelihood that members of the public would be present at these locations and exposed to the benzene concentrations would be low. It said that the maximum predicted one-hour air concentration in the assessment likely overstates the actual risks to public health as this concentration is associated with infrequent and unusual meteorological conditions. The company said the likelihood of achieving this maximum concentration is low, since an upset scenario (already an improbable event) is unlikely to take place at the exact time when such "worst-case" meteorological conditions may occur.

Trans Mountain said no exceedances were predicted to occur at the closest residences, elementary schools or assisted living complexes, or within any of the neighbouring communities surrounding the WMT, the risks to public health from short-term inhalation exposure to benzene were considered to be low, and that adverse health effects are not expected.

Trans Mountain said that for the credible worst-case spill scenario for the WMT, (160 m3 of spilled oil), exceedances of the acute exposure limits were predicted to occur for the following COPC: aliphatic C1-C4, aliphatic C5-C8, and aromatic C9-C16 groups, benzene, toluene and xylenes. Trans Mountain said the exceedances indicate the possibility that people exposed to each of these COPC during the early stages of the spill incident could potentially experience adverse health effects.

Trans Mountain said that the exceedances were predicted to occur over water only, with the spatial extent either confined to an area within the Westridge containment boom (i.e., smaller size spill) or an area in close proximity to the tanker berths (i.e., credible worst-case spill). Exceedances of the acute exposure limits were predicted to occur over the first one-to-two hours following the start of the smaller spill scenario. For some COPC (aromatic C9-C16 group and benzene), the exceedances were predicted to occur for up to 13 hours after the start of the spill under the credible worst-case spill scenario.

Trans Mountain said that a comparison of the predicted maximum one-hour average airborne concentrations of the COPC against the corresponding one-hour AEGL and ERPG guidelines revealed the predicted concentrations were consistently lower than these guidelines, indicating that people in the area would not be expected to experience health effects other than mild, transient sensory and/or non-sensory effects. Trans Mountain noted examples of these: discomfort, irritability, mild irritation of the eyes, nose or throat, mild cough, and symptoms consistent with nominal central nervous system involvement such as mild headache, light headedness, minor vertigo, dizziness or nausea. Trans Mountain said these effects would likely resolve quickly when exposure ended, with no lingering after-effects.

Trans Mountain said the absence of significant adverse health effects applied whether the COPC were assessed on an individual basis or as part of mixtures.

Several intervenors raised concerns about the methodology used by Trans Mountain to assess the Project's potential human health effects. Concerns raised by Metro Vancouver, the City of Vancouver and Living Oceans noted apparent deficiencies in the assumptions used in Trans Mountain's air dispersion models, how these may significantly underestimate the impacts of the Project, and that certain exposure pathways and activities were excluded from the assessment. Living Oceans said that while Trans Mountain's assessment followed a conventional HHRA paradigm, it was based on misleading and non-comparable scenarios.

Concerns were expressed about the selected spill scenario location (within Metro Vancouver) and the methods and assumptions used to assess potential human health effects associated with a pipeline oil spill. Living Oceans Society raised a number of specific concerns regarding Trans Mountain's pipeline spill scenario. Living Oceans Society said that Trans Mountain's scenarios do not represent worst-case credible conditions for emissions, concentrations and human health risks. It said that Trans Mountain's own evidence show a maximum outflow volume within Metro Vancouver of approximately 3 100 m^3, and there

are numerous locations where the estimated outflow volumes exceed 2 500 m^3, which are all credible spill volumes that were not analyzed. Living Oceans Society also said the meteorological conditions used do not follow US EPA guidance for the Risk Management Program, and that the use of appropriate worst-case meteorological parameters would very substantially increase concentrations (e.g., by a factor of 10), and would result in much larger hazard zones where concentrations exceed exposure limits.

The City of Vancouver made a number of recommendations to address these deficiencies, including the provision of revised detailed HHRA reports which include all plausible pathways and routes of human exposure.

Trans Mountain said that the assumptions and parameters used in the dispersion modelling followed the Guidelines for Air Quality Dispersion Modelling in British Columbia (British Columbia Ministry of Environment (B.C. MOE) 2008), which is an established industry and government standard. It said that the outcomes of the pipeline spill scenarios assessment were considered representative of the types of health effects that might be experienced by people living in smaller communities, including Aboriginal and rural communities located along the pipeline route.

Trans Mountain said that the spill volume of 1 558 m^3 is consistent with a credible worst-case spill scenario as it corresponds to a reasonable upper bound estimate (95^{th} percentile) of the volume of oil that might be spilled on land in the unlikely event of third party damage to the segment of the proposed pipeline running through Metro Vancouver. Trans Mountain said the credible worst-case scenario was based on the development and analysis of estimates of potential spill volumes that could occur at more than 2,000 locations along this pipeline segment, taking into the consideration the distance between emergency shut-down valves, valve closure times, and drain-down volumes between valve locations.

Trans Mountain also said that with respect to on-land oil spills at the Burnaby, Edmonton and Sumas terminals, it believes that the simulated pipeline oil spill can be considered representative of a tank terminal spill scenario and the potential health effects from exposure to hydrocarbon vapours in the event of an oil spill at any of the terminals

A number of concerns raised by intervenors focused on potential air quality health impacts resulting from routine operations, as well as potential accidents. Concerns were raised about the Project's potential human health effects in the vicinity of the WMT. Metro Vancouver and Health Canada raised concerns about the potential health effects of ground-level ambient ozone. Metro Vancouver said that there is no known safe level for ambient ozone concentrations and the sensitive Lower Fraser Valley airshed continues to experience occasional episodes where applicable objectives and standards for ambient concentrations of ground-level ozone may be exceeded.

In response, Trans Mountain said the U.S. EPA concludes that, based on the weight-of-evidence, there is no clear health effects threshold for ozone, however there is some uncertainty in the lower end of the concentration-response evaluations for ozone (i.e., below 20 ppb) due to data limitations. Because the observed ozone concentrations in Metro Vancouver already exceed this level, any increase in regional ozone concentrations could be associated with adverse health effects. For the Project, and in accordance with current provincial and federal guidance, the management of ozone in relation to potential human health effects will be focused on the monitoring of precursor emissions, such as NOx and VOCs. An emissions management plan for the precursor compounds will help mitigate potential ozone-related health risks in the area.

Several letters of comment were submitted by people expressing their concerns about how increased emissions from the WMT would potentially affect their health or the health of families and residents in the area because of existing health conditions such as asthma, chemical sensitivities or chronic obstructive pulmonary disease (COPD). Other participants raised concerns about the Project's potential impact on air quality, including the potential health effects of benzene in the vicinity of the WMT, and the potential health effects of a major fire at the Burnaby Tank Terminal.

Specific concerns of intervenors included potential effects from Project-related particulate matter (including diesel particulate matter, $PM_{2.5}$ and PM_{10}), 1,3-Butadiene, and potential exceedances of exposure limits for benzene.

Benzene

BROKE, North Shore No Pipeline Expansion (NS NOPE), Living Oceans Society, and Metro Vancouver expressed concerns over potential human health effects associated with short-term and long-term exposure to benzene. Specifically, concerns were raised that maximum predicted ground-level air concentrations of benzene, including in Burrard Inlet, would exceed Alberta's one-hour Ambient Air Quality Objective (AAQO). Health Canada expressed concern regarding benzene concentrations at the Edmonton Terminal.

Trans Mountain said it used the acute health-based exposure limit developed by the Texas Commission on Environmental Quality (TCEQ) for benzene. By virtue of the manner in which it was derived, the reference value confers a very high degree of protection. Trans Mountain noted that Alberta's one hour AAQO for benzene was not selected for use in the HHRAs as it did not satisfy the requirement for adequate supporting documentation. As a result, Trans Mountain was unable to comment on the scientific merit of this limit, and can make no assertions as to the adequacy of the study upon which it may be based.

Trans Mountain said that, based on its assessment, in all cases the potential health risks associated with short-term and long-term inhalation of benzene were below the corresponding exposure limits. This applied whether benzene was assessed on an individual basis or as part of a mixture such as immunotoxicants and hematotoxicants.

Trans Mountain committed to meeting the lowest applicable AAQO established in B.C. or Alberta at each terminal, including Alberta's one-hour AAQO for benzene. It said that it was in the process of evolving and refining the vapour control designs of its terminals, with the goal of ensuring sufficient recovery and destruction efficiencies to meet these objectives.

Particulate matter

The City of Burnaby, Living Oceans Society, the City of Vancouver, FVRD, Metro Vancouver and B. Miller expressed concern regarding the potential health risks associated with exposure to particulate matter emitted from routine operations and at the WMT, including potential cancer risks. Concerns included the potential health effects associated with exposure to $PM_{2.5}$ and PM_{10}, and diesel particulate matter (DPM).

Metro Vancouver said that the incremental emissions associated with the Project and cumulative scenarios would result in maximum DPM concentrations and associated cancer risks that exceed Health Canada's 10 per million screening level by a considerable margin.

Metro Vancouver requested that the Board reject Trans Mountain's analysis and conclusions regarding DPM cancer risk. Metro Vancouver recommended that Trans Mountain be required to establish additional ambient air quality monitoring in the WMT area for $PM_{2.5}$, and to establish a continuous improvement program that targets reductions in emissions from vessels loading at WMT, including DPM.

Trans Mountain said that it fully recognizes that there is general consensus among regulatory agencies that diesel exhaust, including DPM, is carcinogenic, but that considerable uncertainty exists with respect to the actual dose-response relationship of DPM. It said that neither Health Canada nor the U.S. EPA has developed a cancer-based exposure limit for DPM.

In response to the concerns raised by FVRD and Metro Vancouver with respect to DPM, Trans Mountain provided an explanation for its approach and conclusions regarding its assessment of DPM risks in its reply evidence. Trans Mountain said that it used a scientifically defensible approach for assessing the potential health risks for DPM. It said there is low confidence in the California Office of Environmental Health Hazard Assessment unit risk value that FVRD and Metro Vancouver used to characterize the potential carcinogenic risks associated with DPM. Trans Mountain said that Metro Vancouver's evidence incorrectly concluded DPM is the dominant risk factor for lung cancer in the region and exaggerated the actual DPM-related cancer risks in the region. It said that its predicted 24 hour and annual air concentrations were compared to exposure limits developed by the U.S. EPA, and that Project-related excess cancer risks for DPM were less than 1 in 100 000 (i.e., 0.8 in 100 000), which is the benchmark that Health Canada and the British Columbia Ministry of the Environment use to assume that any level of long-term exposure to carcinogenic chemicals is associated with some hypothetical risk of cancer.

In response to concerns raised about the health impacts of particulate matter, Trans Mountain noted that additional air dispersion modelling was completed for the WMT expansion in response to the Lower Fraser Valley Air Quality Coordinating Committee and that the updated modelling presents predicted peak

24-hour and maximum annual concentrations for $PM_{2.5}$ and PM_{10} under the Base and Application cases that are lower than those assessed in the HHRA for the WMT.

Trans Mountain said that in all cases, the potential health risks associated with short-term and long-term exposure to $PM_{2.5}$ and PM_{10} were below the benchmark risk estimate of 1.0, indicating that predicted exposures were less than the corresponding exposure limits, and that the contribution of the Project to cumulative $PM_{2.5}$ and PM_{10} exposures was negligible.

1,3-butadiene

BROKE, the City of Burnaby, the City of Vancouver, and NS NOPE expressed concern over the potential human health effects associated with short-term and long-term exposure to 1,3 butadiene emitted from the Project.

Trans Mountain said 1,3-butadiene was not detected in either the bulk liquid analysis or the vapours of Cold Lake Winter Blend, which served as the basis for the fugitive or uncontrolled emissions inventory for the Project. Trans Mountain said that, in all cases, the maximum predicted short-term and long-term exposures to 1,3-butadiene were below the corresponding exposure limits, indicating that adverse health effects would not be anticipated.

Fire

The City of Burnaby raised concerns about the potential health effects that could result from a major fire at the Burnaby Tank Terminal, including release of toxic smoke plumes. It said that the potential health impacts are most likely to harm those with pre-existing chronic respiratory conditions, may increase rates of asthma and cardiovascular illness, and may present undetermined effects on longer term illness such as cancer. The City of Burnaby concluded that the Burnaby Mountain Terminal expansion is not appropriate given these, among other risks and its location.

Trans Mountain said that its proposed emergency and spill response measures (discussed in detail in Chapter 9) will be taken as part of a coordinated action to contain and recover spilled oil and to mitigate potential health and environmental impacts, and that these measures will further prevent fires from occurring. The coordinated action will determine the need for and types of measures required to protect people's health if public health or safety were threatened.

11.8.2 Groundwater

Trans Mountain identified the Project's potential groundwater quality and quantity effects, the spill scenarios (including pathways) through which oil could enter surface water or ground water sources, and described the company's recommended mitigation measures.

The measures identified by Trans Mountain to address effects on groundwater include:

- notifying landowners with water wells before blasting is carried out, and assessing groundwater conditions and risks;
- monitoring all registered or known potable water wells located within 200 m of any blasting prior to and following blasting;
- re-establishing or replacing a potable water supply if water wells located within 30 m of the construction RoW are damaged (i.e., diminishment in quantity and/or quality); and
- using spill prevention practices that protect wells and aquifers.

A number of Aboriginal groups, municipal and provincial governments, and federal authorities raised concerns about the potential impacts of the project on groundwater quality and availability, including potential impacts related to a spill or accident.

The Coldwater Indian Band said that it relies entirely on groundwater from the aquifer beneath IR No.1 for drinking water, and other purposes including farming, and that Trans Mountain's proposed east alternative and modified east alternative routes will be located upslope and east of the Coldwater IR No.1. It recommended installation of independent monitoring wells to monitor aquifer yields, sustainability and quality in perpetuity for the proposed east routes. Trans Mountain said that it believes there is no opportunity for the existing or proposed pipeline to undermine the physical hydrogeology in the area of

the Coldwater Indian Band that would create any concerns with respect to groundwater flow and aquifer sustainability or yield.

The Province of British Columbia raised concerns about long-term groundwater quality monitoring, particularly in high consequence areas (HCAs) where community drinking water is obtained from highly vulnerable aquifers.

The City of Vancouver recommended more ground-truthing of well locations and use prior to the construction of the pipeline, and the establishment of monitoring wells adjacent to or within vulnerable aquifers.

Health Canada said that impacts on drinking water during normal operations will be low, but that this is contingent on the effective implementation of spill control measures to limit dispersion of oil into drinking water sources. Health Canada recommended that high consequence areas be identified to take into account the use of these by Aboriginal people as sources of drinking water, for cultural and spiritual purposes, and that appropriate priority be given to these areas in spill response plans. Natural Resources Canada raised concerns about potential impacts on surface water or groundwater sources used by Aboriginal groups for drinking, cultural, spiritual, traditional or agricultural purposes.

Trans Mountain committed to work with communities that have specific concerns related to the protection of municipal water sources, and to discussions on potential groundwater modelling and reviews of maintenance policies and programs. Trans Mountain acknowledged the need for special consideration of aquifers and surface watercourses in close proximity to Aboriginal communities. The company committed to work with the leadership of Aboriginal communities to understand the manner and extent of use of the water sources, and to collectively determine the appropriate measures to be taken to protect Aboriginal people's health.

Trans Mountain committed to incorporating a list of potential drinking water sources for Aboriginal communities into its updated EMP. The list of potential drinking water sources would be used to issue an immediate drinking water advisory in the event of a spill contaminating a watercourse or aquifer used for drinking water purposes. It would also ground-truth the exact sources of drinking water affected by a spill by attempting to meet with Aboriginal communities, landowners, municipalities, etc. and then refining the drinking water advisory with the results of the ground-truthing activities. If a drinking water advisory were to be issued as a result of a spill, Trans Mountain committed to working with the leadership of the Aboriginal community to identify surplus capacity from other drinking water sources in the area, while suitable replacement alternatives are established and implemented.

11.8.3 Community health

Trans Mountain evaluated the potential effects of the project on key community health issues, including:

- socio-economic health effects, including mental well-being, and alcohol and drug misuse;
- infectious diseases;
- environmental health effects, including stress and anxiety related to the perception of contamination; and
- Aboriginal health, including diet and nutritional outcomes.

Trans Mountain said that the Project is likely to have both beneficial and adverse effects on socio-economic health outcomes. It said that socio-economic health effects are linked largely to project construction, and would primarily affect those communities that act as construction hubs, communities that have limited mental health and addictions services, or communities where the level of stress about the Project is high. Trans Mountain said that the possibility of a spill or other malfunction, the presence of the pipeline itself, or perception of contamination can cause stress and anxiety.

Trans Mountain said that the Project has the potential to contribute to dietary change away from a traditional subsistence diet by Aboriginal people. It predicted that there would be residual effects to animal habitat, animal movements, and increased mortality risk for wildlife along the corridor, and that some subsistence food sources will be affected by Project activities. Some community members may avoid eating subsistence foods due to fears of contamination, and that the degree to which this would occur is unknown.

Several Aboriginal groups expressed concerns about the Project's potential direct or indirect effects on community health, particularly in the event of a spill, through impacts on cultural activities, traditional food resources, or through increased anxiety and perception of contamination. The Upper Nicola Band raised concerns about the ability to continue traditional land use activities, and resulting effects on the physical and psychological health of community members.

Matsqui said that adverse short-term and long-term health impacts resulting from a spill event affecting Matsqui reserve lands, the Fraser River or Burrard Inlet are of particular concern, and were rated as "extremely significant." Matsqui First Nation provided an assessment of potential impacts based on spill scenarios (including pipelines ruptures near Hope, McLennan Creek, and a marine spill in the Strait of Georgia). In each of these scenarios, Matsqui said that the predicted impacts on physical health are characterized as severe, including outcomes such as lethargy, low energy (from limited time/activity outdoors after a spill), higher rates of illness (from lower nutrition due to limited consumption of fish after a spill), high stress (from a more sedentary lifestyle), and reduced pre-natal health and youth development (from diminished nutrition during critical developmental periods).

Health Canada said that the health risk assessment for consumption of country foods by Aboriginal residents, urban dwellers and area users in the vicinity of the Burnaby and WMTs indicates that there will be little project-related effects due to contamination of these food sources during normal operations. Health Canada said that consideration should be given to the potential impacts of a spill on the availability and potential contamination of terrestrial and marine country foods consumed by Aboriginal communities.

Trans Mountain said that it proposed mitigation measures described in the Pipeline EPP to protect the biophysical environment and provide for ongoing monitoring, and that communication with stakeholders is particularly important in minimizing any adverse effects on environmental health, public safety and the health of Aboriginal people. Trans Mountain's key mitigation measures include:

- developing site-specific traffic access and control management plans;
- developing a Worker Accommodation Strategy;
- ensuring construction camps meet all provincial health and safety requirements;
- developing a Code of Conduct to guide appropriate worker/community interactions; and
- developing an issues-tracking process to monitor community health and socio-economic issues and opportunities that may emerge during construction and reclamation.

Trans Mountain said that although some subsistence food sources will be affected by Project activities over the short-term, and anxiety around potential contamination may lead some Aboriginal community members to avoid eating subsistence foods, the residual effect on Aboriginal community health will not be significant, as the magnitude of changes to traditional food sources is negligible to low.

Views of the Board

Assessment methodology

A number of participants raised concerns and presented opposing evidence, views and conclusions about specific aspects of Trans Mountain's methodology, such as air dispersion modelling, and predictions of risk based on chemical exposures. The Board is of the view that Trans Mountain followed a generally acceptable risk assessment paradigm, and that its assessment adequately identified and evaluated the Project's potential effects on human health. The Board accepts Trans Mountain's reliance, primarily, on the use of exposure limits developed or recommended by authorities such as Health Canada and the US EPA. The Board finds this approach acceptable, as these guidelines are broadly protective of human health. The Board is of the view that additional assessment, as recommended by some intervenors, is not required.

Facilities

The Board accepts Trans Mountain's conclusion that for the construction of the Project and for routine operation of the pipeline, pump stations and Edmonton, Burnaby and Sumas tank terminals, adverse health effects would not be expected. This is because there would be limited potential emissions during construction, the predicted short term and chronic levels of exposure to chemicals

of potential concern at the tank terminals are below levels of exposure that would be expected to cause health effects, and because the pump stations will be electrically driven and would not be a direct source of emissions available for dispersion beyond the stations' boundaries. The Board therefore finds that these elements of the Project are not likely to cause significant adverse effects on human health, including the health of Aboriginal people.

The Board acknowledges the concerns raised by Aboriginal groups, municipalities, provincial governments and federal departments about existing air quality in the vicinity of the Westridge Marine Terminal (WMT) (and the lower mainland in general). The Board notes in particular those concerns regarding how the Project's potential emissions from the operation of the WMT, including particulate matter, could affect human health. The Board acknowledges the general consensus that $PM_{2.5}$ and diesel particulate matter (DPM) have known negative health effects.

The Board considered these concerns, the evidence provided by Trans Mountain, and all evidence on the record regarding the proposed expansion of the WMT. The Board notes the predicted exceedance for the respiratory irritants mixture during routine operations of the WMT. The Board is of the view that the Project contribution to this exceedance will have inconsequential impact on any incremental health risks associated with short-term exposure resulting from operations at the WMT, and therefore is not likely to cause significant adverse effects on human health, including the health of Aboriginal people.

The Board acknowledges that a number of people expressed their concerns about how they believed increased emissions from the WMT would potentially affect their health or the health of families and residents in the area because of existing health conditions such as asthma, chemical sensitivities or COPD. The Board is of the view that Trans Mountain's assessment of potential long-term health effects associated with the operation of the WMT follows a generally accepted risk assessment paradigm and is based on the use of exposure limits developed or recommended by Health Canada and other reputable authorities. The Board finds that, based on the generally accepted methodologies used by Trans Mountain, the potential health risks associated with long-term inhalation of chemicals, such as benzene, were below the corresponding exposure limits, and that this applied whether benzene was assessed on its own or as part of a mixture of chemicals. The Board therefore finds that for long-term exposure risks associated with the operation of the WMT, the maximum predicted concentrations of carcinogenic and non-carcinogenic chemicals, including benzene, $PM_{2.5}$, and 1.3 butadiene, are likely to be lower than the corresponding exposure limits that were examined, including those exposure limits developed by Health Canada and other authorities, and are not likely to cause significant adverse effects on human health, including the health of Aboriginal people.

Metro Vancouver requested that the Board reject Trans Mountain's analysis and conclusions regarding DPM cancer risk. The Board acknowledges that there is a degree of uncertainty in all predictive assessments, including human health risk assessments. The Board also acknowledges the consensus that DPM is a potential carcinogen. The Board has considered all the evidence presented on this matter and is not persuaded that Trans Mountain's analysis and conclusions with respect to DPM risks should be rejected. The Board finds that Trans Mountain has undertaken a scientifically defensible approach for assessing the potential health risks for DPM. The Board finds that Trans Mountain, in its reply evidence, provided sufficient and detailed explanation for its approach and conclusions regarding potential DPM risks. The Board finds that Metro Vancouver's evidence relating to its estimations of the DPM cancer risks assign a potentially disproportionately high level of lung cancer risk to DPM in the lower mainland, and the Board therefore questions the potential value of the conclusions reached in this evidence. Based on the balance of the evidence, the Board therefore finds that long-term emissions exposure associated with the operation of the WMT is not likely to cause significant adverse effects on human health, including the health of Aboriginal people.

The Board acknowledges intervenors' interest related to monitoring air emissions, including the recommendations made by Metro Vancouver for additional monitoring of particulate matter emissions. In the Board's view, monitoring air emissions serves as a valuable tool in verifying and validating the results of predictive air emissions modelling, including those used to predict potential effects on human health. To this end, the Board would require Trans Mountain to develop and implement air emissions management plans for the WMT and for the Edmonton, Sumas and Burnaby

Terminals (Conditions 52 and 79). These plans are intended to protect both the environment and human health, and would require monitoring of contaminants of potential concern, including particulate matter, nitrogen oxide, sulphur dioxide, and volatile organic compounds at the WMT.

The Board would require Trans Mountain to include with the filed plans a summary of its consultations with appropriate government authorities and any potentially affected Aboriginal groups. In its summary, Trans Mountain must also provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plans.

The Board's assessment of the Project's environmental effects of air emissions, and the Board's views on these, is provided in Chapter 10.

With respect to the potential health risks associated with short-term exposure to chemical emissions resulting from failures of the vapour combustion unit (VCU) and the vapour recovery units (VRUs) at the WMT, the Board notes Trans Mountain predicted exceedance of the acute inhalation exposure limit for benzene under both of these scenarios. The Board also notes these exceedances were predicted to occur within the terminal and water lot lease boundaries, within adjacent vacant lands, and that the likelihood that members of the public would be present at these locations and exposed to the benzene concentrations would be low. The Board finds that, although there would be risks to public health from short-term inhalation exposure to benzene in these scenarios, the scenarios presented are low probability, the geographic and temporal extent of the potential exceedance would limited, and the potential for human exposure would be low and therefore of low magnitude and not likely to cause significant adverse effects on human health.

The Board acknowledges the concerns raised regarding Trans Mountain's assessment of potential health impacts resulting from a pipeline spill, including concerns regarding the assumptions used in selecting and assessing the spill scenarios. The Board has considered these concerns as well as Trans Mountain's assessment and evidence. The Board is of the view that Trans Mountain has presented a credible worst-case scenario for the purposes of assessing the potential effects on human health that could result from a pipeline spill. Trans Mountain's scenario was based on the analysis of potential spill volumes that could occur at more than 2 000 locations along the pipeline, and took into account factors such as distances between emergency shut-down valves, valve closure times, and drain-down volumes between valve locations. The Board finds this an acceptable approach for the purposes of assessing potential human health effects.

The Board notes Trans Mountain's conclusions regarding the Project's potential effects on human health that may result from a spill or accident would be largely limited to mild and transitory effects. The Board finds that, based on the evidence presented, there would likely be potential adverse effects on human health for those people in the vicinity of a spill, but that these effects would be limited in duration and magnitude and therefore these are not likely to cause significant adverse effects on human health.

The Board's views on Trans Mountain's measures to address emergency prevention and response, and air quality are discussed in Chapters 9 and 10 respectively. The Board is of the view that its requirements relating to emergency preparedness and response are also protective of human health. The Board would require Trans Mountain to prepare a number of plans relating to emergency response and air quality, including an Emergency Response Plan for the pipeline and the Edmonton, Sumas and Burnaby terminals, and an Emergency Response Plan for the WMT (Conditions 125 and 126).

The Board shares the concern raised by participants about water quality for Aboriginal communities that utilize groundwater resources. The Board acknowledges the importance of water use for Aboriginal communities, for consumption, agricultural and municipal use, and as sources associated with traditional uses and values.

The Board notes the concerns raised in this regard by the Coldwater Indian Band and Health Canada. The Coldwater Indian Band stated the draft conditions proposed by the Board fail to address their concerns regarding impacts and risks posed by the proposed Project, and will not result in the avoidance of impacts and risks to Coldwater's water supply. They recommended that the proposed

requirement for a water well inventory must also identify the location and extent of aquifers transected, and that the Board's proposed condition for consultation on protection of municipal water sources does not stipulate whether measures have to be taken to mitigate risks or put in place protections to protect water sources.

Trans Mountain made a number of commitments to address the concerns raised by governments and Aboriginal groups. These included commitments to discuss how groundwater modelling and monitoring could be undertaken to help address concerns, and to work with Aboriginal communities to collectively determine appropriate measures to protect people's health. However, Trans Mountain has not conducted a hydrogeological study at the Coldwater Reserve that could more precisely predict any potential interactions from the proposed pipeline and the aquifer relied on by the Coldwater Indian Band. The Board finds that Trans Mountain has not sufficiently substantiated in its evidence that there is no potential interactions with the aquifer underlying Coldwater IR No. 1 and the proposed project route. The Board would therefore impose Condition 39 requiring Trans Mountain to file a hydrogeological study to more precisely determine the potential for interactions and impacts on the aquifer at the Coldwater IR 1, and to assess the need for any additional measures to protect the aquifer, including monitoring.

The Board is of the view that its proposed conditions, along with the commitments by Trans Mountain, can effectively address any effects on human health via potential Project impacts to groundwater. The Board would therefore impose a number conditions, including requirements for Trans Mountain to file with the Board a Pipeline Environmental Protection Plan (Condition 72), a water well inventory (Condition 93), consultation reports for protection of municipal water sources (Condition 94) a Groundwater Seepage Management Plan (Condition 87) and a Groundwater Monitoring Program (Condition 130).

Community health

Aboriginal groups, as well as federal departments, raised concerns about potential impacts to the social health of Aboriginal communities, and in particular, effects associated with any potential reductions in access to and consumption of traditional country foods. The Board accepts the evidence and comments provided by many Aboriginal groups that they rely on, and have a preference for, eating traditional foods. The Board notes the views of both Trans Mountain and Aboriginal groups regarding the potential feelings of stress and anxiety that could be associated with the construction and operation of the Project, and in particular, as a result of the prospect of a potential spill or accident. The Board notes the evidence provided by Matsqui describing the specific impacts it suggests would occur in the event of a spill, including higher rates of illness (from lower nutrition due to limited consumption of fish after a spill), high stress (from a more sedentary lifestyle), and reduced pre-natal health and youth development. The Board accepts the evidence of both intervenors and Trans Mountain that perceptions of contamination could have a negative effect on traditional harvesting and food consumption.

However, as described in Chapter 9 of this report, the Board is of the view that the probability of a credible worst-case spill from the pipeline is very low. While feelings of anxiety related to potential spills are concerns for many individuals, communities and Aboriginal groups, the Board is of the view that, should the Project be designed, constructed and operated according to the fulfillment of its certificate conditions and Trans Mountain's commitments, the probability of an accident or malfunction that could result in significant adverse environmental or socio-economic effects is very low. With respect to perceptions of contamination that could have a negative effect on traditional harvesting and food consumption, the Board has assessed both the potential environmental effects of the Project on biophysical resources relied on by Aboriginal groups for traditional harvesting and land use, as well as the effects of the Project on those uses. The Board concurs with Trans Mountain's conclusion that during construction and routine operations some subsistence food sources will be affected by Project activities over the short-term, but that the effect is likely to be temporary, and of low magnitude. The Board is of the view that any residual effect is likely to be limited to the period during construction, restricted primarily to the Project footprint, and is therefore low in magnitude.

The Board notes Trans Mountain's commitments to develop and implement an issues tracking process to monitor and respond to Project-related socio-economic issues and opportunities

that emerge during construction and operation of the Project. In order to ensure that the potential negative socio-economic effects of Project construction can be effectively addressed by Trans Mountain, the Board would impose Condition 13 requiring Trans Mountain to file with the Board a plan for monitoring the potential adverse socio-economic effects resulting from construction activities. This would ensure that measures to reduce or eliminate adverse effects are effectively implemented within the timeframes for which effects might occur. The Board also encourages Aboriginal groups to consider their potential participation in monitoring activities during construction. In order to facilitate the potential participation of Aboriginal groups interested in participating in construction monitoring, the Board would impose Condition 98 requiring Trans Mountain to file a plan to address the potential participation of Aboriginal communities in construction monitoring.

The Board is of the view that with Trans Mountain's proposed measures and commitments, and with the Board's conditions, the construction and routine operations of the pipeline and the WMT facilities are not likely to cause significant adverse effects on community health, including the health of Aboriginal communities.

The potential effects of spills into the marine environment are addressed in Chapter 14.





12.0





Need for the project and economic feasibility

In making a recommendation on an application under section 52 of the NEB Act the Board considers the need for and the economic feasibility of a proposed pipeline. Paragraphs 52(2)(a), (b), and (c) of the NEB Act specifically allow the Board to have regard to:

(a) the availability of oil, gas or any other commodity to the pipeline;

(b) the existence of markets, actual or potential;

(c) the economic feasibility of the pipeline.

These factors are directly relevant to the need for, and the continued use of, a project. The purpose of the Board's analysis in this regard is for the Board to come to a conclusion whether a project will be sufficiently used over its lifetime.

In this regard, the Board requires the applicant to provide economic information that must include details on:

- Supply - indicating that there is or will be adequate supply to support the use of the pipeline, taking into account all potential supply sources that the applied-for facilities could access over their expected economic life;
- Transportation - indicating that the volumes are appropriate for the applied-for facilities and that the proposed facilities are utilized at a reasonable level over their economic life;
- Markets - indicating that adequate markets exist for the increased volumes available to the marketplace as a result of the applied-for facilities; and
- Financing - showing the applicant's ability to finance the proposed facilities, the method of financing, and any changes to the financial risk of the company, the impact of the proposed facilities on the applicant's abandonment cost estimate, and the toll impact.

As part of its evidence, Trans Mountain commissioned Mr. Neil Earnest of Muse Stancil (Muse) to provide an opinion on the outlook for oil market supply and demand, and related issues. As well, Mr. John Reed (Mr. Reed), of Concentric Energy Advisors, Inc., provided evidence on the economic and energy industry benefits of the Project. A study of the economic benefits of the Project for Canada and its regions was provided by Mr. Glen Hodgson of the Conference Board of Canada (Conference Board). Intervenors also submitted evidence on these issues;

Living Oceans Society and Conservation Foundation, Tsawout First Nation, and Upper Nicola all submitted a report authored by Dr. Gunton, Dr. Broadbent, Dr. Joseph, and Mr. Hoffele, dated May 2015, entitled "Public Interest Evaluation of the Trans Mountain Expansion Project" (Gunton Evaluation), and the City of Vancouver submitted a report by Dr. Harrison.

12.1 Need for the Project

12.1.1 Broader public interest

Trans Mountain said that the Project is required from a broader public interest perspective to ensure that producers and governments obtain the highest value for their petroleum resources. In Trans Mountain's view, Canadians are the ultimate owners of petroleum resources. Oil markets are continually subject to changing market conditions, refinery shutdowns, supply interruptions and other events. Trans Mountain's view is that sufficient pipeline capacity to alternative markets is required for Western Canadian producers to access the highest value markets. Trans Mountain said that its replacement evidence reinforces this key principle: market efficiency is in the public interest because, as part of the Board's regulatory framework, one of the Board's goals is that Canadians benefit from efficient energy infrastructure and markets.

Trans Mountain submitted evidence on the economic benefits and socio-economic impacts of the Project. Intervenors also submitted evidence in response. This topic is fully addressed in Chapter 11.

The Independent Contractors and Businesses Association of British Columbia (ICBA) said that the approval of this Project through a robust and predictable regulatory process, a process that could and should balance economic and environmental issues, is critical to Canada's (and B.C.'s) long-term interests. The ICBA said that safe, efficient and responsible movement of oil and other energy products to domestic and export markets is a time-tested cornerstone of the Canadian economy. According to a Natural Resources Canada briefing prepared for a 2012 conference of Canada's Energy and Mines Ministers, the natural resource sector, including oil production, accounts for 15 per cent of national gross domestic product and is a key contributor to the high standard of living enjoyed by Canadians.

Canadian Oil Sands, Cenovus, Devon, Husky Oil, Imperial Oil, Statoil, Suncor, Tesoro and Total (TMX Shippers) said that it is in the best interest of Canadians to diversify the markets for its oil exports by providing enhanced access to tide water. The TMX Shippers also said that it is in the best interest of Canadians to maximize the prices received for Canadian crude oil production. As well, the TMX Shippers said that petroleum industry is a significant driver of the Canadian economy.

The Explorers and Producers Association of Canada said that it strongly supports the Project and believes it is in the national interest.

The City of Burnaby said that Trans Mountain's application and related evidence provides a distorted and unrealistic picture of the economic impact and economic feasibility of the proposed Project. In its view, Trans Mountain has misinformed the Board, obfuscated issues and withheld from the hearing record pertinent financial and economic information. It said that the burdens of the Project far outweigh its benefits. A number of other intervenors made similar points regarding the benefits and burdens.

12.1.2 Marketplace need

Trans Mountain said the marketplace has demonstrated the need for the Project. The demand for transportation services exceeds the current Trans Mountain Pipeline (TMPL) system capacity and results in the need to apportion the available capacity. According to Trans Mountain, the degree of apportion[66] and the willingness of shippers to pay large bid premiums to secure access to transportation service on TMPL to the Westridge Marine Terminal (WMT) are clear indicators of the value shippers place on obtaining access to west coast and offshore markets.

66 When shippers nominate more volume than the pipeline can transport then each shipper's nominated volume is apportioned or reduced by the same percentage.

The Project is underpinned by firm commitments of approximately 112 300 m^3/d (707,500 b/d), or 80 per cent of the nominal capacity on the expanded system, from 13 shippers that have signed 15 or 20 year contract commitments. Trans Mountain said that these contracts demonstrate that the Project could expect to be utilized at a high rate.

Muse said that oil is a global commodity with a well-established transportation infrastructure and, as a result, global benchmark prices are usually identical once adjustments for quality and transportation costs are taken into account. Muse said that this has not been the case in recent years with North American benchmark prices lagging considerably behind their global peers. Muse said that this situation has had significant negative economic and fiscal consequences for Canada, particularly in its oil producing regions.

In 2012 and 2013, Muse said that Canadian heavy crude oil producers intermittently struggled with severe market imbalance. In Muse's professional opinion, this imbalance was primarily due to a lack of market diversification for Canadian crude oil producers. Muse said that projects such as the Trans Mountain Expansion Project offer Canadian crude oil producers precisely the diversification lacking in 2012 2013.

The Muse Stancil evidence was challenged by the Gunton Evaluation, which concluded there is no need for the Project because:

- Trans Mountain has underestimated the amount of pipeline capacity that will be in place and the Project will only create excess capacity;
- Trans Mountain has overestimated the likely growth in crude oil production; and
- Trans Mountain demonstrated upward bias in its oil price forecasts.

Some intervenors and commenters said that the Project was not needed and that it would be better to invest in clean non-polluting energy projects. Ms. Douglas said that in due course, low oil prices would increase demand and reduce supply. Therefore, it would be better to concentrate on research and development, and waste less on expensive technologies that were unlikely to be cost competitive. Ms. Douglas said that they should be treated for what they are, stranded assets.

Mr. Senichenko said that Kinder Morgan and the industry should be investing in clean, non greenhouse gas polluting energy projects. Mr. Senichenko said that it would be irresponsible and unethical to continue allowing new fossil fuel extraction and transportation projects, such as the Trans Mountain Expansion Project.

The Graduate Student Society at Simon Fraser University said that renewable energy is increasingly competitive with crude oil on price, reliability and environmental impact. The students said that the need for the proposed Project could not be objectively assessed without considering competition from wind, solar and other forms of renewable energy, and the impact that these would have over the lifetime of the proposed Project.

Other intervenors, such as Ms. Markle, said that there was no demonstrated need for the Project other than to increase the profits of the oil companies and the oil pipeline. Ms. Markle said that most of the potential commercial impacts would accrue to Alberta and the oil companies. B.C., on the other hand, would stand to lose the most if there were a problem.

The Government of Alberta, relying on the expert evidence of Trans Mountain, said that improved market access for Canada's oil and gas industry will substantially increase corporate income taxes, benefitting all of Canada. In addition, improved market access significantly increased employment opportunities across the country. The Government Alberta said that this important pipeline infrastructure will support an integrated energy economy in Canada that will be more attractive to investors, which in turn will generate more economic activity Canada-wide.

The British Columbia Chamber of Commerce said that the infrastructure is critical to both the B.C. and Canadian economies with the ability to transform Canadian oil producers from price takers to price makers in international markets.

The Edmonton Chamber of Commerce said that demand by shippers to move oil through the existing pipeline already exceeds capacity. Shippers dispatching product from Edmonton today face increasing uncertainty about having adequate access to existing Trans Mountain pipeline capacity on a month-to-month basis.

Muse said that the Project will greatly enhance the Canadian crude oil producers' access to new markets. The Project would be a major addition to the crude oil distribution infrastructure in North America, particularly to the sizeable Asia-Pacific market, and would give Canadian crude oil producers a significant alternative to their historical markets within North America.

Muse's evidence did not assess the impact on the Canadian economy of higher crude oil prices, nor did Muse include any impacts on the refining sector.

Mr. Reed said that Canadian oil is exported almost exclusively to U.S. markets. With U.S. oil production increasing, Mr. Reed was of the view that developing another market for Canadian oil was vital to ensure that Canadian oil producers receive full value for their production and, in turn, ensure that Canadians receive maximum benefits from the development and sale of these natural resources.

Muse said that the key analytical assumptions regarding supply, demand, competition and transportation costs are:

- Supply – Western Canadian crude oil supply is the Canadian Association of Petroleum Producers (CAPP) June 2015 forecast. This forecast considers the drop in crude oil prices in the latter half of 2014;
- Transportation Options – Ample rail loading and unloading capacity to enable Western Canadian crude oil to reach the North American and overseas markets; and
- Demand – The Northeast Asia demand potential.

These assumptions are discussed in more detail in the following sections.

12.2 Supply

In support of its Application, Trans Mountain submitted evidence on the crude oil supply outlook in Western Canada. In its replacement evidence, Trans Mountain included a report by Muse, as well as the 2015 CAPP supply forecast. Muse used the 2015 CAPP supply forecast through 2030, and then extrapolated it to the end of 2038. Muse's justification for using the CAPP 2015 supply forecast was that it is public; it is the most current forecast available; it reflects the current crude oil price environment; and it is reasonably corroborated by the most recent NEB and Alberta Energy Regulator (AER) Canadian crude oil forecasts. Muse considered the CAPP estimates to be reasonable.

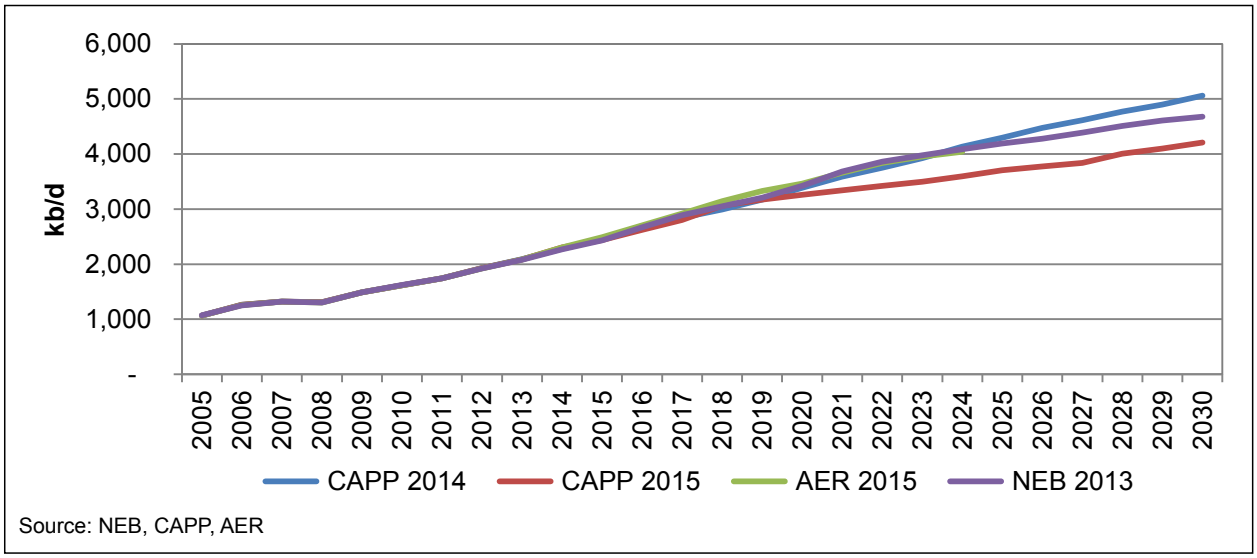
Muse said that the 2015 CAPP supply forecast, reflecting the current crude oil price environment, anticipates that total oil production would grow at a slower pace than was forecast in 2014. However, Muse said that CAPP's forecast still projects that Western Canadian crude oil supply will increase by 328 000 m^3/d (2.1 million b/d) from 2015 to 2030. For 2031 to 2035, Muse took the annual rates of change (either positive or negative) in the individual crude oil categories provided by CAPP for 2025 to 2030 and applied that average annual rate of change over the 2031 to 2035 period. For 2036 to 2038, the rates of change were halved and applied to the extrapolated 2035 volume estimates. The individual crude oil categories used were Light and Medium Conventional, Conventional Heavy, Upgraded Light (Synthetic), and Oil Sands Heavy. Muse further disaggregated the Oil Sands Heavy category into Western Canadian Select, Cold Lake Blend, Athabasca Diluent blended bitumen, Athabasca synthetic bitumen, and sour synthetic.

Trans Mountain said that Western Canadian total crude oil supply is forecast to grow from 635 000 m^3/d (4.0 million b/d) in 2015 to 1.01 million m^3/d (6.9 million b/d) in 2038. Total light oil supply is forecast to grow from 254 000 m^3/d (1.6 million b/d) in 2015 to 328 000 m^3/d (2.1 million b/d) in 2038, and total heavy oil supply from 381 000 m^3/d (2.4 million b/d) in 2015 to 762 000 m^3/d (4.8 million b/d) in 2038.

Muse also compared CAPP's 2015 forecast with CAPP's 2014 forecast, the AER's 2015 forecast and the NEB's 2013 Energy Futures forecast for Western Canadian Bitumen Production, as shown in Figure 22. All forecasts show that Western Canadian heavy crude oil supply is anticipated to grow through to 2030.

Muse said that although the NEB, CAPP and AER forecasts differ in the details, they broadly communicate the same message — the forward outlook for Western Canada is one of significant increases in heavy crude oil supply.

Figure 22: Western Canadian bitumen production



Source: NEB, CAPP, AER

The CAPP 2015 supply forecast stated that the Oil and Gas Journal reports Canada's proven oil reserves at 173 billion barrels, including the oil sands' 167 billion barrels of oil reserves. Muse forecasts total Western Canadian production from 2015 to 2038 to be 7.8 million m^3 (49.3 billion barrels).

The Gunton Evaluation said that Muse did not and should have also performed its analysis using what it called CAPP's 'low growth' supply forecast. (The analysis in the Gunton Evaluation used both 'low growth' and 'high growth' CAPP supply forecasts). The Gunton Evaluation said that the difference in supply between the two CAPP forecasts is over 158 730 m^3/d (1 million b/d) by 2030, the difference in modelling results from using the low and high range would be significant, and Muse's use of only CAPP's higher growth forecast results in inaccurate conclusions in regard to the need and benefits of the Project.

Trans Mountain said that while CAPP does not provide an assessment of the likelihood of the two forecasts, the CAPP Growth Forecast is their expected or most likely case. CAPP stated that its 2015 supply forecast does not present 'low' and 'high' supply cases but rather simply provides a breakdown of oil sands production growth into those projects operating and in construction and those projects that are expected to be constructed later.

Kathryn Harrison (on behalf of City of Vancouver) said that the Muse report was flawed because it relies on a CAPP production forecast that is not constrained by a lack of transportation infrastructure, therefore overestimating the supply of crude oil that would be produced in the absence of the Project. Dr. Harrison also said that including this additional production in the Muse model would overstate the transportation constraints on crude oil shipped from Edmonton, decreasing the Edmonton price of crude oil in the Base Case Scenario and, in turn, artificially increasing the apparent benefits of constructing the Project. In sum, Dr. Harrison said reliance on a scenario that presumes construction of new pipelines overstates the economic benefits of the Project.

Trans Mountain said that Dr. Harrison's assumption that CAPP's production forecast would increase the production forecast of the producers is reasonable; however, she provided no evidence regarding the extent to which this assumption influenced the CAPP crude oil supply forecast. Producers that assumed more export pipelines would be built would likely have higher crude oil production forecasts than those that assumed fewer pipelines would be built, all else equal.

CAPP said that its forecast shows the need for more pipeline capacity. CAPP also said that the current drop in oil prices changes the rate of supply growth but it does not change the fact that supply is growing and needs increased market access.

12.3 Transportation

The Trans Mountain Pipeline system began transporting crude oil in 1953. Between 1957 and 2013, the capacity of the TMPL system gradually increased from 23 800 m^3/d (150,000 b/d) to 47 600 m^3/d (300,000 b/d). The existing TMPL system is approximately 1 147 km in length extending from Edmonton, Alberta to Burnaby, B.C. It transports crude petroleum and refined products to multiple locations in B.C., including refined product deliveries to Kamloops and Port Moody, crude petroleum deliveries to Burnaby, the WMT for offshore export; and Sumas for deliveries on the Trans Mountain Pipeline, (Puget Sound) LLC Pipeline to Anacortes, Ferndale, and Cherry Point in Washington State.

Trans Mountain said that as part of the Project, it would build one 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 WMT. This would be followed by the deactivation and demolition of the existing berth.

The existing TMPL facilities, combined with the facilities proposed in this Application, would result in two parallel pipelines:

- Line 1 would have a sustainable capacity of 55 640 m^3/d (350,000 b/d) and transport refined products and light crude oils, with the capability of transporting heavy crude oils; and
- Line 2 would consist of three new pipeline segments and two reactivated existing segments and would have a sustainable capacity of 85 850 m^3/d (540,000 b/d) and transport heavy crude oils as well as light oils.

Trans Mountain said that future cargoes would be crude oil, primarily diluted bitumen. Of the 141 500 m^3/d (890,000 b/d) capacity of the expanded system, up to 100 200 m^3/d (630,000 b/d) could be delivered to the WMT.

Muse said that the Project would not act as a price setting mechanism for Western Canadian crude oil prices because it would not transport the marginal or incremental barrel of Western Canadian crude oil. For most of the forecast period under the Project Scenario,[67] the incremental crude oil barrel would be transported from Western Canada by rail rather than pipeline.

The ICBA, in support of the Project, said that Canada is a world expert in moving energy products safely to market. The ICBA submitted that, according to the Canadian Energy Pipeline Association, pipelines safely transported 99.9995 per cent of liquid products between 2002 and 2013. Three million barrels of crude oil is transported via pipeline each day.

The ICBA said that a modern, federally regulated oil pipeline expansion project therefore aligns with Canada's short- and long-term economic and social interests. The ICBA said that it would be in Canada's interest to see the Project approved and built.

British Columbians for Prosperity said that Canada receives a discounted price for its oil, in part due to stagnant and declining demand by its only customer, the U.S., and in part due to a bottlenecked transportation system. To expand its markets, Canada requires pipeline capacity. British Columbians for Prosperity believe that the best contingency plan for transporting oil would be by pipeline rather than by rail or truck.

The Association of Consulting Engineering Companies of B.C. (ACEC-BC) said that the Project is a long-term infrastructure investment that would open new markets for an important Canadian natural resource product.

CAPP said that Western Canadian producers face a pipeline capacity shortfall. This shortfall, CAPP said, is not affected by the current lower rate of growth in crude oil supply. CAPP said that Trans Mountain, in the Muse report, addresses such claim, and demonstrates the need for the capacity that the project would provide.

12.3.1 Canadian crude oil export pipeline utilization

Muse said that the Project is forecast to operate at its effective crude oil capacity of 133 500 m^3/d (804 kb/d) for the entire forecast period. Muse said that the Project would provide access to the sizable Asia-Pacific market and give Canadian crude oil producers a significant alternative to their historical markets within North America.

67 The Project Scenario adds only the Project to the transportation modes available in the Base Scenario.

Muse evaluated two scenarios using the Crude Oil Market Optimization Model for each year of the forecast period: the Base Scenario, which incorporates the transportation modes that are available today, or expected to be available by 2018 to the Canadian crude oil producers; and the Project Scenario, which adds only the Project to the transportation modes available in the Base Scenario.

Muse said that the only model input that differed between the Base Scenario and the Project Scenario was the commissioning of the Project. Since all model input variables were the same, all differences predicted in the Canadian crude oil prices and transportation flows could be attributed to the Project.

For the Base Case, all of the major crude oil pipelines in North America were modeled. Muse assumed that certain U.S. pipeline projects would be commissioned, as well as the integrity related Enbridge Line 3 Replacement Project. Barge and rail volumes were also included.

Muse said it did not include Energy East, Keystone XL and Enbridge Northern Gateway in its Base Scenario or the Project Scenario. Muse said that there was considerable information asymmetry between the Trans Mountain Expansion Project and these potential projects regarding the tolls, the commissioning timing, and, in the case of Energy East, the delivery locations. Inclusion of these projects required the analyst to forecast permitting dates, commission dates and tolls, and make other assessments. Muse said no analyst using public information could rigorously quantify these key input variables required by the optimization model.

The City of Vancouver said that Mr. Earnest's decision to exclude all other transportation capacity but the Project from his analysis raises serious doubt about the reliability of the other opinions and conclusion expressed in the Muse Report. The City of Vancouver also argued that there were differences in assumptions made by Mr. Earnest in the Muse report compared to his evidence in past hearings.

The Gunton Evaluation said that the decision by Muse to omit three proposed pipelines (Energy East, Keystone XL and Enbridge Northern Gateway) is inconsistent with the evidence Muse submitted to the NEB and to the Minnesota Public Utilities Commission on behalf of Enbridge's Line 3 replacement, in which Muse included all three pipelines in its analysis. The Gunton Evaluation noted Muse omitted any consideration of the Project in the Enbridge Line 3 evidence.

Trans Mountain said that it had no obligation under the relevant NEB guidelines to demonstrate that its Project would be utilized in the hypothetical circumstances where other pipelines are constructed, and the NEB did not evaluate projects on a comparative basis.

Calgary Economic Development (CED) said that as Alberta's oil producers move ahead with plans to expand oil sands production and their customer base, additional pipeline capacity and greater access to markets is needed to support global pricing structure. CED was of the view that the Alberta energy sector is one of Canada's key economic drivers and would carry this responsibility for the foreseeable future. The Project would provide infrastructure and an opportunity for innovation that is critical to the industry's future growth in Canada.

Mr. Reed said that some level of optionality in capacity markets promotes economic efficiency, reflects the likelihood of future additional demand, and does not detract from the economic feasibility of the Project. Mr. Reed's view was having transportation infrastructure that accommodates shifts in market preferences provides the option and ability to redirect flows as markets change.

Muse said that having some excess pipeline capacity enables crude oil producers to access the highest value markets in response to continually changing market facts. Furthermore, while there may be some "deadweight" costs from excess capacity, Muse said that these costs would be offset, wholly or in part, by the flexibility benefits provided by the excess capacity.

The Gunton Evaluation said that Trans Mountain does not provide a comprehensive assessment of oil transportation capacity and demand to assess the need for the Project. The authors of the Gunton Evaluation did their own estimate of Western Canadian oil supply transportation capacity and concluded that under the low growth forecast, surplus capacity increases from 1.6 million b/d in 2020 to over 1.9 million b/d by 2047. Under the high growth forecast, surplus capacity peaks at 1.6 million b/d in 2020 and remains until 2034. The Gunton Evaluation said that these estimates of surplus capacity do not include pipeline capacity from Enbridge Northern Gateway and Keystone XL.

The Gunton Evaluation said that although some unused capacity is necessary and beneficial, the magnitude of unused capacity resulting from premature construction of the Project would impose a large

cost on Canada's oil transportation sector, oil producers and the Canadian public in the form of reduced tax revenues.

CAPP argued that the authors of the Gunton Evaluation engaged in a perverse manipulation of the CAPP 2015 Forecast to suggest that the CAPP 2015 Forecast does not demonstrate a need for the pipeline capacity that the Project would provide. CAPP further said that the authors' claim that they based this conclusion on the CAPP 2015 Forecast is plainly and obviously false.

Trans Mountain said that if this was a substantive concern to industry, one could expect some industry objections to the Project. No other pipeline company or shipper has intervened to object to the Project on the grounds that it will create excess capacity.

Trans Mountain also stated that the Gunton Evaluation does not explain why all asserted costs of unused oil transportation capacity are assigned to the Project.

The TMX Shippers said that the Trans Mountain Expansion Project would not have significant commercial impacts on other participants in Canada's oil industry. In this regard, the TMX Shippers said that the owners of other Canadian pipelines did not express concern that the Project would create surplus capacity on their systems. The TMX Shippers also noted that the owners of Canadian refineries and upgraders did not express concern that the Project would impede their ability to secure feedstock for their facilities.

The Government of Alberta said that there is convincing evidence to support the Board finding that there are more than adequate crude oil reserves, as well as forecast growth in supplies and corresponding market demand to support a finding that the Project will be high utilized. The Board, the Government Alberta stated should not have any doubts in finding that Canada has more than abundant supplies of crude oil to fully utilize the additional pipeline capacity proposed by this Project.

12.3.2 Commercial arrangements

As a result of an open season process, 13 companies entered into binding 15 to 20 year transportation service agreements with Trans Mountain for a total of 112 300 m^3/d (707,500 b/d), or approximately 80 per cent of the expanded system's nominal capacity. The agreements provide for a sharing of risks between Trans Mountain and its shippers during the development stage, including the construction of the Project, and the long-term operations of the pipeline system.

Mr. Reed said that the take-or-pay provisions in the Transportation Service Agreements (TSAs) ensure that fixed charges will be paid over the first 15 to 20 years of operation. These contracts provide evidence that the market views the Project as necessary and economical. Mr. Reed said that the sizing of the Project to meet contractual demand while providing a reasonable level of uncommitted service promotes productive efficiency and limits the risk of underutilization. At the same time, the Project's firm service contracts promote allocative efficiency by awarding capacity to the shippers who value it the most, and the contract provision that allows for capacity release into the secondary market ensures that capacity would continue to be allocated to those shippers who value it most on an ongoing basis throughout the Project's life.

Living Oceans said that although the existence of take-or-pay contracts for 15 to 20 years (the "Contracts") signed by shippers are an important factor to be taken into account in the determination of need for transportation services provided by the Project, the Contracts by themselves are not sufficient evidence to confirm the need for the Project. Other factors to consider when determining the need for oil transportation services include the overall oil transportation supply and demand balance; the economic impact of the excess transportation capacity provided by the Project on the transportation system; the oil and gas sector; the Canadian government and the Canadian public; and the environmental effects, risk and uncertainties.

Living Oceans was of the view that there are several specific reasons why the Contracts do not confirm the need for the Project. One reason was that the Contracts were negotiated from the fall of 2011 to January 2013 and, subsequent to the negotiation of these Contracts, there has been a material change in energy markets that has significantly reduced demand for oil transportation services.

Trans Mountain said the current price environment has no impact on the long-term financial commitments shippers have made to the Project. In response to the Board's questioning, Trans Mountain stated that the financial commitments are binding and shippers do not have the option of walking away because of market changes, including short term price volatility.

BP Canada Energy Group ULC (BP Canada) said that it is a shipper on the Trans Mountain Pipeline system, which connects directly to BP Canada's Cherry Point Refinery in the Puget Sound area of Washington State, and that it supports the Application. BP Canada said it has made a firm commitment by executing a TSA for 20 years and that the current lower-price environment had not altered its long-term financial commitment as a committed shipper to the Project. BP Canada said that the Project continues to be important to BP Canada, providing enhanced security of supply of Canadian crude for its Cherry Point refinery and greater optionality for Canadian crude oil.

The TMX Shippers said that they became Firm Service shippers so that they would have access to new markets and to diversify the markets where they sell their oil. The TMX Shippers said that the current lower price environment would have no impact on the long-term financial commitment made to the Project.

12.3.3 Alternatives (the use of rail instead of pipeline)

Muse said that in all years, the Project would reduce the volume of rail traffic in Canada, as well as in the U.S., and in the first few years, would largely eliminate the need to use rail in Western Canada.

In its report, Muse said that total effective Western Canada rail loading capacity in 2018 was 87 400 m^3/d (550 kb/d), growing to 615 300 m^3/d (3,870 kb/d) by 2038. Muse said that prior to about 2024, the Project would greatly reduce the need to transport sizable volumes of Western Canadian heavy crude oil via rail to market. The combination of the market expansion to Northeast Asia with the reduction of supply to North America and avoidance of comparatively expensive rail transport would considerably improve the overall netbacks for the Canadian heavy crude oil producers. Muse noted that the Project would also increase the access of the Canadian light crude oil producers to the Puget Sound, California, and Northeast Asia markets by about 15 900 m^3/d (100 kb/d). In subsequent years, rail transport would be required to transport a portion of the Western Canadian crude oil production even with the Project, according to Muse.

Trans Mountain said pipeline transportation is far more efficient and less costly than transport by rail. Shippers will use pipeline capacity when it is available because rail is generally not a cost effective option, except in unique situations.

12.4 Markets

Muse said that the primary markets for crude oil shipped on the expanded Trans Mountain Pipeline are the Burnaby/Puget Sound area (which encompasses the Chevron Burnaby refinery and five refineries in Washington State) and Northeast Asia, with secondary markets in California and Hawaii. Muse said that the single Canadian refinery located on the west coast, the Chevron Burnaby refinery in the Vancouver area, processes Canadian light and medium crude oils, and is possibly supplemented by rail deliveries of Bakken crude oil.

Muse said that in the early years of the forecast period, the improved market access provided by the Project is predicted to increase the prices of both Canadian light and heavy crude oils significantly, shifting to mostly increasing the heavy crude oil prices in the latter years. Muse said that the higher Western Canadian crude oil prices prior to about 2024 are attributable to two factors: the Project would largely eliminate the need for rail transport of Canadian crude oil; and the Project would reduce the volume of Canadian crude oil that otherwise would be forced into the finite North American crude oil market.

British Columbians for Prosperity said that Canada is losing a huge economic opportunity by continuing to sell oil only to the U.S. at discounted prices. U.S. domestic oil production will eclipse Saudi Arabia by 2020, resulting in a loss of demand for Canadian oil by our only customer. British Columbians for Prosperity was of the view that Canada must expand its markets and, according to the IEA, Asia is the expanding market.

CAPP stated the world needs oil, and it needs large amounts of it. Demand, particularly in Asia, as demonstrated by the Muse report will continue to grow. Canada has a wealth of oil and can contribute to the supply that will meet this growing demand. That is what Canadian oil producers seek to achieve. It makes no sense for Canada to refuse to participate in the global oil economy. Other countries would supply what Canada does not. An economic opportunity would be lost and nothing gained.

12.4.1 Primary markets

Puget Sound (Washington)

Muse said that there are five refineries in Puget Sound with a combined capacity of 100 410 m³/d (632 kb/d), all capable of receiving crude oil by tanker. Four of the five refineries receive Western Canadian crude oil via the Trans Mountain Pipeline, and the fifth receives Western Canada crude oil via barge from the WMT in the Vancouver area. Western Canada provides over 84 per cent of the total imports, with the balance from Russia and Angola.

Muse said that the Puget Sound is an attractive, but volume-limited market for shippers on the Trans Mountain Expansion Project.

Northeast Asia

Muse said that the Northeast Asia market is regarded as the most prospective one for Canadian crude oil producers due to its size, the installed capability of the regional refineries, and its physical proximity to the west coast of Canada. In fact, China and Japan are the second and third largest oil markets in the world, followed only by the U.S. Muse said that Northeast Asian refiners are interested in alternatives supplies of crude oil. According to Muse, supply diversification provides opportunities to acquire lower cost crude oil, optimize refinery operations, and reduce the refiner's exposure to geopolitical risk in the Middle East and elsewhere.

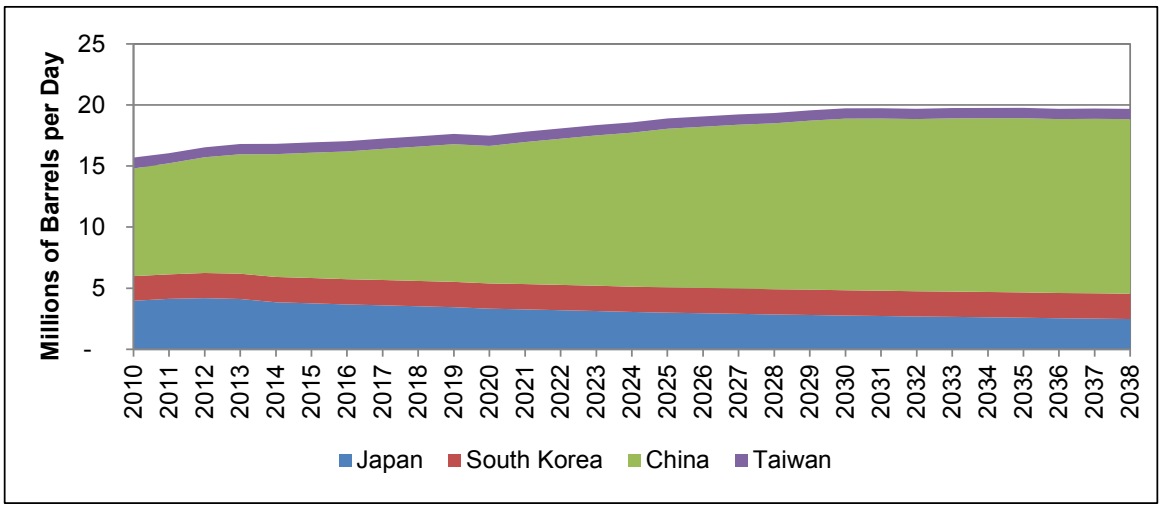
Muse said total potential demand exceeds 369 700 m³/d (2,330 kb/d) and that Northeast Asia has one of strongest projected oil demand growth rates in the world, as shown in Table 16. Due to its size and proximity, Northeast Asia is expected to be a very important market for the shippers on Trans Mountain Expansion Project. In 2014, crude oil imports into China, Japan, South Korea, and Taiwan totaled 2 072 900 m³/d (13,038 kb/d).

Table 16 Total northeast Asia potential demand

Total Northeast Asia Potential Demand		
Country	**m³/d**	**kb/d**
Japan	93,500	590
Northern China	129,800	820
Southern China	38,400	240
South Korea	78,300	490
Taiwan	29,700	190
Total	**369,700**	**2,330**

Muse said that, according to the IEA Bridge Scenario, the rate of oil demand growth in China through 2030 would be 1.7 per cent per annum and in the overall Asia-Pacific markets, 1.1 per cent per annum, as shown in Figure 23. Muse said that an economic slowdown in Northeast Asia would not materially affect the market prospects for Canadian crude oil due to the small market share attributable to the Project.

Figure 23 Northeast Asian oil demand



Muse said that the distance from WMT to Northeast Asia is between 65 to 85 per cent of that from the region's supply sources in the Middle East, and less than half the distance from West Africa, as shown in Table 17. Muse said that this means the relative proximity of WMT to the Northeast Asia market would provide an important long-term structural competitive advantage for the Western Canadian crude oil producers seeking to supply this market and ensure the Trans Mountain Pipeline would be fully utilized.

Table 17 Waterborne voyage distances

Waterborne Voyage Distances (Nautical Miles, Round Trip)			
Destination	**Westridge**	**Load Port Arabian Gulf**	**Nigeria**
China (Shanghai)	10,253	11,994	20,649
Japan (Yokohama)	8,604	13,277	21,931
South Korea (Ulsan)	9,249	12,546	21,201

Japan

Muse said that Japan is the second largest importer of crude oil in Northeast Asia, after China, and that it is the closest major Asian market to the west coast of Canada. Total crude oil imports in 2014 totaled 547 100 m^3/d (3,441 kb/d). Muse said that about 83 per cent of Japanese crude oil imports were from the Middle East in 2014, and Middle Eastern imports have been the primary supply source for Japanese refiners for many years. Japanese refiners are concerned about this degree of reliance upon the Middle East, and have been seeking to diversify their crude oil sources in recent years. Muse said that most Middle Eastern crude oils are in the medium sour category and, accordingly, the average sulphur and gravity of the Japanese imported crude oil basket is reflective of a medium sour grade.

According to Muse, the Japanese industry is a strong potential customer for Canadian synthetic crude oils, particularly the premium synthetic crude oil grades that feature better distillate properties. Muse said that, overall, the potential market size for Canadian crude oil producers in Japan is estimated to be about 93 800 m^3/d (590 kb/d. Muse based this market size estimate on an assessment of the capacity and capabilities of the individual Japanese refineries, which was translated into the potential demand estimate for Canadian light and heavy crude oils.

China

Muse said that China has perhaps the most diversified array of crude oil sources in all of Northeast Asia. China is the only country in Northeast Asia for which the share of Middle Eastern crude oil imports is as low as about 50 per cent. According to Muse, Chinese imports have been growing at an annualized rate of 10 per cent since 2008. Total crude oil imports in 2014 totaled 982 900 m^3/d (6,182 kb/d).

Muse said that over 90 per cent of the northern Chinese refining industry is assessed to have a high or medium capability to process heavy, high sulphur crude oils. The total capacity of the northern Chinese refineries is approximately 799 700 m^3/d (5,030 kb/d).

According to Muse, the current potential market size for Canadian crude oil producers in China is estimated to be approximately 168 500 m^3/d (1,060 kb/d), and the market potential is estimated to be growing at a rate of about 5 per cent per year.

Muse said that its analysis did not consider regional environmental policies as these could change over time; however, it did take into account regional environmental policies with regard to fuel specifications. It was Muse's view that changes in North American environmental policies could make the Northeast Asian markets relatively more attractive for the Canadian crude oil producers. Accordingly, Muse's assessment was that there is a very low probability that the utilization of the Project would be significantly influenced by changing Northeast Asian environmental policies.

Dr. Harrison said that the Muse Report failed to consider the impact of future changes in public policy on either supply or demand for Western Canadian crude oil. Dr. Harrison said that recent developments in Chinese climate policy were particularly noteworthy given the Muse Report projection of almost all of the Project's capacity, roughly 79 365 m^3/d (500 kb/d), would be exported to that country from 2025 on. Dr. Harrison said that Muse did not consider the implications of Canada's own changing policies for the costs of production and competitiveness of Canadian crude oil from the oil sands.

South Korea

Muse said that South Korea imported 404 000 m^3/d (2,541 kb/d) of crude oil in 2014 with roughly 85 per cent sourced from the Middle East. Crude oil imports from Asia Pacific tend to be various heavy sweet grades.

Muse said that South Korean refining capacity totals 472 000 m^3/d (2,969 kb/d) and, accordingly, there is a strong potential for Canadian crude oil sales to South Korea. The overall potential market size for Canadian crude oil is estimated to be approximately 77 900 m^3/d (490 kb/d).

Taiwan

Muse said that total Taiwanese crude oil imports were 137 400 m^3/d (864 kb/d) in 2014, with 83 per cent sourced from the Middle East. Taiwanese refineries predominately process a mix of light sweet and medium sour crude oils.

According to Muse, Taiwanese refining capacity totals 208 300 m^3/d (1,310 kb/d). The overall potential market size for Canadian crude oil is estimated to be approximately 30 200 m^3/d (190 kb/d).

12.4.2 Secondary markets

California

Muse said that there is strong demand for heavy crude oil in California; however, its analysis indicated that Canadian heavy crude oil sales into the Northeast Asian markets are more attractive than sales to California.

Muse said that the central California crude oils share many, but not all, of the characteristics of the Canadian heavy crude oil grades and there is a reasonable degree of inter-substitutability. However, the economics of processing most grades of Canadian synthetic and heavy crude oil in California are hampered by the state's Low Carbon Fuel Standards, which impose a relatively high CO2 emission rating to Canadian synthetic and heavy crude oils.

San Francisco Area

Muse said that there are five fuel refineries in the San Francisco area with a total capacity of 132 390 m^3/d (833 kb/d). Crude oil imports account for almost half of the total crude oil processed with the balance consisting of Alaska North Slope (ANS) and California crude oils. It was Muse's view that crude oil imports from Canada were not material.

Los Angeles Area

There are six fuels refineries in the Los Angeles area with a total capacity of 159 630 m^3/d (1,004 kb/d). Muse said that total crude oil imports are estimated to be half of the total crude oil processed, with the balance consisting of ANS and California crude oils. In Muse's current assessment, the potential market size for Canadian crude oil producers is in excess of 39 700 m^3/d (250 kb/d). Muse said that crude oil imports from Canada were not material.

Hawaii and Alaska

There are two fuels refineries in Hawaii with a total capacity of 23 440 m^3/d (48 kb/d), and a single refinery in Alaska with a capacity of 10 330 m^3/d (65 kb/d). Muse said that an estimated 52 per cent of total Hawaiian imports are from non-U.S. sources, with the balance from Alaska. In Muse's current assessment, the potential market size for Canadian crude oil producers is estimated to be approximately 11 900 m^3/d (75 kb/d).

Mr. Robert McCandless said that more pipeline capacity assumes a significant increase in demand for bitumen shipments to Pacific markets, or that Alberta bitumen will compete with, or even displace, product obtained from Middle Eastern or southwest Pacific sources. Mr. McCandless asks the Board to consider the conclusions of Dr. Piketty in his book Capital in the Twenty-First Century noting that if they prove correct and there is little global economic growth, expanding the pipeline's capacity might prove uneconomic.

12.5 Project financing

Trans Mountain said that the expected capital cost for the Project is approximately $5.5 billion. Financing would be arranged by Trans Mountain's parent company, Kinder Morgan Energy Partners, L.P. (KMP).

Trans Mountain said that KMP is one of the largest midstream energy companies in North America with an enterprise value of more than $48 billion U.S. The company typically finances growth projects using a mix of 50 per cent debt and 50 per cent equity. Funding sources could include a combination of the issuance of long-term debt securities, bank financing, and the issuance of public equity at KMP.

The C$5.5 billion capital cost estimate (exclusive of the firm service fee credit) for the Project was included in NEB Decision RH-01-2012. The cost estimates shown below in Table 18 are generally consistent with the categories indicated in the NEB Filing Manual.

Table 18: Project cost estimates

Item	Estimate (M$)*
Project Management	192.3
Engineering, Survey, and Environment	252.6
Pipeline Materials	674.7
Right-of-way and Other Land Costs	370.0
Pipeline Construction and Reactivation • New Construction • Reactivation	2,267.6 2,217.7 49.9
Facilities Materials and Construction • Pump Stations • Terminals • Other Facilities	1,332.2 440.6 861.2 30.4
Other	94.6
Subtotal	5,184.0
AFUDC	322.3
Total	**5,506.3**

Trans Mountain said that the success of a pipeline project and its related financing depends upon the economics of linking a supply basin with a major market region and the resulting transportation agreements between the pipeline carrier and shippers. As discussed in sections 12.2 and 12.4, at one end the Project will have access to the large reserves and growing crude oil production from the Western Canadian Sedimentary Basin (WCSB). At the other end, it will provide access to one of the largest petroleum markets in the world in the Pacific Rim region. The financial market recognizes that Canadian oil producers need to diversify their markets.

Trans Mountain said that it had received long-term financial commitments from a group of shippers that are significant players in the energy industry with investment grade or better credit ratings. It is Trans Mountain's view that this provides further assurance regarding the cash flow to be generated by the Project and its ability to support the long-term financing requirements. Taking into account the financial capacity and credit quality of KMP, the value that the Project brings to the market, and the term, size, and quality of the long-term shipper commitments, Trans Mountain said that it does not anticipate KMP will face any significant challenges in securing the funds required to finance the Project.

A number of intervenors, including the City of Burnaby argued that Trans Mountain has misled the Board in four material ways:

i) KMP was downgraded by all three credit rating agencies in November 2014 was delisted from the New York Stock Exchange and ceased to be a Master Limited Partnership. KMP has not provided updates to its application.

ii) KMP ceased being able to issue long-term debt in November 2014 and thus cannot provide long-term debt to the Project as claimed. The purchase of KMP has resulted in KMI as the sole surviving entity with the ability to issue debt. All future short-term and long-term debt for Kinder Morgan will be issued at KMI. All the existing debt at the operating subsidiaries will be refinanced (by KMI) as it matures.

iii) KMI, KMP's and Trans Mountain's new 100 per cent owner, is the intended source of financing for the project but KMI has been unsuccessful in gaining an enhanced credit rating in line with KMP's pre-November 2014 rating. KMI's credit standing is "BBB- from Standard and Poor's, Baa3 from Moody's and BBB- from Fitch. The agencies identified KMI's vulnerability to a downgrade (in November 2014).

iv) Despite KMI entering into cross-guarantees with virtually all its subsidiaries in November 2014 in an attempt to enhance security for its lenders, credit rating agencies have put financial markets on alert regarding KMI's financial exposure—the Kinder Morgan entities are far from having a sound, reconfirmed standing with the credit agencies. "Standard and Poor's explained that notwithstanding the cross-guarantees KMI is "highly leveraged" and has "aggressive financial policies, namely high financial leverage and the reliance on the capital markets to fund large discretionary cash flow deficits.

12.6 Benefits and costs of the pipeline Project

Muse said that there were essentially three sources of benefits from the Project:

- first, it would remedy the current situation in which access to the Pacific Basin markets is almost non-existent, thus providing desirable diversification and optionality benefits to the Canadian crude oil producers;
- second, it would lessen the amount of Western Canadian crude oil that otherwise would be forced into the North American crude oil markets, thereby generating a price lift for all producers; and
- third, in the initial years of the Project's operation, the need for more expensive rail transportation would be largely eliminated and transportation savings would flow back to the Canadian crude oil producers in the form of higher prices.

Trans Mountain said that, if approved, the Project would generate economic and fiscal benefits in three key areas. The first would be when the Pipeline is being developed and built. The second would occur during the operational period of the Project, through the economic impacts associated with running and maintaining the pipeline. The third would come from the expectation that the Project would lead to higher netbacks for producers of heavy oil in Western Canada.

Mr. Reed said that the Project would provide the following benefits to Western Canada Sedimentary Basin (WCSB) oil producers and to federal, provincial and local governments:

- enhanced quality and value of service for the Project's firm shippers;

- enhanced access to Northeast Asia markets, providing essential market diversification for Canadian oil producers;
- higher prices/netbacks to Canadian oil producers as quantified by Muse;
- the reduction in the likelihood of recurring price discounts for Canadian crude, based on the existence of paths to multiple markets, and flexibility to target the highest netback markets;
- enhancement in secondary market competition to serve uncommitted volumes;
- promotion of competition among oil pipelines;
- increased flexibility and optionality in the entire oil pipeline transportation system;
- the promotion of economic efficiency in pipeline transport markets; and
- macroeconomic benefits in local, provincial and federal economies.

Mr. Reed said that the Project would allow Canada to maximize the benefits it derives from the development of natural resources, and provide a feasible and efficient means of addressing the asymmetrical risk of too much or too little capacity. Mr. Reed said that the Project's development did not hinge on the success or failure of any other planned oil pipeline projects; the shipper commitments were not contingent on what happens with other projects, and shippers provided clear and convincing support for the development of this expanded path to high-value markets. According to Mr. Reed, the Board can, and should, place considerable weight on the willingness of 13 major producers and the Project sponsor to underwrite the cost of the Project for up to 20 years. Mr. Reed believed that these facts, taken together, provide a compelling case for concluding that the Project is financially and economically feasible, and highly beneficial.

Muse estimated that in its Project Scenario vs. its Base Scenario higher prices for Western Canadian crude oil production would provide total producer benefits of $73.5 billion on an undiscounted basis, and a present value of approximately $38 billion attributable to the market access provided by the Project (CAD$2012) for the forecast period 2017–2037.

Muse said factors that could reduce the "netback" differential between shipping via the Project versus the alternative were lower rail transportation costs, lower crude oil prices in the Pacific Basin versus the Atlantic Basin, and higher Project tolls. Viability for the Project would be determined by the payment of fixed charges by firm shippers, which would be assured by the signed Firm Service Agreements (FSAs) in effect at the commencement of service.

Muse said that producers of crude oil in Western Canada would pay all additional royalties and corporate income taxes. These additional royalties and corporate income taxes would be the result of new market access the Project would provide.

It was Trans Mountain view that, of the estimated total federal and provincial benefits projected to be $23.7 billion, 100 per cent were related to the direct operation of the pipeline (excluding benefits resulting from activity such as extraction, domestic processing, and exports to markets outside Canada), and not related to the extraction and domestic processing or crude oil (upstream economic activities) or sale of exports to markets outside of Canada (downstream activities).

There are numerous comments for and against the Project. Those supporting the Project include the Edmonton Chamber of Commerce, Lake Cowichan First Nation, O'Chiese First Nation, Pauquachin Nation, Burnaby Board of Trade, British Columbians for Prosperity, and the Calgary Chamber of Commerce.

The Government of Alberta urged the Board to place substantial weight on all of Trans Mountain's filed economic need and benefit evidence in considering whether to recommend approval of the project to Federal Cabinet.

The Edmonton Chamber of Commerce said that the Project is demonstrably positive for Canada, for Alberta and B.C. The Edmonton Chamber of Commerce said that the contribution of this Project to Canada's long-term balance of trade and the wealth of its citizens is overwhelmingly positive. It was of the view that the Project should be approved on the basis of its economic merits, and the Applicant's extensive commitments to safe and responsible pipeline construction and operation.

The Lake Cowichan First Nation, O'Chiese First Nation and Pauquachin Nation were of the view that there would be positive effects as a result of the Project.

The Burnaby Board of Trade commented that it believes in the imperative transition to sustainable energy sources but recognizes that the country still relies on oil for energy and for economic activity. In addition, the contributions Canada's oil resources make to provincial and national economies is significant and cannot be discounted. The Burnaby Board of Trade said that as producers gain market access, they will be able to sell their product for higher prices. The Burnaby Board of Trade was of the belief that all Canadians will benefit from the Project, but it did not think that the economic benefits of this Project flow to the jurisdiction assuming the most risk.

British Columbians for Prosperity commented that the Project would yield access to additional markets, greater competition for Canadian exports, and an escape from the 'single customer' monopoly that has resulted in heavily discounted 'netback' prices for Canadian producers.

The Calgary Chamber of Commerce commented that by increasing market diversity, and thereby, increasing the netbacks received by oil producers, the Project would result in a very significant net positive economic impact for Canadians.

Trans Mountain said that the Project would provide higher netbacks to producers. The approach taken by Trans Mountain to estimate these benefits is consistent with sound economic theory and the real world nature of competitive markets.

Unifor said it opposes approval of the Project because it would undermine investment in a value added, diversified and more stable oil and gas sector. Unifor said that a well-managed petroleum industry could provide good, stable jobs, and create wealth for producing communities and all Canadians. Unifor said that the Project is proposed in the absence of a realistic and enforceable policy framework for the regulation of greenhouse gas emissions from the petroleum industry. The Board did not consider this, Unifor said, because it was not part of the List of Issues for this hearing.

The Alberta Federation of Labour (AFL) said that, if the Board did not recommend the Project, and instead required or encouraged the market to upgrade and refine in Alberta, or B.C., or Saskatchewan, the refineries would receive cheap feedstock which would allow them to increase their revenues by turning that product into useful end products for Canadians and for export.

CAPP said, when it makes good economic sense to upgrade or refine the oil in Canada, we see upgraders and refineries being built. If it made economic sense to upgrade or refine all oil then we would see that happening, but we do not.

It is Trans Mountain's view that neither the Board nor any other government entity should be engaged in protectionist policy-making designed to subsidize or give preference to domestic upgrading and refining.

In economic terms, if the Project adequately addresses the potential negative environmental and safety concerns (externalities), the costs of addressing environmental and safety issues are internalized to the Project. Therefore, there is no need to conduct an exercise that attempts to quantify these impacts because the costs associated with these externalities are already internalized to the Project costs and borne by Trans Mountain. If the Project remains economically feasible after these concerns are addressed, it will be in the public interest.

Participants said the Gunton Evaluation shows that:

- the Application fails to show that the Project meets the need and public interest criteria required for NEB approval;
- the Project will result in a net cost to Canada if the Project is built as planned; therefore, approving the Application is not in Canada's public interest; and
- if and when the Project transportation capacity is required, the Project should be evaluated as part of a comprehensive oil transportation strategy that comparatively evaluates all proposed projects from a social, economic, and environmental perspective to determine which project or mix of projects are required and best meet Canada's public interest.

Mr. David Anson said that Kinder Morgan failed to predict the consequences of higher prices for gasoline and oil products for the Canadian consumer. Therefore, in his view, the potential economic impacts of the Project were limited.

Mr. Mike Ward said that the potential commercial impacts of the proposal, such as any potential gains in terms of employment or revenue, are dwarfed by the potential risks and certain risks of this proposal. Mr. Ward said that most of the profits accrue to foreign corporations, such as Kinder Morgan, while the lion's share of the risk is passed on to local residents.

Mr. Arthur Entlich said that the Project should be rejected as he did not believe the potential risk factors justified the Project going ahead. Mr. Entlich said that he did not believe the benefits outweighed the potential negative outcomes, from an employment, economic, sociological, geopolitical, environmental or progressive point of view.

Views of the Board

The Board finds that increasing pipeline capacity for the purpose of accessing Pacific Basin markets is important to the Canadian economy and that this economic benefit of the Project is significant. As required by the legislation, the Board looks at the benefits and burdens of the Project before it and not the benefits or burdens of this Project compared to other Projects that may or may not be before the Board.

The forecast supply and market demand growth, combined with robust contractual and financial underpinnings for the Project, demonstrate that the applied-for facilities will be used and useful over their economic life. The reasons for these conclusions are detailed below.

Commercial support and project need

To obtain regulatory approval, there must be a strong likelihood that the facilities will be used at a reasonable level. There is always a degree of uncertainty in projecting the long term utilization of transportation facilities since utilization is influenced by many variables, including supply, market development and the evolution of transportation infrastructure overall. It is in this context that the Board placed significant weight on the existence of long-term firm transportation service agreements (TSA) with shippers in determining whether the facilities are needed and likely to be well utilized over their economic life. The Project has strong support from 13 shippers with firm commitments of approximately 112 300 m^3/d (707,500 b/d) in long-term contracts of 15 or 20 years. The Board finds that these contracts are a clear demonstration that the Project can be expected to be utilized at a high load factor for many years. The Board recognizes that the Project shippers' long term take-or-pay commitments demonstrate and represent the shippers' belief that this will be a good use of their capital resources, relative to other transportation options. There was no credible evidence from intervenors that challenged the long-term firm TSAs executed by shippers. The Board does not accept the contention of Living Oceans and others that the firm commitments should be given reduced weight because of material changes in the energy markets during the time the long-term contracts were entered into. In fact, the evidence in response to Board questioning on this subject confirmed that the long term firm TSA's remain binding despite the lower crude oil price environment. While the Board accepts the evidence regarding the long-term shipper commitments, and assigns significant weight to this evidence, given the importance of the contracts to the Board's assessment of the Project, the Board would impose Condition 57, requiring Trans Mountain to file with the Board 90 days prior to construction, signed confirmation that secured agreements or contracts remain in force with shippers for a minimum 60 per cent of its total capacity of 141 500 m^3/d (890,000 bbl/d).

Unifor and Alberta Federation of Labour (AFL) opposed the approval of the Project because it would undermine investment in a value-added, diversified and more stable oil and gas sector. As well, the AFL made a similar argument saying that the Board should not recommend the Project, and instead require or encourage the market to upgrade and refine in Alberta, or B.C., or Saskatchewan. The Board is of the view that there was no persuasive evidence on the record to support that, if this Project is not approved, upgrading and refining is more likely to occur in Western Canada. If AFL and Unifor were of this view then they had an onus to provide sufficient evidence to support such a view. They did not do so.

Trans Mountain Pipeline (TMPL) has been apportioned for several years and producers have been increasingly dependent on rail. The Board is of the view that this demonstrates the need for additional capacity off the west coast of Canada that would be met by the new pipeline. While it considered evidence of forecasts for rail transportation as part of its analysis of supply, markets and transportation matters, the Board did not specifically consider benefits or burdens of this Project compared to rail transportation.

Supply, markets, and transportation matters for the oil export pipeline

The Board finds adequate supply would be available for the Project. Muse said that Western Canadian total crude oil supply is forecast to grow from 635 000 m^3/d (4.0 million b/d) in 2015 to 1.01 million m^3/d (6.9 million b/d) in 2038. This forecast is supported by crude oil reserves of 173 billion barrels, including the oil sands' 167 billion barrels of oil reserves. The Board accepts Muse's statement that this forecast is the most current available and it is the only one that specifically provides a crude oil supply outlook for Western Canada. The Board notes that this forecast is similar to those forecast prepared by the NEB and the AER. The Board concurs that the 2015 CAPP forecast is reflective of the current crude oil price environment and while this forecast is appreciably lower than the 2014 CAPP forecast, the 2015 CAPP forecast still projects that crude oil supply will increase between the years 2015 and 2030.

The Board was not persuaded by the argument of Vancouver and others that claimed the Board should be considering evidence and assumptions from past hearings provided by Mr. Earnest that are claimed to be inconsistent with the Muse evidence. The Board assigns low weight to selective citations regarding the evidence of Mr. Earnest in past hearings. Past evidence can be impacted by the passage of time and the factors at play in other hearings.

Several participants, including Dr. Kathryn Harrison, City of Vancouver and those who submitted the Gunton Evaluation said that the Project could result in excess pipeline capacity. The Gunton Evaluation concluded that under both CAPP'S low and high growth forecast, surplus capacity would exist if the Project is built. The Board finds that CAPP does not have a low supply and high supply forecast. Consequently, the Board assigns low weight to the evidence in the Gunton Evaluation on this point. The Board is of the view that determining the need for additional pipeline capacity is difficult and many uncertain variables exist; however, it accepts as reasonable that additional pipeline capacity is needed to access the Pacific Basin markets. Trans Mountain filed as part of its evidence several reports that provide a forecast of the benefits of the pipeline. The Board is of the view that even in CAPP's "Oil sands Operating and In Construction ONLY" forecast, supply would grow and pipeline capacity to the west coast of Canada would enable Canadian crude oil exports access to the large Pacific Basis market.

The Gunton Evaluation also included pipeline projects that have been approved or are before the Board in their analysis, noting that in each of the supply forecast, excess capacity would exist. As noted above, the Board, on review of the conclusions in the Gunton Evaluation, found that CAPP's 2015 forecast was misrepresented. The Board did not find the Gunton Evaluation to be compelling. The Board finds that some of the information in the Gunton Evaluation was subjective and not substantiated by facts. For example, the Board is not convinced by the evidence in the Gunton Evaluation that the pipeline is not needed, and that the Project would result in a significant net cost to Canada. The Board finds that because of apportionment on the TMPL, producers are unable to transport their crude oil to the most profitable market thereby forcing them to transport their crude oil by rail at a higher cost or by pipeline to a less profitable market.

The Board does not, in its review of a pipeline project, compare competing projects or existing pipelines to the project before it when making its assessment. Therefore, the Project will be assessed on its own merit. The Board finds that there is no reliable evidence before it demonstrating that any excess capacity would be unmanageable by sophisticated industry parties. As well, no shippers or pipeline companies provided evidence that the Project would create excess pipeline capacity. The Board agrees with Trans Mountain that there is currently no excess capacity between western Canada and the west coast of Canada enabling access to growing Pacific Basin markets. The evidence indicates that the Pacific Basin market demand is 369 700 m^3/d (2,330 kb/d) and this could be an important export market for Canadian crude oil. The Board is of the view that all western Canadian producers are likely to benefit from the Project in the longer term, through broader market access, greater customer choice and efficiencies gained through competition among pipelines.

The Board finds that markets would be available for the Project. Muse identified Northeast Asia to be a primary market for the Project. The Board accepts that the committed shippers are seeking high-growth market alternatives for their production. The Board accepts evidence that there is likelihood that US domestic oil production will continue to increase over time thereby decreasing

the need for crude oil imports. Northeast Asia has growth potential, and there is a strong likelihood that a portion of the required imports in to that market will be met by Canadian oil transported by the Project. The Board notes that no party took the position there would not be adequate markets available to absorb the volumes expected to be delivered from the pipeline expansion. The Board agrees with Trans Mountain that the Project is likely to provide producers with flexibility, diversity, the ability to manage risk associated with competing in multiple markets, and the ability to manage development and operational risk.

The Board observes that the replacement evidence did not consider the impacts of other pipeline projects (filed, recommended or approved by the Board) on the Project. Muse said all of the key variables concerning the Project were known with precision and were provided to the Board. The Board acknowledges that Muse provided the benefits of the Project in isolation of all other potential pipeline projects. The Board, when it deliberates on a pipeline application, considers the project that is before it and is of the view that the market will determine which pipeline projects are required to ensure the proper functioning of the petroleum market and which projects will provide competitive transportation service.[68]

Regarding the evidence and argument of some parties that there is no need for the Project because of likely future competition from wind, solar and other renewable energy, the Board finds such positions were not supported by credible evidence. The Board accepts renewable energy will be increasingly important in the years ahead; however, the Board is of the view that world demand for crude oil is likely to continue to increase over the next 20 years. The Board is of the view that it is possible there could be some modifications in policies around the world; however, this is not expected to materially change the continued global dependence on crude oil.

The Board is of the view that it is difficult to determine precisely the impact that a major project, such as the Trans Mountain Expansion Project, may have on netback prices. Despite the uncertainty surrounding the quantitative impacts, the Board finds that the Project would contribute to the realization of full market value pricing over the long term. More specifically, the Board finds that by allowing Western Canadian crude to be sold to multiple markets, rather than relying solely on the U.S. market, there will be a reduction in the likelihood of price discounts to Canadian crude. The Project will also increase the flexibility and optionality for shippers. These are all benefits of the Project and to some extent, these benefits may accrue to market participants beyond those shippers who have contract capacity on the Project.

Many people and parties voiced their opinion about the economic benefits and costs of the Project. The Board is not persuaded by the evidence in the Gunton Evaluation that Muse's use of the higher growth forecast results in an inaccurate conclusion in regard to the need and benefits of the Project. Muse in its evidence, does not use a higher growth forecast, as asserted in the Gunton Evaluation, rather the forecast Muse uses in its analysis is called the "Operating & In Construction + Growth". This forecast as mentioned is comparable to those provided by AER and the NEB. Further, the Board is not persuaded by Dr. Harrison's evidence that the Muse report was flawed because it relied on a CAPP production forecast that is not constrained by a lack of transportation infrastructure, therefore overestimating the supply of crude oil that would be produced in the absence of the Project. The Board is of the view that the CAPP supply forecast considers the impacts of available and projected transportation infrastructure. However, the Board does not believe that producers make decisions on production purely based on infrastructure developments.

68 The Board took a similar approach in its Reasons for Decision in TransCanada Keystone Pipeline GP Ltd., OH 1 2009, page 33 and 34, where it was not persuaded by an argument that Keystone XL was not in the public interest because there might be other potential options that could be developed in the future. In that instance, the Board also assigned significant weight to long-term commercial contracts.

Economic feasibility

Some intervenors argued that Trans Mountain had mislead the Board by not providing it with market-related evidence that demonstrates significant changes to Trans Mountain's source of financing, financing structure and KMI's financial position, stability or ability to finance the Project. The Board is not persuaded by the arguments put forth by the City of Vancouver and others that KMI would not have the ability to finance the Project. With the necessary TSAs in place, the Board finds that KMI would be able to finance the Project.

Given the Board's view on crude oil supply, markets and contracts, the Board is satisfied that the Project would likely be used at a reasonable rate over its economic life and that the tolls would be paid.





13.0



Financial matters

13.1 Introduction

In this chapter, the Board analyzes evidence submitted on the appropriateness of Trans Mountain's business structure and the financial assurances Trans Mountain has provided to pay for a spill from the Project. In the case of a potential malfunctions, accidents, and failures during operation, a pipeline operator must have the financial means necessary to implement its emergency response plans and cover all the costs of cleanup, damages, remediation, and liabilities. This includes the ability to pay for the costs of large oil spills originating from the oil pipeline and tank and terminal facilities connected to the pipelines, including credible worst-case spills. Trans Mountain's financial assurances must be in place for the entire life of the Project to ensure the safe operation.

This chapter discusses the financial assurances that are directly related to facilities and activities regulated by the Board under the National Energy Board Act (NEB Act). This includes the Project's terrestrial pipelines and terminals, such as the expanded Westridge Marine Terminal (WMT). Chapter 14, section 14.7 contains information relating to financial assurances related to marine shipping.

Under section 52(2)(d) of the NEB Act, in making its recommendation, the Board shall have regard to all considerations that appear to it to be directly related to the pipeline and to be relevant, and may have regard to, among other things, the financial responsibility and financial structure of the applicant. On 18 June 2015, the *2015 Pipeline Safety Act – An Act to amend the National Energy Board Act and the Canada Oil and Gas Operations Act* (*Pipeline Safety Act*) became an Act of Parliament and the provisions are to come into force within 12 months of 18 June 2015, or days to be fixed by the order of Governor in Council.

For companies that have the capacity to transport at least 250,000 barrels of oil per day, such as Trans Mountain Pipeline ULC (Trans Mountain), the *Pipeline Safety Act* establishes the absolute liability limit at no less than one billion dollars. Absolute liability means that a pipeline operator, like Trans Mountain, must pay for any spill up to one billion dollars, regardless of whether there is proof of its fault or negligence. If a pipeline operator's fault or negligence causes a spill or unintended release, there is no limit to liability. In other words, if a pipeline operator causes a spill, even if the cost to clean up and remediate a spill exceeds one billion dollars, the pipeline operator must pay the full cost.

The *Pipeline Safety Act* also requires any company authorized to construct or operate an oil pipeline that can transport at least 250,000 barrels of oil per day to maintain at least one billion dollars of financial resources. The Board may increase the amount of financial resources required.

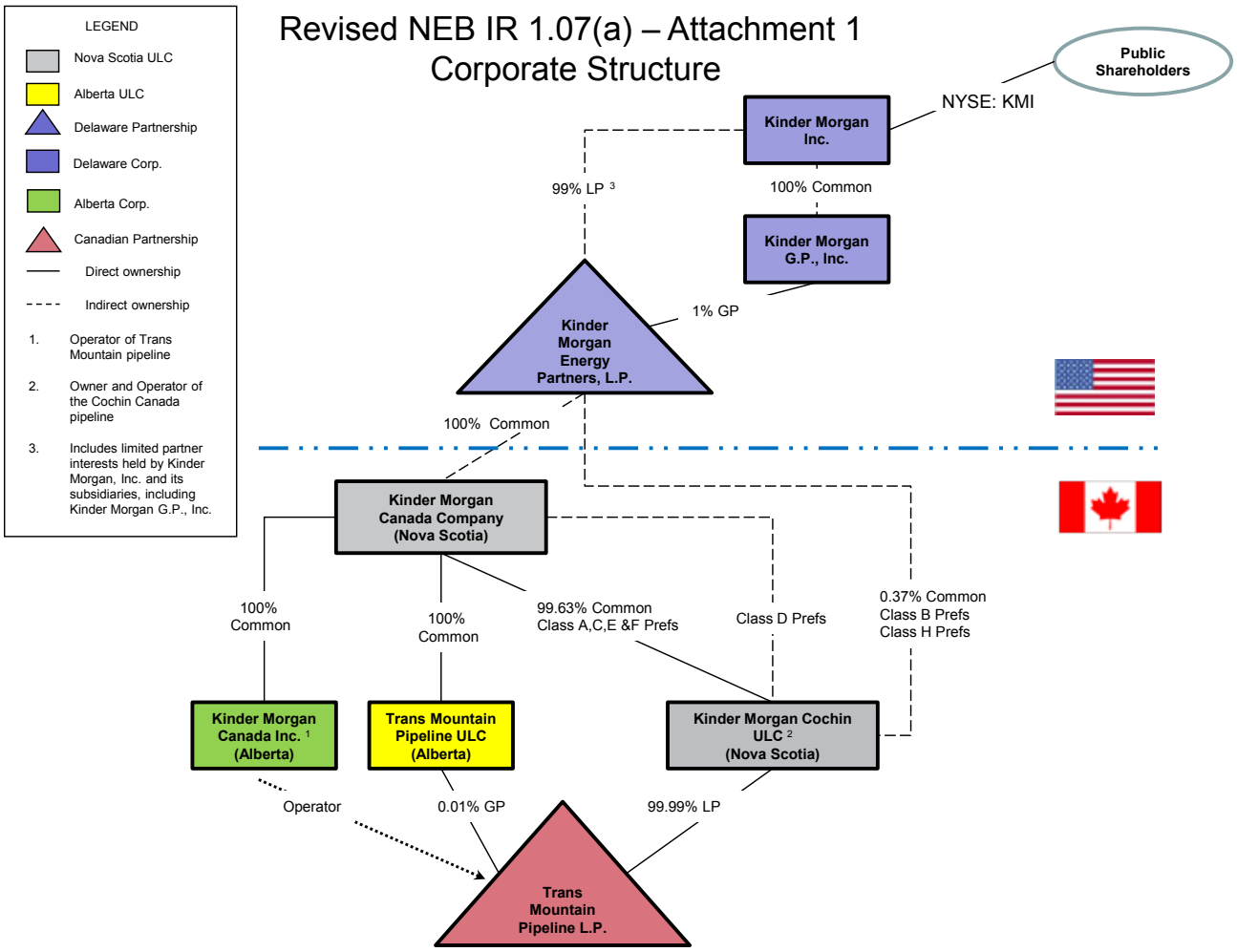
13.2 Business structure

According to Trans Mountain, it is an Alberta unlimited liability corporation, and the general partner of Trans Mountain Pipeline L.P., holding 0.01 per cent partnership interest. Trans Mountain is the corporate entity that will hold the Certificate of Public Convenience and Necessity (CPCN), should it be issued. Trans Mountain Pipeline L.P., a limited partnership registered in the province of Alberta, is the entity that owns the existing Trans Mountain pipeline assets. Kinder Morgan Canada Inc. operates the Trans Mountain pipeline.

Some participants expressed concerns about the corporate structure of Trans Mountain and the adequacy of its financial resources in the case of an oil spill.

Trans Mountain said that given its corporate structure, Trans Mountain Pipeline ULC, as general partner, has unlimited liability for the liabilities and obligations of Trans Mountain L.P. Kinder Morgan Cochin ULC, as the limited partner of Trans Mountain Pipeline L.P., would not be liable to creditors of Trans Mountain L.P. because the liability of the limited partner is limited to any amount of its required capital contributions that remain unpaid.

Figure 24: Trans Mountain corporate structure diagram



Views of the Board

The Board heard concerns from participants about the corporate structure of Trans Mountain and the adequacy of its financial resources in the case of an oil spill. In the case of an oil spill, Trans Mountain is responsible for cleaning up the environment and compensating affected parties.

There are many reasons why a particular organization chooses a particular corporate legal structure, including tax reasons. The Board regulates Trans Mountain as the operator of the Project, and the Board can impose conditions on the operator of the Project. As discussed in more detail in this

chapter, the Board would impose Condition 121 requiring Trans Mountain to maintain $1.1 billion of financial assurances.

To comply with this condition, Trans Mountain must prove that, as the operator, it has $1.1 billion of financial assurances. When the Board evaluates Trans Mountain's financial assurances plan, it will take into account its partnership distribution policy, or other structural or legal characteristics of the limited partnership. With this condition in place, the Board finds the limited partnership structure of which Trans Mountain is the general partner to be acceptable.

13.3 Financial assurances

Financial assurances are used to demonstrate that a pipeline operator has sufficient financial means or financial instruments in place to cover the costs of cleanup, damages, remediation and liabilities that may arise from potential malfunctions, accidents and failures during the operation of the pipeline. This comprises all large oil spills originating from the oil pipeline and tank and terminal facilities connected to the pipelines, including credible worst-case spills.

13.3.1 Cost of an oil spill

Trans Mountain filed an expert report by Dr. H. Jack Ruitenbeek assessing the potential spill costs of seven hypothetical spills, ranging in size from a leak of 4.8 m^3 to a large 4 000 m^3 spill (30 bbl to 25,160 bbl) on the Trans Mountain pipeline.

To calculate the cost of a spill, Dr. Ruitenbeek analyzed the costs directly attributable to the spill. He excluded passive use values, which are a category of values associated with ecosystem goods and services that are experienced by some parts of the population even though they do not directly use these ecosystem goods and services. Dr. Ruitenbeek said that these values cannot be credibly measured and the loss of such values is not explicitly compensated in any jurisdiction.

Dr. Ruitenbeek used a Basic Oil Spill Cost Estimation Model (Spill Cost Model) developed by Dr. Dagmar Etkin for the cleanup cost algorithms to determine the total spill cleanup and damage costs.

Dr. Ruitenbeek determined that the costs per barrel to cleanup and compensate for damages ranged from $6,390 (2013$) for a large spill in a non-high consequence (NHCA) area to $85,203 per barrel for a leak. The highest estimated spill cost for the Trans Mountain pipeline was $340 million for a 4 000 m^3 (25,160 barrels) spill in a high consequence area (HCA) with $10,000 per barrel damage costs and $3,532 per barrel cleanup costs.

Trans Mountain submitted a report, *Simulations of Hypothetical Oil Spills from the Trans Mountain Expansion Project Pipeline (Line 2)* by Mr. Chris Galagan, Mr. Jeremy Fontenault and Ms. Jenna Turner (Galagan Report). The Galagan Report simulated hypothetical spills occurring along the proposed corridor of the Project and then determined the overland and downstream pathways of the spills using volumes provided by Trans Mountain. The volumes ranged from minimum of 3,026 bbl (481 m^3) to a maximum of 29,146 bbl (4 634 m^3). The maximum volume of oil estimated to enter rivers and lakes along the pipeline route were 26,367 bbl (4 191 m^3) and 25,920 bbl (4 120 m^3) respectively. The details of Dr. Ruitenbeek's analysis are summarized in Table 19:

Table 19: Estimated cost of oil spills from the Project

Scenario	Leak		Rupture		Terminal Loading
Spill size(bbl)	30	715	12,580	25,160	648
Location	non HCA	non HCA	HCA	HCA	HCA
Cleanup cost (per bbl)	$ 34,081	$ 11,076	$ 3,532	$3,532	$ 11,000
Damage cost (per bbl)	$ 51,122	$ 16,615	$ 5,298	$10,000	$ 9,350
Total Cost (per bbl)	$ 85,203	$ 27,691	$ 8,830	$13,532	$ 20,350
Total Cost of Spill	$ 2,556,090	$19,799,065	$111,081,400	$340,465,120	$ 13,186,800

Tsawout First Nation, Upper Nicola Band and Tsleil-Waututh Nation submitted a report by Drs. Thomas Gunton and Sean Broadbent, entitled "An Assessment of Spill Risk for the Trans Mountain Expansion Project" (the Gunton Report), that assessed potential spill cleanup and damage costs. The Gunton Report used three methods to estimate the cost of a spill along the pipeline. All costs are in 2014 Canadian dollars.

The Gunton Report first calculated two scenarios using the Spill Cost Model, stating that Dr. Ruitenbeek's interpretation resulted in a range of potential estimates associated with heavy oil spill costs that was too low. The Gunton Report evaluated two scenarios using the Spill Cost Model: the first, a lower bound estimate, uses the minimum values for all cost modifiers for response, socio economic and environmental costs; and the second, the upper bound estimate, uses the maximum values for all cost modifiers. Total costs range from $3,022 per bbl for the largest spill size category, spills greater than 23,800 bbl, to $167,244 for smaller spills between 24 and 238 bbl.

Second, the Gunton Report used data collected from January 2010 to November 2014 by the Pipeline and Hazardous Materials Safety Administration of the U.S. Department of Transportation to calculate an estimated cost of an oil spill. In this dataset, pipeline operators reported average costs of approximately $3,188 per bbl for leaks and $30,750 per bbl for ruptures.

Third, the Gunton Report proposed using the cost of the Enbridge Line 6B rupture, which released 3 192 m^3 (20,074 bbl) of diluted bitumen into a wetland in Marshall, Michigan in 2010, as an upper bound pipeline spill costs. The Gunton Report said that the total cost of the Line 6B rupture are $1.21 billion, resulting in a per barrel cost of $60,177.

Table 20: Drs. Gunton and Broadbent per barrel cost for oil spill cleanup and damage costs using different methodologies (2014$)

Methodology	Leak	Rupture
Spill Cost Model	$5,341 - $167,244[69]	$3,022 - $35,950[70]
Pipeline and Hazardous Materials Safety Administration	$3,188	$30,750
Enbridge Line 6B Rupture	N/A	$60,177

Of the three methodologies examined, the Gunton Report concluded that the Enbridge Line 6B spill was the most reliable estimate of a pipeline spill cost in a high consequence area because of the high profile nature of the spill, the explicit cleanup and remediation requirements, and Enbridge's obligation to provide an accurate assessment of the total costs of the rupture in its financial filings. However, the Gunton Report said that these cost estimates omit a number of costs, including passive use values, and therefore, the costs reflect a conservative estimate of the total cost of an oil spill.

The Gunton Report provided a review of potential passive use damages. Passive use values reflect the worth that people ascribe to the protection or preservation of natural resources and the environment that they may not directly use. They estimated a lower bound value of $1.4 billion and an upper bound of $21.1 billion.

Intervenors Catherine Douglas, North Shore No Pipeline Expansion, and Pro Information Pro Environment United People Network submitted the report *Economic Costs and Benefits of the Project for B.C. and Metro Vancouver* by Mr. Ian Goodman and Ms. Brigid Rowan. As part of this report, Mr. Goodman and Ms. Rowan evaluated the cost of a bad to worst-case onshore spill from the Trans Mountain pipeline.

Drs. Goodman and Rowan disputed Trans Mountain's approach of evaluating the cost of a worst-case scenario by multiplying the per barrel cost of damage and cleanup by the volume spilled because, in their opinion, Trans Mountain underestimated both the per barrel cost and the potential spill volume. Instead, Drs. Goodman and Rowan proposed relying on real-world examples of costs related to oil and gas accidents.

To determine the potential cost of a worst-case scenario on the Project, they reviewed the cost of four disasters:

- oil spill from Enbridge's Line 6B in Marshall, Michigan in 2010;

69 This cost range is for spills up to 23,800 barrels.

70 This cost range is for spills greater than 23,800 barrels.

- train derailment of oil tanker cars in Lac-Mégantic, Quebec in 2013;
- natural gas pipeline explosion and fire in the San Francisco metropolitan area in 2010; and
- crude oil pipeline rupture, explosion and fire in Qingdao, China in 2013.

From their evaluation of these incidents, Drs. Goodman and Rowan concluded that a worst-case spill could cost between $1 billion and $5 billion U.S. dollars. They also said that given their results, they have concerns about Trans Mountain's financial capability, responsibility, and willingness to mitigate and compensate for all the potential damages for spills costing $1 billion or more.

Other participants commented on the amount of financial assurances that should be required, without relating them specifically to the cost of an oil spill. Alan James recommended that the Board require at least $10 billion of financial assurances from Trans Mountain. David Anson expressed concern that Trans Mountain's estimates downplay the cost of a large oil spill and noted that the cost of the Enbridge Line 6B spill exceeded the worst-case scenario submitted by Trans Mountain's consultant.

13.3.2 Financial tools

Trans Mountain proposed a layered approach to financial assurances. First, it would use accessible cash to pay for any damages. Next, Trans Mountain would access its insurance coverage through the Kinder Morgan corporate insurance program. Finally, if required, it would use a parental guarantee from Kinder Morgan Energy Partners, L.P.

Trans Mountain identified the following financial resources that it would use in the case of a spill to pay the full cost of cleaning up, remediating the environment and compensating affected parties:

- $750 million of spill liability insurance;
- $3.2 billion of equity upon Trans Mountain expansion completion;
- parental guarantee from Kinder Morgan Energy Partners, L.P.; and
- $140 million, the equivalent to 60 days of operating cash flow, immediately available to accommodate payments within the first 10 business days following an incident.

Insurance

Trans Mountain currently has $750 million of spill liability insurance in place and it plans to keep its insurance at this level once the Project is operating. Kinder Morgan, Inc. holds the insurance policies and Trans Mountain Pipeline ULC, on behalf of Trans Mountain Pipeline L.P. and Kinder Morgan Canada Inc., are named entities insured under the insurance policies. Trans Mountain's insurance is made up of to two components (see Table 21):

Table 21: Trans Mountain insurance

General Liability insurance policy	General/Excess Liability policy
• $150 million. • Covers all the current operations of Kinder Morgan in Canada. • 10 unique insurance providers.	• $600 million. • Covers all of Kinder Morgan's operations located in Canada, United States and Mexico. • 25 unique insurance providers. • Omnibus insurance program covering Kinder Morgan's legal liabilities arising from all wholly owned operations, 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.

In the case of an incident, Trans Mountain said that the first $2 million of Trans Mountain's insurance policy is covered by self-insurance. It said that the $750 million limit is both a per occurrence and an annual coverage limit. Trans Mountain said that claims made against the $750 million limit are on a "first in, first out" basis; that is, any claim made reduces the amount of insurance available for subsequent claims. It said that, if a specific claim within a policy year results in significant erosion of the $750 million

limit, Kinder Morgan would attempt to go out to the insurance market with a request to reinstate limits. However, a full reinstatement may not be possible, as 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 would not be available to achieve a full reinstatement. In this case, Trans Mountain may choose to use other financial means to backstop the reduced amount of insurance available. Trans Mountain added that its insurance does not cover some events, such as damage from gradual seepage. Trans Mountain said that the exclusions of an insurance policy are not static from one policy year to the next and that it is unable to confirm that the exclusions in place today will remain in effect for the life of the Project.

Trans Mountain said that during construction, it will have a stand-alone liability policy of at least $20 million, and that any third-party construction contractors involved in Project construction would be required to have their own separate insurance coverage.

If a spill occurred, Trans Mountain said it would make a payment when the obligation for payment was identified and then, after the payment was made, Trans Mountain would submit a claim to its insurance provider. Trans Mountain said that while it has no pre-set priority for the payment of claims, payment of claims would likely mirror the phases of a response to a spill; that is, the safety of people and assets first, with containment, clean up and remediation to follow.

Parental Guarantee

While no formal financial backstopping arrangement currently exists between Trans Mountain and Kinder Morgan Energy Partners, L.P., Trans Mountain said that, if the Board required a parental guarantee as a condition of approval, it would comply. However, Trans Mountain said that Kinder Morgan Energy Partners, L.P. would not isolate the funds associated with the parental guarantee from day-to-day operating and capital accounts. This is because Kinder Morgan Energy Partners L.P. has access to significant sources of liquidity, rendering such a requirement unnecessary and economically inefficient.

Immediate Cash

Trans Mountain committed to ensuring that, either through cash reserves or through credit facilities, it will have immediate access to cash in the case of an incident. Trans Mountain projected that approximately $140 million, the equivalent to 60 days of operating cash flow, would be available in cash to accommodate payments within the first 10 business days following an incident.

Abandonment

Trans Mountain did not submit a preliminary abandonment plan due to the Project not having sufficient engineering details available at the time. Instead, it substituted a proposed update of the Physical Plan with abandonment methodology for a preliminary abandonment plan. Trans Mountain said that this would serve two purposes. One is to update abandonment cost estimates. This would include a re evaluation of current infrastructure and the addition of the Project. The second purpose of the Physical Plan is to inform the abandonment planning process at the time of abandonment, which would include an application for abandonment. Trans Mountain submitted a conceptual abandonment cost estimate, including insurance, taxes and contingency, of $602.7 million.

Other Financial Tools

Participants proposed other financial tools for Trans Mountain to use to prove that it has sufficient financial assurances in place to address an incident.

The City of Vancouver analyzed risk transfer mechanisms that could be purchased by Trans Mountain to provide compensation for those economic impacts of an oil spill and recommended a catastrophe bond. Catastrophe bonds are risk-linked securities that transfer a specified set of risks from a sponsor to investors. A bond issue would provide an advantageous interest rate in the event that the triggering event, like an oil spill, did not occur. If the event did occur, the bond sponsor uses the capital provided by the investors to pay for losses resulting from the triggering event.

Commenter Bud Smith recommended using a captive insurer under British Columbia's *Insurance (Captive Company) Act* to establish an industry-supported fund to pay for immediate clean up, as well as long term remediation and loss from an accident.

Views of the Board

The Board heard from many participants who said that they expected Trans Mountain to operate the Project safely and with as little risk as possible to the environment or property. Some participants expressed concerns that Trans Mountain would be unwilling or unable to pay for the full costs of cleaning up the environment and remediating damages if a spill occurred, particularly in dense urban areas or delicate ecosystems.

Trans Mountain has committed to pay for the full cost to clean up any spill from the Project, and has agreed to pay the full costs of a spill, even if it exceeds Trans Mountain's insurance. In the case of a spill, malfunction or incident from the Project, Trans Mountain must pay for the full cost of cleaning up and remediating any damages caused.

The Board is of the view that an undertaking the size of the Project must operate in a way that minimizes risks to people, the environment and property. Trans Mountain, as the operator, is responsible for the safe operation of the Project at all times and, in the case of damages, the financial consequences of losses and liabilities to third parties. To determine the appropriate amount of financial resources the company must hold, the Board reviewed the potential costs of a large spill from the Project. The Board finds that Trans Mountain must have sufficient financial resources in place to cover up to $1.1 billion for the costs of liabilities for, without limitation, clean up, remediation, and other damages caused by the Project during the operations phase.

This chapter only discusses the potential spill costs and damages that are directly related to activities regulated by the Board under the National Energy Board Act. The Marine Liability Act establishes the framework for marine liability and compensation in Canada, and is implemented by the Government of Canada. The Marine Liability Act also establishes the Ship-source Oil Pollution Fund that provides funding for spills from all classes of vessels in Canadian waters. For more details on financial responsibility, liability and insurance related to marine shipping, please review Chapter 14, section 14.7.

Trans Mountain and some participants differed in their estimates of the probability of spills during the lifetime of the Project. The Board is of the view that, while it is Trans Mountain's responsibility to minimize the chance of a spill, it is not useful to evaluate the probability of spills when determining the appropriate amount of financial assurances. There is sufficient evidence that a large spill may occur at some point during the Project's operations. Such a spill would require Trans Mountain to have the financial resources to fully cleanup, repair damages and compensate affected third parties. Given this, the Board would impose a condition requiring Trans Mountain to have sufficient financial resources to address the cost of a large spill in a high consequence area. The condition requires Trans Mountain to maintain at least $1.1 billion dollars of financial assurances to address the costs of a spill over the lifetime of the Project. (The amount is based on a large spill with clean up, damage and remediation costs, totalling $1.1 billion.) At least $100 million must be in the form of ready cash to cover costs, including compensation to third parties for losses and damages, in the near term while insurance claims are being processed. For the remaining $1 billion, Trans Mountain must submit a portfolio of multiple financial instruments, describing how they meet stipulated requirements in the condition. Condition 121 describes, in detail, the requirements for the Financial Assurances Plan required by the Board to ensure that Trans Mountain has sufficient financial resources over the course of the Project to address the costs of a major spill.

The Board calculated the cost of a major spill by multiplying the estimated quantity of a large oil spill by the unit cost to address a spill. The unit cost includes the estimated costs for spill cleanup, remediation and other damages caused by the Project facilities during the operations phase.

Trans Mountain and intervenors submitted evidence that was orders of magnitude apart with respect to costs of an oil spill along the pipeline right-of-way. The Board reviewed all evidence from intervenors discussing the size of other incidents and their costs. The Board found costs from incidents that may occur on the Project to be the most useful. For example, evidence submitted on the Enbridge Line 6B spill was relevant in the assessment because this evidence demonstrated the actual cost of a large oil spill into a river and wetlands. The Board is of the view that the Enbridge Line 6B spill represents a real-world example of a large spill with severe consequences because of the magnitude of the spill and the high consequence nature of the spill location. Its inclusion in the

Board's assessment is appropriate to evaluate the potential financial consequences of the Project.

In the same vein, evidence submitted on the costs of cleaning up oil spills in Canada is also useful as it reflects the costs of oil spill cleanup and remediation given the Canadian legal context. However, evidence submitted on the costs of incidents involving the cost of natural gas pipeline explosions was not helpful to the Board in assessing the potential costs of an incident on the Project, as the Project is not a natural gas pipeline.

The Board finds that the passive use values and option values do not provide meaningful information to determine the amount of financial assurances necessary in the case of an oil spill or other incident. Passive use values, as described in the Gunton Report, are often inappropriate when evaluating the significances of the environment or natural resources to Aboriginal people and other stakeholders. In addition, in the case of an incident, it is unclear how financial assurances set aside for passive use values would be practically distributed to those harmed, or whether, with sufficient clean up and restoration of the environment, these passive use values would return on their own.

The Board find that financial assurances must be grounded in actual costs that would be incurred to clean up and remediate the environment, as well as to compensate those individuals with demonstrable losses to income or private property.

Participants and Trans Mountain proposed segregating the costs of a spill into a number of different categories. Providing these categories are data-based, the Board has no concerns and recognize that different methodologies will categorize costs differently. For the purposes of determining the potential cost of a major spill, the Board considers the best estimates to be the ones based on the cost of oil spills in high consequence areas that have been fully remediated.

Dr. Ruitenbeek for Trans Mountain proposed a number of spill sizes, the largest being 4 000 m^3 (25,160 bbl). This is a spill along the pipeline or in the terminal while loading, rather than a tanker spill. The Galagan Report for Trans Mountain simulated hypothetical spills occurring along the proposed corridor of the Project and determined a maximum spill size of 4 634 m^3 (29,146 bbl). This range of spill sizes, from 4 000 m^3 (25,160 bbl) to 4 634 m^3 (29,146 bbl) exceeds the size of the Enbridge Line 6B rupture as described in the Gunton Report, which was 3 192 m^3 (20,074 bbl).

No evidence offered by participants provided credible reasons for considering larger spills along the pipeline right-of-way for this Project.

As previously noted, the above spill sizes are based on credibly large spills along the pipeline right-of-way or from the terminal, and are not based on marine spills from tankers. The Board's findings on marine spills can be found in Chapter 14. Based on evidence submitted, the Board finds that largest credible spill along the pipeline right-of-way or from the terminal in evidence is 4 634 m^3 (29,146 bbl).

The Board finds that a total unit cost of $235,890 per m^3 ($37,500 per barrel) to clean up a spill and remediate environmental damage is an appropriate estimate. This is slightly higher than the midway between the differing costs per barrel proposed by participants and Trans Mountain. Dr. Ruitenbeek for Trans Mountain proposed an upper limit of $85,111 per m^3 ($13,532 per barrel) for a rupture while the Gunton Report submitted by Tsawout First Nation, Upper Nicola Band and Tsleil-Waututh Nation said that the Enbridge Line 6B spill cost $378,489 per m^3 ($60,177 per barrel). However, the other two methodologies used in the Gunton Report result in upper limits of spill costs for $193,405 per m^3 ($30,750 per barrel), based on data from the Pipeline and Hazardous Materials Safety Administration, and $226,111 per m^3 ($35,950 per barrel), based on the Dr. Etkin's Spill Cost model which was also used by Trans Mountain. These other two methodologies result in a mid-point between Dr. Ruitenbeek's evidence and other methodology used in the Gunton Report.

Using these spill volumes and cost per barrel cleanup in the calculation below, the Board estimate the total cost of a large spill to be $1.1 billion.

Total Cost of a Spill = 29,146 barrels x $37,500 per barrel

= $1.093 billion or $1.1 billion rounded up

The Board based the financial assurance requirements for Trans Mountain on a spill that is estimated to cost $1.1 billion. The Board would impose a condition requiring Trans Mountain to develop a Financial Assurances Plan made up of two components that total $1.1 billion. First, Trans Mountain must have ready cash of at least $100 million to cover immediate costs of a spill. Second, Trans Mountain must have core coverage of $1 billion to cover the costs of cleaning up a spill, remediating the environment and compensating affected third parties. This core coverage must be a portfolio of financial instruments. At least one financial instrument must be funds readily accessible to Trans Mountain.

The Board would require Trans Mountain to file a Financial Assurances Plan with the NEB for approval, at least 6 months prior to applying for leave to open. The Project may not receive leave to open without an approved Financial Assurances Plan in place, as the Board finds it to be in the public interest to ensure that Trans Mountain has sufficient resources to address the costs of a major spill. The full details of the requirements of the Financial Assurances Plan can be found in Condition 121.

In Condition 121, the Board outlines the criteria for acceptable instruments. For example, any letter of credit that forms part of the Financial Assurances Plan must be unconditional and irrevocable, segregated from Trans Mountain's day-to-day business activities, and be dedicated to providing funds to cover the costs of liabilities for, without limitation, cleanup, remediation, and other damages.

The Financial Assurances Plan must be filed on the public record. It must also be filed with a report from an appropriate third party that has assessed the Financial Assurances Plan and its key components. The report must summarize the key features of each financial and insurance instrument proposed for inclusion in the Financial Assurances Plan.

The Board is a life-cycle regulator and Trans Mountain has financial obligations for the duration of the pipeline's life. Trans Mountain's Financial Assurance Plan must be in place for the duration of the pipeline's operation. Therefore, each year after its leave to open application is approved, Trans Mountain must file a letter on the public record by the 31st January signed by an officer of the company verifying that all components of the Financial Assurances Plan remain complete and as the NEB approved.

The Board will review the Financial Assurances Plan annually to ensure it complies with Condition 121.

If Trans Mountain wishes to change its Financial Assurances Plan, it must publically file a letter requesting approval from the Board at least 60 days prior to any intended changes. This letter must describe the intended changes and how the changes provide the same or greater level of protection.

If Trans Mountain accesses any component of the Financial Assurances Plan for any reason, it has 30 days to publically file a report detailing the component accessed, the reason for accessing it, and Trans Mountain's plan to ensure that it continues to meet the requirements of its NEB-approved Financial Assurances Plan.

The Board finds that some of Trans Mountain's proposed financial instruments may not be appropriate for use as financial assurances. In the event a CPCN is issued, the Board views it as critical that Trans Mountain, as the company holding the CPCN, has access to immediate cash in the case of any incident. Trans Mountain must ensure that its corporate structure does not impair its ability to access at least $100 million immediately in the case of an incident. Trans Mountain's proposal to use operating cash flow to address the immediate costs of an incident calls into question how operating

expenses will be paid during this time period. Immediate cash cannot serve more than one purpose. The Board recognizes that the immediate cash or other instruments that allow access to immediate cash can be costly for Trans Mountain. As part of this recognition, the Board does not require all of Trans Mountain's financial assurances to be in a segregated, immediate cash form. Meaningful credit facilities may also serve the purpose of immediate cash. Trans Mountain is responsible for satisfying the Board that its Financial Assurance Plan complies with the condition the Board would impose.

As noted in the introduction, details of the regulations are unknown at this time. However, when the regulations become law, Trans Mountain will be required to comply with whichever requirement is stricter: the requirements of the future regulations or the financial condition the Board would impose with this recommendation.

The Board also notes that Trans Mountain discussed its plan to refile its Abandonment Cost Estimate for Board approval. In the Set-Aside and Collection Mechanisms hearing (MH-001-2013), the Board ordered Trans Mountain to establish a trust to satisfy its obligations relating to the abandonment, decommissioning, and deactivation of its pipelines. With any substantive changes to its pipeline system, Trans Mountain must refile its Abandonment Cost Estimate with the Board for approval.

The Board is of the view that the Project would constitute a substantive change to the pipeline system. The Board has a process developed for the review and approval of abandonment cost estimates and so takes no stance on the conceptual abandonment cost estimate described in this Application. Once Trans Mountain is ready to abandon its pipeline, it must first seek leave of the Board.



14.0



Project-related increase in shipping activities

As described in Section 14.2, marine vessel traffic is regulated by government agencies, such as Transport Canada, Port Metro Vancouver, Pacific Pilotage Authority and the Canadian Coast Guard, under a broad and detailed regulatory framework. The Board does not have regulatory oversight of marine vessel traffic, whether or not the vessel traffic relates to the Project. There is an existing regime that oversees marine vessel traffic. The Board's regulatory oversight of the Project, as well as the scope of its assessment of the Project under the *Canadian Environmental Assessment Act* (CEAA 2012), reaches from Edmonton to Burnaby, up to and including the Westridge Marine Terminal (WMT).[71] However, the Board determined that potential environmental and socio-economic effects of Project-related tanker traffic, including the potential effects of accidents or malfunctions that may occur, are relevant to the Board's consideration of the public interest under the NEB Act.[72] Having made this determination, the Board developed a set of Filing Requirements[73] specific to the issue of the potential effects of Project-related marine shipping activities to complement the Filing Manual. These additional filing requirements were related to consultation, description and extent of increase in marine shipping activities, effects assessment including but not limited to, an assessment of credible worst-case spill scenarios, and navigation and safety and mitigation measures. The Board said that it did not intend to duplicate the work being undertaken by the TERMPOL[74] Review Committee.[75]

This chapter includes an assessment, under section 52 of the NEB Act, of potential environmental and socio-economic effects of Project-related tankers for general operations and in the event of spill (Issue # 5 in the List of Issues, Appendix 1: List of Issues).

71 Chapter 9 discusses potential spills from the Westridge Marine Terminal.

72 "Factors and Scope of the Factors for the Environmental Assessment pursuant to the *Canadian Environmental Assessment Act, 2012*", 2 April 2014.

73 "Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increased Marine Shipping Activities", 10 September 2013.

74 "Technical Review Process of Marine Terminal Systems and Transhipment Sites." TERMPOL is an extensive yet voluntary review process that proponents involved in building and operating a marine terminal system for bulk handling of oil, chemicals and liquefied gases can request. It focuses on the marine transportation components of a project.

75 Transport Canada chairs a TERMPOL Review Committee for this Project. The following agencies and organizations have been involved in the TERMPOL Review Process: Transport Canada; Fisheries and Oceans Canada; the Canadian Coast Guard; Environment and Climate Change Canada; the Canadian Hydrographic Service; Pacific Pilotage Authority Canada; British Columbia Coast Pilots; and Port Metro Vancouver.

During the hearing, the Board heard concerns from many participants related to marine shipping, navigation and safety. Many participants expressed concerns regarding increased spill risk as a result of increased Project-related tanker traffic, and the environmental and socio-economic effects that would result from spills. The Board also heard from Trans Mountain and some participants, including government departments, regarding the existing protections they said were already in place with respect to marine vessel traffic.

The table below identifies the various topics and the corresponding section numbers where the evidence and the Board's views on each topic can be found in this chapter.

	Section	Topic
	14.1	Description and extent of the existing, Project-related and future shipping activities
	14.2	Regulatory framework for marine shipping
	14.3	Environmental and socio-economic effects assessment of increased marine shipping (routine operation of the tankers)
	14.4	Spill prevention (safety measures and marine shipping risk analysis)
	14.5	Emergency preparedness and response
	14.6	Environmental and socio-economic effects of spills
	14.7	Financial responsibility, liability and insurance

14.1 Description and extent of the existing, future, and Project-related shipping activities

Trans Mountain said that it does not own or operate the vessels associated with existing marine shipping operations, nor will it directly own or operate those associated with the Project. Trans Mountain said that all large vessels destined for Port Metro Vancouver, including those that would be associated with the Project, use existing shipping routes (Figure 25). It said that these routes are suitable for safe transit by current and future Trans Mountain Project-related tankers. The route is approximately 160 nautical miles (296 km) in total between Westridge and the 12 mile limit off the west end of the Juan de Fuca Strait. The passage takes approximately 14 to15 hours to navigate, including about 8 hours transit time from the pilot boarding station near Victoria, B.C. to the WMT. The vessel speed would vary between 6 to 14 knots, depending on the route segment and on whether the tankers are empty or laden. Trans Mountain said that such speeds have proven to be both safe and efficient over many years of operating practice.

Trans Mountain provided a summary of the existing and future vessel movements at five locations in the Regional Study Area (RSA)[76] (Table 22). Trans Mountain said that future marine vessel movements in the RSA were projected to have a growth rate of two per cent per annum through to 2030 for marine tankers, including oil tankers, chemical tankers and LNG carriers. It said that cargo carriers and container ships were projected to grow at one per cent per annum through to 2030 and that the projected growth rate for all other marine vessels (e.g., tugs, barges, government vessels, passenger vessels and all other vessels) was also one per cent per annum over the same time period, with the exception of fishing vessels, which were projected to have a zero per cent growth rate. Trans Mountain identified multiple proposed development projects (e.g., Roberts Bank 2 Expansion Project, Fraser Surrey Docks and Gateway Pacific Terminal) and said, if approved, these developments are expected to contribute to the increase in commercial marine vessel traffic in Burrard Inlet, the Strait of Georgia, Haro Strait and Juan de Fuca Strait. Trans Mountain also said that proposed parks and other recreational areas in the RSA that include marine components may also contribute to future increases in marine use by recreational and tourism users.

Trans Mountain said that Panamax tankers (less than 75,000 metric tonnes DWT) and Aframax tankers (75,000 to 120,000 metric tonnes DWT) call at the WMT.

76 For the marine transportation component, the RSA extends from the Westridge Marine Terminal to the 12 nautical mile limit and is of variable width extending from the marine shipping lanes, depending on the indicator.

Table 22: Trans Mountain's summary of existing and future vessel movements at five locations in the Regional Study Area

Location of cross section[1]		Vessel movements by vessel type in 2012 (#/yr)									Project-related vessel movements[10] (#/yr)			Project-related tanker contribution to 2012 vessel traffic (%)	Project-related tanker and tug contribution to 2012 vessel traffic (%)	Estimated increase in non-Project vessel movements by 2030 (#/yr)	Estimated total vessel movements in 2030 (#/yr)	Project-related tanker contribution to total projected future vessel traffic (%)	Project-related tanker and tug contribution to total projected future vessel traffic (%)
Name	Description	Tanker[2]	Cargo/Carrier[3]	Tug[4]	Service[5]	Passenger[6]	Fishing[7]	Other[8]	Unknown[9]	Total	Tanker	Tug	Total						
Burrard Inlet[15]	North-south across Burrard Inlet just west of the Westridge Marine Terminal	263	108	5,631	473	68	25	261	29	6,858	720	2,160	2,880	9.5	29.6	1,401	11,139	6.5	25.9
English Bay	North-south from Point Atkinson in West Vancouver to Point Grey area in Vancouver	384	3,170	5,755	682	477	192	1,244	337	12,241	720	720	1,440	5.6	10.5	2,453	16,134	4.5	8.9
Strait of Georgia	Northeast across southern Strait of Georgia, from Delta near Tsawwassen to Active Pass area	385	5,301	3,237	1,316	5,634	459	672	590	17,594	720	720	1,440	3.9	7.6	3,450	22,484	3.2	6.4
Haro Strait	Northeast from Victoria area east to San Juan Island	391	4,506	975	850	506	300	907	461	8,896	720	720	1,440	7.5	13.9	1,777	12,113	5.9	11.9
Juan de Fuca Strait	Southeast from Victoria to Port Angeles area	1,197	7,695	2,294	2,189	2,146	742	1,409	831	18,503	720	720	1,440	3.7	7.2	3,762	23,705	3.0	6.1

Source: TERMPOL 3.2 (Volume 8C, TR 8C-2)

Notes:

1 Cross sections were placed across the shipping lanes to characterize the movements of vessels in the area that may be travelling in or adjacent to the shipping lanes.

2 Tanker traffic includes all chemical and petroleum products.

3 Cargo/carrier includes bulk carriers and general cargo carriers.

4 Tug traffic includes all tug movements, such as tugs engaged in towing and barging activities and harbour assist tugs.

5 Service vessels include: law enforcement/patrol vessels, military vessels, pilot vessels, pollution control vessels, research/survey vessels, dredges, and others.

6 Passenger includes ferries and cruise ships. While cruise ships operate in the summer months, most ferry services are year round. Strait of Georgia passenger vessel movements may be biased due to placement of the cross section parallel to major ferry routes and may include more than one instance per ferry crossing. Due to the fact that the passenger vessels category combines ferry and cruise ship traffic, ferry movements were estimated as 1% per annum from 2012 to 2030.

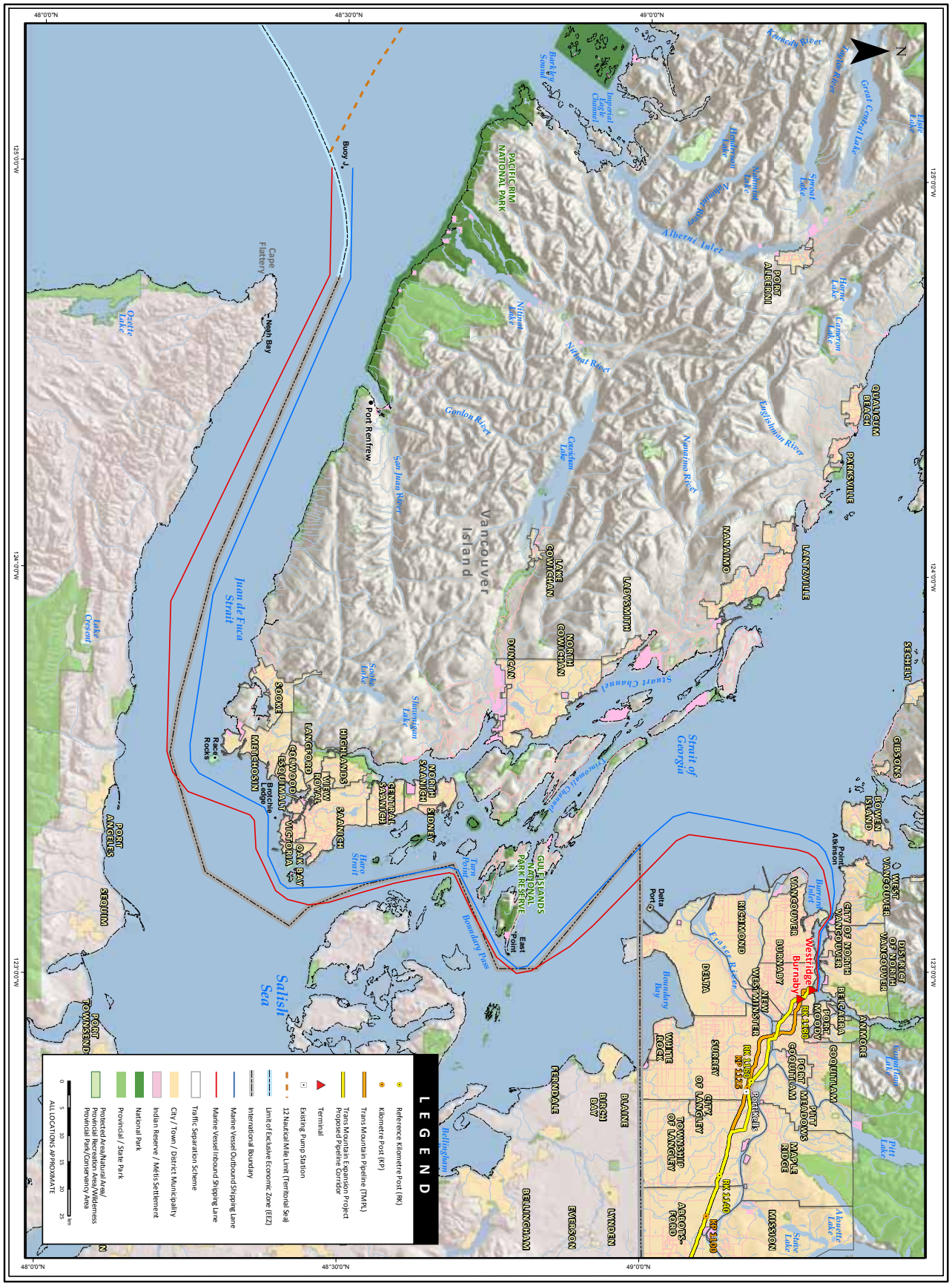
7 Fishing: only fishing vessels greater than 24 m in length and 150 gross tonnes are required to call in to VTS. Smaller vessel movements are not captured.

8 'Other' category may include pleasure craft greater than 30 m in length (required to call into VTS).

9 'Unknown' category is likely to include private recreational vessels and all vessels smaller than 30 m that are not required to call into VTS.

10 Tanker numbers calculated as: 30 vessels/month ×12 months/yr × 2 transits/vessel (inbound + outbound). Tug numbers calculated assuming 3 escort tugs for outbound tankers in Burrard Inlet and 1 escort tug for outbound tankers along the remainder of the shipping lanes. Tug numbers include outbound trip (i.e., while escorting tanker) and inbound trip (i.e., returning to point of origin).

Figure 25: Shipping lanes to and from the Westridge Marine Terminal



Trans Mountain said the existing WMT typically loads five tankers per month. The expanded system associated with the Project would require approximately 34 Aframax class vessels per month, with actual demand driven by market conditions. Aframax vessels would be the maximum size of vessel accessing WMT.

Trans Mountain said that if the Project was approved, the Project-related increase in marine traffic within Burrard Inlet would represent approximately 16.4 per cent of total marine traffic volume, compared to the current 3.0 per cent. It also said that within Juan de Fuca Strait, Project related tanker traffic would increase to about 6.6 per cent of total marine traffic volume as compared to the current 1.1 per cent.

Ms. Michelle Baudais said that Project-related tanker traffic east of the Second Narrows bridge would account for an even higher percentage of total large vessel traffic as compared to consideration of large vessel traffic within Burrard Inlet overall.

14.2 Regulatory framework

14.2.1 Overview of existing regulatory framework for marine shipping

Evidence filed by many participants, including Trans Mountain, Transport Canada, Port Metro Vancouver, Pacific Pilotage Authority and the Canadian Coast Guard sets out a broad and detailed regulatory framework governing safety, security and environmental protection in relation to marine shipping, which would cover tankers associated with the Project. A summary of the framework is provided here.

International

Transport Canada said that regulations and standards that govern shipping operations are implemented through international agreements. It said that countries negotiate their governments' approved positions on international standards for the safety, security and environmental performance of international shipping, and, once agreement has been reached, member countries, like Canada, must create regulatory frameworks for the shipping industry that reflect the agreement. Transport Canada said there are over 50 International Maritime Organization (IMO) conventions covering a range of topics. The conventions are reflected in Canada's marine safety and security system, including the Canada Shipping Act, 2001. Canadian maritime laws apply to all vessels operating in Canadian waters, and to Canadian vessels worldwide.

In addition to the IMO conventions, Canada and B.C. have other cooperative agreements and working relationships in place with the United States regarding spill prevention and response.

Some of the major conventions and agreements include:

	International Convention / Agreement	Highlights
	International Convention for the Safety of Life At Sea (SOLAS)	• how a vessel is constructed, its required safety equipment and establishes security requirements
	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW)	• the competencies of a vessel's crew

	International Convention for the Prevention of Pollution from Ships (MARPOL)	• limits on a vessel's operational discharges and sets detailed technical standards for:
		  • carrying and handling oil;
		  • carrying and handling noxious liquid substances in bulk;
		  • carrying packaged dangerous goods; and
		  • managing vessel sewage discharges, garbage and air emissions

	International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)	• measures for dealing with pollution incidents, including oil pollution, either nationally or in co-operation with other countries
	Maritime Labour Convention, 2006	• standards for protecting the rights of seafarers
	United Nations Convention on the Law of the Sea (UNCLOS)	• sovereign rights that a coastal state can exercise in these areas of the sea • the rights that other countries can exercise when they wish to undertake activities in these areas of the sea

	International Maritime Organisation's 2011 Guidelines for the Control and Management of Ship's Biofouling	• voluntary guidelines that encourage the ship-owners to adopt practices to control and manage biofouling
	International Convention on the Control of Harmful Anti-fouling Systems	• prohibits, and/or restricts the use of harmful anti fouling systems
	Pacific States/British Columbia Oil Spill Task Force	• emphasizes working together to reduce the likelihood of a transboundary spill occurring and to improve spill response
	Canada-United States Joint Marine Pollution Contingency Plan	• Canadian Coast Guard and United States Coast Guard agreement to provide a coordinated system for planning, preparedness and responding to pollution incidents in contiguous Canadian and US waters.
	Trans-boundary exercises and mutual aid agreements	• CCG and United States Coast Guard hold joint planning and response exercises in the Juan de Fuca Strait on an annual basis • in the event of a cross-border oil spill, a mutual aid plan for the members of the Pacific States-British Columbia Oil Spill Task Force would be activated in order to coordinate the movement of mutual aid resources • Western Canada Marine Response Corporation (WCMRC) participates in annual joint exercises, and cross border mutual aid exercises with partners in Washington and Alaska • Trans-boundary cooperation is described in more detail in section 14.5

National

Trans Mountain said that Transport Canada is responsible for Canada's transportation policies and programs that promote safe, secure, efficient and environmentally responsible transportation.

Participants filed evidence to show the role that federal departments have in regulating marine shipping activities or in marine spill response. Highlights are provided here:

	Department	Legislation / Program	Highlights
	Transport Canada (TC)	Canada Shipping Act, 2001	• Part 4, which covers safety; • Part 5, which covers navigation services; • Part 8, which covers environmental preparedness and response, and is the foundation of Transport Canada's programs that certify Response Organizations and inspect oil handling facilities. Transport Canada requires response plans for Response Organizations to be based on regulations and planning standards set out under the Response Organizations Standards TP 12401 • Part 9, which prohibits discharge of prescribed pollutants, requires vessels to have pollution emergency plans and grants the Minister of Transport the authority to direct vessels that have discharged or are likely to discharge pollutants; and • Part 11, which relates to oversight and enforcement.
	Transport Canada (TC)	Ballast Water Control and Management Regulations	• vessels must have a ballast water management plan before arriving at the port • regulations outlines measures and procedures for safe and effective ballast water management
	Transport Canada (TC)	Marine Transportation Security Act (MTSA)	• provides for the security of marine transportation

	Transport Canada (TC)	Marine Liability Act (MLA)	• establishes the Ship-Source Oil Pollution Fund and provides funding for spills from all classes of vessels in Canada • MLA is discussed more in section 14.7
	Transport Canada (TC)	TERMPOL review process	• focuses on the marine transportation components of a project and examines the safety of tankers entering Canadian waters, navigating through channels, approaching berthing at a marine terminal and loading or unloading oil or gas • TERMPOL report is discussed more in section 14.4.1
	Fisheries and Oceans Canada (DFO) / Canadian Coast Guard (CCG)	Fisheries Act	• CCG, as a Special Operating Agency of DFO, provides maritime services related to navigation, spill response, communication, security, and search and rescue • for a spill, CCG assumes role of Federal Monitoring Officer, monitoring the overall effort of the response organization to ensure it is timely, effective, and appropriate to the incident • within Canadian waters and the Exclusive Economic Zone, CCG is responsible for providing aids to navigation and waterways management services, and providing marine communication and traffic services
	Environment and Climate Change Canada (ECCC)	National Environmental Emergencies Centre (NEEC)	• provides ECCC's technical and scientific environmental advice and assistance to the Lead Agency in the event of an environmental emergency • uses a mapping application and data viewing portal, enabling quick identification of the location of an incident, its geographical context, and environmental concerns and protection priorities • consolidates geospatial data for the purpose of delivering expert advice in a variety of formats – maps, reports and other associated documentation are delivered to the lead agency and others that assist on environmental emergencies. • NEEC conducts post-emergency assessment, provides specialized advice on shoreline cleanup assessment technique, and provides advice on ecosystem recovery objectives.
	Environment and Climate Change Canada (ECCC)	Sulphur in Diesel Fuel Regulations	• standard setting the allowable sulphur levels in marine diesel fuel available for large ships

Provincial

While the federal government has constitutional authority for navigation and shipping, both the provincial and federal governments have shared authority over the environment. The province also has authority for the management of provincial lands and natural resources.

	Province	**Program**	**Highlights**
	Province of British Columbia	Environmental Management Act	• Managing discharge of pollutants • Environmental Emergency management • Cost recovery from a spiller (polluter pays)
	Province of British Columbia	Wildlife Act	• Protection of wildlife
	Province of British Columbia	B.C. Emergency Program Act	• Environmental Emergency management

Regional

There are also regionally-focused bodies and organizations that have a role in regulating marine shipping activities or in marine spill response. Highlights are as follows:

	Agency / Authority	Authorization	Highlights
	Western Canada Marine Response Corporation (WCMRC)	Canada Shipping Act, 2001	• ensure emergency preparedness and response capacity in the event an oil spill occurs in the marine environment on the West Coast of B.C. • WCMRC is discussed further in section 14.5
	Vancouver Fraser Port Authority, doing business as Port Metro Vancouver (PMV)	Canada Marine Act	• facilitate trade, ensuring goods are moved safely, while protecting the environment and considering local communities • responsible for the operation and development of the assets and jurisdictions of the former Fraser River Port Authority, North Fraser Port Authority and Vancouver Port Authority, which were amalgamated in 2008 • responsible for managing over 16,000 hectares of water, over 1,000 hectares of land and assets along hundreds of kilometres of shoreline
	Pacific Pilotage Authority (PPA)	Pilotage Act	• mandate is to provide a safe, reliable and efficient marine pilotage service on the west coast of Canada • pilots are a resource to the master and bridge team providing them with expert local knowledge, and are responsible to the master for the safe navigation of the vessel while it is in British Columbia pilotage waters • provides added level of safety to the vessel by placing a pilot on the vessel meaning at least one member of the bridge team has in-depth knowledge of local dangers, is not fatigued, and is a knowledgeable resource • according to PPA, a robust pilotage is one of the tools used by governments to reduce a human error-based vessel incident
	The British Columbia Coast Pilots Association (BCCPA)	Pilotage Act Canada Shipping Act, 2001	• provides service to the Pacific Pilotage Authority • pilots have to meet rigorous levels of knowledge and experience requirements, and then be examined and licensed by the Pacific Pilotage Authority training program

The operation of this regime in the context of Project-related tankers and any additional mitigation Trans Mountain is proposing are described, in part, in section 14.4.1, see subsection on Project-related tankers.

14.2.2 Federal improvement initiatives

World-class Tanker Safety System

In 2013, the Tanker Safety Expert Panel submitted their report, *A Review of Canada's Ship-source Oil Spill Preparedness and Response Regime — Setting the Course for the Future*, to the Minister of Transport. The review and report focused on the Ship-source Oil Spill Preparedness and Response Regime south of the 60th parallel as it was in 2013. Generally, the Tanker Safety Expert Panel found that "the foundational principles of the Regime have stood the test of time, but that there are a number of areas that could be improved to enhance Canada's preparedness and response to ship-source oil spills".

The Tanker Safety Expert Panel made 45 recommendations for action by the federal Government and by federal departments, including Transport Canada, the Canadian Coast Guard, Environment and Climate Change Canada (ECCC) and Fisheries and Oceans Canada. Among the recommendations are:

- Transport Canada should require Response Organizations to have in place the arrangements for cascading resources and mutual assistance agreements necessary to address a worst-case discharge in their Areas of Response.
- The Government of Canada should implement a risk-based Area Response Planning model to prepare for ship-source oil spills.
- Transport Canada should regularly review and update the national Risk Assessment for Marine Spills in Canadian Waters and make these results public.
- Using a consistent methodology, Transport Canada should perform regional risk assessments for each Area of Response and make the results public.
- The Canadian Coast Guard should invite other stakeholders who are involved in oil spill preparedness and response to participate during the planning process. The Area Response Plans should be made publicly available.

Transport Canada outlined its roles and responsibilities as part of the World Class Tanker Safety System (WCTSS) initiative. It said that:

- the WCTSS is a comprehensive, multiyear strategy for all of Canada and that it is independent of any energy infrastructure project;
- implementation of the WCTSS measures was already underway; and
- WCTSS initiatives take into consideration the advice of the Tanker Safety Expert Panel, stakeholder input and other analyses.

The Canadian Coast Guard said that Canada's marine navigation system was being modernized through investments related to the World Class Tanker Safety System. It said that it was investing in state-of-the-art navigational services and technologies, and working with Transport Canada to examine current Automated Information System carriage requirements.

The Canadian Coast Guard said that it would be establishing the Incident Command System across the organization as part of the World Class Tanker Safety System. It said that this system allows multiple stakeholders to participate in important decision-making processes simultaneously and allows for effective planning and response initiatives to address all marine pollution and all-hazard incidents in a predictable and structured fashion.

The Canadian Coast Guard also said that in conjunction with other partners, it would develop Area Response Plans, to gain a common understanding of the key planning elements, and to further improve the decision-making process. Partners engaged would include local stakeholders and representatives from Aboriginal communities, industry, other federal government departments and other levels of government. It noted that the Area Response Plans would be improved through scientific research on pollutants and how they behave in water. The southern portion of B.C. was identified as pilot area for implementation of area response planning. The Canadian Coast Guard noted the creation of a $2.1M Community Participation Funding Program to facilitate the participation of eligible stakeholders in the Area Response Planning pilot project. It said that draft Area Response Plans would be completed by March 2017.

ECCC also outlined its role in informing preparedness and response decisions (e.g., providing scientific information to inform response), as well as its role in research (e.g., behaviour of transported substances) in relation to the World Class Tanker Safety initiative.

Senate Standing Committee on Energy, the Environment and Natural Resources Report

Trans Mountain said that it supported recommendations from the August 2013 Senate Standing Committee on Energy, the Environment and Natural Resources Report, including:

- The current spill preparedness and response capacity of 10,000 tonnes within prescribed time frames should be increased to fit the assessed needs of each region as determined by Transport Canada.
- The federal government should provide umbrella protection to Canadian marine response organizations for all non-ship source spills, including marine spills from pipelines, trains and trucks.
- The Canadian Coast Guard (CCG)'s mandated spill preparedness and response capabilities should be certified by Transport Canada or an independent, third-party agency periodically.

14.3 Effects assessment of increased marine shipping (routine operation of the tankers)

This section focuses on the changes to the environmental and socio-economic setting caused by the routine operation of the Project-related marine vessels. The environmental effects of the spills from marine shipping are discussed in section 14.6.1.

The Board assessed the potential environmental and socio-economic effects of the increased marine shipping resulting from the designated Project as part of its public interest determination under the NEB Act, and not under CEAA 2012. The Board followed an approach similar to the environmental assessment conducted under CEAA 2012 as described in Chapter 10, to the extent it was appropriate, to inform the Board's public interest determination.

When the Board established the List of Issues it would consider for this hearing, it included Issue 5 – The potential environmental and socio-economic effects of marine shipping activities that would result from the proposed Project, including the potential effects of accidents or malfunctions that may occur. The Board stated that this would be considered under the NEB Act.[77] On 10 September 2013, the Board issued specific filing requirements[78] related to the environmental and socio-economic effects assessment of increased marine shipping that Trans Mountain should consider in its application to the Board. In the Board's overall public interest recommendation under the NEB Act, the Board took into consideration its findings on Issue 5.

In order to determine whether the effects of marine shipping are likely to cause significant environmental effects, the Board considered the existing regulatory regime in the absence of any specific mitigation. Since marine shipping is beyond the Board's regulatory authority, the Board does not have the ability to impose specific mitigation conditions to address environmental effects of Project-related marine shipping.

The Board generally adopted the spatial and temporal boundaries for each valued component as defined by Trans Mountain, for both Project-related marine shipping effects and cumulative effects. The spatial boundaries (or study areas) are described in Appendix 11. The marine shipping lanes are defined to include the normal tanker transit patterns from the WMT to the 12 nautical mile limit, including transit within Burrard Inlet in the internationally designated marine shipping lanes. The time frame of the assessment includes the operation phase of the Project related marine vessels (i.e., the time during which increased marine vessel traffic operations are expected to occur, or more than 50 years).

The Board considered any cumulative effects that are likely to result from Project-related shipping, in combination with environmental effects arising from other current or reasonably foreseeable marine vessel traffic, in the element-specific RSA.

Living Oceans Society argued that Trans Mountain's assessment of Project-related marine shipping's effects (including effects from spills) on Southern resident killer whales falls short of the rigorous review required by SARA section 79(2), as it does not identify all adverse effects on the species and does not identify mitigation measures for those adverse effects. As a result, Living Oceans Society argued that the Board cannot meet its obligations under section 79(2) and should not recommend approval of the Project.

Views of the Board

Chapter 10 describes the Board's responsibilities under the SARA. The Board notes that Living Oceans Society's argument does not address the Board's 2 April 2014 Scoping Document, which stated that the designated project being assessed by the Board under CEAA 2012 consisted of the pipeline and facilities, including the Westridge Marine Terminal (WMT), or otherwise explain why or how section 79 of SARA applies to the Board's consideration of the effects of Project-related marine shipping. As a result, the Board is not persuaded by Living Oceans Society's argument that the Board's obligations under section 79 of SARA apply to its consideration of the effects of Project-related marine shipping.

Notwithstanding this, the Board notified the Ministers of Environment and Climate Change Canada, Fisheries and Oceans Canada and Parks Canada Agency of all species listed on Schedule 1 of the SARA (SARA-listed species) and their critical habitat that may be affected by Project-related marine shipping on 23 April 2014.

77 NEB letter of 2 April 2014, Trans Mountain Expansion Project, Factors and Scope of Factors for the Environmental Assessment, pursuant to CEAA, 2012 (Scoping Document).

78 This document was titled: Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increased Marine Shipping Activities, Trans Mountain Expansion Project

Further, the Board's assessment of the environmental effects of Project-related marine shipping under the NEB Act considered:

- *adverse impacts of Project-related marine shipping on SARA-listed wildlife species and their critical habitat;*
- *all reasonable alternatives to Project-related marine shipping that would reduce impact on SARA-listed species' critical habitat; and*
- *measures to avoid or lessen any adverse impacts consistent with applicable recovery strategies or action plans.*

The Board's consideration of measures that it could impose to avoid or lessen adverse impacts was limited as it does not regulate, and Trans Mountain does not control, tankers once they leave the WMT, as noted above.

14.3.1 Environmental effects

Marine air and greenhouse gas emissions

Several participants raised concerns about the impacts from Project-related marine shipping on air quality. This section focuses on operational air and greenhouse gas emissions from tankers in transit, at anchor and underway. Air and greenhouse gas emissions from tankers at berth are discussed in Chapter 10.

Trans Mountain conducted an air quality assessment to predict operational air and greenhouse gas emissions from Project-related marine shipping. It estimated air emissions (criteria air contaminants, volatile organic compounds, secondary particulate matter, ozone and visibility) and greenhouse gas emissions for the:

- existing conditions reflecting all projects and activities in the area, including current marine vessels associated with Trans Mountain's current operations;
- Project-related shipping effects, including the proposed increase in vessel traffic associated with the Project; and
- cumulative effects, including existing conditions, the Project-related shipping, and all reasonably foreseeable projects and activities in the area.

Trans Mountain said that combustion emissions are generated by operating tankers, barges and associated tug escorts. Combustion emissions include emissions from tankers' main and auxiliary engines and boilers. Trans Mountain said that combustion emissions are not associated with the barge itself but with the engine aboard the tugboat. Trans Mountain used the methodology adopted in Environment and Climate Change Canada's (ECCC) 2010 National Marine inventory to estimate the combustion and fugitive emissions that will be generated from Project-related marine vessels. Trans Mountain said that fugitive emissions from vessels at berth are associated with product loading activities at the WMT. Fugitive emissions could also potentially escape through tanker vents during transit.

Trans Mountain compared the total predicted annual combustion emissions from Project-related marine shipping to the existing totals in the RSA (defined in Appendix 11). It estimated an increase of 0.6 to 7.0 per cent in annual marine combustion emissions in the RSA as a result of Project-related marine shipping. Trans Mountain predicted that all modelled contaminant concentrations for the Application Case would be below applicable objectives, with the exception of the daily 1-hour 99th percentile for sulphur dioxide.

Trans Mountain said that marine transportation associated with existing operations at the WMT is estimated to represent 0.98 per cent of marine greenhouse gas emissions in the RSA, 0.30 per cent of marine greenhouse gas emissions in B.C., and 0.17 per cent of marine greenhouse gas emissions in Canada. As a result of Project-related marine shipping, Trans Mountain estimates increases of approximately 6.9 per cent in marine greenhouse gas emissions in the RSA, 2.1 per cent in marine greenhouse gas emissions in B.C., and 1.2 per cent in marine greenhouse gas emissions in Canada. Trans Mountain estimated a total of 68,100 carbon dioxide equivalent annual marine greenhouse gas emissions from vessels in transit and at berth associated with Project expansion.

Trans Mountain said that it did not consider mitigation measures in the marine greenhouse gas emissions assessment. It said that new energy efficiency standards were adopted by the International Maritime Organization in July 2011 and that these standards may improve greenhouse gas emissions from new

vessels in the future. Trans Mountain said all Project-related tankers are required to adhere to federal standards that may reduce greenhouse gas emissions, including standards for bunker fuel.

Exclusion of boiler emissions

ECCC said that Trans Mountain's exclusion of tankers' boiler emissions in its estimation of Project-related marine air emissions leads to multiple uncertainties regarding pollutants, such as nitrogen oxides and particulate matter 2.5 microns or less in diameter ($PM_{2.5}$). ECCC said that the boiler emissions were not included in the calculation of marine emissions on the assumption that boilers are used for preheating the heavy fuel oil, and that only distillate would be used after 2015 and the implication of the North American Emission Control Area. ECCC said that the Trans Mountain's decision to exclude boiler emissions is expected to result in a 20 per cent underestimation of Project marine-source $PM_{2.5}$ emissions.

ECCC said that main and auxiliary boilers are used for other reasons than pre-heating heavy fuel oil (e.g., ships' machinery and various services). Trans Mountain disagreed with ECCC's statement and said that neither main nor auxiliary boilers are required to operate when a tanker is at anchor or at berth. Port Metro Vancouver said that although it is unable to confirm whether both main and auxiliary boilers operate when a tanker is at anchor or at berth, it is of the view that boiler emissions should not be excluded from the assessment.

Transport Canada said that beyond setting limits on overall air emissions from vessels, it does not have a regulatory interest in whether boilers operate when a tanker is at berth and at anchor. It noted that the North American Emission Control Area (under MARPOL) puts in place the most stringent air emissions requirements for tankers. Under these standards, all tankers must either burn fuel with 0.10 per cent sulphur content or use alternative technology that results in equivalent emissions. Transport Canada said that engines fitted onto tankers after 1 January 2016 will need to meet Tier III nitrogen oxide standards for a reduction of nitrogen oxide emissions of up to 80 per cent.

Anchorage and berth times and locations

ECCC said that tankers at berth and at anchorage are a source of emissions within the Westridge Local Study Area (LSA). It expressed concerns regarding Trans Mountain's assumptions on anchorage times and locations, and their impact on the air quality assessment. ECCC said that Trans Mountain's estimates indicate that the total time a tanker spends in port, including the inbound trip, the outbound trip, and the time at anchorage and berth, is about 80 hours. It said that only one anchorage location, Indian Arm, was included in Trans Mountain's assessment. ECCC said that it expects that, with the Project, the incidence of tankers using anchorages other than at Indian Arm will increase, as will the frequency at which the English Bay anchorages will be fully used.

Trans Mountain said that it will maintain high level of berth use in order to best manage its future operations. It noted that in most cases, arriving vessels will proceed directly to their assigned terminal berth. If the assigned berth is not available, vessels may anchor at one of the four designated anchorages near the mouth of Indian Arm. Port Metro Vancouver said that when a vessel requires an anchorage, the local shipping agent would request Port Metro Vancouver operations to assign an anchorage. Port Metro Vancouver said that while its role is to direct tankers to an anchorage when one is required or requested, it is not involved in scheduling berths for tankers. It said that this activity is managed by individual operators of each marine terminal.

Port Metro Vancouver said that it is satisfied with Trans Mountain's estimate for the amount of time Project-related tankers may spend at anchor east of Second Narrows and its rationale that anchorage demand will be minimized by increasing berth use. Port Metro Vancouver added that, for the purpose of calculating air emissions from Project-related tankers, the anchorage use assessment is incomplete. It raised concerns that the assessment does not include the amount of time Project-related tankers may spend at locations west of Second Narrows.

Air quality impacts, monitoring and reporting

ECCC said that it found several uncertainties in Trans Mountain's photochemical modelling of the formation of secondary particulate matter and ozone. It conducted a scoping analysis and provided specific recommendations in this regard. Chapter 10 provides a discussion on this issue. In light of the uncertainties related to predicting marine source combustion emissions, ECCC recommended that Trans Mountain

develop an air quality monitoring, reporting, and mitigation plan in conjunction with the Lower Fraser Valley Air Quality Coordinating Committee.

ECCC said that it expects emissions from Project-related tankers to increase concentrations of nitrogen dioxide and $PM_{2.5}$ (with their associated health impacts) in the vicinity of the Tsleil Waututh Nation reserve. It said that although Trans Mountain predicted that pollutant concentrations will remain well within ambient air quality standards, the multiple uncertainties regarding those emissions reduce confidence in that conclusion. Therefore, ECCC recommended that Trans Mountain establish a program to monitor air contaminants, including nitrogen dioxide and PM2.5, at or adjacent to Tsleil-Waututh Nation's Burrard Inlet No. 3 reserve. ECCC said that the monitoring program should verify predicted impacts under the full range of expected meteorological conditions.

In response to ECCC's comment on Board's draft conditions, Trans Mountain said that it will consult with Aboriginal groups about the possibility of undertaking an ambient survey on the Tsleil-Waututh Nation's reserve lands. Trans Mountain said that it is willing to consider and discuss the request with the interested parties, such as Tsleil-Waututh Nation and other groups, such as North Shore No Pipeline Expansion (NS NOPE), who also reside on the North Shore and expressed interest in ambient air quality measurements.

Port Metro Vancouver said that in conducting its review, it would rely on the results of the environmental assessment carried out by the Board to the extent the results satisfy its standards and requirements. Port Metro Vancouver said that its air emissions management plans do not typically address emissions from tankers at anchor. Rather, these plans focus on measures the terminal can control and influence. It added that all tankers operating at the port are expected to comply with the relevant regulations in its Port Information Guide.

Mitigation

Trans Mountain said that it does not own or operate the vessels associated with existing marine shipping operations, nor will it directly own or operate those associated with the Project. It said that its tanker acceptance criteria require tankers and barges to be of modern build, to be equipped and maintained in accordance with international and federal regulations, and to be operated using best practices. It added that regular vessel surveys and maintenance (including on propulsion and auxiliary machinery, boilers, and oil handling equipment) will ensure that design parameters and emission limits are met during vessel operations. Trans Mountain said that Project-related tankers would carry an International Air Pollution Prevention Certificate and must have onboard a Ship Energy Efficiency Management Plan.

Trans Mountain said all marine vessels are required to adhere to the federal requirements including:

- Canada's *Vessel Pollution and Dangerous Chemicals Regulations* under the *Canada Shipping Act*, 2001; and
- ECCC's *Sulphur in Diesel Fuel Regulations.*

Transport Canada said that the *Vessel Pollution and Dangerous Chemicals Regulations* under the *Canada Shipping Act, 2001* requires a crude oil tanker's master or owner to ensure the implementation of a volatile organic compounds management plan that meets the requirements of the International Convention for the Prevention of Pollution from Ships.

Trans Mountain said that tugboats classified as large marine vessels will adhere to ECCC's *Sulphur in Diesel Fuel Regulations*. As of June 2014, these vessels must meet marine diesel sulphur content requirements of less than 1,000 milligrams per kilogram (0.1 per cent).

Trans Mountain said that it will take a phased approach in implementing programs and initiatives, such as the Energy Efficiency Design Index and Ship Energy Efficiency Management Plan, which, in its view, would help further reduce any nitrogen dioxide exceedances. It said that all new vessels will be required to meet all applicable local and international regulations.

Cumulative effects

Trans Mountain said that the modelled particulate matter and sulphur dioxide concentrations for the Cumulative Case (including non-Project-related vessels) in the RSA decreased substantially relative to the Base and Application Cases. It associated this decrease with more stringent fuel sulphur regulations.

Trans Mountain predicted that nitrogen dioxide concentrations for the Cumulative Case would decrease relative to the Base and Application Cases due to the more rigorous Tier II and Tier III standards for marine vessels built on 2 January 2011 or later, and 1 January 2016 or later, respectively.

Trans Mountain said that by year 2030, more stringent marine vessel emissions requirements would be in place. As a result, sulphur dioxide and particulate matter emissions for tankers underway and at anchor are projected to decrease substantially.

Trans Mountain said that it expects carbon monoxide and volatile organic compounds concentrations to increase by almost 40 per cent and 20 per cent respectively, from the Base and Application Cases due to the growth in marine traffic.

Views of the Board

Air emissions

The Board finds that although Project-related increase in marine shipping is expected to increase emissions in the Regional Study Area (RSA), these emissions are expected to remain below applicable objectives. The Board recognizes that volatile organic compounds and carbon monoxide in the study area are expected to increase over time as a result of the growth in marine shipping, whereas other contaminants (e.g. nitrogen dioxide, sulphur dioxide, particulate matter) are expected to decrease due to more stringent regulations.

With respect to Trans Mountain's exclusion of boiler emissions in its assessment, the Board notes that neither Port Metro Vancouver nor Transport Canada were able to confirm whether both main and auxiliary boilers operate when a tanker is at berth or at anchor. The Board understands that Transport Canada sets limits on vessels' air emissions, but also that it does not have a regulatory interest in whether boilers operate when a tanker is at berth or at anchor.

Trans Mountain has committed to maintain a high level of berth utilization. In the Board's view, it is difficult to estimate the amount of time spent at the anchorage locations and at berth, which, in turn, could affect any air quality assessment, as it depends on a number of factors. The Board notes that Port Metro Vancouver's role is to direct vessels to an anchorage when one is required or requested, but is not involved in scheduling berths.

The Board acknowledges that there is an existing regulatory regime governing air emissions from tankers underway or in transit. All Project related tankers and barges are required to follow international and federal regulations, and apply best practices during operations. These tankers would carry an International Air Pollution Prevention Certificate and be required to have onboard a volatile organic compound management plan.

The Board realizes that more stringent emission requirements may be in place for marine vessels in the future, such as Tier III reductions in the Emission Control Areas. Trans Mountain's implementation of programs and initiatives, such as the Energy Efficiency Design Index and Ship Energy Efficiency Management Plan, would help further reduce certain emissions.

The Board finds that Trans Mountain's predicted concentrations for both PM2.5 and nitrogen dioxide emissions at the Tsleil-Waututh Nation's Burrard Inlet No. 3 reserve, as a result of Project-related marine shipping, are well below the applicable objectives. The Board acknowledges ECCC's concern that nitrogen dioxide concentrations are generally high in the area due to other non-Project sources and that there are uncertainties with Trans Mountain's prediction of marine-source combustion emissions. As mentioned in Chapter 10, section 10.2.1, the Board would impose Condition 52 requiring Trans Mountain to develop an air emissions management plan at the Westridge Marine Terminal for approval by the Board. Air monitoring conducted pursuant to this plan would verify predicted emissions levels, and exceedances of criteria established within the approved plan would require Trans Mountain to implement appropriate mitigation. Trans Mountain has committed to consult with the relevant Aboriginal groups about the possibility of undertaking an ambient survey on Tsleil-Waututh Nation's reserve lands. Consequently, the Board is not persuaded that a program to monitor air contaminants at or adjacent to Tsleil-Waututh Nation's reserve is warranted at this time. The Board's views around photochemical modelling are discussed in Chapter 10.

Taking into consideration that Trans Mountain and Project-related vessels will be required to adhere to all federal and international emission requirements to reduce emissions from Project-related marine shipping, and given that Transport Canada is the regulatory body that governs air emissions from the Project-related tankers, the Board finds that the residual effects from Project-related marine shipping is not likely to cause significant adverse effects. The Board finds that the increase in operational air emissions from the tankers is expected to be of long-term (expected to occur for the operational life of the tankers), reversible (emissions will reverse shortly once the tankers exit the RSA), low to moderate magnitude, and is expected to disperse in the RSA. In addition, the Board finds that the contribution from Project-related marine shipping to total cumulative effects on marine air emissions is not likely to be significant given that there is an existing regulatory regime that governs the air emissions from the tankers.

Greenhouse gas emissions

The Board has focused its assessment on the direct greenhouse gas emissions generated from the Project-related vessels, as opposed to assessing the global climate effects of the greenhouse gas emissions. As described in Chapter 10, section 10.2.2 in the Board's view, attempting to determine and assess the eventual global climate effects of greenhouse gas emissions generated by the Project-related vessels is not practical in terms of meaningfully informing an environmental assessment recommendation on this Project.

The evidence indicates that the Project-related marine vessels are expected to result in an increase of approximately 6.9 per cent in marine greenhouse gas emissions in the RSA, 2.1 per cent in marine greenhouse gas emissions in B.C., and 1.2 per cent in marine greenhouse gas emissions in Canada. No mitigation measures were considered in Trans Mountain's marine greenhouse gas emissions assessment and there are currently no regulatory reporting thresholds in Canada for marine greenhouse gas emissions. The Board notes that Project-related marine vessels are required to adhere to all federal and international emission requirements, including standards for bunker fuel. The Board recognizes that new energy efficiency standards were adopted by the International Maritime Organisation in July 2011, and that these standards may reduce greenhouse gas emissions from new vessels in the future.

The Board finds that greenhouse gas emissions are a concern because of their long term accumulation in the atmosphere. The Board also finds that any incremental contribution from Project-related marine vessels would increase the burden at a global scale, regardless of how large or small the contribution.

Given that the there are no regulatory reporting thresholds or specific requirements for marine greenhouse gas emissions in Canada, and that the modelled emissions would result in measurable per cent increases as noted above, the Board finds the magnitude of these emissions to be high. Consequently, the Board finds that greenhouse gas emissions from Project-related marine vessels are likely to be significant.

Marine fish and fish habitat

Trans Mountain described the RSA as a productive marine environment, home to hundreds of different marine fish, including eight SARA-listed species or populations (Table 23). Trans Mountain said that no critical habitat has been identified for marine fish species at risk within the RSA; however, portions of the RSA have been classified by DFO as Important Areas for Pacific herring and Pacific salmon. Participants identified that marine resources within the RSA had over time been reduced in abundance (e.g., Pacific salmon).

Table 23: Marine fish species listed under Schedule 1 of the Species at Risk Act potentially found within the Regional Study Area

Species	SARA Status
Basking Shark	Endangered
Bluntnose sixgill	Special Concern
Longspine thornyhead	Special Concern
Northern Abalone	Endangered
Olympia oyster	Special Concern
Tope	Special Concern
Yelloweye rockfish (outside and inside population)	Special Concern
Rougheye rockfish type I and type II	Special Concern

Participants raised several issues related to effects of Project-related marine shipping on marine fish and fish habitat. In this section, the Board focuses on:

- effects of Project-related vessel wake waves on intertidal habitat and marine fish;
- sensory disturbance to marine fish from underwater noise; and
- introduction of aquatic invasive species from Project-related marine vessel ballast water.

Effects of marine vessel wake waves on intertidal habitat and marine fish

Trans Mountain indicated that wake waves produced from Project-related marine vessels could result in impacts to intertidal areas and the associated biota. Trans Mountain conducted predictive wake wave height modelling for Project-related marine vessels travelling at various speeds and depths. Trans Mountain concluded that Project related marine vessel wake wave heights at the shoreline would be well within the range of natural conditions and that wake waves generated from Project-related marine vessels are unlikely to result in any measurable changes to the biophysical characteristics of intertidal habitats. Trans Mountain said that marine organisms that occupy intertidal areas are regularly exposed to waves that are greater than the predicted wake wave heights and would have adapted to the physical forces imparted by Project-related marine vessel wake waves. As such, Trans Mountain said that the Project's contribution to total cumulative effects would be low.

The Board requested a species-specific assessment for all SARA-listed marine fish from Project related marine vessels, which included a request for species-specific mitigation. Trans Mountain identified that the frequency of occurrence within the LSA and the RSA for SARA listed marine fish ranged from patchy, uncommon, to rare (Appendix 11 provides a description of the spatial boundaries). For each species, Trans Mountain identified that effects from Project-related marine vessel wakes would be of negligible magnitude and recommended that no mitigation measure be implemented for effects of vessel wakes on marine fish and fish habitat.

Numerous participants raised concerns related to wake waves impacting intertidal habitats and the associated biota. Metro Vancouver's evidence highlighted various ways that shoreline invertebrates and marine fish could potentially be impacted from Project-related marine vessels, including higher invertebrate detachment rates, reduced growth and energy storage of native invertebrates, increased energy expenditure, dislocation of suitable habitat, and decreased feeding efficiency.

The Tsawout First Nation Marine Use Study indicated that molting crabs are susceptible to vessel wakes. It said that when crabs molt, they change their shells and during this time they are very light, and get disturbed and damaged by sudden changes in wave action, such as vessel wakes.

DFO said that potential effects on intertidal fish habitat from Project-related vessel wake are unlikely to differ substantially from current conditions in the RSA, and it considered the likelihood and magnitude of such occurrences to be of low risk to intertidal habitat and associated biota.

A number of participants highlighted the importance of eelgrass beds as marine fish and invertebrate habitat, as well as providing beneficial ecosystem services. Tsawout First Nation said that eelgrass beds at James Island and Sidney Island are being lost due to all the wake waves from vessel traffic. As noted by Marine Use Study Respondents, it is fairly shallow in those areas and the waves are building up the sediment. The eelgrass then disappears and it affects all the crabs and other spawning fish that depend upon it. Trans Mountain said that although there are no mapped eelgrass beds within the Canadian portion of the LSA, any eelgrass beds that are present (i.e., within the eelgrass biobands) would be acclimated to both natural wave conditions and wake waves from existing vessel traffic. Therefore, it considers unlikely that any eelgrass beds would be adversely affected by the Project.

Sensory disturbance to marine fish from underwater noise

Trans Mountain said that it did not conduct a detailed effects assessment on the potential impact of underwater noise produced by Project-related marine vessels on marine fish as there are no standard criteria or thresholds to assess these effects against and there is a lack of data and knowledge surrounding the effects of underwater noise on marine fish. Trans Mountain did acknowledge that underwater noise from Project-related marine vessels could potentially trigger behavioral responses by marine fish ranging from small temporary movements to large scale change displacements. However, Trans Mountain further stated that there is no evidence in the literature that vessel traffic will result in the large scale displacement of fish or invertebrate populations from foraging, spawning, rearing or migrations areas, or will otherwise affect their distribution or abundance. Trans Mountain said that its conclusion is supported by the existing overlap of areas of high shipping activity and Pacific herring and Pacific salmon migration areas, such as the Haro Strait and the Fraser and Columbia Rivers.

Participants raised concerns over underwater noise impacting marine fish. Raincoast Conservation Foundation said that Trans Mountain failed to consider behavioral changes beyond large-scale displacements and that underwater noise produced from Project-related marine vessels may result in sub-lethal consequences, such as cardiovascular disturbances. It noted that the lack of inclusion of information regarding responses of fish to underwater noise could have served to minimize the potential Project-related effects.

Ms. A.L. Schwartz commented that Pacific herring, as well as other species, respond negatively to shipping sounds. Ms. Schwartz further suggested that short-term behavioral changes can lead to long-term significant changes in populations, spawning locations and extents, and feeding grounds.

DFO said that it would be difficult for Trans Mountain to conduct a detailed effects discussion on the potential effects of underwater noise on marine fish and invertebrates, given the limited information on species-specific behavioral responses to marine vessel noise and the absence of Canadian standards or thresholds established for assessing such impacts. It noted that the presence and magnitude of a residual effect from underwater noise generated by Project-related marine vessels, in addition to the existing underwater noise environment in the RSA, is uncertain.

Introduction of aquatic invasive species from Project-related marine vessels ballast water

Trans Mountain said that the release of ballast water in Canadian waters is regulated by the Ballast Water Control and Management Regulations pursuant to the Canada Shipping Act, 2001 Both Trans Mountain and DFO noted that compliance with this regulation will minimize the likelihood of aquatic invasive species being introduced during ballast water exchange.

Participants raised concerns regarding the introduction of aquatic invasive species to Canadian waters through Project-related marine vessel ballast water. Cowichan Tribes said that no form of mitigation measures can eliminate the risk of aquatic invasive species introductions. It further recommended that ballast water discharge should include mandatory treatment of ballast water to standards recommended by the IMO.

Views of the Board

The Board recognises the concerns presented by participants in regards to potential impacts to shorelines and associated biota from Project related marine vessel wake waves. The Board notes that evidence provided by some Intervenors, such as Metro Vancouver, was generic in nature and was not specific to the assessment areas for Project-related marine vessels. In the context

of Project-related marine vessels, the Board finds Trans Mountain's predicted wake wave height modelling to be adequate and concurs with Trans Mountain's conclusion that Project-related marine vessel wake wave heights at the shoreline would be within the range of natural conditions. The Board generally concurs with Trans Mountain and DFO in that Project related marine vessels are unlikely to result in any measurable changes to the biophysical characteristics of intertidal habitats. The Board acknowledges the evidence provided by Tsawout First Nation, and agrees that some impacts to intertidal habitat could occur from Project-related marine vessel wake waves, such as increased sedimentation. However, the Board is of the view that these effects would be localised to very small portions of the Local Study Area (LSA).

Therefore, the Board is of the view that effects from Project-related marine vessel wake waves on intertidal habitat and marine fish, including eelgrass beds, would be of low magnitude. The Board finds that the effects would occur for the duration of operations (long-term) and would be reversible. The Board also finds that the contribution from Project-related marine vessels to total cumulative effects on marine fish and fish habitat within the RSA is expected to be inconsequential. Therefore, the Board finds that the adverse effects on marine fish and fish habitat from Project-related marine vessels are not likely to be significant. The Board recognizes that SARA-listed marine fish species are present within the LSA and RSA. The Board is of the view that effects on these species would be similar to other fish species. Given their limited abundance, and absence of critical habitat within in the LSA and RSA, the Board finds that adverse effects on SARA-listed marine fish from Project-related marine vessels are not likely to be significant.

The Board agrees with DFO and Trans Mountain in that a detailed assessment of underwater noise produced by Project-related marine vessels on marine fish is not practicable due to lack of Canadian standards and the limitations in data to support such an assessment. The Board acknowledges the evidence provided by participants and agrees that some form of adverse, short-term effect (e.g., small behavioral changes) is likely to occur from underwater noise produced by Project-related marine vessels. However, the Board was not convinced that these short-term effects would translate into larger, more substantial impacts. Given lack of Canadian standards and the limitations in data to support such an assessment, the Board finds that the exact nature of the effect of underwater noise produced by Project-related marine vessels on marine fish is uncertain. In addition, marine shipping is beyond the Board's regulatory authority and the Board does not have the ability to impose specific mitigation conditions to address environmental effects of Project-related marine shipping.

The Board acknowledges the evidence provided by participants and agrees that ballast water from commercial marine vessels can promote introduction of aquatic invasive species. However, the Board shares the opinion of Trans Mountain and DFO which indicates that compliance with Ballast Water Control and Management Regulations of the Canada Shipping Act, 2001 would effectively minimize any potential introduction of aquatic invasive species from Project-related marine vessels. Therefore, the Board has not provided a detailed assessment of the potential effects on marine fish from the introduction of aquatic invasive species from Project-related ballast water.

Marine mammals

Trans Mountain described the marine waters of B.C. as home to a broad range of marine mammal species, including cetaceans (whales, dolphins, and porpoises), pinnipeds (seals and sea lions), and sea otters. It said that the productive straits and sounds of the RSA provide important habitat for foraging, breeding, socializing, and migration. Trans Mountain said that many species of marine mammal can be observed in the RSA year-round, and thus depend on this environment for all aspects of their life history, while other species are predominantly seasonal in their presence, coming to feed for a season or simply passing through during migration. Trans Mountain identified 10 species of marine mammals, and 4 killer whale ecotypes, that are SARA listed and have potential to occur in the RSA (Table 24). Trans Mountain said that critical habitat for the Southern resident killer whale and the North Pacific humpback whale has been identified in the RSA (Figure 26).

Trans Mountain said that marine mammals in the RSA face a variety of anthropogenic threats and stressors. It said that stressors vary in intensity and relative importance for individual species but, broadly speaking, include: chemical contamination from both legacy contaminants and current inputs; reductions in prey abundance or quality; physical disturbance; acoustic disturbance or injury from both acute and chronic sources; risk of collisions; risk of entanglements; and, climate change.

Table 24: Species listed under Schedule I of the Species at Risk Act potentially found within the Regional Study Area

Species	Status
Humpback whale	Threatened
Fin whale	Threatened
Sei whale	Endangered
Grey whale	Special Concern
Blue whale	Endangered
North Pacific right whale	Endangered
Offshore killer whale	Threatened
Bigg's killer whale (formerly Transient)	Threatened
Northern resident killer whale	Threatened
Southern resident killer whale	Endangered
Harbour porpoise	Special Concern
Stellar sea lion	Special Concern
Sea otter	Special Concern

Several participants raised issues related to impact of Project-related marine vessels on marine mammals. This section focuses on the following key issues:

- permanent auditory injury, temporary auditory injury, and sensory disturbance;
- vessel strikes;
- southern resident killer whale;
- other marine mammals; and
- mitigation and the Marine Mammal Protection Program.

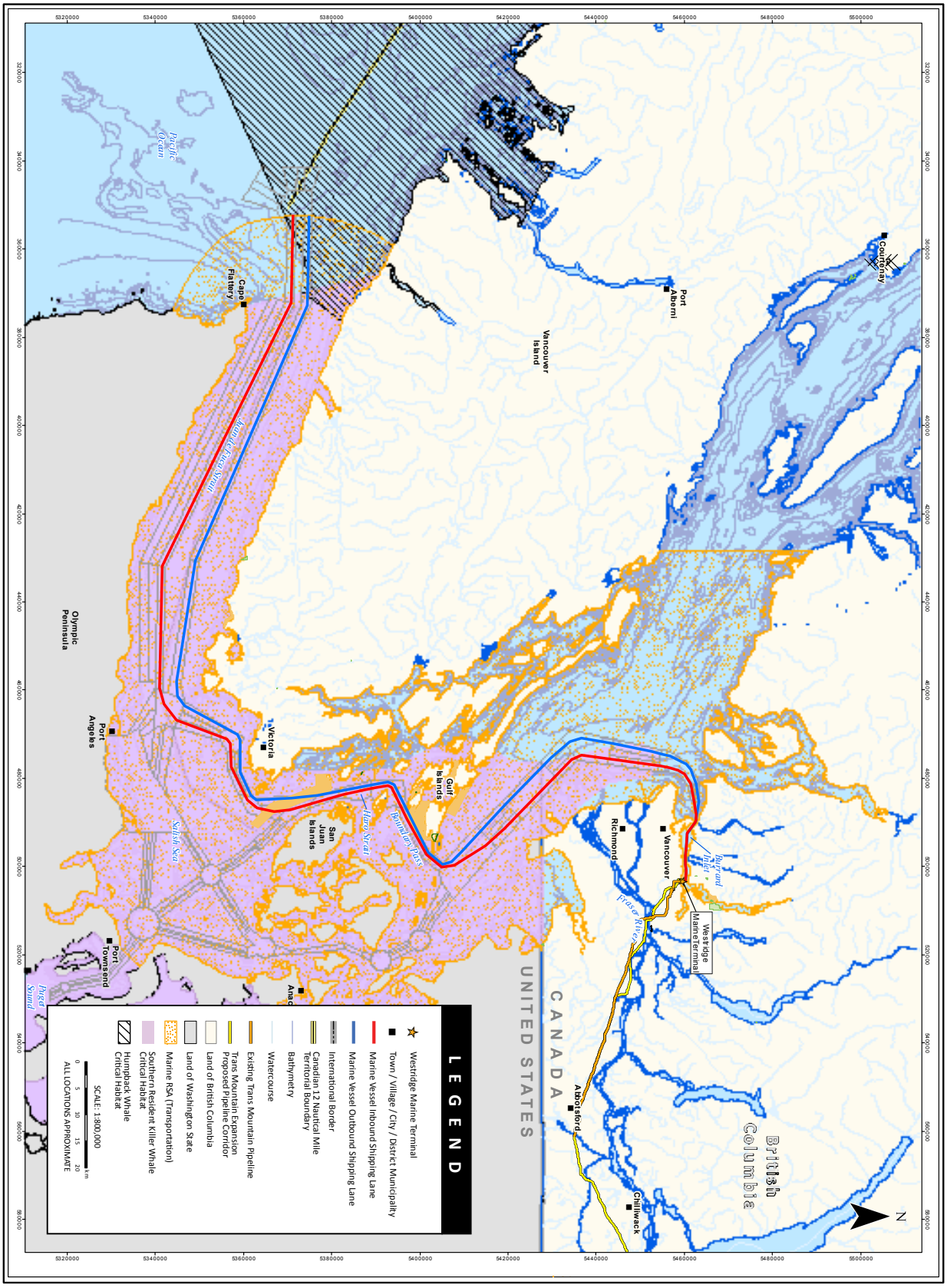
Permanent auditory injury, temporary auditory injury, and sensory disturbance

Trans Mountain said that loud underwater noise has the potential to result in temporary or permanent auditory injury (i.e. temporary or permanent threshold shifts (TTS) or (PTS)), or cause sensory disturbance to marine mammals. To determine the potential effects of Project related vessel-based underwater noise on marine mammals, Trans Mountain, in the absence of any Canadian legislation or guidelines, compared sound source levels from tankers and tugs, based on literature values and acoustic modelling, against thresholds predicted to cause PTS, TTS, and sensory disturbance to marine mammals. Trans Mountain said that based on these results, no PTS or TTS to marine mammals is expected as a result of Project-related marine vessel operations.

Trans Mountain said that based on the results of the acoustic modelling study, noise levels associated with an increase in Project-related marine vessel traffic within the RSA are expected to exceed thresholds for behavioral disruption. Trans Mountain said that underwater noise levels above the threshold are predicted to extend for 4 to 7 km from Project-related marine vessels and would be centered on the shipping lanes. Trans Mountain said that sensory disturbance could result in a variety of impacts, such as habitat avoidance, changes in activity states (e.g., feeding, resting, or travelling), and/or interference of communication or perception of sounds (i.e., masking). It said that the degree of sensory disturbance experienced by a marine mammal depends on numerous factors, including: the source level; frequency and duration of the underwater noise; the context (i.e., the animal's activity state at the time); and the species in question.

Trans Mountain said that while exposure of a stationary marine mammal in the RSA to a Project related marine vessel will be intermittent, this daily exposure will occur throughout the life of the Project. It said that most studies report that marine mammal behaviour returns to normal after sound production ceases, and in consideration of only routine effects associated with the Project, it is expected that the time between

Figure 26: Southern resident killer whale and North Pacific humpback whale critical habitat identified in the Regional Study Area



vessel transits would allow marine mammals to recover from the sensory disturbance before the next transit of a Project-related marine vessel. Trans Mountain further said that while marine mammals may not encounter another Project related marine vessel for the remainder of the day, they are very likely to encounter other marine vessels within minutes to hours of the Project-related marine vessel passing, which could conceivably approach near-continuous sensory disturbance. Trans Mountain said that shipping is not a novel activity in the RSA, and many species that use this area regularly are likely to have become 'habituated' to sounds associated with marine transportation activities.

Raincoast Conservation Foundation indicated that compensatory mechanisms (i.e. habituation) come with an energetic cost.

Participants raised concerns over potential impacts of underwater noise on marine mammals. Dr. Lance G. Barrett-Lennard commented that the impact of increased underwater noise from tankers and escort tugs would affect the behaviour, distribution and potentially the health of marine mammals.

DFO raised concerns regarding Trans Mountain's assessment methods, indicating that the locations and dataset used by Trans Mountain in its underwater noise predictive modelling may not accurately represent all locations within the assessment area, specifically in areas considered critical habitat for the Southern resident killer whale (e.g., Boundary Pass). Trans Mountain said that the four locations selected for acoustic modelling scenarios were meant to be reasonably representative of all locations within the RSA and that the addition of an extra modelling scenario location for Boundary Pass would not alter the conclusions of the assessment. DFO noted that Trans Mountain's assessment only addressed the noise produced and propagated from Project-related ships, and did not consider the potential cumulative and/or additive effects of such noise in combination with existing shipping activity.

Vessel strikes

Trans Mountain said that all marine vessels have the potential to accidently strike marine mammals. Trans Mountain indicated that the probability and resulting effect of a strike depends on a variety of factors, including the speed of the vessel, the species of marine mammals, and density of vessel traffic and marine mammals in a given area. Trans Mountain said that depending on the severity of the injury, an individual marine mammal may or may not recover from a vessel strike. It said that while the primary effects associated with being struck are blunt-force trauma or lacerations, long-term consequences may include immediate direct mortality; indirect mortality resulting from complications or infection of internal or external injuries; long-term or permanent injuries; reduced fitness or fecundity; or short-term recoverable injuries. Trans Mountain said that the magnitude of this effect may therefore range from low to high. It said that while a strike resulting in minor injuries may be low magnitude, mortality of a SARA-listed species would be considered a high magnitude effect. Trans Mountain said that at the population scale, recovery from the mortality of an individual would depend on the population in question, its generation time, and its conservation status. Whereas population-level effects for some species may be reversible in the medium-term, mortality of individuals listed as Endangered (e.g., North Pacific right whale) could have long-term or permanent population-level consequences.

Trans Mountain conducted a qualitative review of relevant literature and DFO's Marine Mammal Incident Database to support its assessment of Project-related marine mammal vessel strikes. Trans Mountain said that the overall probability of a Project-related marine vessel striking and injuring a marine mammal is considered low. It said that while ship strikes leading to marine mammal fatalities can and do occur, such occurrences are infrequent relative to the number of vessels (of all sizes and classes) on the water. DFO cautioned that the DFO's Marine Mammal Incident Database, or any database that relies on the recovery of dead whales, may not be representative of the true frequency of ship strike occurrences and may underrepresent the true frequency of marine mammal vessel strikes.

The Board requested Trans Mountain provide a quantitative study that evaluated the risk to marine mammals from Project-related marine vessel strikes. Trans Mountain developed an encounter risk model to predict the probability of Project-related marine vessel encountering various marine mammals along the shipping lanes and anywhere within the RSA, in combination with the existing and predicted marine traffic levels. Trans Mountain said that, based on the model results, the encounter risk for any particular vessel is quite small and to date, there have been no known instances of a tanker servicing the WMT having collided with a whale. As such, the potential for Project-related vessel strikes is considered to be a low probability event.

Several participants raised general concerns related to marine mammal vessel strikes.

Raincoast Conservation Foundation said that Trans Mountain's encounter risk model relied on occurrence data derived from opportunistic sightings collected primarily from whale watchers and not corrected for effort. It further said that that density cannot be derived from opportunistic sightings and consequently, the assessment is severely limited and unreliable for estimating ship strike risk or identifying areas of greatest risk.

Trans Mountain acknowledged the limitations of the data used to inform the encounter risk model and said that a quantitative seasonal accounting of densities is not publicly available for many of the marine mammal species considered, or for the entire RSA, and that such information would greatly improve the applicability and spatial resolution of the encounter model. Trans Mountain committed to include, as part of its Port Information and Terminal Operations, explicit guidance for reporting marine mammal vessel strikes and mammals in distress to the appropriate authorities to ensure clarity around marine mammal vessel strikes.

DFO said that although it is possible to estimate the current risk to marine mammal indicator species from ship strikes in the RSA and the additional risk that could result from Project-related vessel traffic, such estimates would likely have a high degree of uncertainty. DFO further said that high resolution spatial data on the densities of marine mammal indicator species are lacking, particularly for the humpback whale, which is the species most likely to be affected by ship strikes. Thus, an accurate quantitative assessment of risk to humpback whales from existing shipping traffic is not feasible at this time, nor is an estimate of the increased risk associated with Project-related vessels.

Southern resident killer whale

Participants noted that the Southern resident killer whale is listed as Endangered under the SARA. Trans Mountain said that according to DFO's *Recovery Strategy for Northern and Southern Resident Killer Whale* and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) *Assessment and Update Status Report on the Killer Whale*, key threats to the Southern resident killer whale population include: chemical and biological contaminants; reductions in the availability or quality of prey (primarily Chinook and chum salmon); and physical and acoustic disturbance. Trans Mountain also said that DFO has included the environment's acoustic attributes in their designation of critical habitat for Southern resident killer whales, and sources of acoustic disturbance are noted as including both high-intensity sounds, such as those produced by seismic surveys, and chronic sources such as vessel traffic.

Trans Mountain's environmental assessment concluded that even though the Project contribution to overall sensory disturbance effects is small, the potential effects of increased Project-related marine vessel traffic, and their contribution to potential cumulative effects, are determined to be significant for Southern resident killer whales. Trans Mountain acknowledged that, despite operating legally, and being proportionally small relative to the existing marine vessel traffic, the Project will contribute additional underwater noise that could affect the Southern resident killer whale population, and that this noise will act cumulatively with noise from existing and reasonably foreseeable marine vessel traffic. Trans Mountain said that past and current activities, including all forms of mortality, high contaminant loads, reduced prey, and sensory and physical disturbance, have resulted in significant adverse cumulative effects to the Southern resident killer whale population. Trans Mountain said that given the current state of knowledge, and the ability of threats to interact with one another, it is not possible to completely partition how each threat may be affecting the population. Trans Mountain argued that the shipping lanes will continue to host marine vessel traffic with or without the Project, and that the impacts to the Southern resident killer whales will continue to exist with or without the Project.

Trans Mountain said that a Project-related marine vessel was predicted to encounter killer whales along the shipping lanes once every six days. Trans Mountain said that the return intervals only represent the frequency with which a Project-related vessel and marine mammal are expected to occur in the same place at the same time. It said that encounter risk model does not factor in any behavioural responses of the whale (i.e., movement out of the area as the vessel approaches), nor any avoidance response (e.g., dives, bursts of speed, changes of course), and that only a fraction of the encounters will result in actual physical contact between a vessel and a whale, and out of the incidences of physical contact, only a fraction will result in fatal injuries. Trans Mountain said that killer whales in particular are small, agile, and fast-moving, and that based on historical records, the percentage of encounters that ultimately lead to collisions with killer whales is expected to be low. According to strike event records obtained from DFO's B.C. Marine Mammal Incident Database (1973 to October 2012), there have been six records of strikes with killer whales

that were confirmed or deemed likely to have occurred in B.C. (maximum vessel size reported for a killer whale strike was a ferry in the Strait of Georgia).

Participants provided substantial amounts of evidence in regards to the Southern resident killer whales and potential Project-related effects.

DFO supported Trans Mountain's significance conclusion, stating that overall, Trans Mountain's assessment of residual effects on the Southern resident killer whale may be accurate, given the current endangered status and the declining trend of this population in recent decades. DFO said that the poor survival and birth rates of Southern resident killer whales over the past 20 years suggest that the current habitat quality, including that of designated critical habitat within the RSA, may be insufficient to allow for recovery of this population. It further noted that due to a lack of information that is needed to quantify the impact of existing underwater noise conditions in the RSA on the Southern resident killer whale population, it is not possible to predict what further effects might be anticipated from future Project-related vessel traffic. DFO also acknowledged that the risk to Southern resident killer whales from Project-related marine vessel collision may be extremely low or negligible.

Raincoast Conservation Foundation said that the viability and conservation status of the Southern resident killer whales is adversely affected by repeated and multiple human-caused disturbances that interact and have cumulative harmful effects. It said that the main factors believed to be impeding recovery and viability of the Southern resident killer whales include physical and acoustical disturbance caused by marine traffic and other industrial activities, nutritional stress from inadequate prey availability, and exposure to environmental contaminants. Raincoast Conservation Foundation further stated that the Project-related marine vessels have the potential to exacerbate many threats facing Southern resident killer whales and that while an understanding of how the current threats may act synergistically to impact killer whales is unknown, in other species multiple stressors have been shown to have strong negative and often lethal effects, particularly when animals carry elevated levels of environmental contaminants.

Raincoast Conservation Foundation said empirical measurements of ambient sound levels (natural and anthropogenic) found that critical habitats for Southern resident killer whales have the noisiest levels of all sites sampled along the B.C. mainland coast and that the Project's proposed activities will only increase noise levels in an already noisy environment. Raincoast Conservation Foundation said that present noise levels under busy ship traffic conditions are already so high that additional ship traffic may seem to have little impact on communication space when in fact that additional noise could essentially eliminate even those few remaining opportunities for killer whales to communicate.

Raincoast Conservation Foundation said that there is a reasonable likelihood of population level and ecological consequences for Southern resident killer whales from Project-related increases in vessel noise events and the chronic deterioration of whales' acoustic habitat. Raincoast Conservation Foundation critiqued Trans Mountain's assessment methods and suggested that the Project-related marine vessel effects need to be translated into population and ecological level risks. Raincoast Conservation Foundation completed a Population Viability Analysis which modelled the future population based on current conditions with no Project, and contrasted that with a model that assumes the Project is approved. Raincoast Conservation Foundation said that modelling results indicated that if base line conditions persist, the Southern resident killer whale population will most likely remain about at its current size or continue a very slow decline. It further said that modelling shows that increased threats from Project-related effects increase the risk of extinction and accelerate decline. It said that it is abundantly clear that the population cannot withstand additional negative pressures, recover from its current endangered status, and persist. Raincoast Conservation Foundation also said that the factor with the largest effect on depressing population size and possibly leading to extinction is a reduction of Chinook prey base.

Tsawwassen First Nation indicated that the Southern resident killer whale population has declined over recent years and said that population recovery seems unlikely unless drastic changes to those factors compromising the population's demographics occur.

Other marine mammals

Baleen whales

Trans Mountain indicated that the North Pacific humpback whale is listed as Threatened under Schedule 1 of the SARA. It said that a small portion of a much larger north pacific population of humpback whales is found seasonally within the RSA. Trans Mountain said that activities identified by DFO's *Recovery Strategy for the North Pacific Humpback Whale (Megaptera novaeangliae)* in Canada as likely to destroy or degrade critical habitat include vessel traffic, toxic spills, overfishing, seismic exploration, sonar and pile driving. Trans Mountain said that no scientific study has established a causal link between increased vessel noise and population-level effects on humpback whales. Trans Mountain said that based on results of acoustic modelling, underwater noise will be detectable by humpback whales over large distances and may cause sensory disturbance within 4 to 7 km of the shipping lanes. Trans Mountain also identified that sensory disturbance would occur within North Pacific humpback whale critical habitat, but said that the critical habitat within the RSA is only a small portion of the critical habitat identified in Canadian waters. Trans Mountain said that a 2011 re-assessment by COSEWIC has indicated that the humpback whale (North Pacific population) has recovered to a point where it can be reclassified as a species of Special Concern. It said that the Minister of the Environment, on the advice of the Minister of Fisheries and Oceans, has recommended to the Governor in Council to make a regulatory amendment to Schedule 1 of SARA in order to change the status of the species from Threatened to Special Concern.

DFO said that Trans Mountain, in its assessment, did not consider the strong long-term site fidelity of humpback whales to feeding areas within the RSA and the resulting repetitive exposure of these individuals to Project-related shipping noise levels that could result in behavioural disturbance. Trans Mountain disagreed with DFO and maintained that its assessment of effects on humpback whales and subsequent significance determination accurately considered the localized areas of high humpback whale abundance that occur within the RSA.

Trans Mountain and DFO both identified the North Pacific humpback whale as the species at the highest relative risk of marine mammal vessel strike in the RSA, as the species is known to seasonally congregate in critical habitat along the western portion of the RSA. Trans Mountain said that in B.C., humpback whales are the most commonly struck species, as reported to the B.C. Marine Mammal Response Network. Trans Mountain's encounter risk model predicted that Project-related marine vessels would encounter a North Pacific humpback whale along the shipping lanes every 334.2 days. Trans Mountain said that only a fraction of these encounters will result in actual physical contact between a vessel and a whale, and out of the incidences of physical contact, only a fraction will result in fatal injuries.

Trans Mountain said that other baleen whales that frequent the RSA on occasion include Fin whales, Grey whales, and Minke whales. Trans Mountain said that while these other species of baleen whale are not altogether uncommon in the area, neither is considered particularly abundant, and that no critical habitat or DFO Important Areas have been identified within the RSA for any species of baleen whale other than humpback whales. It further said that all baleen whales belong to the same functional hearing group, and while species such as Fin whales may be somewhat more sensitive than humpback whales to low frequency sounds associated with shipping, effects of sensory disturbance to the humpback whale indicator are expected to be generally comparable to effects on all baleen whale species found within the RSA.

Raincoast Conservation Foundation said the increase in shipping associated with the Project creates an increased risk of ships striking marine mammals and, in particular, great whales such as Blue, Fin, Sei, Humpback, and Grey whales, as well as smaller cetaceans, such as killer whales, dolphins and porpoises. It said that many of these marine mammals are listed as species at risk in Canada, and that injury or death because of ship strikes are significant threats to recovering populations of marine mammals, posing the greatest risk to small or isolated whale populations, such as the Southern resident killer whales, where a single strike-related mortality could have population-level effects.

Trans Mountain said that based on the encounter risk model, the overall probability of a Project related vessel encountering a Blue, Sei, Fin, or North Pacific right whale is considered very low.

Other Toothed whales

Trans Mountain said that other toothed whales may be observed in the RSA, including Dall's porpoises, Harbour porpoises, Pacific white-sided dolphins and the other ecotypes of killer whales. It said that based on results of acoustic modelling, underwater noise will be detectable by toothed whales over large distances and may cause sensory disturbance within 4 to 7 km of the shipping lanes. Trans Mountain said that species, such as the Harbour porpoise, may have somewhat more pronounced responses to disturbance, but that acoustic modelling suggested that the extent of sensory disturbance is expected to be generally comparable across all toothed whale species found within the RSA. It said that in contrast to the Southern resident killer whale, Project-related residual effects will affect only localized portions of the overall North Pacific (or Canadian) populations of toothed whales in the RSA. As such, and in consideration of the notable differences between population status, abundance, and occurrence of Southern resident killer whales versus the various other species of toothed whales in the RSA, effects of increased Project-related marine vessel traffic on toothed whales (other than Southern resident killer whales) are deemed to have a negative impact balance but are not significant. Trans Mountain also noted that no critical habitat has been identified for any species of toothed whale[79] (excluding the Southern resident killer whale) and that the RSA is considered a DFO Important Area for Harbour porpoise.

Trans Mountain said that according to strike event records obtained from DFO's B.C. Marine Mammal Incident Database (1973 to October 2012), there has been eight recorded strikes on toothed whales that were confirmed or deemed likely to have occurred in B.C.: one involved a Dall's porpoise calf; one involved a Harbour porpoise calf; and six involved killer whales with a maximum vessel size reported for a killer whale strike being a ferry in the Strait of Georgia. Trans Mountain said that killer whales are small, agile, and fast moving, and although no mathematical probabilities have been determined to calculate actual strike risk for this species, historical records suggest that the percentage of encounters that ultimately lead to collisions with killer whales is low. Trans Mountain said that DFO's *Recovery Strategy for the Transient Killer Whale (Orcinus orca) in Canada* recognizes collisions with vessels as a stressor with demonstrated causal certainty, but a low level of concern.

Mitigation and the Marine Mammal Protection Program

Trans Mountain said that while it can actively enforce restrictions on tankers docked at the WMT to comply with its operating practices and standards, once the tanker departs from the WMT, the company has little direct control over the operating practices of the tankers or tugs as Project-related marine vessels are owned and operated by third parties. It said that marine transportation in Canadian waters is authorized and regulated through the *Canada Shipping Act, 2001*, related legislation, and regulations administered by Transport Canada and the CCG. As such, no direct mitigation has been proposed by Trans Mountain for effects associated with increased Project-related marine transportation. The Board requested a species-specific assessment for SARA-listed marine mammals that are likely to be impacted from Project-related marine transportation, which included a request for species-specific mitigation. Trans Mountain, for every species, recommended no mitigation. Trans Mountain reiterated that Project-related marine vessels are owned and operated by a third party, and 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 indicated that it would be interested in supporting and participating in a joint industry-government advisory group that would be charged with determining and/or developing effective mitigation measures to reduce potential effects of underwater noise on marine mammals in the region.

Trans Mountain committed to developing a Marine Mammal Protection Program with a purpose of outlining Project-related tanker specific measures and regional collaborative initiatives that would be implemented by Trans Mountain and other operators along the marine shipping lanes to mitigate and manage potential environmental effects on marine mammals. Trans Mountain said that one of the objectives of the Marine Mammal Protection Program would include actively encouraging and participating in multi-stakeholder or independent initiatives that contribute to Southern resident killer whale recovery strategies.

Trans Mountain indicated that one of the strategies of the Marine Mammal Protection Program is to ensure that Southern resident killer whales have an adequate and accessible food supply to allow recovery.

79 Potential critical habitat for transient killer whales was identified in the Regional Study Area.

Trans Mountain said that it remains committed to supporting wild Pacific salmon and has indicated that it is willing to support the Pacific Salmon Foundation – Salish Sea Marine Survival Project, which it believes would contribute to better conservation and increased abundance of chinook salmon. Trans Mountain said that recovery of at-risk whale populations in the Salish Sea is a complex and multi-faceted problem, and that integrated, multi-party solutions are required. DFO said that it is supportive of these multi-stakeholder partnerships and initiatives, which are necessary for ensuring recovery of aquatic species at risk.

Trans Mountain also committed to supporting the Port Metro Vancouver led Enhancing Cetacean Habitat and Observation Program (ECHO). Port Metro Vancouver said that ECHO has been established in collaboration with government agencies, First Nations, marine industry users, non government organizations and scientific experts, to better understand and manage the potential impacts to cetaceans from commercial vessel activities throughout the southern coast of B.C. Port Metro Vancouver said that under the umbrella of the ECHO Program, a series of individual initiatives are being considered to better understand potential threats associated with commercial vessel related activities. The outcomes of these projects will inform the possible development of mitigation and management measures to reduce potential impacts of shipping to cetaceans. Trans Mountain said that it would be participating in Green Marine, a voluntary environmental program for the maritime industry as a whole to reduce its environmental footprint. Trans Mountain and DFO identified various national and international initiatives currently underway or proposed that have a goal of developing mitigation around both vessel strikes and underwater noise. Trans Mountain said that its Tanker Acceptance Standards require all accepted vessels to meet all applicable international and local rules and regulations. It further said that should future guidelines or standards for reducing underwater noise from commercial vessels come into force as international and local rules and regulation, Project-related marine vessels would meet those rules and regulations.

Participants indicated that measures that alter vessel movements, such as speed restrictions or relocating shipping lanes to avoid marine mammal congregation areas, are effective at reducing impacts from marine shipping practices. Trans Mountain said that steps have been taken by some countries, primarily through government agencies, to reduce ship strike potential to endangered whale species through modifications to vessel operations, such as changing shipping routes. Trans Mountain said that in the Bay of Fundy internationally-mandated shipping lanes were shifted, from an area with high right whale densities to an area with lower right whale densities, which has reduced the relative potential for accidental collisions between right whales and ships by approximately 80 per cent.

The Board requested information from Transport Canada regarding potential alternative shipping lanes or vessel speed reductions to reduce impacts to marine mammals from marine shipping for the southern coast of B.C. Transport Canada indicated that it was not currently contemplating any such reviews, but did identify that it would be participating in the ECHO Program.

DFO said that its review has suggested that Trans Mountain's assertion that mitigation measures are not available, may be accurate and that specific mitigation measures that Trans Mountain can feasibly implement to reduce Project-related effects do not appear to be available. DFO recommended that as the Marine Mammal Protection Program is further refined and developed, Trans Mountain explore the potential for having trained marine mammal observers on-board Project-related marine vessels. These observers may be staff on-board the vessels or potentially members of the Pacific Pilotage Authority that have undergone training to help them identify risks to marine mammals and make appropriate vessel navigation alterations to reduce effects on marine mammals species.

Tsawwassen First Nation argued that what is necessary is urgent regulatory action to reduce underwater noise in the Salish Sea. Tsawwassen First Nation argued that the results of the scientific studies undertaken as part of the Marine Mammal Protection Program have no guarantee that effective mitigation will be developed. It argued that scientific information may, in fact, inform the marine shipping industry and Transport Canada in ways that serve the interests of the Southern resident killer whale recovery, but there can be no certainty of this at the present time.

Views of the Board

Permanent auditory injury, temporary auditory injury, and sensory disturbance

The Board accepts Trans Mountain's acoustic modelling and finds that permanent or temporary auditory injury is not expected to occur as a result of Project-related marine vessel traffic.

The Board finds that underwater noise produced from Project-related marine vessels would result in sensory disturbance to marine mammals. The Board is of the view that sensory disturbance is expected to be a long-term effect as it is likely to occur intermittently for the duration of operations of Project-related marine vessel traffic. The Board finds this effect to be reversible and is of the view that once a marine mammal is no longer exposed to underwater noise from Project-related marine vessels, then behavior would likely return to normal. The Board accepts that some marine mammals may habituate to underwater noise associated with marine shipping. However, the Board recognizes that sensory disturbance and habituation would result in a variety of adverse effects on marine mammals. The Board also recognizes that the Regional Study Area (RSA) is a heavily utilized marine environment, which is predicted to increase in use, and that once exposure to underwater noise from Project-related marine vessels ceases, it is likely that marine mammals would be exposed to some form of disturbance soon after from another marine vessel. The Board is of the view that the magnitude of this effect would vary, according to biological and environmental conditions, and the species exposed. The Board has carried the above criteria (e.g., reversibility, temporal, and spatial extent) through to its species specific assessment, which is provided below.

Vessel strikes

The Board recognizes that Project-related marine vessels have the potential to strike a marine mammal, which could result in lethal or non-lethal effects. The Board is of the view that the risk of a marine mammal vessel strike in the RSA would exist for the duration of operations of Project-related marine vessel traffic. The Board finds that the effects of a marine mammal vessel strike would range from reversible to permanent, depending on the severity of the strike (i.e., mortality would be permanent). The Board is of the view that the magnitude of a marine mammal vessel strike would vary according to the extent of the injury and the species struck. The Board has carried the above criteria (e.g., reversibility, temporal, and spatial extent) through to its species specific assessment, which is provided below. The Board also recognizes that the RSA is a heavily utilized marine environment which is predicted to increase in use, and that the increase in Project-related marine traffic would contribute to the cumulative risk of marine mammal vessel strikes. The Board acknowledges Trans Mountain's commitment to include, as part of its Port Information and Terminal Operations, explicit guidance for reporting marine mammal vessel strikes and mammals in distress to the appropriate authorities to provide clarity around the frequency of marine mammal vessel strikes.

Mitigation and the Marine Mammal Protection Program

The Board shares participants' concerns surrounding a lack of possible mitigation to address effects from Project-related marine vessels. The Board agrees with DFO and Trans Mountain that there is no direct mitigation Trans Mountain can apply to reduce or eliminate potential adverse effects from Project-related marine vessels. The Board recognizes that altering vessel operations, such as shifting shipping lanes away from marine mammal congregation areas or reducing marine vessel speed, can be an effective mitigation to reduce impacts on marine mammals from marine shipping. However, these potential mitigation measures are outside of the Board's regulatory authority, and out of Trans Mountain's control. The Board encourages other regulatory authorities, such as Transport Canada or Fisheries and Oceans Canada which regulate the marine environment and marine traffic, to explore any such initiatives that would aim to reduce the potential effects of marine vessels on marine mammals.

The Board recognizes that numerous initiatives are currently underway or are proposed with an intent to address issues related to underwater noise and vessel strikes, and notes Trans Mountain's commitment to participate in some of these initiatives. The Board would impose Condition 132 requiring Trans Mountain to develop a Marine Mammal Protection Program and undertake or support initiatives that focus on understanding and mitigating Project-related effects. The Board

would expect Trans Mountain to develop the program in consultation with appropriate government authorities, species experts, and Aboriginal groups. The Board would require Trans Mountain to file the initial Program with the Board prior to commencing Project operations, with any further iterations being developed and implemented in consultation with the appropriate regulatory authorities for marine shipping.

The Marine Mammal Protection Program is meant to ensure Trans Mountain fulfills its commitments to participate in the development of industry wide shipping practices in conjunction with the appropriate authorities. The Board recognizes that the Marine Mammal Protection Program offers no assurance that effective mitigation would be developed and implemented to address Project-related effects on marine mammals. The Board is also cognizant of DFO's recommendation that Trans Mountain explore the use of marine mammal on-board observers on Project-related marine vessels. The Board agrees that these could be valuable programs and expects to see similar initiatives as part of Trans Mountain's Marine Mammal Protection Program. The Board also recognizes a commitment by Trans Mountain to require Project-related marine vessels to meet any future guidelines or standards for reducing underwater noise from commercial vessels as they come into force.

Southern resident killer whale

The Board is of the view that the Southern resident killer whale population has crossed a threshold where any additional adverse environmental effects would be considered significant. The Board is also of the view that the current level of vessel traffic in the RSA and the predicted future increase of vessel traffic in the RSA, even excluding the Project related marine vessels, have and would increase the pressure on the Southern resident killer whale population. Trans Mountain's Summary of Existing and Future Vessel Movements at Five Locations in the RSA indicates that Project-related marine vessels would represent a maximum of 13.9 per cent of all vessel traffic in the RSA, excluding Burrard Inlet, and would decrease over time as the volume of marine vessel movements in RSA is anticipated to grow. While the effects from Project-related marine vessels will be a small fraction of the total cumulative effects, the Board acknowledges that this increase in marine vessels associated with the Project would further contribute to cumulative effects that are already jeopardizing the recovery of the Southern resident killer whale. The effects associated with Project-related marine vessels will impact numerous individuals of the Southern resident killer whale population in a habitat identified as critical to the recovery and classifies the effects as high magnitude. Consequently, the Board finds that the operation of Project-related marine vessels is likely to result in significant adverse effects to the Southern resident killer whale.

The Board recognizes that DFO's Recovery Strategy for the Northern and Southern Resident Killer Whale (Orcinus orca) in Canada identifies that vessel noise is considered a threat to the acoustic integrity of Southern resident killer whale critical habitat, and that physical and acoustic disturbance from human activities may be key factors causing depletion or preventing recovery of resident killer whale populations. The Board notes that mortality of a Southern resident killer whale from a Project-related marine vessel collision, despite the low likelihood of such an event, would have population level consequences. The Board acknowledges that Project-related marine vessels will encounter a killer whale relatively often. However, given the limited number of recorded killer whale marine vessel strikes and the potential avoidance behaviors of killer whales, the Board agrees with Trans Mountain and DFO that the probability of a Project-related marine mammal vessel strike on a Southern resident killer whale is low.

The Board is mindful that the recovery of the Southern resident killer whale would require complex, multi-party initiatives. DFO and other organizations are currently undertaking numerous initiatives to support the recovery of the Southern resident killer whales, including finalizing the Action Plan for the Northern and Southern Resident Killer Whales (Orcinus orca) in Canada. As part of the Marine Mammal Protection Program, Trans Mountain has committed to support the objectives and recovery measures identified in the Action Plan. The draft Action Plan includes a detailed prioritized list of initiatives, and the Board expects to see Trans Mountain supporting some of these initiatives within the Marine Mammal Protection Program. The Board encourages these initiatives, and those of the Government of Canada to prioritize and implement specific measures to promote the recovery of the Southern resident killer whale.

The Board also acknowledges Raincoast Conservation Foundation's Population Viability Analysis, which indicates that the factor with the largest effect on depressing population size and possibly leading to extinction is a reduction of Chinook prey base, and that Trans Mountain has indicated its historical support for wild salmon, as well as support for potential projects such as the Pacific Salmon Foundation – Salish Sea Marine Survival Project, which Trans Mountain believes would contribute to better conservation and increased abundance of Chinook salmon.

The Board recognizes that Port Metro Vancouver and the RSA currently support a large amount of vessel traffic and that the level of traffic is expected to increase with or without Project-related marine vessels. This increase will place even greater burden on the Southern resident killer whale. In this context, and in light of all of the evidence, the Board finds that the operation of Project-related marine vessels is likely to result in significant adverse effects to the Southern resident killer whale.

Other marine mammals

The Board is of the view that adverse effects from an increase in vessel traffic, including Project-related marine vessels, would be comparable within similar species (e.g., toothed whales, baleen whales). The Board agrees with Trans Mountain in that the disparity between habitat usage, occurrence, and abundance of other marine mammals within the RSA are important deciding factors in determining whether or not Project-related marine vessels are likely to cause significant adverse environmental effects.

In regards to other toothed whales, the Board is of the view that effects on other toothed whales from sensory disturbance are likely to be similar across species. Some species, such as the Harbour porpoise, are likely to show more pronounced effects as they are known to be more sensitive than other toothed whales to underwater noise.

The Board agrees with Trans Mountain that vessel strikes would be considered a low probability event. The Board recognizes that DFO's Recovery Strategy for the Transient Killer Whale (Orcinus orca) in Canada indicates that collisions with vessels are likely of low concern. The Board finds that Project-related marine vessels would result in impacts to a few or many individual toothed whales of much larger North Pacific populations and are unlikely to result in population level consequences. The Board also recognizes that no other critical habitat has been identified in the RSA for other toothed whales. Therefore, the Board finds that the effects from Project-related marine vessels on other toothed whales are not likely to be significant. The Board finds that the contribution from Project-related marine vessels on the other toothed whales to total cumulative effects is expected to be inconsequential.

The Board recognizes that sensory disturbance resulting from any increase in vessel traffic, including Project related marine vessels, would impact humpback whales and a small portion of their critical habitat. While the Board acknowledges that humpback whales have the potential to be struck and killed by Project-related marine vessels, DFO's Recovery Strategy for the North Pacific Humpback Whale (Megaptera novaeangliae) in Canada indicates that given the current estimated population growth rate of humpbacks in B.C., present levels of marine shipping activities do not appear to be negatively affecting population viability at this time. The Board is of the view that humpback whales found seasonally in the RSA, and a small portion of their critical habitat, would be adversely affected from Project-related marine vessels. In light of this, the Board finds that adverse Project-related effects on the North Pacific humpback whale are expected to be of moderate magnitude and not likely to be significant. The Board finds that the contribution from Project-related marine vessels on the North Pacific humpback whale to total cumulative effects is expected to be inconsequential.

The Board acknowledges that other baleen whales, many of which are SARA-listed, could potentially be found within the RSA. However, given the limited abundance and occurrence of these species in the RSA, and that no critical habitat has been identified in the RSA for baleen species other than the North Pacific humpback whale, the Board finds that adverse Project-related marine shipping effects on other baleen whales are not likely to be significant. The Board finds that the contribution from Project-related marine vessels on other baleen whales to total cumulative effects is expected to be inconsequential.

Marine birds

Several participants, including Cowichan Tribes and the District of North Vancouver, noted the importance of the southern coast of B.C. and in particular, Burrard Inlet and the Fraser River Estuary, to marine birds during winter, and during fall and spring migration.

Trans Mountain said the RSA encompasses many marine bird breeding and staging areas that are in close proximity to the shipping lanes. Trans Mountain noted that out of a total of 124 marine bird species in the RSA, 19 species of waterfowl and coastal seabirds of conservation concern have been identified as potentially occurring within the RSA. Table 25 lists the species that are listed under Schedule 1 of the SARA. Trans Mountain noted that critical habitat was not identified within the RSA for any of these species.

Table 25: Marine bird species at risk potentially affected by Project-related increase in marine vessel traffic

Species	SARA Status
Marbled murrelet	Threatened
Pink footed shearwater	Threatened
Red knot	Threatened
Short-tailed albatross	Threatened
Ancient murrelet	Special concern
Black-footed albatross	Special concern
Great blue heron	Special concern
Long-billed curlew	Special concern

Concerns were raised by various participants, including B.C. Nature and Nature Canada, ECCC, Mr. R.S. MacVicar, and the Lyackson First Nation regarding effects of a Project-related increase in marine vessel traffic on marine birds, including injury and mortality and behavioural changes from sensory disturbance.

Injury and mortality

Trans Mountain noted that marine bird collisions with Project-related marine vessels are sporadic events that are highly dependent on location, weather and season. It said that vessel strikes are mostly due to attraction to light by nocturnally-foraging species that are naturally attracted to light as they feed on bioluminescent prey.

Trans Mountain said that species potentially sensitive to light (albatross, petrels, auks, murres, and puffins) are generally in low number in the RSA relative to their overall populations. It said that given the relatively small number of individuals reported in the RSA and the fact that light attraction does not necessarily result in mortality, it is unlikely that a population level effect would result.

B.C. Nature and Nature Canada asked if Trans Mountain would include a low-lighting protocol as a condition of contracting with tankers, tugs and any other vessels associated with the Project. Trans Mountain said that it would explore options for reducing lighting on Project-related vessels, to the extent that it is feasible with respect to safety and industry regulations.

Sensory disturbance

Trans Mountain said that marine birds could alter their normal movement patterns to avoid sensory disturbances in the LSA associated with Project-related marine traffic. It also said that birds could avoid preferred sites within the LSA because of atmospheric and underwater noise during vessel operations. Trans Mountain said that the magnitude of effect varies by species and setting, as well as from the type and frequency of disturbance.

Trans Mountain said that existing atmospheric sound in the vicinity of the marine shipping lanes is a combination of natural and man-made sound, and no changes to the type or intensity of sound generated are expected as a result of the Project. It said that the only change expected is the number of pass-by occurrences from the increase in tanker traffic, which is expected to be, on average, one laden tanker and one empty tanker daily. Trans Mountain said that vessels associated with the Project represent a small portion of the total vessel traffic in the RSA.

Trans Mountain said that given there is already substantial amount of marine vessel traffic in the LSA and RSA, birds have likely become habituated to noise, and there is no evidence to suggest that the increase in Project-related marine vessel traffic could result in population level cumulative effects. Trans Mountain noted that intolerant marine birds would be displaced by marine traffic, so birds that continue to use this habitat have adjusted to accept this disturbance. Trans Mountain said that proving habituation is difficult in most cases, but especially so at sea where adequate baseline data are scarce. It said that, based on the reasonable assumption that habituation occurs, the cumulative effect on marine birds has been reduced relative to what it would be without habituation.

ECCC said that the continued presence of marine birds in the LSA and RSA where they are currently exposed to vessel traffic and industrial activity does not mean that they would continue to acclimate to increases in vessel traffic and industrial activity as a result of the proposed Project. It said that the response of marine birds can be expected to vary with volume and frequency of vessel traffic and industrial activity to such a point where birds abandon the area.

Trans Mountain said that it did not propose mitigation for Project-related marine vessel effects on marine birds from sensory disturbance or mortality because Project-related marine vessels would be operated by third parties acting under relevant shipping and piloting laws and regulations. It said that since it has little direct control over the actions of vessel owners and operators, mitigation is considered to include existing regulations and shipping standards that are monitored by several federal and international authorities. Trans Mountain said it expects that, through its tanker acceptance process, Project-related vessels would be maintained and operated to high industry standards. For example, all Project-related vessels would be fitted with exhaust silencers.

The Board requested a species-specific assessment for all SARA-listed marine birds from Project-related marine transportation, which included a request for species-specific mitigation. For each species, Trans Mountain recommended that no mitigation measure be implemented for effects on marine birds from Project-related marine vessels. Trans Mountain said that Project related marine vessels will be operated by third-party subcontracting corporations acting under relevant shipping and piloting authorities, and that marine transportation in Canadian territorial waters is regulated through the *Canada Shipping Act* administered by Transport Canada and the Canadian Coast Guard.

ECCC recommended that certificate conditions include an Avian Monitoring Plan to assess the effectiveness of proposed mitigation measures to avoid harm (incidental take) to migratory birds that could arise from activities related to marine transportation, or any other lighting sources. It said that this plan should include monitoring aboard tankers during shipping to assess the effectiveness of mitigation measures in avoiding incidental take through collisions and to identify the need for additional mitigation measures.

In response to ECCC's recommendation, Trans Mountain said that although it is not the owner or operator of tankers and cannot commit operators of Project-related vessels to report marine bird strikes/collisions with vessels in transit, it would include a section on marine birds in its Port and Terminal Book. Trans Mountain said the Port and Terminal Book would be submitted to the TERMPOL Review Committee a minimum of six months prior to commencement of operation, and would include a request for vessel operators to report any bird strikes/collisions to Marine Communication and Traffic Services.

Trans Mountain said that a bird strike notification system would be best developed by federal departments responsible for protecting the marine environment, such as ECCC.

Views of the Board

Trans Mountain and intervenors have filed conflicting evidence about the level of habituation that may occur with marine birds. The Board is of the view that habituation is species and context dependent, and that it is reasonable to expect that where marine birds that have not already been displaced from busy marine waters, that some level of habituation has occurred.

ECCC recommended a condition for an Avian Monitoring Plan to assess effectiveness of mitigation measures proposed by Trans Mountain to reduce effects of Project-related marine vessel traffic on marine birds. The Board is of the view that given Trans Mountain would not own or operate the tankers that are related to the Project, such a condition would be inappropriate. Trans Mountain did commit to requesting that vessel operators report any bird strikes and collisions to the Marine

Communication and Traffic Services through its Port and Terminal Book. The Board agrees that federal departments, such as ECCC, may be best able to develop a marine bird strike notification system for all vessels.

Project-related marine shipping (mortality and sensory disturbance) on marine birds are expected to be long-term and would vary in spatial extent from the Local Study Area to the Regional Study Area. However, effects are expected to be reversible, and of low magnitude and that population-level effects are not likely to occur, even in the absence of specific mitigation. Similarly, the contribution from Project-related marine vessels to total cumulative effects on marine birds from Project-related marine shipping is expected to be of long-term duration, reversible in the short term, and of low magnitude.

14.3.2 Socio-economic effects

Marine commercial, recreational and tourism use

Trans Mountain said that Aboriginal and non-Aboriginal people using marine waters may experience potential marine commercial, recreational and tourism use effects from increased Project-related marine vessel traffic.

Commercial fisheries

Trans Mountain said there are substantial commercial fishing activities throughout the RSA, including areas of the southern Strait of Georgia, Boundary Pass, Haro Strait and the Juan de Fuca Strait. There are also aquaculture operations in the RSA, although none are proximal to the shipping lanes. Trans Mountain said that in 2011 commercial fisheries in B.C. harvested approximately 168,000 tonnes of fish, worth $845.3 million. Targeted species, including salmon, herring, groundfish, crab, shrimp and prawn, are fished year-round. However, the location and timing of specific commercial fishing activities depends on a number of factors, such as the abundance and distribution of the species, the season, the value of the fishery and regulations determined by DFO. Although fishing vessels are permitted to fish in the shipping lanes as long as the passage of other vessels is not impeded, most fishing activity takes place outside of the shipping lanes.

Marine transportation

Trans Mountain said that marine transportation in the RSA includes commercial marine transport, such as passenger ferries, cargo ships, the CN Rail Bridge at the Second Narrows in Burrard Inlet, and marine transport services such as tugs and barges. There are about 475,000 vessel movements per year on the West Coast, and tankers accounted for about 1,500 movements (0.3 per cent) during 2009-2010. Most commercial vessels use the shipping lanes for transiting through B.C. coastal waters, although tugs engaged in barging activities may also use the most expedient route through smaller navigable channels, and ferries travel specific routes between terminals that cross shipping lanes.

Marine recreational use

Trans Mountain said that residents and visitors use the area for recreational activities including fishing, boating, sea kayaking and scuba diving, and marine tourism activities including cruise ship journeys, commercial sport fishing and whale-watching. It described specific characteristics of recreational use in the RSA in areas located in or near the shipping lanes, as well as near-shore locations such as river mouths, coastal campgrounds and marinas.

Marine tourism use

Trans Mountain said that tourism is a large contributor to the provincial economy, and contributed $6.5 billion to the B.C. economy in 2011. Marine tourism within the RSA is diverse, and includes cruise ships calling from international and US ports, commercial sport fishing, fishing lodges, marinas, sea kayaking tours, dive charters, whale-watching and wildlife viewing tours, and marine cruising.

Project interactions and effects

Trans Mountain said that a disruption of marine commercial, recreational or tourism uses may occur due to increased transit of Project-related marine vessel traffic through the RSA The company said there is a potential for increased marine vessel collisions between Project-related vessels and commercial, recreational or tourism vessels, but that such collisions are considered to be unlikely due to adherence to regulatory standards and navigational and safety measures by most marine vessels. A collision event could result in damage to vessels or gear or economic impacts for commercial marine users.

Trans Mountain said commercial fishers, marine transportation users, and some recreational marine vessels and tourism operators may alter their movement patterns to accommodate the increased presence of Project-related marine vessel traffic, and that marine vessels in Burrard Inlet may be the most affected. The increase in tankers may be perceived to affect the quality of recreational or tourism experiences and this may lead to avoidance of certain recreational marine areas near the shipping lanes.

Aboriginal and non-Aboriginal participants, including Adam Olsen, Cowichan Tribes, the First Nations of Maa-nulth Treaty Society, Musqueam Indian Band, Tsawout First Nation, T'Sou-ke Nation, the Swinomish, Tulalip, Suquamish, and Lummi Indian Nations, Lyackson First Nation, and Unifor, raised concerns about the social and economic importance of commercial fisheries and seafood processing. They described their right to fish for commercial trade purposes, and the scope and extent of commercial fishing activities, including historical practices, frequented fishing areas, revenues and quotas. Many raised concerns that the increase in Project-related tankers, both in transit and while at anchor, may restrict the times and locations in which commercial fishing activities can take place or impede the ability of fishers to access fishing areas. Others expressed safety concerns about potential collisions with tankers and potential associated economic losses.

North Shore No Pipeline Expansion (NS NOPE) said that Trans Mountain understated the number and frequency of pleasure boat traffic in the vicinity of the WMT, and failed to include an adequate assessment of impacts to recreational boater traffic or the risks of a tanker accident related to recreational boater traffic, including incidents resulting in bodily injury or death. Several participants also raised concerns regarding the impact that increased Project-related traffic will have on congestion at the Second Narrows, resulting in unsafe conditions for recreational vessels and delays.

Trans Mountain said that it assessed the impact of Project-related marine traffic on the capacity of the Second Narrows Marine Restricted Area. It said there should be sufficient transit opportunities through the Second Narrows Marine Restricted Area to accommodate both Project related marine traffic, as well as other foreseeable commercial and recreational traffic on most days of the year.

Trans Mountain said that there is potential for commercial fishers, and recreational and tourism users to experience increased sensory disturbance related to nuisance noise, visual effects and air quality associated with Project-related marine vessels transiting through the shipping lanes. However, once the tanker has passed, the nuisance effect will quickly decline.

Several participants raised concerns regarding noise, vibration, odour and light emissions from the increase in Project-related vessels. Some intervenors said that the increased use of anchorages in Burrard Inlet and English Bay would detract from the experiences of other marine users and would negatively affect residents in nearby communities through increased noise and light. Others said that the increase in other activities, such as bunkering and increased use of escort vessels, would increase noise and air pollution for users.

Several participants noted that increased marine vessel traffic from the Project may indirectly contribute to a decrease in marine tourism, even during normal operations, resulting in economic loss. Some participants referred to the reputation of B.C. as an international ecotourism destination, and questioned whether increasing oil tankers in B.C. coastal waters would present an unfavourable image of B.C. to the world.

Trans Mountain said that any change in tourism patterns could have any number of contributing factors, and it is considered unlikely that increased Project-related marine vessel traffic under normal operating circumstances could be directly attributed to a decline in tourism, if one were to occur.

To mitigate these effects and concerns, Trans Mountain committed to, among other measures, provide regular updated information to fishing industry organizations, shipping associations, including the Chamber of Shipping and CN Rail, Aboriginal communities and other affected stakeholders. It also committed to initiate a public outreach program prior to the Project operations phase to communicate information on Project-related timing and scheduling with affected marine users and Aboriginal groups.

Trans Mountain said it supports the TERMPOL Report Recommendation 11, that Trans Mountain should provide input to the appropriate authorities for the development of an engagement and awareness strategy with respect to safety of navigation and prevention of collisions targeting recreational boaters, fishing vessel operators, and operators of small vessels. Trans Mountain also accepted Finding 20 regarding Trans Mountain's commitment to provide financial support for an enhanced education campaign for small vessel operators about safe boating practices.

Trans Mountain also said that Project-related marine vessels would be fully compliant with all applicable navigational, communications and safety regulations, including those of Transport Canada, the Canadian Coast Guard, the Pacific Pilotage Authority (PPA) and Port Metro Vancouver (PMV).

Views of the Board

The Board acknowledges the many ways in which people use and enjoy the waters within the Project's marine setting. The Board recognizes that Project-related vessels would pass through areas of great significance to Aboriginal groups, community members, tourists, and recreational users, among others.

The Board is encouraged by Trans Mountain's support of the TERMPOL Report Recommendation 11, and notes that it is a key measure to minimize the potential disruption to recreational boaters, fishing vessel operators, and operators of small vessels as a result of increased Project-related marine vessel traffic. The Board would impose Condition 131 requiring Trans Mountain to develop a public outreach program prior to Project operations in order to ensure that the program is designed in consultation with the Pacific Pilotage Authority and implemented in a manner that is appropriate to its intended audience.

Many concerns raised by participants regarding marine shipping are under the jurisdiction of several federal and international authorities. The Board expects that Project-related marine vessels will be fully compliant with all applicable navigational, communications and safety regulations including those of Transport Canada, the Canadian Coast Guard, the Pacific Pilotage Authority and Port Metro Vancouver (PMV). With regard to the concerns raised by participants about noise and light from tankers docked at the PMV managed anchorages, the Board notes that all vessels at anchor within PMV's jurisdiction are expected to adhere to PMV's guidelines regarding noise and light pollution.

Heritage resources

Several Aboriginal intervenors raised concerns regarding the impact to archaeological and cultural heritage sites as a result of increased Project-related marine vessel traffic. Pauquachin First Nation said that although the possible risk of Project-related vessel wake erosion is small, assuming the projected wake heights provided by Trans Mountain are accurate, it is possible that even small waves, combined with high tide and storms, may have a negative cumulative impact, particularly given the frequency and high volume of the predicted traffic. Several Aboriginal groups recommended that sites at potential risk due to erosion be visited, mapped, assessed and monitored over time to determine the current extent and ongoing rate of erosion and its impacts, and that a specific spill response plan with mitigation be developed.

Trans Mountain said there are 81 previously recorded archaeological sites located in proximity to the marine vessel corridor. The combination of existing vessel traffic, Project-related vessel traffic and reasonably foreseeable vessel traffic will increase the frequency of wake waves interacting with the shoreline. Trans Mountain said that as wakes generated by vessels will be within natural wave size variation by the time they reach the shoreline, there is no discernible impact on shorelines associated with the shipping channel and, therefore, it did not complete an Archaeological Impact Assessment for the entire marine zone.

Views of the Board

The Board accepts Trans Mountain's evidence that Project-related vessel wake will not be detectable from existing wave conditions along the shoreline adjacent to the shipping lanes given vessel size and speed along with the channel depth and width. As such, the Board is of the view that there will not be an impact to archaeological sites located on the shoreline due to an increase in marine traffic, and, therefore, an Archaeological Impact Assessment was not required.

The Board acknowledges that archaeological sites are of significance and value to Aboriginal groups. The Board encourages Aboriginal groups to share information regarding potential archaeological and cultural heritage sites with the B.C. Ministry of Forests, Lands & Natural Resource Operations.

Traditional marine resource use

Trans Mountain conducted traditional marine resource use (TMRU) studies to evaluate the potential effects of Project-related marine vessel traffic on traditional resource use. The spatial and temporal boundaries used for the TMRU assessment are described in Appendix 11.

Methodology and scope of assessment

Trans Mountain said the TMRU studies took place in coastal and international waters to provide information regarding the marine-based activities that participating Aboriginal communities undertake. The company said that the information collected in the TMRU studies was used to assess potential Project effects on travelways, plant gathering sites, hunting, fishing, gathering places and sacred areas.

Trans Mountain said the results of the TMRU studies, and desktop analysis and literature review, indicate that Aboriginal groups have historically used and presently use the RSA to maintain a traditional lifestyle, and that they continue to use marine resources throughout the RSA for a variety of purposes. Trans Mountain said that this includes, but is not limited to fish, shellfish, mammal and bird harvesting, aquatic plant gathering, and spiritual/cultural pursuits, as well as the use of navigable waters within the RSA to access subsistence resources, neighbouring communities and coastal settlements. As part of its assessment, Trans Mountain prepared and submitted a supplemental TMRU report incorporating information from traditional marine resource use reports and related evidence filed directly with the Board by Aboriginal intervenors, or that were provided directly to Trans Mountain. Trans Mountain stated that the TMRU result and concerns raised by these Aboriginal communities are summarized in these reports.

Trans Mountain said that the two indicators used to assess potential effects from increased Project-related marine vessel traffic on TMRU were subsistence activities and cultural sites. The company said that subsistence activities and sites represent the extensive land and water bases on which activities take place, and provide a broad view of where and how people move in the landscape, how they use it and where they inhabit it. The company said that cultural sites represent people's long-term connection to the land and water, and include the ability to participate in and continue practices and activities conducted by past generations, and the ability to pass on the collective knowledge and use of the environment according to tradition. Trans Mountain noted that access to and continued use of cultural sites promotes cultural continuity, and that gathering areas and sacred areas are collective terms used to incorporate all types of sites unrelated to the acquisition of environmental resources.

Aboriginal groups raised a numbers of concerns about Trans Mountain's approach to assessing potential effects to TMRU, including cumulative effects. These included:

- failure to conduct an effects assessment specific to each Aboriginal group's areas of interest;
- that the level of site-specific mitigation for TMRU was not sufficient, and should be developed in consultation with Aboriginal groups;
- flaws in spatial scope identified for the Project;
- failure to include the potential effects of increased Project-related marine vessel traffic on coastal habitation and cultural sites; and
- Trans Mountain's conclusion that there would be no significant adverse effects to traditional marine resource use, except potential adverse effects to traditional use of Southern resident killer whale populations.

In response to the concerns raised by Aboriginal groups regarding its approach to assessing potential effects to TMRU, determination of significance, and proposed mitigation measures, Trans Mountain said that its assessment addresses the potential interactions identified by Aboriginal groups through the assessment of the likely effect of the Project on the environment and TMRU. Trans Mountain said it reviewed the findings of each TMRU report submitted by Aboriginal groups in the context of the assessment and determined that the significance conclusions with regard to TMRU remain unchanged by

this evidence. In addition, Trans Mountain said that, where feasible, it identified mitigation to reduce the magnitude and duration of potential TMRU effects.

Trans Mountain said that with respect to the size of the study areas that were used in the assessment, the spatial extent of the RSA represents a trade-off between choosing too large an area that would mask Project effects, versus choosing an area too small where the effects on the population under consideration might no longer be meaningful at a landscape scale.

Several Aboriginal groups raised concerns regarding potential damage or erosion to coastal natural habitats/harvesting areas such as kelp beds and reefs, and culturally or spiritually sensitive shoreline areas as a result of Project-related vessel wake. Squamish First Nation said that Trans Mountain's lack of assessment regarding these coastal sites represents an error in assessment scoping because it fails to consider the profound connections between land, sea, and culture of the Squamish Nation that are potentially affected by the Project.

Trans Mountain said that due to the average channel width, and the relatively rapid rate at which wake waves decrease in height away from the transiting tankers and escort tugs, vessel wake is not expected to be detectable from existing wave conditions along most of the shoreline in the RSA. Therefore, it did not include the potential effects of Project-related marine vessel traffic on coastal habitation sites since it was not considered to interact with land-based activities.

Effects of Project-related marine vessel traffic on traditional marine harvesting and cultural activities

Trans Mountain said that resources used and activities associated with TMRU are located within the RSA and situated along or near shipping lanes. Based on the results of the TMRU studies and the desktop analysis, travel corridors are essential for conducting traditional activities and accessing locations for traditional harvesting, and the shipping lanes must be traversed to access TMRU sites. Trans Mountain noted that subsistence harvesting and associated travel can occur within the RSA year round.

Trans Mountain said that the potential effects of Project-related marine vessels on TMRU include the disruption of subsistence hunting, fishing, plant gathering activities, the disruption of use of travelways, and the disturbance of gathering places and sacred areas.

Trans Mountain said that a disruption of subsistence activities may occur due to increased transit of Project-related marine vessel traffic through the RSA by restricting access to traditional use areas particularly if the resource users' travel occurs at the same time and in the same location as the Project vessel's transit. The company said that this could result in limiting the ability to harvest in certain areas, missed harvesting opportunities, or an increase in travel time to reach a destination, all which could reduce access to marine resources. Trans Mountain stated the magnitude of the effect is considered to be low, since it is expected that subsistence activities may be interrupted due to Project-related marine vessel traffic but the Project-related disruption would only be temporary and activities are likely to be resumed in most cases once the vessel has passed, and the frequency of Project-related marine vessels would be once a day.

Trans Mountain said that sensory disturbance as a result of increased marine vessel traffic may deter resource harvesters from using areas or could influence the focus of the activity, particularly if the Project-related marine traffic occurs at the same time and place as the subsistence activities. Trans Mountain said that sensory disturbance due to increased marine vessel traffic may also result in disruption to cultural activities (e.g., gathering places, sacred areas), as well as influence the focus and intent of ceremonial activities. The company said this could result in choosing other locations for their traditional activities, and increased travel time to reach a destination.

Trans Mountain said that there is a potential for increased disruption of traditional marine resource user activities from Project-related marine vessel wake, and increased potential for marine vessel collisions between Project-related vessels and traditional marine vessel traffic. The company said that such disruptions and collisions are considered to be unlikely due to adherence to regulatory standards and navigational and safety measures by most marine vessels. A collision event could result in lost opportunities for traditional resource harvesting may result if an incident occurs. Trans Mountain also said damage or loss to fishing vessels or fishing gear may result from interactions between Project-related marine vessels and traditional marine resource users' fishing vessels. Trans Mountain said lost economic opportunities to marine users could result from: damage or loss of marine vessels; damage to fishing gear; injury; or

physical displacement of marine users from the presence of Project-related marine vessels in transit or occupying anchorages.

Trans Mountain said that changes to the distribution and abundance of resources could 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. 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 the increase in Project-related marine vessel traffic the effects are considered to be not significant, with the exception of Southern resident killer whales. Trans Mountain said it has been determined that there is a currently-existing significant adverse cumulative effect on this population and that while the endangered status of the Southern resident killer whale prohibits the current hunting of this species, historical data indicates that Southern killer whale populations were once, and may in future be, a traditionally harvested resource within the RSA.

With the exception of effects on the Southern resident killer whale, Trans Mountain said the Project's contribution to broader Aboriginal cultural effects related to change in traditional marine use patterns is considered not significant. Trans Mountain noted that some traditional resource use vessels may only be temporarily inconvenienced by the presence of Project-related marine vessels (low magnitude), but for others, fishing activities may be delayed (medium magnitude) since routes to fishing grounds may need to be altered, or fishers may not be able to fish in preferred locations due to increased Project-related marine vessel traffic.

Trans Mountain said the combined effects from Project-related marine vessel traffic on TMRU are long-term and with a low to high magnitude given the predicted residual effects on the Southern resident killer whale population. It said effects are considered in the context of existing high-volume vessel activity within the RSA and an existing regulatory framework. Trans Mountain also said this takes into account the context of the availability of a traditionally harvested resource to meet the cultural and subsistence needs of potentially affected Aboriginal peoples. Trans Mountain said the combined residual effects associated with Project-related marine vessel traffic on TMRU are considered not significant, with the exception of the expected residual effects on the Southern resident killer whale population, which are considered to be significant.

Trans Mountain said it assessed cumulative effects for marine transportation by considering projects that overlap with potential effects of Project-related marine vessel traffic. All components of the marine environment are understood to support the marine resource base and habitat conditions essential to the practice of traditional activities. As such, the potential cumulative effects on subsistence activities and sites were assessed in consideration of all pertinent biophysical resources known or assumed to be of importance to Aboriginal communities for traditional use, as well as in consideration of the existing high volume of large vessel traffic within the RSA.

Trans Mountain said that increased marine vessel traffic is likely to increase congestion in areas that are geographically constrained and already experience high marine traffic volumes and may potentially cause some traditional marine users to avoid these areas or to alter their preferred routes due to sensory disturbance from transiting marine vessels. Trans Mountain said that 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, however, total cumulative effects on other traditional marine resources and indicators, and the Project contribution to those effects, are concluded to be not significant.

Marine Shipping impacts on TMRU provided by Aboriginal groups

Several Aboriginal communities and Adam Olson expressed the importance of their continued ability to exercise their Aboriginal rights to fish, harvest, and hunt throughout their respective traditional territories within the RSA. The information provided by Aboriginal intervenors described the scope and extent of their activities, and focused on how communities and individuals use the lands, waters, and their respective resources to exercise their claimed or established Aboriginal and treaty rights. This included information about food harvesting activities (primarily relating to fishing, but also hunting, trapping, medicinal herbs, and plant and berry gathering), as well as the cultural importance of these activities.

Aboriginal groups described the traditional methods of fishing, the important role the harvesting sites and camps play in passing traditional knowledge on to future generations, how food is prepared and stored, and the sharing, trading, and feasting that comes after foods are harvested. They also described how their cultural systems, practices, and stewardship are inextricably connected to the traditional use of the lands and the waters. They included specific information on annual and seasonal harvesting locations and species used by Aboriginal groups for the activities described, how the needs of that community continued to be met by these activities, as well as specific sites that are of cultural or spiritual importance to potentially affected Aboriginal groups.

Several Aboriginal groups, including Cowichan Tribes, Scia'new First Nation, Ditidaht First Nation, Esquimalt Nation, Pacheedaht First Nation, Lyackson First Nation, Tsawout First Nation, T'Souke First Nation, Squamish First Nation, Musqueam First Nation, Tsartlip First Nation and Tsleil-Waututh Nation, said that existing levels of large ship traffic and industrialization have already reduced the ability to harvest in the certain areas, and reduced the frequency of interactions with mainland nations for cultural, ceremonial and economic reasons. They also raised concerns about the effects of existing development on the health of the ecosystems and resources harvested and their cultural and spiritual well-being.

Lyackson First Nation said that it estimates more than 50 per cent of their salmon harvest relies on transit of the Salish Sea and the Fraser River.

T'Souke First Nation characterized the ongoing impact of cumulative effects in the T'Sou-ke territory as "death by a thousand cuts" or the "tyranny of small decisions" carried out over generations affecting the T'Sou-ke Nation's traditional mode of life, including its ability to maintain the sustainability of traditional marine resources to a level adequate to ground T'Sou-ke Nation's cultural connection to its territory.

Several Aboriginal groups, including Esquimalt First Nation and Stz'uminus First Nation expressed concern that accessing marine harvesting, and cultural and spiritual sites will be further restricted as a result of increased Project-related marine traffic. Aboriginal groups, including Tsleil-Waututh Nation, T'Sou-ke First Nation and Pacheedaht First Nation, described how a disruption or reduction to traditional travelways would represent a loss of cultural expression and identity, as well as a loss of teaching opportunities for youth.

Aboriginal groups, including Tsleil-Waututh Nation, Scia'new First Nation and Lyackson First Nation, expressed concerns that noise from Project-related vessel traffic would impact cultural heritage and activities by disrupting ceremonial activities, alienating members from some parts of their territory, complicating ties with other First Nations communities, and exposing territory, including sacred sites, to Project-related risks They said that the Project-related vessel traffic would create loss of privacy and quiet for cultural and sacred practices.

Aboriginal groups noted concerns regarding marine safety. Aboriginal groups, including Esquimalt First Nation, Pacheedaht First Nation and Ditidaht First Nation, said that increased tanker traffic would threaten marine safety, presenting increased risks of collisions between tankers and smaller traditional resource use vessels. They explained that a collision could result in damage to vessels or gear utilized to exercise harvesting rights. Tsleil-Waututh Nation said the increased shipping associated with the Project could physically curtail their ability to travel around the inlet in small vessels. Lyackson First Nation said they were concerned with the increased risk of accident and interference with small boat navigation including canoes and subsistence fishing boats.

Several Aboriginal groups raised concerns with respect to the alteration of subsistence resources as a result of increased Project-related vessels. The Aboriginal groups said that an increase in tanker traffic will alter subsistence hunting and fishing resources by changing wildlife behaviour and migration routes. This would have a negative impact on their ability to harvest these resources.

A number of Aboriginal groups raised concerns about the increased tanker traffic at Swiftsure Bank, which has been a shared fishing area for centuries. These Aboriginal groups said studies should look at weather extremes including full stochastic modelling of extreme wind and wave conditions.

Southern resident killer whale

A number of Aboriginal groups expressed concern about the social and cultural effects that would result from impacts of marine shipping on the Southern Resident Killer Whale. Tsawwassen First Nation stated it does not have a history as a whaling nation but has strong cultural ties to killer whale. The species figures prominently in the stories of Tsawwassen First Nation citizens and the Tsawwassen have adorned their ocean-going canoe with an image of the killer whale. Tsawout First Nation said there are clans and families that are connected to killer whales, and the impacts and loss of whales in their territories is a loss to those clans and families.

Pacheedaht First Nation said that increased tanker traffic will further impact the recovery of the killer whales. Given the importance of killer whales to their culture, this was a serious concern to Pacheedaht First Nation. T'Sou-ke First Nation said adverse effect on a key resource such as killer whale could have catastrophic ripple effects on their rights, title and sense of identity as Aboriginal peoples of Canada.

Tsartlip First Nation said killer whales are culturally and spiritually important to Tsartlip people. Tsartlip First Nation described the profound spiritual importance of killer whales to their people, their relationship with them, and their obligation to protect them.

Mitigation

To mitigate the effects and concerns regarding traditional marine harvesting and cultural activities, Trans Mountain committed to, among other measures, provide regular updated information on Project-related marine vessel traffic to Aboriginal communities. It also committed to initiate a public outreach program prior to the Project operations phase to communicate information on Project-related timing and scheduling with Transport Canada, the Canadian Coast Guard, the Chamber of Shipping for British Columbia, commercial and tourism associations, and potentially affected Aboriginal groups.

Trans Mountain said that Project-related marine vessels would be fully compliant with all applicable navigational, communications and safety regulations, including those of Transport Canada, the Canadian Coast Guard, the PPA and PMV.

Trans Mountain said it has identified mitigation to reduce the magnitude and duration of potential effects, where feasible. However, Trans Mountain said that as the shipping industry follows internationally and federally regulated guidelines and rules (such as the use of the international shipping lanes for routing and the use of pilots during transit), the company said there is limited ability for any tanker or vessel to alter route or schedule. Trans Mountain stated that all Aboriginal groups will be invited to attend regional EPP workshops where mitigation measures and monitoring programs will be discussed.

With respect to the Southern resident killer whale, Trans Mountain committed to developing a Marine Mammal Protection Program with a purpose of outlining Project-related tanker specific measures and regional collaborative initiatives that would be implemented by Trans Mountain and other operators along the marine shipping lanes to mitigate and manage potential environmental effects on marine mammals.

With respect to Swiftsure Bank, Trans Mountain acknowledged its importance to Aboriginal communities, and recognizes that the shipping lanes cross over Swiftsure Bank. Trans Mountain said it will raise awareness amongst Project tankers about conditions near Swiftsure Bank in its Port Information and Terminal Operations Manual.

Views of the Board

The Board acknowledges that uses, practices and activities such as hunting, fishing, harvesting, plant gathering and the use of cultural sites are very important for Aboriginal groups along the coastal areas of B.C. These uses, practices and activities are undertaken for both subsistence and traditional cultural purposes, and are important for maintaining Aboriginal cultures and transmitting these across generations. The Board also acknowledges the significant and detailed evidence provided by Aboriginal groups about their use of the marine environment where Project-related marine vessel traffic is proposed to take place. The Board considered all of the evidence provided by Aboriginal groups, Trans Mountain and other participants on these matters.

The Board is of the view that, for the purposes of assessing the potential effects of Project related marine traffic on traditional marine use, the methodology used by Trans Mountain was appropriate

and effective for identifying and evaluating the Project-related potential effects. Trans Mountain identified components of the marine environment that are understood to support the marine resource base and habitat conditions essential to the practice of traditional use, practices and activities, and that potential residual effects were assessed in consideration of pertinent biophysical resources known or assumed to be of importance to Aboriginal communities for traditional use. TMRU studies completed by Aboriginal groups provided information on impacts of Project-related marine traffic in the shipping lanes on subsistence sites and resource use. In its supplemental technical reports on TMRU, Trans Mountain incorporated the results of TMRU studies filed by Aboriginal groups, and described mitigation for the effects and concerns raised.

The Board finds that Project-related vessel wake will not be detectable from existing wave conditions along the shoreline adjacent to the shipping lanes based on Trans Mountain's predicted wake wave height modelling. As Project-related vessel wake will be of the same magnitude as existing wave conditions along the shoreline adjacent to shipping lanes, the Board also finds that Project-related marine vessels are unlikely to result in any measurable changes to coastal habitats, harvesting and culturally sensitive areas.

The Board notes Trans Mountain's commitments to provide regular updated information on Project-related marine vessel traffic to Aboriginal communities, and to initiate a public outreach program prior to the Project operations phase to communicate information on Project-related timing and scheduling with Transport Canada, the Canadian Coast Guard, the Chamber of Shipping for British Columbia, commercial and tourism associations, and potentially affected Aboriginal groups. The Board also notes Trans Mountain's commitment to raise awareness amongst Project-related tankers about conditions near Swiftsure Bank in its Port Information and Terminal Operations Manual.

With respect to the effects of Project-related marine vessel traffic on traditional marine resource uses, activities and sites, the Board finds that there will be disruptions to Aboriginal marine vessels and harvesters, and that this may disrupt activities or access to sites. The Board is of the view that these disruptions will be temporary, only occurring during the period of time when Project-related tanker vessels are in transit. The Board is of the view that Aboriginal marine vessel users will maintain the ability to continue to harvest marine resources and to access subsistence and cultural sites in the presence of these periodic and short-term disruptions. The Board therefore finds that, with the exception of effects on the Southern resident killer whale, the magnitude of effects of Project-related marine vessel traffic on traditional marine resource uses, activities and sites is low. Given the low frequency, duration and magnitude of effects associated with potential disruptions, and Trans Mountain's commitments to provide regular updated information on Project related marine vessel traffic to Aboriginal communities, the Board finds that adverse effects on traditional marine resource uses, activities and sites is not likely, and that overall, Project-related marine traffic's contribution to overall effects related to changes in traditional marine use patterns is not likely to be significant. The Board is also of the view that Project-related marine traffic's contribution to cumulative effects is of low to medium magnitude and reversible in the long-term. The Board therefore finds significant adverse cumulative effects associated with Project-related marine vessel traffic on TMRU are not likely to be significant, with the exception of effects associated with the traditional use of the Southern resident killer whale, which are considered significant.

The Board acknowledges the concerns raised by Aboriginal groups about marine safety, increased congestion of marine vessel traffic, and potential disruptions that may occur as a result of vessel collisions. This potentially includes damage to or loss of fishing gear, or vessel damage or loss in the event of a direct collision. While there is concern about interactions between Project-related marine vessels and traditional fishing vessels, the Board is of the view that disruptions that may result from interference or collisions with Project-related vessels are considered to be unlikely due to adherence to regulatory standards and navigational and safety measures by marine vessels. The Board is also of the view that that any disruptions to Aboriginal marine vessel users that would result from Project-related Marine vessel traffic would be temporary, that the frequency of Project related marine vessels would be one return transit per day, and that all other marine vessels, including Aboriginal marine vessel users, would be able to continue their movements very shortly after the transit of the tanker. In the unlikely event of a collision or damage to or loss of fishing gear, a comprehensive scheme of compensation would be available. Further information on financial responsibility and compensation is discussed in section 14.7.

The Board finds, as described in its views in this chapter on marine mammals, that the increase in marine vessel traffic associated with the Project is likely to result in significant adverse effects on the Southern resident killer whale. The Board finds that Project-related marine vessel traffic would further contribute to total cumulative effects which are determined to be significant, with or without the Project. Given these conclusions and recognizing the stated cultural importance of the killer whale to certain Aboriginal groups, the Board finds that the increase in marine vessel traffic associated with the Project is likely to result in significant adverse effects on the traditional Aboriginal use associated with the Southern resident killer whale.

As noted in the section in this chapter on marine mammals, Trans Mountain committed to developing a Marine Mammal Protection Program. One of the objectives of the Marine Mammal Protection Program would be to encourage participation in multi-stakeholder or independent initiatives that contribute to Southern resident killer whale recovery. The Board encourages these initiatives, and those of the Government of Canada, to prioritize and implement specific measures to promote the recovery of the Southern resident killer whale.

Human health effects from marine shipping

Trans Mountain estimated the potential effects on human health from the routine operations of marine transportation associated with the Project.

Trans Mountain said it followed a conventional risk assessment paradigm, which is an approach endorsed by a number of federal, provincial and regional regulatory health authorities, including Health Canada, Environment and Climate Change Canada (ECCC), the Canadian Council of Ministers of the Environment (CCME) and B.C. Ministry of Environment (BC MOE).

The spatial boundaries for Trans Mountain's assessment of human health effects of marine transportation are described in Appendix 11, and included the inbound and outbound marine shipping lanes, the area between the shipping lanes, where it exists, and a 5 km buffer extending from the outermost edge of each shipping lane. Trans Mountain said for the purposes of its assessment, the shipping lanes were divided into four distinct regions: Burrard Inlet; Strait of Georgia; Boundary Passage and Haro Strait; and Juan de Fuca Strait. Trans Mountain said of these, only Burrard Inlet revealed some potential exceedances of contaminants that may affect human health and therefore this was the only region carried forward for detailed assessment.

Trans Mountain said specific consideration was given to Aboriginal peoples because of the unique opportunities for chemical exposures that might occur through traditional Aboriginal practices, including the consumption of traditional foods such as game meat, fish, beach food and wild plants.

Trans Mountain said it evaluated potential health risks that could result from exposure to the chemical emissions originating from Project-related marine vessel traffic. Trans Mountain considered the potential effects on people living within the assessed area boundaries, on those who might frequent these areas for recreation or other purposes, as well as how age, gender or health status may affect people's vulnerability to potential effects.

Trans Mountain said it used exposure limits to assess the potential health effects that could result from short-term and long-term exposure to the various chemical emissions associated with Project-related marine transportation. Reliance was placed on exposure limits developed or recommended by regulatory authorities or reputable scientific authorities for the protection of human health. These included, among others, those available from Health Canada, the BC MOE, the United States Environmental Protection Agency (US EPA) and the World Health Organization (WHO).

Trans Mountain said it assessed short-term (acute), long-term (chronic) and cumulative exposure scenarios, and considered the potential health risks associated with the chemicals of potential concern (COPC) acting either singly or in combination (i.e., chemical mixtures). Inhalation was considered the primary exposure pathway, but it also considered secondary pathways including food ingestion and skin contact. Trans Mountain said that due to strict regulations prohibiting the release of untreated bilge water and ballast water under routine operating conditions, releases to water were not considered.

Acute effects

Trans Mountain said the maximum predicted acute exposure to the COPC (acting either singly or in combination) were below their exposure limits, with the exception of short-term inhalation of nitrogen dioxide (NO_2) and the respiratory irritants mixture. For acute exposure to NO_2, Trans Mountain said no exceedances were predicted for residents within the communities surrounding Burrard Inlet, or for the area users frequenting the provincial parks. The company said exceedances only were predicted at an isolated location along the water's edge of Burrard Inlet within the perimeter of another industrial facility, where public access will be restricted.

Trans Mountain said the risk estimates for short-term inhalation of NO_2 did not change between the assessment cases (i.e., base, application and cumulative cases), indicating that the incremental change associated with the Project-related marine vessel traffic will have very little, if any, effect on the health risks associated with short-term exposure to NO_2.

Trans Mountain said that short-term exceedances were predicted for the respiratory irritants mixture across all the assessment cases for the residents of the Squamish Nation at Capilano 5, and for the District of North Vancouver. Exceedances were not predicted at any of the other Aboriginal communities (i.e., Tsleil-Waututh First Nation at Burrard Inlet 3 and Squamish Nation at Seymour Creek 2, Kitsilano 6 and Mission 1). Trans Mountain said the incremental changes as a result of COPC emissions from the marine vessel traffic associated with the Project and the reasonably foreseeable increase in other marine vessel traffic are essentially negligible, and that the Project will have very little, if any, impact on health risks associated with short-term exposure to the respiratory irritants at these locations.

The company concluded that, overall, adverse health effects from acute exposures would not be expected.

Chronic effects

Trans Mountain said that, for chronic effects via the primary inhalation pathway, in all cases the maximum predicted air concentrations of the COPC (acting either singly or in combination) associated with the Project were lower than the corresponding exposure limits. Trans Mountain concluded long-term health risks associated with the COPC exposures are considered negligible or low, and adverse health effects from the long-term inhalation of the COPC associated with the Project-related marine vessel traffic are not expected.

Trans Mountain said the potential health risks associated with Project-related marine vessel traffic via the relevant secondary exposure pathways were also examined. The company said that potential chronic multiple pathway health risks were estimated based on the assumption that residents would be continuously exposed for an assumed lifespan of 80 years. Trans Mountain said that in all cases the maximum predicted exposures through the secondary pathways of the COPC (acting either singly or in combination) were lower than the corresponding exposure limits, and that long-term health risks are therefore considered negligible or low, and adverse health effects from the inhalation of dust, food ingestion, and dermal contact are not expected.

Trans Mountain said the high degree of conservatism incorporated into both the exposure estimates and the exposure limits must be considered in the interpretation of the exceedances, and that based on the weight of evidence, it is unlikely that people would experience health effects as a result of the potential increase in Project-related marine vessel traffic.

Cumulative effects

Trans Mountain said the RSA was used for the purposes of assessing the cumulative health effects associated with the chemical emissions from increased Project-related marine vessel traffic. It said the contribution from Project-related marine vessel traffic to the cumulative exposure to COPCs was negligible. Trans Mountain said in the majority of instances, the potential health risks remained unchanged between the cases, indicating that Project-related marine vessel traffic will have very little, if any, effect on the base case health risks or cumulative exposure contributions

A number of participants raised concerns regarding Trans Mountain's assessment of the potential effects on human health resulting from Project-related marine traffic.

Burnaby Residents Opposed to Kinder Morgan Expansion (BROKE) said that Trans Mountain did not adequately assess the human health risks, including acute and chronic health effects of exposure to benzene and 1,3-butadiene. BROKE said additional information to understand the human health impacts in the area surrounding the terminal and the exit for ships through the First and Second Narrows is needed to better understand the impacts, and should include a focus on those most vulnerable to exposure to benzene and 1,3-butadiene, such as young children and those with genetic susceptibility to carcinogens.

BROKE and North Shore No Pipeline Expansion (NS NOPE) expressed concern over the potential human health effects associated with short-term and long-term exposure to benzene, including as part of a mixture with 1,3-butadiene. Living Oceans Society raised concern that the maximum predicted ground-level air concentrations of benzene in Burrard Inlet area would exceed the national one-hour Ambient Air Quality Objective (AAQO) for benzene.

In response to concerns about the potential effects of butadiene, for acute exposure to 1,3-butadiene, Trans Mountain said the predicted 24-hour air concentrations for the three assessment cases (i.e., Base Case, Application Case and Cumulative Case) were compared with the acute (24-hour) exposure limit or Reference Concentration developed by the U.S. EPA for the protection of the human population (including sensitive individuals) against the potential reproductive and developmental effects associated with short-term inhalation of 1,3-butadiene. Trans Mountain said that chronic health risks were assessed by comparing the maximum predicted annual air concentrations for the three assessment cases (i.e., Base Case, Application Case and Cumulative Case) to the U.S. EPA's chronic Reference Concentration for the potential reproductive and developmental effects associated with long-term inhalation of 1,3-butadiene (U.S. EPA 2002a). The potential cancer risks, specifically the risk of developing leukemia, also were assessed.

Trans Mountain said that in all instances, cancer risks for 1,3-butadiene were predicted to be less than 1 in 100,000, indicating that the incremental cancer risks from the Project-related increase in marine vessel traffic are deemed to be "essentially negligible." It said the contribution from the Project-related marine vessel traffic to the cumulative 1,3-butadiene exposures was negligible, and that in all instances, the potential health risks remained unchanged between the Base Case and Application Case, signifying that the Project-related marine vessel traffic will have very little, if any, effect on the Base Case health risks associated with 1,3-butadiene exposure.

With respect to benzene, Trans Mountain said it used the acute health-based exposure limit developed by the Texas Commission on Environmental Quality (TCEQ) for benzene rather than Alberta's one hour AAQO for benzene as the latter did not satisfy the requirement for adequate supporting documentation. Nonetheless, Trans Mountain said it committed to meeting the lowest applicable AAQO established in B.C. or Alberta at each terminal, including Alberta's one-hour AAQO for benzene.

Trans Mountain said the findings of its HHRAs indicate that adverse health effects from short-term and long-term exposure to benzene are not anticipated as a result of the Project-related marine vessel traffic. In all cases, the potential health risks associated with short-term and long term inhalation of benzene were below the benchmark (or target risk estimate) of 1.0, indicating that the predicted peak hourly and annual average air concentrations of benzene were below the corresponding exposure limits. Trans Mountain also said incremental lifetime cancer risks associated with Project-related marine vessel traffic were predicted to be less than 1 in 100,000 (i.e., less than one extra cancer case in a population of 100,000 people). This indicates that the incremental cancer risks from the Project-related marine vessel traffic are deemed to be "essentially negligible."

Trans Mountain said benzene was assessed in the acute immunotoxicants mixtures, and in assessment of chronic effects, benzene was included in both the immunotoxicants and hematotoxicants mixtures. It said the potential health risks for each of the mixtures was predicted to be below the target risk estimate of 1.0, indicating that adverse health effects from short-term and long-term exposure to the immunotoxicants and hematotoxicants mixtures, of which benzene is a constituent, would not be anticipated. Trans Mountain concluded that overall, the absence of adverse health effects associated with the Project and Project-related marine vessel traffic applied whether benzene was assessed on an individual basis or as part of a mixture.

Living Oceans said Trans Mountain's assessment does not provide the information needed to adequately assess the human health risks, and significantly underestimates the impact of operations on air quality.

Living Oceans said that where emissions exceed exposure limits, such as for the respiratory irritants mixture, these emissions should be mitigated to improve air quality and reduce human health risks.

The Upper Nicola Band and Tsawout First Nation said that Project components, including the incremental tanker and tug traffic associated with the Project, would release sulphur dioxide (SO_2), nitrogen oxides (NO_X), and particulate matter (PM_{10}; $PM_{2.5}$) that affect human health, and that exposure to these pollutants can cause respiratory and heart health effects and increase mortality rates in humans. Living Oceans raised concerns regarding emissions from tugs and tankers, and that exceedance of air quality limits for NO_x and SO_2 will occur along the tanker route, and produce plumes that potentially affect long sections of coastline.

Health Canada said the information provided by Trans Mountain suggests that overall, there is low likelihood for acute and chronic health effects due to Project air emissions, including effects due to Project-related marine vessel emissions. Most of the health risks appear to be a result of the ambient air quality, since there are minor changes in health risk estimates for the base, applicat ion, and cumulative cases. However Health Canada said deficiencies identified by a number of participants regarding the air dispersion modelling affected its level of confidence, and that individuals with existing respiratory or cardiovascular conditions may experience reactions to even small changes in Project-related emissions. Health Canada said it supports Trans Mountain's commitment to continuous improvement in the implementation of efficient emission control measures and air quality monitoring to manage the health risks due to changes in air quality.

In response to these concerns, Trans Mountain noted that the results of additional air dispersion modelling for marine transportation present the predicted peak 24-hour and maximum annual concentrations for $PM_{2.5}$ and PM_{10} under the Base Case, Application Case and Cumulative Case, and that the revised results are lower than those assessed in the HHRA of marine transportation. The company said the results of the additional air dispersion modelling for PM do not affect the conclusions of the HHRAs in that they continued to show a low potential for adverse health effects as a result of the Project and Project-related marine vessel traffic.

Trans Mountain said the results of its HHRA of marine transportation revealed exceedances of the one hour Metro Vancouver AAQO for NO_2 under each of the assessment cases (i.e., Base Case, Application Case and Cumulative Case). However, it said maximum predicted annual average air concentration for NO_2 within the LSA for marine transportation (i.e., 5-km buffer extending from the outermost edge of each shipping lane within Burrard Inlet) was below Metro Vancouver's annual AAQO, suggesting that adverse health effects associated with long-term exposure to NO_2 are not expected. Trans Mountain also noted that the results of additional air dispersion modelling show a peak predicted one-hour concentration for NO_2 of 186 $\mu g/m^3$ for the Base Case, Application Case and Cumulative Case, and this predicted peak is below the one-hour Metro Vancouver AAQO. Trans Mountain said for these reasons, the risk of people experiencing adverse health effects within the LSA for marine transportation from the short-term inhalation of NO_2 is low.

Trans Mountain said the findings of the HHRAs indicate that adverse health effects from SO_2 exposure associated with Project-related marine vessel traffic are not anticipated. In all assessment cases (i.e., Base Case, Application Case and Cumulative Case), the predicted health risks associated with short-term exposure to SO_2 were below the benchmark (or target risk estimate) of 1.0, indicating that peak predicted 10-minute and one-hour air concentrations for SO_2 were less than the corresponding exposure limits. The company also noted that the air dispersion modelling that formed the basis of the HHRAs did not take into account the more stringent fuel sulphur regulations that were introduced in January 2015. Under these regulations, the maximum sulphur content in fuel oils within ECAs is 0.1 per cent. Inclusion of the lower sulphur fuel content into air dispersion modelling would serve to reduce the SO_2 emissions from marine vessels and subsequently the predicted air concentrations of SO_2 in the Burrard Inlet area.

Views of the Board

The Board is of the view that for the purposes of assessing the potential effects on human health resulting from Project-related marine shipping, Trans Mountain followed a generally acceptable risk assessment paradigm, and that its assessment adequately identified and evaluated the potential effects on human health from Project-related marine shipping. The Board notes that Trans Mountain relied primarily on the use of exposure limits developed or recommended by authorities such as

Health Canada and the United States Environmental Protection Agency (US EPA). The Board finds this approach acceptable, as these guidelines are broadly protective of human health.

The Board acknowledges that several Aboriginal groups, municipalities and federal departments expressed concerns that the potential emissions associated with Project related marine vessel traffic could affect human health. The Board acknowledges that there would be minor predicted exceedances of the short-term exposure limits for respiratory irritants at the Squamish Nation Capilano 5 reserve and for the District of North Vancouver. The Board notes, however, that these predicted exceedances occurred through all of the assessment cases examined by Trans Mountain. Therefore, the Board is of the view that the contributions of Project-related marine traffic to these exceedances would be inconsequential and not likely to cause significant adverse effects on human health.

A number of intervenors raised concerns regarding the potential health risks associated with exposure to chemicals of potential concern (COPCs) including benzene and 1,3-butadiene. The Board considered these concerns, the evidence of intervenors and the applicant. The Board finds that, based on the generally accepted methodologies used by Trans Mountain, the potential health risks associated with long-term inhalation of chemicals, such as benzene, were below the corresponding exposure limits, and that this applied whether benzene was assessed on its own or as part of a mixture of chemicals. The Board therefore finds that for long-term exposure risks associated with Project-related marine shipping, the maximum predicted concentrations of carcinogenic and non-carcinogenic chemicals, including benzene and 1.3-butadiene, are likely to be lower than the corresponding exposure limits developed by Health Canada and other authorities and, therefore, are not likely to cause significant adverse effects on human health.

The Board acknowledges the relevant conclusions drawn in this chapter on air emissions that, although Project-related marine shipping is expected to result in increased emissions in the Regional Study Area (RSA), such emissions are expected to remain below applicable ambient air quality objectives. As discussed in the section in this chapter on marine air emissions, the Board finds that Trans Mountain's predicted concentrations for both $PM_{2.5}$ and nitrogen dioxide emissions at the Tsleil-Waututh Nation's Burrard Inlet No. 3 reserve, as a result of Project-related marine shipping, are well below the applicable objectives. The Board notes Trans Mountain's commitment to discuss the possibility of undertaking an ambient survey on Tsleil-Waututh Nation's reserve lands. The Board is not persuaded that a program to monitor air contaminants at or adjacent to Tsleil-Waututh Nation's reserve is warranted at this time.

The Board acknowledges that there is an existing regulatory regime governing air emissions from tankers underway or in transit. Trans Mountain would require Project related tankers and barges to follow international and federal regulations and apply best practices during operations. Under Transport Canada's Vessel Pollution and Dangerous Chemicals Regulations pursuant to the Canada Shipping Act, these tankers would be required to carry onboard a volatile organic compound management plan that meets the requirements of the International Convention for the Prevention of Pollution from Ships.

As stated in Chapter 10, the Board would impose Condition 52 requiring Trans Mountain to develop an air emissions management plan for the Westridge Marine Terminal. Monitoring conducted pursuant to this plan would verify predicted emissions levels, and would require Trans Mountain to implement appropriate mitigation if there are exceedances of criteria established within the approved plan.

Considering that Trans Mountain will be required to adhere to all federal and international emission requirements to reduce emissions from the Project-related marine shipping, the Board finds that the residual effects from Project-related marine shipping is not likely to cause significant adverse effects on human health, including the health of Aboriginal people.

14.4 Spill prevention

14.4.1 Safety Measures

Project-related tankers

Trans Mountain said that the sailing route from the WMT to the high seas outside the mouth of the Strait of Juan de Fuca is a relatively uncomplicated route. The most challenging part of the route is from the WMT to the Second and First Narrows in the Movement Restricted Area within Vancouver Harbour.

Trans Mountain said that weather conditions and oceanographic factors along the tanker route are considered to be mild and should not cause delays or alterations to the vessel route, except for reduced visibility due to fog. The TERMPOL Review Committee said that said that with respect to the oil tanker transits, there are no restrictions in place along the proposed route aside from those within Port Metro Vancouver's Movement Restriction Area, where vessels are not permitted to continue transit if weather prevents them from staying on course. The Pacific Pilotage Authority has not had to abort a transit due to poor weather since its inception, and ensures its pilots exercise the practices of good seamanship in adverse weather conditions. The Committee found weather related restrictions beyond existing requirements were not currently necessary and that additional weather monitoring is not required in the southern Strait of Georgia as the area is already adequately monitored.

Trans Mountain said that the global safety record in the marine industry has improved continuously over the past 40 years due to regulatory changes and improved safety procedures. In particular, the worldwide incident frequency involving oil tankers was among the lowest for all marine vessels from 2002 to 2011. Despite the increase in volume of oil transported, the number of oil spills has decreased between 1970 and 2012. Trans Mountain said that between 2002 and 2011, there was one incident on the west coast involving an oil tanker; no damage was done to the tanker's hull and no oil was released. It specifically said that double hull tanker design has significantly reduced the number of oil spills from tankers and that only a fraction of tanker incidents result in the release of oil. Other contributing factors included the segregation of oil cargo tanks, improved reliability of machinery, improved navigational aids, and improved risk management.

Trans Mountain said that there has not been a complete loss of cargo from a double hull tanker over the last 30 years. Between 1998 and 2011, there have been five collision incidents involving double hull and double sided crude and product tankers that led to spills; the average cargo oil outflow was approximately 2,000 metric tonnes. Trans Mountain said that this record highlights the benefits of double hulls in limiting outflow from a tanker in case of hull damage. Trans Mountain said that tankers have operated out of the WMT for 60 years with no oil pollution incident from tanker operations.

TERMPOL review process

Trans Mountain said that it participated in a TERMPOL review process focused on the increase in marine transportation related to the Project. The review process was chaired and led by Transport Canada. Other federal departments and stakeholders that participated included Fisheries and Oceans Canada, the Canadian Coast Guard, ECCC, the Canadian Hydrographic Service, Pacific Pilotage Authority Canada, British Columbia Coast Pilots and Port Metro Vancouver.

Trans Mountain said that, in general, the TERMPOL process focuses on the marine transportation components of a project, and examines the safety of tankers entering Canadian waters, navigating through channels, approaching berthing at a marine terminal and loading or unloading oil or gas. With respect to the increase in existing marine traffic related to the Project, the TERMPOL process focused on the effects of the incremental increase in marine traffic related to the Project.

Trans Mountain said that, to fulfill the requirements of TERMPOL, it submitted a number of studies to Transport Canada for review, and that the relevant results of these studies had been incorporated into its environmental and socio-economic assessment. In particular, Trans Mountain said that the results of a quantitative risk assessment informed the assessment of accidents and malfunctions, the description of spill prevention, emergency preparedness and response, and the identification of improved practices.

Transport Canada filed with the Board a copy of the TERMPOL Report which included a number of findings and recommendations from the TERMPOL Review Committee. Trans Mountain said that it supported

and agreed to adopt, and provided information on how it would address, each of the recommendations and findings.

The TERMPOL report is discussed more in section 14.4.1.

Tanker construction and design

Trans Mountain said that before coming to Canada, tankers are required to meet high standards of design and construction:

- Tankers are built according to regulations established by the International Maritime Organization and adopted by their flag state.
- Ship construction and repairs are inspected and documented by a classification society to ensure construction meets these regulations and specifications.
- All oil tankers calling at the WMT would be of double-hull construction and have segregated cargo holds. This type of construction reduces the possibility of cargo spills and minimizes potential spill volume in the event of damage to the hull.

Tanker operations

Trans Mountain said that tankers coming into and departing from the WMT are subject to requirements that contribute to navigational safety and thus spill prevention in Canadian waters.

Trans Mountain said that, throughout operations, tankers are:

- inspected by their flag state, by classification societies and by insurers;
- vetted by charterers and terminals; and
- inspected in other ports of call by inspectors of the respective local national authorities, including those (e.g., Canada) that are signatories to the various international conventions on port state control (ship inspection programs).

Trans Mountain said that its Tanker Acceptance Standard describes the requirements for accepting a vessel for berth at the WMT and it applies to all ocean going tankers carrying crude oil. In noted the following in relation to its *Tanker Acceptance Standard*.

- Pipeline shippers own the product shipped on the Trans Mountain pipeline and that the shippers are responsible for chartering tankers to transport the product that arrives at the WMT.
- Pipeline shippers have their own tanker screening and selection process to ensure that tankers calling on the WMT meet international regulations and Trans Mountain's Tanker Acceptance Standard.
- Pipeline shippers are required to submit a Vessel Proposal Form to Trans Mountain prior to the pipeline shipper's first batch of product leaving from Edmonton to the WMT.
- Based on the information submitted and the vessel's inspection history, which is maintained on an international database, Trans Mountain has the right to reject any vessel proposed by the pipeline shipper that does not meet the standards and criteria set by the harbour master for Port Metro Vancouver, and by Trans Mountain.

Upon coming to Canada, tankers are scrutinized to ensure they are compliant with Canadian and Trans Mountain's requirements including:

- Vessels proposed by a pipeline shipper to receive oil at the WMT are pre-screened by the Trans Mountain loading master using industry databases and the company's own records before being accepted or rejected for scheduling purposes.
- The pipeline shipper arranges for a local shipping agent to assist the vessel with local logistical and regulatory requirements.
- A tanker must have an arrangement with a Transport Canada certified response organization for spill response services and a Shipboard Oil Pollution Emergency Plan before entering Canadian waters.

- A tanker must contact the Canadian Coast Guard for permission to enter Canadian waters before entry.

Upon arrival in Canadian waters, tankers must follow strict communications and guidance protocols:

- A tanker must contact the Canadian Coast Guard for permission to enter Canadian waters before entry.
- A tanker travelling in Juan de Fuca Strait must use the International Maritime Organization approved traffic separation scheme, which is managed jointly by Canadian and United States authorities. Traffic Separation Schemes are used worldwide and have been proven to reduce the possibility of collision between vessels by regulating the flow of crossing traffic.
- Ship traffic through the shipping lanes in the Salish Sea Region is jointly monitored by the Canadian and United States Coast Guards.
- The tanker remains in communication with the Canadian Coast Guard Marine Communications and Traffic Services and the tanker's position is monitored throughout the transit. A combination of radar, automatic information system and direct radio communication is used to coordinate safe conduct of the vessel with other masters and pilots.
- Empty tankers headed for the WMT pick up a pilot at the Victoria pilot station near Brotchie Ledge.
- Under the pilot's guidance, and monitored by the Marine Communications and Traffic Services, the ship navigates through the established shipping lanes to Port Metro Vancouver.
- The established shipping lanes maintain separation between inbound and outbound traffic. Many different types of vessels use the shipping lanes to access the ports and terminals of the Puget Sound, various ferry terminals, Robert's Bank terminal, the mouths of the Fraser River, and the Burrard Inlet/Vancouver Harbour.

Once a tanker enters the jurisdiction of Port Metro Vancouver, a series of additional established operating rules and protocols apply. Should the Project be approved, Trans Mountain said that existing rules and protocols would likely apply subject to improvements resulting from the TERMPOL process and from other federal and provincial reviews currently underway:

- Port Metro Vancouver rules for conduct of shipping within its jurisdictional area are documented in its Harbour Operations Manual.
- The ship's agent would have requested Port Metro Vancouver operations to assign an anchorage for the tanker based on availability and operational requirements. A tanker may anchor at one of the designated locations in English Bay or off the WMT, depending on the timing of tides, the WMT loading schedule, and the tanker's own requirements for provisioning and maintenance. In some cases, the tanker may proceed directly to berth.
- Pilots leave the tanker when it is at anchor, but are aboard anytime it moves, even if from anchor to the dock and back.
- The tanker is inspected by Transport Canada upon its first arrival in Canada and once per year after that. This might occur at anchor or alongside the WMT.

Trans Mountain said that, when a tanker berths at the WMT:

- The tanker is assisted by docking and mooring tugs tethered to the tanker at the WMT dock.
- The WMT loading facility is operated in accordance with regulations established by the National Energy Board, Transport Canada, and others as required.
- In accordance with its *Tanker Acceptance Standard*, prior to commencing any cargo operation, the tanker is physically inspected by Trans Mountain's loading master to confirm both the information presented in the pre-screening and the condition of the vessel. Any deficiencies noted have to be rectified before cargo loading can commence.
- A spill containment boom is deployed to enclose the tanker and terminal. A second boom is on-hand as a back-up in case of an emergency and WCMRC moors a skimming vessel at Trans Mountain's utility dock near the loading dock.

- Loading arms and vapour recovery lines are connected to the tanker. The WMT vapour destruction system is started and loading commences. Loading typically takes 24 to 36 hours depending on the size of the vessel.
- The Loading Master stays aboard the tanker throughout the loading process, and has the authority to stop the loading process at any time should concerns arise. The Loading Master also acts as the key shipside contact for communication with the terminal.
- Terminal operating procedures include an emergency response plan. Staff is trained and regular exercises are held to practice procedures.
- WCMRC has spill response equipment staged on the water in Vancouver Harbour and a main base of operations close to the WMT in Burnaby. WCMRC also maintains equipment caches on Vancouver Island for response in the Salish Sea.
- Trans Mountain has its own spill response equipment.

When tanker loading is complete and the vessel departs:

- Tran Mountain's Loading Master stays on board until pilots come to move the vessel away from the dock.
- After the tugs are made fast, the tanker is cast off and typically goes to anchorage to wait for tide for the Second Narrows transit, as required by Port Metro Vancouver's Harbour Operations Manual.
- Two Pacific Pilotage Authority-certified pilots come aboard to safely navigate the tanker out of Canadian waters. Laden tankers must have two pilots on board, one to ensure safe conduct of the vessel and one to monitor the bridge crew and ship systems.
- Port Metro Vancouver's Harbour Operations Manual defines the Second Narrows Movement Restriction Area and associated rules of transit, including daylight transit, size restrictions, required tug escorts and speed restrictions. Only one vessel at a time is allowed in the Second Narrows Movement Restriction Area and First Narrows. Marine Communications and Traffic Services monitors the tankers' progress and other vessels' traffic in the Vancouver Harbour.
- Before the transit begins, Marine Communications and Traffic Services declare a clear narrows and the Canadian National Railway is contacted to raise its rail bridge, which spans the Second Narrows.
- Port Metro Vancouver's rules require that two large tugs be tethered to the stern and at least one tug to the bow for the Second Narrows Movement Restriction Area transit. The two large tugs tethered to the stern are required for the transit through the remainder of Vancouver Harbour.
- After clearing the First Narrows, the escort tugs fall away and the tanker transits without escort until it approaches the East Point on Saturna Island.
- The Pacific Pilotage Authority has established tug escort requirements for the Salish Sea region, in particular in Haro Strait through Boundary Pass. A single large tug must be tethered to the tanker before East Point and remain tethered until Victoria. The tug remains in untethered escort until the tanker passes Race Rocks.
- The two Pacific Pilotage Authority-certified pilots disembark at the Victoria pilot station near Brotchie Ledge.
- The tug leaves the tanker at Race Rocks as the tanker enters the Juan de Fuca Strait.
- No pilotage or escort is required through the Juan de Fuca Strait but the tanker and all other traffic are monitored by Marine Communications and Traffic Services.
- United States industries fund a rescue tug at Neah Bay, Washington, to assist any vessels in distress in the Juan de Fuca Strait.
- Upon clearing the Juan de Fuca Strait, the tanker continues to its destination.

Trans Mountain said that Trans Mountain shippers exporting crude oil via Westridge are aware of the need to only nominate tankers of high operating standards. Shippers know a tanker that fails to be accepted or is rejected outright could lead to delays and business loss. Trans Mountain said that it has not had to reject a tanker once it had been deemed acceptable at the conclusion of the pre-screening for scheduling purposes.

14.4.2 Marine shipping risk analysis

Numerous participants, including Ms. Daphne Louis and Ms. Sheila Harrington, said that the significant increase in tanker traffic associated with the Project would increase the risk of a large spill and said that the risk of a catastrophic oil spill is too great to allow the Project to proceed Participants referred to the potential for a spill from a tanker at berth or within Burrard Inlet to be 8,000 m^3 or more or for a spill along the marine shipping routes to be the complete loss of the tanker's cargo. Participants said that such scenarios should be considered credible worst-case scenarios.

Lopez No Coalition said that although project tankers will be double hulled and accompanied by tugs, the probability of such a major oil spill in San Juan Islands waters cannot be completely eliminated.

Trans Mountain said that its marine shipping risk analysis considered regional traffic growth, navigational hazards, vessel construction, and risk controls under the existing marine shipping safety regime. The analysis identified potential locations for tanker accidents, the probability of an incident and potential spill volumes associated with those incidents. It said that its marine shipping risk analysis was based on the use of Aframax tankers and the spill volume associated with a credible worst-case spill scenario was 16 500 m^3, with a mean case spill volume of 8 250 m^3. Neither of these spill volumes represented the loss of the entire cargo of an Aframax tanker and Trans Mountain said that such an event was so unlikely it was not a credible event. Trans Mountain said that exclusive use of smaller Panamax vessels for the risk assessment would not materially change the overall oil spill risk.

Following its marine shipping risk analysis, Trans Mountain conducted additional detailed analysis indicating that any large volume tanker spill within Burrard Inlet would not be a credible event. This conclusion was based on lack of energy to puncture the hull and marine safety mitigation measures within Burrard Inlet and area such as pilotage and traffic restrictions.

Trans Mountain's marine shipping risk analysis identified eight locations along the tanker route where there is a higher degree of navigation complexity and probability of an incident due to a navigation issue involving collision or grounding of a tanker due to vessel traffic or narrow passage width (Figure 27). Five of these eight locations were then modeled for hypothetical spill scenarios as described in section 8.3. Trans Mountain said that it chose its modelling locations based on an assessment of both probability and consequence associated with an oil spill. Spill modelling was not conducted at locations B and C because of the low probability of an accident occurring at these locations. Site F was not modeled because the modelling conducted at site G would be representative of both locations.

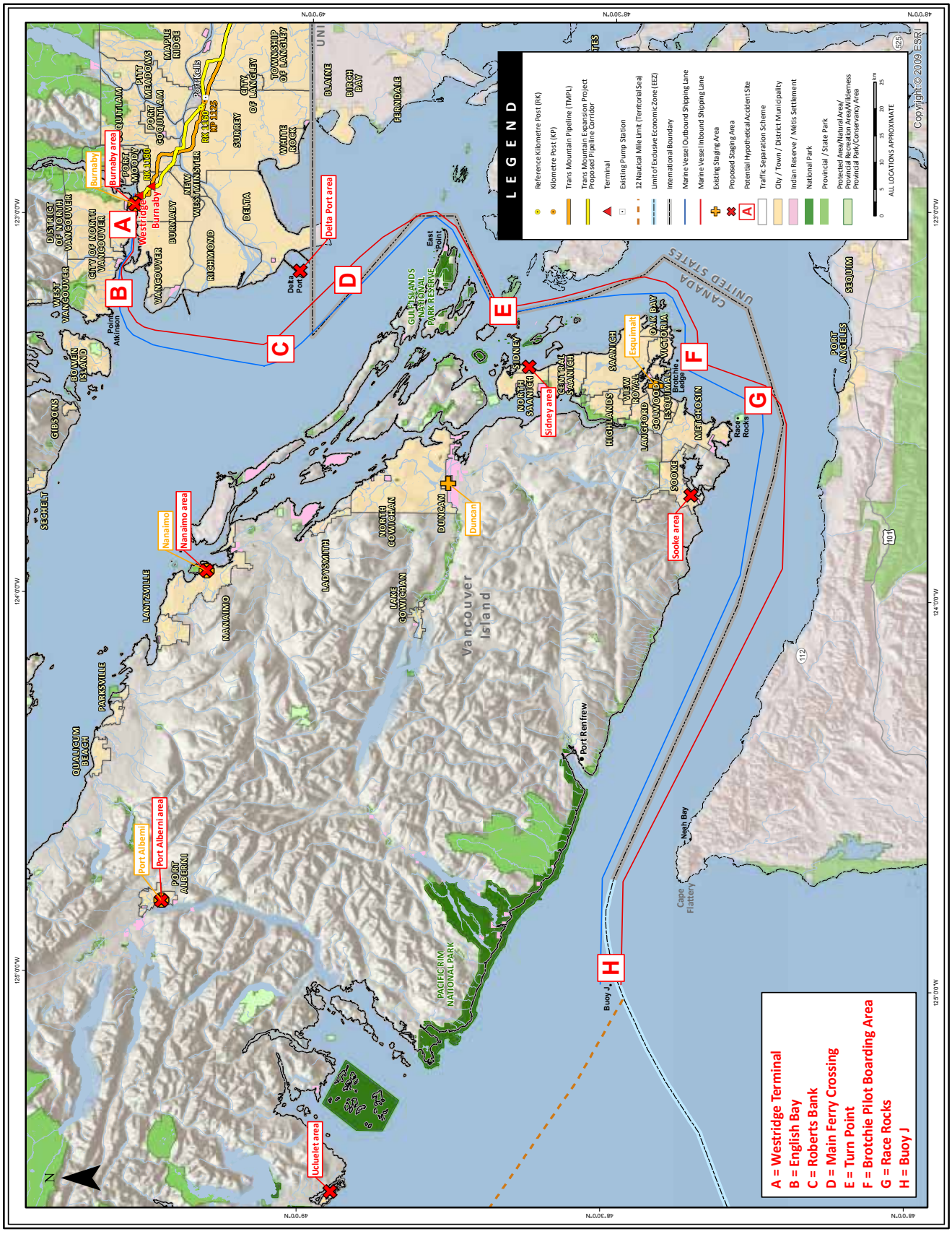
The Tsleil-Waututh Nation, the City of Vancouver and the City of Burnaby said that spill volumes ranging from 8 000 m^3 at the WMT to 16 000 m^3 at other locations in Burrard Inlet and area, including from a tanker at anchor in English Bay, were credible worst case scenarios.

Trans Mountain said that its risk assessment work indicated that there was a very low likelihood of major oil spills within Burrard Inlet and English Bay and that no credible large oil spill scenarios in these segments of the transit were identified. In response to the assertion made by Tsleil-Waututh Nation, City of Vancouver and the City of Burnaby that 16 000 m^3 in English Bay was a credible scenario, Trans Mountain said that a potential large spill for a tanker at anchor in English Bay was not credible because:

- there is no incident on record of a vessel being struck by another while at anchor in English Bay;
- the selected spill site is close to 2 km from the route used by those vessels that are large enough and capable of causing sufficient damage to the inner hull of a double hull tanker at anchor as to cause an oil spill;
- vessels entering Burrard Inlet are subject to a number of navigational and safety measures;
- a laden tanker would almost always proceed directly to sea and not anchor in English Bay; and
- it would take more energy on the part of the colliding vessel to breach a vessel at anchor than it would if both vessels were moving.

The Cowichan Tribes critiqued Trans Mountain's marine shipping risk analysis including the model upon which the analysis was based. The Cowichan Tribes said that while the underlying methodology was sound and followed industry accepted practice, the underlying data and details of the implementation lead to several significant weaknesses. It said that key conclusions drawn from Trans Mountain's analysis were incomplete and misleading.

Figure 27: Possible locations for an accident involving a Project-related tanker



The City of Vancouver said that Trans Mountain's marine shipping risk assessment incorrectly focused on hazard probability instead of risk and this resulted in an improper exclusion of a large range of low probability, high consequence events from the risk assessment. It said that an assessment of the risk of a diluted bitumen spill to Vancouver requires an assessment of both the likelihood of a spill occurring and the impact of a spill on Vancouver.

Metro Vancouver said that Trans Mountain failed to adequately assess the potential effects of a credible worst-case oil spill scenario of 16 500 m^3 within Burrard Inlet, and the associated impacts on air quality, human health and environment.

Trans Mountain said that intervenors, such as the Cowichan First Nation, the City of Vancouver and Metro Vancouver, focused on potential consequences associated with spills but did not consider the likelihood of such an incident occurring. Trans Mountain said that by focusing on consequences, these intervenors did not consider: the presence (or lack) of hazards that might cause accidents, the engineering and procedural controls and safety management systems which are applied to reduce their likelihood, or steps that might be taken to mitigate the consequences.

Concerned Registered Professional Engineers said that the spill return periods estimated by Trans Mountain are mathematically equivalent, for example, to a 10 per cent probability that a spill of 8.25 million or more litres will occur in a 50 year operating period, even taking into account all the proposed mitigation strategies (e.g., use of escort tugs). Concerned Registered Professional Engineers said that this risk was unacceptable.

The Tsawout First Nation compared Trans Mountain's marine shipping risk estimates to alternative methodologies. The Tsawout concluded that Trans Mountain's spill risk estimates are at the low end of the range of estimates and work conducted by the Tsawout was at the upper end of the range of estimates. The Tsawout said that a comparison of strengths and weaknesses for each method suggests that there is no single best guess estimate of potential spill risk from the increase in Project-related tankers. It said that Trans Mountain's estimates should not be relied upon as an accurate estimate of tanker spill risk.

In response to the Tsawout First Nation's work, Trans Mountain said that it did not agree with the Tsawout's conclusions and that it took exception to several aspects of the report. Trans Mountain said that the Tsawout had made no attempt to gather independent data and carry out a structured risk assessment as had been done for Trans Mountain or for Transport Canada as part of the Tanker Safety Expert Panel Review. Trans Mountain said that the results of the risk assessment conducted for the Tanker Safety Expert Panel and its own risk assessment were closely correlated.

The Islands Trust Council, Pacheedaht First Nation and Capital Regional District also referred to the marine shipping risk assessment prepared for Transport Canada and the report of the Tanker Safety Expert Panel. The participants said the information confirms that there is high risk associated with oil spills in the waters off the southern coast of Vancouver Island, due to large volumes of marine traffic close to environmentally sensitive areas. Capital Regional District said that the risk would increase further if tanker traffic increased. The Islands Trust Council noted that the Tanker Safety Expert Panel report said that the southern coast of B.C., including Vancouver Island, was one of two areas in Canada with the highest potential impact from a spill.

Participants filed comments regarding recent marine shipping risk assessment work conducted in Washington State. The United States Environmental Protection Agency recommended that the NEB review the Vessel Traffic Risk Assessment Study developed for the Gateway Pacific Environmental Impact Assessment for additional conditions that the NEB or other Canadian agencies may require for vessel traffic associated with the Project.

Trans Mountain said that the NEB's Filing Requirements Related to the Potential Environmental and Socio-economic Effects of Increased Marine Shipping Activities required it to include an assessment of potential accidents at the Terminal and at representative locations along the marine shipping routes. Selection of locations should be risk-informed, considering both probability and consequence, and that the assessment must include a description of credible worst-case spill scenarios and smaller spill scenarios.

Trans Mountain said that the TERMPOL Review Process Guidelines do not define a credible worst-case scenario but that the definition is determined by the risk assessor and then evaluated by the TERMPOL Review Committee. Trans Mountain said that there is no precedent of complete loss of all cargo from a double hull tanker. Its analysis concluded that the credible worst-case spill volume along the tanker route was 16 500 m^3. The volume of oil spilled during an accident is directly related to the severity of the incident

and the type and extent of damage caused. Therefore, the probability of a very large oil volume being released during a tanker incident must be assessed, in the first place, based upon the probability of the selected location being capable of hosting such a severe incident.

Trans Mountain said that there are no proposed or widely accepted risk acceptance criteria for marine oil spills. If criteria were defined, the proposed operations could be either acceptable or not acceptable. Trans Mountain said that its quantitative marine risk assessment shows a substantial reduction of risks, on a risk per cargo transported basis. This was achieved by adopting an informal risk acceptance criterion for marine oil spills of "minimum increase of risk compared to present day operations." Trans Mountain said that the adoption of such an approach resulted in the proposed extraordinary precautionary measures undertaken during tanker loading and transit and its proposal to significantly enhance oil spill response in the region.

Trans Mountain's additional mitigation measures

Trans Mountain said that, with existing mitigation measures, a project-related spill from a tanker would be an unlikely event. It said that its marine shipping risk analysis concluded that existing risk controls in the project area are comparable to global best practices. To increase shipping safety, Trans Mountain proposed a number of enhancements, including extended tug escort through the Strait of Georgia.

Trans Mountain identified the possibility of drift grounding[80] or collision with another vessel as key areas of navigation where additional mitigation would result in a significant improvement to navigational safety. To reduce oil cargo spill risk resulting from the Project, Trans Mountain proposed an increase in the existing level of tug escort for laden Project-related tankers during their entire passage from the WMT to Buoy J, near the limit of Canada's territorial sea. This would be outside of the Pacific Pilotage Authority and Port Metro Vancouver's geographical jurisdiction.

Trans Mountain said that, if the requirements for enhanced tug escort are not mandated under federal regulation, it would develop a tug matrix for inclusion as part of its Tanker Acceptance Standard. This standard would prescribe minimum tug capabilities required upon departure of the tanker from the WMT. The tug matrix would define the capabilities and number of tugs required for foreseeable meteorological and ocean conditions and would be based on tanker and cargo size. Trans Mountain said that, should weather conditions be forecast to exceed the criteria established in the tug matrix or the capabilities of available tugs, a tanker would be required to delay its departure until the weather subsides or a sufficient escort was available. This situation was not expected to be common.

The TERMPOL Review Committee supported Trans Mountain's proposed enhanced tug escort requirements and recommended that a tug matrix should be developed in consultation with the Pacific Pilotage Authority, British Columbia Coast Pilots and Transport Canada.

Trans Mountain said that it's Tanker Acceptance Standard requires that vessels departing Canada via the Juan de Fuca Strait take the most direct route out of the Canadian Exclusive Economic Zone (EEZ) (200 NM from coast of Canada). This reduces the exposure to circumstances where a disabled tanker could run aground on Canada's coastline, as the tanker's risk for drift grounding steadily declines as its distance from shore increases. Trans Mountain said that within 61 km (33 nautical miles) of leaving Buoy J (i.e. within about three hours) the tanker is beyond the limits of the Voluntary Tanker Exclusion Zone which is considered by Transport Canada as the point where there is sufficient time and distance to secure external marine resources to prevent grounding in an emergency. Prior to this, the escort tug would be available to return to assist the tanker.

San Juan County Council recommended that prior to Project approval, a prepositioned emergency towing vessel capable of responding to any vessel that has lost power be located in the area of Boundary Pass and Haro Straits.

The Pacific Pilotage Authority submitted information regarding its tug escort requirements and recent changes and amendments to those requirements. The Pacific Pilotage Authority concluded that it had done "exemplary work in determining the requirements for tethered escort tug on the West Coast" and they "will continue to use these principles for all new liquid bulk proposals."

80 A tanker losing power and drifting on to a rocky shore

Trans Mountain said that with the implementation of its proposed mitigation of additional dedicated tug escort and other risk reduction measures, the return period for a spill of any size from Project-related tanker traffic would be 1 in 284 years and return periods for the mean case spill volume and credible worst-case spill scenario would be 1 in 568 years and 1 in 2841 years respectively. Trans Mountain said that this would maintain the potential oil spill risk associated with the increased tanker traffic resulting from the project at close to the level associated with the current level of tanker traffic.

Trans Mountain's expert consultant, Det Norske Veritas, said that, with implementation of Trans Mountain's proposed extra risk controls, the level of care and safety in the study area would be raised well above globally accepted shipping standards.

Conclusions of the TERMPOL Review Committee

The TERMPOL Review Committee supported key risk reduction measures proposed by Trans Mountain and concluded that it did not consider the overall increase in marine traffic levels to be an issue. The Committee said that while there will always be some risk in any project, after reviewing Trans Mountain's studies and taking into account its commitments, it had not identified any regulatory concerns, associated with Project-related tankers, for the tankers, tanker operations, the proposed routes, navigability, other waterway users and the marine terminal operations. The Committee said that implementation of its findings and recommendations, in conjunction with Trans Mountain's commitments, would provide for a higher level of safety for tanker operations commensurate with the increase in traffic.

Trans Mountain said that it supported and agreed to adopt each of the Committee's findings and recommendations.

Trans Mountain said that it would appropriately implement, monitor and enforce adherence to marine shipping best practices, commitments such as enhanced tug escort, and other requirements through its Tanker Acceptance Program, as a member of the Board of Directors of WCMRC, regular shipper meetings and close liaison with marine authorities.

Views of the Board

The Board accepts the evidence filed by Trans Mountain regarding marine shipping navigation and safety, including the reports filed as part of the TERMPOL Review Process. The Board finds that Trans Mountain's application met the requirements outlined in the Board's 10 September 2013 "Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increased Marine Shipping Activities" regarding spill prevention.

Marine shipping regulatory framework

In section 14.2.1, the Board summarized the existing regulatory regime related to marine shipping navigation, safety, spill prevention, environmental protection, emergency response and preparedness. These areas are not under its regulatory jurisdiction.

The evidence before the Board indicates that there are competent authorities responsible for this regime and that these jurisdictions cooperate with each other and other organizations in facilitating the safety of marine shipping. The evidence indicates that the regime is functioning appropriately. The evidence indicates that the regime is reviewed periodically and there is currently a review of the regulatory regime occurring. Any changes to the existing regime would be the responsibility of those competent authorities.

The Board acknowledges the work of the TERMPOL Review Committee and, as it said in its 10 September 2013 marine shipping filing requirements, the Board did not duplicate the work undertaken by the TERMPOL Review Committee.

The Board notes that the TERMPOL Review Committee made a number of findings and recommendations in its report, and that Trans Mountain said that it supported and agreed to adopt each finding and recommendation.

Safety measures

The Board accepts Trans Mountain's evidence that the global safety record in the marine industry, particularly for oil tankers, has improved continuously over the past 40 years due to regulatory changes, improved safety procedures, and improved tanker design such as double hulls.

The Board accepts the evidence filed about tanker construction, design and operations. The Board acknowledges the legal requirements governing vessels entering Canadian waters and also, the requirements set out in Trans Mountain's Tanker Acceptance Standard. The Board is of the view that the evidence filed by those bodies that regulate marine shipping and by Trans Mountain indicate that there is an acceptable level of safety in place regarding marine shipping associated with the Project. To monitor future developments of Trans Mountain's Tanker Acceptance Standard, the Board would impose Condition 134 requiring Trans Mountain to file the Standard and future updates with the Board.

Some participants raised the need for additional tugs to escort Project-related vessels and Trans Mountain made a voluntary commitment to implement enhanced tug escort measures that exceed regulatory requirements. Evidence filed by Trans Mountain, Transport Canada and the Pacific Pilotage Authority indicates that tug escort is an important mitigation measure. In its report, the TERMPOL Review Committee supported the implementation of Trans Mountain's key risk reduction measures, including but not limited to, enhanced tug escort. The Board expects Trans Mountain to follow through on this voluntary commitment and would make it a requirement of any certificate issued by imposing Condition 133 requiring Trans Mountain to implement enhanced tug escort measures. Should such a voluntary commitment become mandatory under federal marine shipping-related legislation, Trans Mountain could apply to the Board to have its certificate varied accordingly.

Marine shipping risk analysis

The Board accepts the evidence filed by Trans Mountain regarding potential spill risks associated with Project-related marine shipping. The Board notes that, in its report, the TERMPOL Review Committee did not identify any concerns regarding Trans Mountain's marine shipping risk analysis. Instead, the Committee said that it had not identified any regulatory concerns related to the marine shipping component of the project and that it did not consider the overall increase in marine traffic levels to be an issue.

The Board acknowledges the evidence filed by participants who raised concerns about Trans Mountain's marine shipping risk analysis. Several participants criticized Trans Mountain's risk assessment methodology and said that the risk of a catastrophic oil spill is too great to allow the Project to proceed. Others said that, even with double hulled tankers and tugs escorts, the probability of such a major oil spill cannot be completely eliminated.

Participants such as the Tsawout First Nation and Concerned Registered Professional Engineers commented on interpreting the results of Trans Mountain's marine shipping risk analysis. The Tsawout First Nation said that Trans Mountain's estimates should not be relied upon as an accurate estimate of tanker spill risk. Concerned Registered Professional Engineers said that the spill return periods estimated by Trans Mountain are mathematically equivalent, for example, to a 10 per cent probability that a spill of 8.25 million or more litres will occur in a 50 year operating period, even taking into account all the proposed mitigation strategies (e.g., use of escort tugs).

Having considered these participants' comments, the Board accepts Trans Mountain's evidence that there are no proposed or widely accepted risk acceptance criteria for marine oil spills. The Board understands that the marine shipping risk assessment performed for the Project-related tankers and the marine shipping risk assessment undertaken for Transport Canada and the report of the Tanker Safety Expert Panel do not recommend stoppage of marine shipping in the area. Rather, such risk assessments are intended to inform mitigation to lessen the potential for an accident to occur, and for spill response planning. That is, the Board does not view the results of these risk assessments as absolute indicators of the actual probability of a spill occurring.

To the extent that risk assessments conducted in Washington State and associated recommended marine shipping mitigation may be relevant to the Project, the Board expects that the appropriate competent authorities such as Transport Canada and Canadian Coast Guard would review and consider such information.

Marine shipping risk

The Board recognizes that the south coast of B.C. has been identified as a high risk area. The Board understands that this designation is based on both the environmental sensitivity of the area and the probability of a tanker spill occurring. The Board has considered the probability as well as the consequences of a spill in its assessment of the evidence before it. The Board's views on the consequences associated with tanker spills are included in section 14.6.

The Board is of the view that although a large spill from a tanker associated with the Project would result in significant adverse environmental and socio-economic effects, such an event is not likely. This view is based on the totality of evidence before the Board, including, but not limited to:

- *the regulatory framework in place and associated regulatory improvement initiatives;*
- *continuous improvement in the global safety record for oil tankers over the past 40 years due to regulatory changes and improved safety procedures;*
- *all shipping associated with the Project would occur within established shipping routes;*
- *the results of Trans Mountain's marine shipping risk analysis;*
- *existing and enhanced safety measures that would apply to the Project;*
- *the findings and recommendations of the TERMPOL Review Committee; and*
- *the results of marine shipping risk assessment work conducted for Transport Canada and the Tanker Safety Expert Panel.*

Specific to potential spills in Burrard Inlet, the Board heard considerable concern regarding potential spill risk, the resultant potential effects from a large spill, and Trans Mountain's exclusion of assessment of those effects from its environmental effects assessment. As discussed further in this chapter and Chapter 10, the Board finds that based on evidence filed by Trans Mountain and intervenors, a large spill in Burrard Inlet would result in significant adverse environmental and socio-economic effects. Evidence filed by parties such as the City of Vancouver, City of Burnaby and the Tsleil-Waututh First Nation indicate the potential extent of such effects. However, based on the evidence before it, the Board finds that a large spill in Burrard Inlet is not a likely event.

The Board does not accept the assertion made by participants that spill volumes ranging from 8 000 m^3 at the Westridge Marine Terminal to 16 000 m^3 at other locations in Burrard Inlet are credible worst-case scenarios. The Board notes that Trans Mountain's risk assessments show a very low likelihood of major oil spills within Burrard Inlet and English Bay. No credible large oil spill scenarios in these segments of the transit were identified and this view is supported by the TERMPOL Review Committee's report. Further, in response to a question from Port Metro Vancouver, Trans Mountain filed additional evidence indicating that an incident in Burrard Inlet would not be likely to puncture a double-hulled tanker. Trans Mountain also discussed specific marine safety mitigation measures within Burrard Inlet and area such as pilotage, tug escort, and traffic restrictions. The Board accepts Trans Mountain's evidence in response to the assertion made by Tsleil-Waututh Nation, City of Vancouver and the City of Burnaby that a potential large spill for a tanker at anchor in English Bay is not credible. Among other reasons, Trans Mountain said that there is no incident on record of a vessel being struck by another while at anchor in English Bay; in the event of a collision, there would not be sufficient energy to puncture both hulls of a double hull tanker; and a laden tanker would not be likely to anchor in English Bay.

14.5 Emergency preparedness and response

Trans Mountain said that in the event of an accident resulting in an oil spill from a vessel in Canadian waters, the master of the tanker, as the responsible party and in accordance with the law, would notify Canadian Coast Guard as per the procedure in the approved Shipboard Oil Pollution Emergency Plan. If the tanker operator were unable or unwilling to assume the role of incident commander, the role would automatically transfer to the Canadian Coast Guard. The responsible party would then activate the response organization, WCMRC, to provide the equipment and resources to respond to the spill.

The District of North Vancouver said a spill response study prepared for the British Columbia Ministry of the Environment concluded that "while all parties should strive for excellence in designing and implementing a marine spill prevention and response system, it should be acknowledged that spills can happen even with the best possible measures in place and that even the best possible spill response system cannot guarantee that resources at risk will be protected from negative impacts if a spill occurs."

Similarly, Dr. Lance Barrett-Lennard said that based on past spill events, a large spill could never be entirely or even largely contained, with even the best equipment, training and will in the world. He said that real-world conditions of the west coast of B.C. would cause a fraction of any oil to sink and become impossible to clean up. The fraction of sunken oil would be higher for crude, bunker C or diluted bitumen.

14.5.1 Current marine oil spill preparedness and response measures on the west coast

Trans Mountain said that Canada's marine spill response regime is built on the principle of cascading resources, which means that in the event of a spill, the resources from a specific area can be supplemented with those from other regions or from international partners, as needed.

The Canadian Coast Guard said that under Canada's Marine Oil Spill Preparedness and Response Regime, the polluter is ultimately responsible for cleaning up and paying for its own marine spills.

Transport Canada and Trans Mountain said that the Response Organizations and Oil Handling Facilities Regulation under the Canada Shipping Act, 2001 establishes certified response organizations to provide emergency response capability, leadership and support in the case of an oil spill in a marine environment.

Western Canada Marine Response Corporation is the Transport Canada-certified response organization to respond to oil spills on the West Coast of Canada. Vessels and oil handling facilities, such as the WMT, must have an arrangement with a certified response organization. Transport Canada and Trans Mountain said that vessels must also have a Shipboard Oil Pollution Emergency Plan and that oil handling facilities such as the WMT, must have an Oil Pollution Emergency Plan and an on-site Oil Pollution Prevention Plan.

Western Canada Marine Response Corporation maintains its certification by undertaking a number of equipment deployment exercises, tabletop exercises, and oil spill response training courses and scenarios within the certification period.

Trans Mountain described Transport Canada's National Aerial Surveillance Program for vessels within Canadian waters. Under this program, Transport Canada performs aerial surveillance over all Canadian waters to detect pollution from ships, deterring potential polluters from dumping oil and other pollution while transiting Canadian waters. Trans Mountain stated that there is an obligation for owners of vessels and operators of oil handling facilities to report marine spills to the Canada Coast Guard. Transport Canada said that, as a part of its World-Class Tanker Safety System measures, it would expand the National Aerial Surveillance Program to deter potential polluters, and identify any pollution incidents early.

Trans Mountain said that WCMRC's area of operation for oil spill recovery and clean up covers all of Canada's West Coast and all internal navigable waters and is referred to as the Geographic Area of Response. Within the Geographic Area of Response, there are particular areas designated by Transport Canada as needing more rigorous planning standards given the increased risks associated with greater traffic density, convergence of vessels, and volume of oil transported. These areas are termed Designated Ports, Primary Area of Response and Enhanced Response Areas (Figure 28). A more rapid response is mandated for a designated port.

Trans Mountain said that within the Port of Vancouver (a Designated Port), WCMRC is required to maintain a dedicated package of response equipment that is capable of responding to a 150 tonne spill within 6 hours. The WMT is within this area. Trans Mountain said that it would be responsible for undertaking a response at the WMT using Trans Mountain's own, and WCMRC, resources.

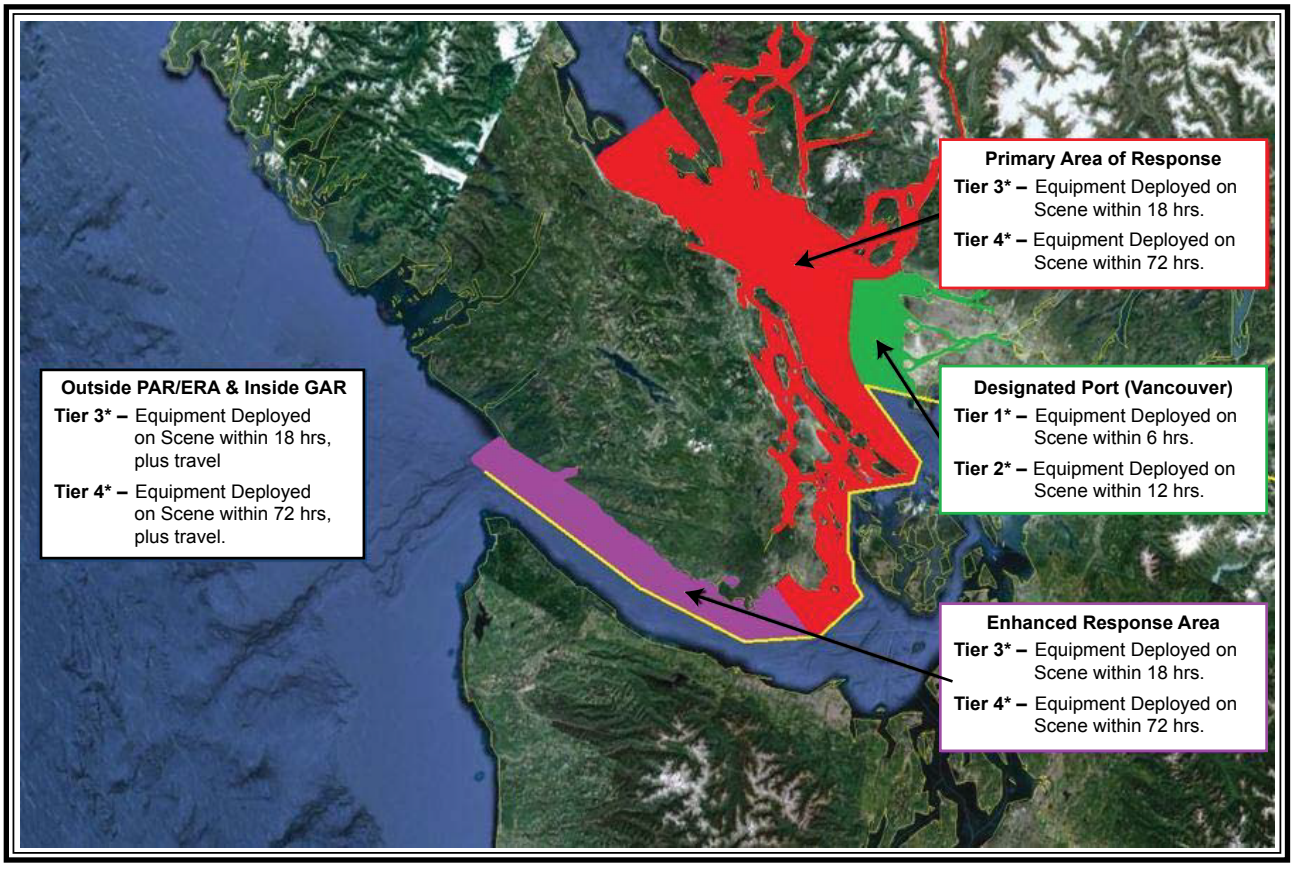
Trans Mountain said that the majority of spills greater than 1,000 tonnes occur outside port boundaries where shipping lanes converge. The Primary Area of Response for the Port of Vancouver extends from the Port boundary to a distance of 50 nautical miles in all directions.

Trans Mountain said that an Enhanced Response Area covers areas not within the Designated Port or Primary Area of Response but that still have a higher risk of oil spills due to traffic convergence and volume of shipping.

Trans Mountain said that WCMRC would respond, under the guidance of the Incident Command System, to a spill of any size. It said that, although WCMRC is government-certified for a 10,000 tonne response capacity, its current equipment capacity is actually rated at 27,000 tonnes. Additional support for a large spill would be cascaded through contractors and mutual aid partners.

The Canadian Coast Guard said that it has bilateral agreements or administrative arrangements with the United States, France and Denmark and can call upon all signatories to the International Convention on Oil Pollution Preparedness, Response and Cooperation to provide mutual aid in the event that a spill exceeds

Figure 28: Western Canada Marine Response Corporation areas of response



the capacity for Canada to respond. The level of support and equipment provided by each nation depends on availability of resources.

Trans Mountain described WCMRC's resources to enable it to meet Transport Canada's mandated response planning standards. Trans Mountain said that Transport Canada inspects the entire WCMRC equipment inventory over a continuous 3-year cycle. Trans Mountain described the mutual aid agreements that WCMRC has in place with Canadian and US counterparts. These provide WCMRC with the ability to call on those resources for assistance and equipment in case of a large oil spill. It said that as a result of these agreements, organizations train and exercise together, ensure equipment is compatible, and share communication frequencies and best management practices.

The Village of Belcarra said that WCMRC should develop a geographic response plan for the Central Burrard Inlet. Trans Mountain said that WCMRC, in collaboration with federal government agencies, local governments, First Nations, and other stakeholders, has been developing new coastal Area Plans to prepare responders for the unique aspects of the B.C. coastline. A subset of Area Plans is Geographic Response Plans which are created to reduce the time needed to make decisions during the initial response, and provide information about the site and strategies needed to protect sensitive resources and promote a fast and effective response.

Trans Mountain said that WCMRC was updating its coastal sensitivity maps with an enhanced coastal mapping system for the B.C. Coast. This system will include coastal sensitivities and associated Geographic Response Strategies and all associated logistical support information. Trans Mountain said that the coastal mapping program was being extended to the entire tanker-shipping route, with a planned completion date of 2017. The program began in 2013 with the initial focus on higher traffic areas such as Vancouver Harbour, southern Georgia Strait, Haro/Juan de Fuca Straits, associated Douglas Channel passages, and Prince Rupert. Pre-spill Shoreline Cleanup Assessment Technique requirements, for high-risk areas, would also be addressed concurrently with the geographic response plan planning process.

Washington State Department of Ecology said that Trans Mountain should be required to fund and help develop, test and implement a joint geographic response plan with Washington State Department of Ecology to address the risk from vessels carrying diluted bitumen through shared waters in the Salish Sea.

The District of North Vancouver, the City of North Vancouver and the District of West Vancouver said they fund the North Shore Emergency Management Office. This office supports municipal and regional response capabilities for the North Shore area. These intervenors expressed concerns regarding the level of cooperation in spill response planning and actual spill response between municipalities such as themselves and the Canadian Coast Guard and WCMRC.

The City of Port Moody and the City of Vancouver raised concerns regarding the level of information shared with them by Trans Mountain and WCMRC regarding resources and response expectations in the event of an emergency, and emergency response planning documents.

The Georgia Strait Alliance surveyed emergency planning personnel from coastal local governments in the Georgia Strait region. The respondents expressed concerns regarding information sharing from WCMRC on the local government's role in marine spill response and the lack of engagement on spill response planning initiatives such as geographic response strategies and training and exercises.

The Capital Regional District expressed concerns that local governments along the tanker routes have legal obligations to respond to emergencies within their jurisdiction but may not have sufficient resources to respond to a major oil spill.

Response measures

The Cowichan Tribes said that the physical properties associated with weathered diluted bitumen significantly reduce response tactic options and effectiveness in areas such as mechanical recovery, shoreline cleanup and reduced natural recovery. It said that there is a high likelihood that weathered bitumen-based crude oil will either sink or submerge in conditions of the Salish Sea or Pacific Ocean. The Cowichan Tribes said that there are no practical on-water solutions to contain and recover a large oil release if it sinks or submerges. It also said that a much higher number of shore-based workforce personnel would be needed for cleanup of a bitumen-based crude oil that has emulsified, than compared to a conventional crude oil. This is because of the need for more labour -intensive shoreline cleanup using shovels, rakes and buckets.

Mechanical recovery - booms and skimmers

Trans Mountain said that the existing response planning standards focus on mechanical recovery such as booming and skimming.

Trans Mountain said that in spill response, booms have three purposes: to protect resources; to concentrate oil into thicker patches; and to increase the encounter rate between the oil and skimmer.

The Village of Belcarra said that it is important that Trans Mountain consider wind and wave conditions with Burrard Inlet in its design and selection of containment booms for deployment around tankers when loading at the WMT. In response, Trans Mountain said that the boom deployed around the tanker could contain up to 12 000 m^3 of oil depending on the type of boom used and environmental conditions. Trans Mountain said its risk assessment had not identified any viable circumstance that could require the containment to hold more than 103 m^3, which is the credible worst-case scenario spill volume during cargo transfer.

Dispersants and in-situ burning

Trans Mountain said dispersants and in-situ burning have proven effective in minimizing environmental harm in the event of a spill. Trans Mountain said that pre-approval for the use of other response techniques would avoid delays that diminish the effectiveness of these techniques in situations where their use would offer a desirable means of diminishing environmental harm. Trans Mountain submitted that response organizations should be empowered with conditional pre-approvals for in-situ burning, the use of dispersants and beach-cleaning agents.

Trans Mountain said that dispersants are not approved for use in Canada and in-situ burning is not pre-approved. In the event of a spill response, strategies for use of these counter-measures would be developed under an Incident Command System structure and approved by Unified Command. This structure would be expected to include ECCC and the B.C. Ministry of Environment who would provide advice on environmental priorities. Any decision to use dispersants or in-situ burning would be based on a net environmental benefit analysis and would need approval of the appropriate regulatory authorities. Trans Mountain said that a net environmental benefits analysis assesses the net environmental benefits gained by clean up and remediation, in consideration of the environmental injuries caused by those activities, with the objective of enhancing recovery outcomes while minimizing further environmental damage.

Trans Mountain said that its research indicated that dispersants tested were only marginally effective on free-floating diluted bitumen for up to six hours, and were not effective on diluted bitumen that had weathered for over one day.

Trans Mountain said that because in-situ burning creates a dense smoke plume, burning in or near population centers is unlikely to be approved. It said that the effectiveness of in-situ burning can diminish as weathering of the oil progresses.

Response to marine vessel fires

Trans Mountain said that all tankers are required to carry firefighting systems that consist of water, foam, and other chemicals. It said that private tug operators operate fire-fighting capable tugs from their bases in Vancouver Harbour.

The City of Vancouver said that in the event of an oil spill resulting in a fire or explosion on board a tanker, the City does not currently have the training or equipment to fight shipboard fires on tankers. It said that it was in the process of finalizing an agreement with Port Metro Vancouver that it would provide fire-fighting support (e.g., external hull cooling, and supply delivery) for vessels over 75 feet. Firefighting support would be on a response-available basis.

Tracking and recovery of submerged and sunken oil

Trans Mountain filed information from WCMRC which said that submerged oils are defined as those products that are either neutrally buoyant or have slight negative buoyancy such that they lie below the surface of the water, often migrating vertically in the water column. Sunken oils are those products that have fallen to the bottom; some submerged oils eventually become sunken oils. Spilled heavy oils, including heavy crudes and fuels such as Bunker C, have the potential to become submerged or sunken during weathering when exposed to the right combination of overwash, sediment load and mixing energy. Exposure

to a single condition is unlikely to cause heavy oils to become submerged or to sink. Oils that have fallen below the surface of the water can also resurface elsewhere in the water plane as environmental conditions influencing the oil change its fate and behavior. Heavy oils can submerge or sink in both freshwater and marine environments.

WCMRC said that since any type of oil could eventually submerge, responding to floating oil has the highest priority. At the same time, technologies and techniques are used to track submerged oils so that appropriate response tactics can be applied. Depending on the level of submergence, some oil may be within the recovery range of conventional technologies such as brush skimming systems. Otherwise, based upon tracking results, a response can be set up at suitable containment, impoundment and recovery locations to intercept submerged oil.

The Shxw'ōwhámel First Nation said that when spilled oil sinks, or becomes submerged in the water column, it can often be very difficult to detect. It also provided information on various detection and recovery methods for submerged and sunken oil. It said that there are varying degrees of success with the use of such methods.

The Living Oceans Society submitted an overview of spill response technologies for viscous oils that submerge. The report concluded there is a need to improve countermeasures for these oils. It outlined the challenges in locating, containing and removing submerged oil and said that, if spilled oil becomes suspended between the water's surface and the bottom, it is unlikely that any commercially available response technologies can be successfully applied to significantly control the spill. Shoreline cleanup operations would have to be initiated in the event the oil stranded on shore. It said that there are some possible recovery techniques for sunken oil, but it noted that each has specific limitations.

Trans Mountain said that its spill contingency plans for the expanded Trans Mountain Pipeline system would consider mitigation and remediation of suspended or sinking oil for spills in a marine environment. It said that various studies and tests indicate that responding to a diluted bitumen spill is no different than responding to a spill of bunker fuel or other heavy crude oil. Trans Mountain said that WCMRC maintains, and will continue to maintain in future, the capability and capacity to respond to all types of oil spills[81].

Trans Mountain said that relative to oil that remains floating, locating oil that has sunk or submerged is more difficult and that the difficulty increases in proportion with the difficulty of accessing the submarine environment. Where it is extremely difficult to access the submarine environment it would be extremely difficult to locate oil that has submerged. If located, Trans Mountain summarized potential recovery technologies and techniques for submerged and sunken oil. Trans Mountain said that remediation of submerged and sunken oil would likely carry on after the emergency phase of a spill response.

14.5.2 Proposed improvements to marine oil spill preparedness and response measures on the west coast

The Mayne Island Conservancy Society recommended that, if the Project is approved, oil spill response capacity be greatly improved along the entire shipping route. These improvements should include stationing equipment in the Southern Gulf Islands and providing training to locals to ensure an ability to deploy equipment at a spill site within one tide change, as compared to the 72-hour standard contained in regulation. Mr. Paul Petrie and Mayne Island Conservancy Society said that sufficient response capacity should be in place to respond to entire loss of cargo from an Aframax tanker.

Trans Mountain said that it engaged WCMRC to review its risk assessment and fate and behavior studies, and to describe enhancements to the existing planning standards that would better accommodate the tanker traffic resulting from the Project. It said that the results of studies indicate that a prompt response can significantly reduce the consequences of a spill. As diluted bitumen tested during Trans Mountain's studies remained floating over the 10-day test period, Trans Mountain said that to be effective, planning standards for on-water operations should be based on removing free oil within 10 days.

Trans Mountain said that it asked WCMRC to develop emergency response measures capable of handling one credible worst-case oil spill of 16 500 m^3 (15 500 tonnes) at any location along the tanker route within Canada's territorial sea. Trans Mountain said that WCMRC, in consultation with Trans Mountain, examined

81 Additional information on the fate and behavior of diluted bitumen is provided in Chapter 8 of this Report.

its current equipment locations and capacity, the mandated response times against the results of the Gainford study, the results of the quantitative risk assessment, known meteorological and oceanographic data, and hypothetical accidental oil spill locations and concluded that certain improvements could be undertaken to improve the effectiveness of its current emergency preparedness and response capacity with respect to the increase in Project-related tankers.

Due to other potential tanker traffic in the area, WCMRC based its assessment on a potential 21 000 m^3 or a 20,000 tonne release of heavy crude oil. WCMRC and Trans Mountain also consulted with other spill and response organizations including other response organizations in Canada, the US and Norway. Trans Mountain outlined a number of potential enhancements to current planning standards and WCMRC's current response capacity to achieve a more effective response to a 21 000 m^3 spill. More stringent response times formed part of the proposed enhancements.

The enhanced response regime would be capable of delivering 20,000 tonnes of capacity within 36 hours with dedicated resources staged within the study area. Trans Mountain noted that this this would represent a response capacity that is double, and a delivery time that is half, the existing planning standards. These enhancements would reduce times for initiating a response to two hours within Vancouver Harbour, and six hours for the remainder of the study area and parts of the West Coast of Vancouver Island. These reduced times would be achieved by creating new base locations along the tanker route. Trans Mountain noted that meeting the response capacities within the designated times would require redundancy of equipment, and as a result of the redundancy, the overall capacity of dedicated response equipment available in the Salish Sea region would be in excess of 30,000 tonnes equivalent when calculated under the current Federal guidelines for response organizations. Trans Mountain said that while the probability of the total loss of containment for an Aframax tanker is so low that it is not a credible planning scenario, such an event could be addressed by cascading equipment from other areas. Trans Mountain said that the enhanced response regime would cost approximately $100 million. Trans Mountain said that its commitment to enhancing marine spill response capacity in the region would benefit the entire shipping community in the Salish Sea.

Trans Mountain said that it had undertaken a project to collect, update and store information about the shoreline and backshore environment in the vicinity of the WMT. The data collected would be used to inform the Shoreline Cleanup Assessment Technique process and the shoreline protection and cleanup response functions in the event of a future oil spill.

Trans Mountain said that it agreed with the Tanker Safety Expert Panel, which recommended the need for Canada to tailor its preparedness efforts for each sector of the country, as the risks across the country are demonstrably different. The Tanker Safety Expert Panel recommended that the Government of Canada implement a risk-based area response planning model to prepare for ship-source oil spills. Trans Mountain submitted that the planning process described by the Panel is similar to that used to develop the marine spill response enhancements described by Trans Mountain and would be expected to result in similar standards.

The TERMPOL Review Committee said that it supported risk-based area response planning and WCMRC's efforts to increase capacity and reduce response time to ensure it is prepared to respond to a credible worst-case scenario as identified by Trans Mountain. The Committee also said that as part of measures to achieve a world-class tanker safety system, appropriate authorities would work with WCMRC and other stakeholders to develop and implement response plans tailored to the southern portion of B.C. The plans would help to ensure the appropriate spill cleanup equipment is in place and readily available.

The Canadian Coast Guard said that in assessing the proposed project and by participating on the TERMPOL Review Committee, and it does not foresee undue burdens placed on its response capability. It considers the current configuration and placement of the response organization and its own assets to be sufficient to meet the demands of increased tanker traffic. It noted that the TERMPOL Review Committee did not identify any regulatory concerns with the proposed oil spill preparedness and response procedures at this time. It also said that Trans Mountain proposed a number of enhanced marine oil spill prevention and preparedness measures in its submission to the Board and these were reviewed by the TERMPOL Review Committee. It said that although these measures are voluntary in nature, the Canadian Coast Guard supports any such enhancements.

14.5.3 On-water recovery and response effectiveness

Using its oil spill model, Trans Mountain assessed the effectiveness of the proposed enhanced response regime. A 16 500 m^3 spill event resulting from a tanker grounding incident at Arachne Reef near Turn Point was compared with and without spill response mitigation. Trans Mountain said that the oil spill model was revised to include consideration of various response measures and techniques over the four day simulation period. Trans Mountain noted that the four day simulation period was selected based on the slick thickness on water. After the end of the fourth day, the slick became too thin to be efficiently recoverable and although some oil could still be recovered, it became difficult to quantify. Trans Mountain said that a primary response technique assessed was double booming[82] of the tanker. Trans Mountain said that this tactic is highly effective in containing the spread of oil and assisting in its recovery, since oil within the boom would be thick and fresh and amenable to skimming and pumping.

The City of Vancouver, Tsleil-Waututh Nation and Tsawout First Nation prepared a marine oil spill response capacity analysis. This work estimated the percentage of a worst-case oil spill that could be recovered at each site modeled during the first 72 hours of the response, showing how response capacity varies by location and time of year. Spill volumes modeled were 8 000 m^3 for a ship at berth at the WMT and 16 000 m^3 for four locations along the tanker routes. The estimate included the additional resources that Trans Mountain noted that WCMRC would be obtaining. The participants said that the modelling approach does not incorporate other limiting factors, such as the likelihood that oil will strand on shorelines before it can be recovered, or the potential for diluted bitumen to submerge or sink so that it cannot be recovered using oil skimmers. The highest recovery estimate was for a summer spill at the Central Harbour site in Burrard Inlet, with the model showing that 78 per cent of the oil could be recovered using skimmers. The lowest modeled recovery estimates were for winter spills at Georgia Strait and Haro Strait, where the model estimates that only 15-16 per cent of a 16 000 m^3 spill would be recovered within 3 days of the spill. Overall the work concluded that on-water oil spill recovery capacity is reduced during winter months by as much as 50 per cent compared to summer and that the spill response forces currently available in Southern B.C. have the capacity to recover only 10-20 per cent of a worst-case oil spill under favourable conditions.

The Shxw'ōwhámel First Nation noted that during the Deepwater Horizon spill response, approximately 3 per cent of the oil spilled was recovered in open water.

Trans Mountain said summer weather conditions were simulated for the hypothetical incident. It said that the weather conditions selected were based on the representativeness of the resulting spill in terms of environmental and human-health consequences. In the summer season, warmer water and air temperatures would facilitate more rapid dissolution or volatilization of lighter pseudo-components of the oil into water or air, respectively. It said that this was a conservative approach, as the concentration in water or air would be increased by rapid dissolution or volatilization. Generally lower wind speeds during the summer would result in less wave action and hence, less vertical mixing of the water column and higher concentrations of dissolved hydrocarbons in the surface water layer. Trans Mountain said that there would also be less dilution of vapours in air. Trans Mountain said that the weather conditions modeled were amenable for response activities.

Under the conditions modeled, Trans Mountain said that, after 4 days, there was almost no oil inside the containment boom as a result of recovery operations and less than 10 per cent of the spilled oil was left on the water. The fraction of spilled oil that contacted shorelines was reduced from about 70 per cent in the unmitigated case after 15 days, to 25 per cent in the mitigated case. Over half the oil was recovered from the water surface during Trans Mountain's modelling analysis. Trans Mountain said that this amount was very high compared to historical recoveries at large spill incidents. Trans Mountain and the Province of British Columbia referred to information from the International Tanker Owners Pollution Federation that said that oil recovery rates at sea vary depending on circumstances but typically, they range from 10-15 per cent or less. Trans Mountain noted a few reasons explaining the high rate of recovery in its study including proper planning, the addition of equipment staging and additional bases along the shipping route, and the use of leading edge oil spill modelling.

Transport Canada said that it is not possible to provide a standard estimate of the percentage of oil recovered from a spill. The size of the spill, oil type, response methods and the environmental conditions at

82 Primary and secondary containment, essentially sufficient boom to wrap the stranded vessel twice.

the time of the incident all affect how much oil is recovered. Depending on the type of product, a significant portion is lost to evaporation. Similarly, ECCC said as there are many factors that affect recovery rates and due to the fact that each spill incident is unique, it is extremely difficult to predict recovery rates.

Response time

Trans Mountain said that the key to meeting proposed response thresholds is reaching the spill site quickly and responding to the spill in an effective manner. Trans Mountain provided a response gap analysis which found that the annual percentage of time that on-water oil spill response in the marine environment may be halted, or limited in effectiveness due to environmental conditions such as wind, waves and tides/currents varies based upon the location along the shipping route. The analysis indicated that effective on-water response could be mounted the majority of time along the tanker routes with potential effectiveness diminishing towards the western portion of the route in the Juan de Fuca Strait. In the event that environmental conditions temporarily limit on-water response operations, Trans Mountain outlined other spill response activities that could occur away from the spill site.

The City of Vancouver, Tsleil-Waututh Nation and Tsawout First Nation also prepared a response gap analysis that concluded that on-water recovery efforts combined with aerial reconnaissance would be limited to varying degrees throughout the tanker routes. Depending on the location assessed, a response gap (i.e. no response possible) ranged from 56 to 78 per cent of the time in the winter and 34 to 49 per cent of the time in the summer. Response conditions were generally more favorable in the Burrard Inlet inner harbour area as compared to open water sites.

The District of North Vancouver said that the weathering characteristics of spilled diluted bitumen indicate the importance of a rapid response time to a spill within Burrard Inlet. Without a rapid, effective response and quick containment and recovery of a spill within the first few hours, it is likely impossible to avoid the formation of tar balls and the spread of oil on the water surface and sub-surface with subsequent shoreline impacts as well. The Cowichan Tribes and District of North Vancouver said that initial spill response could be delayed due to health and safety concerns for responders resulting from chemical characteristics of spilled dilbit. Trans Mountain said that site safety and health procedures for spilled dilbit are no different than for any other spill of heavy crude oil and it outlined procedures to safeguard personnel working on-water and on-shore.

Canadian Coast Guard said that weather conditions, including rough sea-states, strong winds, snow, and ice coverage can all impact response operations, and Canadian Coast Guard, in collaboration with its response partners, supported by scientific expertise coordinated through ECCC, takes weather conditions into consideration as part of all response activities.

Views of the Board

The Board finds that Trans Mountain's application met the requirements outlined in the Board's 10 September 2013 "Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increased Marine Shipping Activities" regarding marine emergency preparedness and response planning.

As noted in section 14.4, the evidence indicates that a large tanker spill is not a likely event. Nonetheless, it is prudent and standard practice to prepare an appropriate response to small and large spill events in any industrial endeavor, such as the Project and related marine shipping.

General principles of marine spill response

The Board accepts evidence filed by Trans Mountain and numerous participants, which in its view, indicates that there are principles that are generally applicable to marine spill response. For example, the Board agrees with The District of North Vancouver which said that spills can happen even with the best possible measures in place and even the best possible spill response system cannot guarantee that resources at risk will be protected from negative impacts if a spill occurs. The Board summarizes these principles as follows and notes that these statements are applicable broadly, and are not necessarily limited to spills associated with the Project and related marine shipping or to a diluted bitumen spill:

- *The circumstances associated with each spill event would affect the success of the response and*

there is no guarantee that a spill response would result in the on-water recovery of a significant portion of the oil spilled.

- *On water spill response may not always be possible due to environmental conditions but during such times, other response measures such as shoreline protection and clean up or tracking of oil would likely be possible.*
- *Response could be delayed due to responder safety.*
- *Even with response efforts, any large spill event would result in significant adverse environmental and socio-economic effects.*

In providing the following views, the Board has considered these General Principles of Marine Spill Response.

Marine spill response regulatory framework

The Board recognizes the regulatory framework that applies to marine oil spill preparedness and response. The Board summarized this framework in section 14.2.1.

As previously noted, the evidence before the Board indicates that there are competent authorities responsible for the marine oil spill preparedness and response regime and that the regime is functioning appropriately. Any changes to the existing regime would be the responsibility of those competent authorities. The evidence indicates that the regime is reviewed periodically and there is currently a review of the regulatory regime occurring.

Trans Mountain does not own the ships associated with the Project-related shipping and therefore, does not have direct control over the ship owner's pollution response planning. Evidence filed by Trans Mountain, Transport Canada and Canadian Coast Guard confirms that vessel owners must have an agreement in place for spill response with Western Canada Marine Response Corporation (WCMRC) and that the vessels must also have a Shipboard Oil Pollution Emergency Plan.

Oil handling facilities, such as the Westridge Marine Terminal (WMT), must have an agreement in place with WCMRC, an Oil Pollution Emergency Plan and an on-site Oil Pollution Prevention Plan. As the WMT is regulated by the National Energy Board, it would also be subject to the response planning requirements contained within the Onshore Pipeline Regulations as discussed in Chapter 9.

Responding to a diluted bitumen spill

The Board heard concerns raised by parties such as Cowichan Tribes, Shxw'ōwhámel First Nation and Living Oceans Society regarding challenges in responding to submerged or sunken diluted bitumen. The Board agrees there is the potential for diluted bitumen to submerge in water but it notes that sinking of diluted bitumen in large, contiguous amounts is not likely. The potential fate and behavior of diluted bitumen is discussed in Chapter 8.

The Board acknowledges that the physical and chemical characteristics of diluted bitumen, like other similar heavier oil products, present response challenges. The Board is of the view that Trans Mountain has provided sufficient information as to how the potential fate and behavior of diluted bitumen would be considered in spill response planning. Evidence filed by Trans Mountain and parties such as Living Oceans Society and the Shxw'ōwhámel First Nation indicates that there are tools and techniques available for responding to heavy oils like diluted bitumen. These tools and techniques are primarily focused on detection and recovery, on-water mechanical recovery and shoreline clean up. The success of each would depend on the specific circumstances associated with the spill.

The Board found in Chapter 8 that diluted bitumen is likely to weather quite quickly to a Group IV oil state for response purposes. The Board also found that weathered diluted bitumen has potential to emulsify or potentially submerge in water. Due to its weathered state, and the physical geography within Burrard Inlet and along the tanker routes, diluted bitumen would also likely strand on shorelines if not recovered on water. A portion could also submerge and wash up on shore some distance from the spill site. A rapid on-water response would assist in mitigating shoreline impacts. The Board notes that Trans Mountain's proposed marine oil spill response improvements would substantially reduce response times along the tanker routes and within Burrard Inlet.

Proposed improvements to spill preparedness and response measures

The Board heard from many participants about ways that marine spill preparedness and response could be improved. The evidence indicates that Trans Mountain, in conjunction with WCMRC is proposing appropriate measures to respond to potential oil spills from Project-related tankers. These proposed measures exceed regulatory requirements and would result in a response capacity that is double, and a delivery time that is half, that required by the existing planning standards. The Board gives substantial weight to the fact that the TERMPOL Review Committee and Canadian Coast Guard did not identify any particular concerns with the marine spill response planning associated with the Project.

In section 14.4, the Board said that the purpose of marine shipping risk assessments is to inform marine shipping safety and spill response planning. Trans Mountain used its marine shipping risk assessment to inform its enhanced marine spill response measures. As noted in section 14.2, the Board does not have regulatory jurisdiction over marine emergency preparedness and response planning. However, the Board would impose Conditions 91, 133, and 144 to ensure implementation of Trans Mountain's proposed emergency preparedness and response measures that exceed regulatory requirements.

The Board heard concerns that sufficient resources should be in place to respond to the complete loss of a tanker's cargo. The evidence presented in section 14.4 indicates that complete loss is not a likely scenario. However, should such an event occur, evidence filed by Trans Mountain and the Canadian Coast Guard indicates that WCMRC and the Canadian Coast Guard have the ability to mobilize resources to respond to a spill that is larger than the credible worst-case scenario. Such resources could be mobilized from around the world, if necessary.

The evidence in section 14.4 indicates that a large spill of 8 000 m^3 for a tanker at the WMT or a 16 000 m^3 spill within Burrard Inlet and English Bay area are not credible worst-case spill scenarios. The Board has therefore given little weight to evidence showing potential effects associated with such a scenario or the response capacity analysis commissioned by the City of Vancouver, Tsleil-Waututh Nation and Tsawout First Nation for these areas. Any spill in these areas would also be subject to response efforts.

Consultation on marine spill response measures and planning

The Board heard several comments from municipal governments and the North Shore Emergency Management Office that they were not sufficiently engaged in the marine spill response planning process and that they were not receiving sufficient information regarding their potential role in marine spill response. The Board shares the view of these participants that engagement with local governments, including Aboriginal groups and emergency responders, is important and those potentially involved in the response should be engaged, to the extent that they choose, in the planning process. Therefore, the Board would impose Condition 90 requiring Trans Mountain to engage with various parties when preparing its Emergency Management Program as it applies to the WMT.

The Board has no jurisdiction to compel consultation with potentially affected municipal governments and Aboriginal groups along the Project-related tanker routes. The Board is of the view that engagement with competent authorities, such as Canadian Coast Guard and Transport Canada, WCMRC, municipal governments and Aboriginal groups, would further inform the spill response planning process. The Board understands there is some consultation ongoing already.

Future spill response research and initiatives

The Board recognizes the current and ongoing work by WCMRC, the Government of Canada and other parties related to spill response such as area response planning, improved coastal mapping, development of geographic response plans, and research regarding alternate response strategies like in-situ burning and use of dispersants. The Board is of the view that this work should further contribute to appropriate marine spill response planning for the Project.

The Board notes Washington State Department of Ecology's suggestion regarding establishment of a joint geographic response plan with Washington State Department of Ecology for vessels

carrying diluted bitumen through shared waters in the Salish Sea. The Board understands that Trans Mountain would not be responsible for completing this task. Competent authorities such as Canadian Coast Guard and Transport Canada, and the certified response organization WCMRC, could engage Washington State further should they see merit in this suggestion.

Chapter 8 includes a discussion on research related to the fate and behaviour of spilled oils and how this research could inform spill response planning.

14.6 Effects of spills

14.6.1 Environmental effects assessment of spills

This section discusses the potential environmental effects of spills from Project-related increase in marine vessels. Chapter 10, section 10.2.17 discusses the effects of spills from the Project, such as from the pipeline or terminals, on various valued environmental components.

Ecological risk assessment methods

Trans Mountain conducted Preliminary and Detailed Quantitative Ecological Risk Assessments to evaluate the potential effects of accidental releases at various locations along the marine transportation route. Trans Mountain evaluated a total of six hypothetical scenarios at three different locations with two credible worst-case crude oil spills: 16 500 m^3 and a smaller volume of 8 250 m^3. Each scenario was evaluated under a range of environmental conditions including winter, spring, summer and fall. Table 26 provides a summary of hypothetical marine transportation oil spill scenarios.

Table 26: Summary of hypothetical marine transportation oil spill scenarios

Scenario	Incident Summary	Release Volume (m^3)
1	Strait of Georgia - Main ferry crossing. Collision with crossing traffic from Fraser River and ferries is a low probability event, but considered because of higher number of crossings per day.	16 500 m^3
2		8 250 m^3
3	Arachne Reef - Powered grounding is a low probability event due to pilots and tethered tug, but this location is rated with greatest level of navigation complexity for the entire passage. Location also has high environmental value.	16 500 m^3
4		8 250 m^3
5	Race Rocks - Collision with crossing traffic from Puget Sound and Rosario Strait or grounding at Race Rock is a low probability event, but considered because not all vessels in this location would have pilot onboard.	16 500 m^3
6		8 250 m^3

Trans Mountain considered the following spatial boundaries for the assessment:

- Oil spill footprint – the area directly affected by oil as a result of a release at various locations along the shipping route; and
- Regional Study Area (RSA) - The RSA is generally centered on the marine shipping route, which extends from the WMT through Burrard Inlet, south through the southern part of the Strait of Georgia, the Gulf Islands and Haro Strait, westward past Victoria and through the Juan de Fuca Strait out to the 12 nautical mile limit of Canada's territorial sea. The western boundary of the RSA extends further out to sea than the western boundary of the Salish Sea and the northern boundary of the RSA is limited to the southern portion of the Strait of Georgia. Puget Sound is excluded from the RSA.

Trans Mountain selected ecological receptors to represent species believed or known to be sensitive to spills, and which act as indicators of overall environmental health. Trans Mountain carried out the recovery assessment based on the recovery of ecological receptors following the Exxon Valdez Oil Spill, as many of these ecological receptors also occur along the Project related shipping route.

Trans Mountain superimposed probability of oiling contours on ecological resource sensitivity maps to quantify the length of shoreline or the area of a particular habitat type that is potentially affected. Trans Mountain said that its ecological risk assessment focused on areas having medium, high or very high

probability of oil exposure. Trans Mountain quantified the habitat exposures to different probabilities of oiling and compared that to the total amount of that habitat within the RSA.

Intervenors filed numerous third party expert reports related to marine oil spills. Living Oceans Society said that Trans Mountain's ecological risk assessment fails to integrate oil exposure risk based on multiple locations within ecologically distinct sub-regions along the marine shipping routes, including at or near ecologically-sensitive areas. It said that Trans Mountain should have assessed hazards based on species' sensitivity to oiling independently of oiling probability. It further noted that Trans Mountain failed to assess the possibility of organisms being exposed to submerged oil and did not consider all the ways oil can harm organisms.

Views of the Board

With regard to concerns raised by intervenors on the spill evaluation methodology used by Trans Mountain, the Board finds Trans Mountain's methods to assess effects from marine transportation spills to be acceptable. Trans Mountain followed the approach in the Board's Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increased Marine Shipping Activities, which requires assessment of potential accidents and malfunctions at representative locations along the marine shipping routes.

Trans Mountain considered a number of hypothetical oil spill scenarios. Dr. Short's report submitted by Tsleil-Waututh Nation, City of Vancouver and Living Oceans Society, questioned whether these scenarios were truly representative, whether they were close enough to particular environmentally sensitive areas, and whether they give an adequately comprehensive view of the potential effects of an oil spill. The Board is of the view Dr. Short's report modelled spill volumes that were much larger than what is considered as a credible event, and that there is little evidentiary basis to support spills of this size to be credible events, as described earlier in Chapter 14.

The Board has not considered Trans Mountain's scenarios as a demonstration of all the potential locations and volumes of a spill. Rather, the Board has used them as examples that provide an idea of the potential effects pathways that could occur, and together with the evidence from other hearing participants, has generalized such pathways to predict the type of effects that could result from a spill.

The Board notes that some of the evidence submitted by participants did not always distinguish the source of the spill when discussing the potential effects. The Board agrees that it is not always necessary to make such a distinction. For example, oil spilled from the pipeline or facilities could enter the marine and estuarine environment and affect valued components discussed in this chapter.

Baseline data

Numerous participants raised concerns about the sufficiency of marine resources baseline data. The Board of the Friends of Ecological Reserves and the City of Port Moody raised concerns over the adequacy of baseline data of marine resources (i.e., fish, vegetation, etc.) within Burrard Inlet and along the shipping lanes. They emphasized that such baseline data is crucial in considering what might be lost if there is a spill, determining effects after a spill, and in crafting criteria for monitoring during post-spill restoration efforts. In response, Trans Mountain said that it conducted the marine transportation effects assessment based on up-to-date research, does not believe that additional data collection would affect the conclusions presented in the Application, and that vessel traffic associated with the Project would represent a relatively small proportion of total vessel traffic along the marine shipping lanes.

B.C. Nature and Nature Canada, and ECCC raised concerns about sufficiency of marine bird baseline data.

B.C. Nature and Nature Canada said that without the quantitative marine bird community baseline information, the Project-related impacts cannot be assessed, mitigated and monitored in the event of a large oil spill in the Marine Transportation RSA.

ECCC said that the existing data would not provide a sufficient baseline to inform the development of recovery initiatives, to determine the types and levels of compensation measures, and to allow for an evaluation of recovery success in the event of a spill. It proposed a condition that would require Trans Mountain to develop a marine bird baseline monitoring plan that would describe species composition and

their spatial and temporal abundance patterns to identify high consequence areas/habitats in the event of an oil spill.

Trans Mountain agreed that collection of additional baseline marine bird data could contribute to coordinated planning initiatives and said it has provided support to several initiatives to collect additional marine bird data in the Marine Transportation RSA. Trans Mountain said that it was exploring additional options to contribute towards the collection of long-term monitoring data for marine birds that may be affected by the Project related marine shipping and other industrial activities, in cooperation with regulatory authorities, industry, local communities, Aboriginal groups, and other stakeholders.

ECCC stated that during an emergency, its National Emergencies Centre under the Environmental Emergencies Program identifies sensitive ecosystems and wildlife, such as migratory birds. ECCC said that the Canadian Wildlife Service conducts monitoring programs to support its mandate for migratory birds, species at risk, and habitat under its jurisdiction, and that available migratory bird and species at risk distribution and abundance data is shared with the National Environmental Emergencies Centre.

ECCC said that as a component of the World Class Tanker Safety initiative, it will collect additional marine bird data for a two and a half year period (starting in winter 2015) which will be used to inform Area Response Planning in B.C. However, ECCC said that this program is designed to address key knowledge gaps and does not provide Project-specific marine bird distribution and abundance data to the extent recommended by it in the marine bird baseline monitoring plan.

Views of the Board

With regard to baseline information, Trans Mountain and participants submitted some general and some specific evidence concerning the distribution of marine habitats and species throughout Burrard Inlet and the RSA. Detailed mapping of all such habitats and species was not provided. However, participants have provided extensive evidence concerning the potential effects of a spill on relevant marine habitats and species, which, together with the evidence on the general location of such habitats and species, has provided the Board with sufficient information to evaluate the potential significance of effects from spills. The Board notes that there are many marine users in Burrard Inlet and along the shipping lanes. Therefore, in the Board's view, it is not reasonable for Trans Mountain to take on the sole burden of baseline data collection and monitoring to determine the overall effects of potential accidents and malfunctions associated with all shipping operations.

With respect to baseline information for marine birds in particular, the Board notes that Trans Mountain is supportive of forming a collaborative partnership along with other industry stakeholders operating in Burrard Inlet and along the shipping route. This partnership would collect data on marine bird abundance, distribution, and diversity in the RSA, and on baseline physiological condition of marine birds.

Air quality

As part of its spill modelling investigations of a hypothetical marine spill at the WMT and the Northern entrance to Haro Strait (Arachne Reef), Trans Mountain conducted air dispersion modelling of a hydrocarbon cloud. Trans Mountain said that evaporation accounts for 20 per cent of the fate of spilled diluted bitumen, and the bulk of evaporation occurs within the first two days. Trans Mountain modelled for the airborne transport of the portion of each pseudo component which evaporated from the spill for both spill locations, using CALPUFF air dispersion modelling.

Several participants expressed concerns with respect to the air dispersion modelling conducted by Trans Mountain in support of the spill modelling. Metro Vancouver said that Trans Mountain did not consider a credible worst-case scenario (similar magnitude spill of 16 500 m^3 at Arachne Reef) in Burrard Inlet. Metro Vancouver said that Trans Mountain has not taken into account the full range of weather conditions and marine conditions that could prevail during a spill event.

Metro Vancouver conducted an air quality assessment (Levelton report) for four potential oil spill locations in Burrard Inlet and English Bay in order to capture a range of possible tidal and meteorological conditions during a spill. Metro Vancouver made several recommendations, one of which is to require Trans Mountain to establish real-time air quality dispersion modelling. This modelling would have to be capable of considering an oil spill using real-time meteorological observations. Metro Vancouver said that Trans

Mountain should be required to provide the modelling results to municipalities and other agencies within 30 minutes of the initiation of a spill event.

Trans Mountain said that the Levelton report modelled spill volumes that were much larger than what is viable or credible in the selected locations. Trans Mountain said that the report over estimated higher airborne concentrations of evaporated volatiles by two orders of magnitude.

Living Oceans Society said that Trans Mountain cannot assume that the evaporation of hydrocarbons following a spill will generally occur within the first 12 hours, as excess concentrations can persist for weeks after a spill. It also said that oil spill air quality monitoring will need to include both primary emissions from the oil slick (e.g. hydrocarbons) and secondary products (e.g. secondary organic aerosol, ozone, organic nitrates). It requested of Trans Mountain that independent scientists, working in coordination with Trans Mountain, be allowed access to any spill or event site so that credible and transparent air quality information can be provided to the public in the days and weeks following the event.

Views of the Board

The Board finds that any air quality modelling would have certain limitations and uncertainties associated with it. There is always a wide range of possible scenarios (i.e. all possible combinations of oil spill trajectories, oil spill emissions and meteorological conditions) that can be included in the assumptions. The Board acknowledges the importance of understanding the risks, as informed by air dispersion modelling, in planning and responding to an emergency situation. This could assist the relevant authorities, such as the health authorities, to act in a responsible way and be able to respond in a timely manner.

The Board concurs with Trans Mountain that the Levelton report submitted by Living Oceans Society modelled spill volumes that were much larger than what is considered as a credible event. The Board finds that there is little evidentiary basis to support spills of this size to be credible events, as described in this chapter. As a result, the Board assigned low weight to the Levelton report.

The Board recognizes the regulatory framework that applies to marine oil spill preparedness and response as summarized in sections 14.2 and 14.5.1. As previously noted, the evidence before the Board indicates that there are competent authorities responsible for the marine oil spill preparedness and response regime and that the regime is functioning appropriately. Trans Mountain does not own the Project-related marine vessels and therefore, does not have direct control over the vessel owner's pollution response planning. Evidence filed by Trans Mountain, Transport Canada and Canadian Coast Guard confirms that vessel owners must have an agreement in place for spill response with Western Canada Marine Response Corporation, and vessels must also have a Shipboard Oil Pollution Emergency Plan.

Environmental effects of spills

Trans Mountain evaluated potential environmental effects of the tanker marine spill scenarios for four main ecological receptor group/habitat combinations:

- shoreline and near shore habitats;
- marine fish community and supporting habitat;
- marine birds and supporting habitat; and
- marine mammals and supporting habitat.

Trans Mountain divided each receptor group into sub-categories to reflect their sensitivity to oil exposure and assigned a biological sensitivity ranking factor from low (a value of 1) to very high (a value of 4). Trans Mountain assessed the potential for negative environmental effects of oil exposure at any given location by the overlap of the probability of oil presence, and the sensitivity of the receptor or habitat present at that location. If the receptor is an endangered species, or if provincial and national parks or other conservation areas are present, Trans Mountain considered those as additional factors.

Intervenors questioned Trans Mountain's assignment of biological sensitivity rankings for marine mammals, shorelines, and marine fish.

Trans Mountain said that there is potential for oiling of marine bird and marine mammals following an accidental spill of crude oil along the marine transportation route, and that the extent of oiling and its subsequent effects would depend on the size of the spill, the efficacy of measures to contain and recover spilled oil, the ability of oil spill responders to capture and treat oiled animals, and the intrinsic sensitivity of animals to exposure.

Shorelines and near shore habitat

Trans Mountain said that low-energy or protected shorelines almost always have a fine subsurface substrate (sand or mud), even though the surface veneer may be coarse pebble, cobble or boulder. It said that the presence of a water-saturated fine subsurface layer is an important factor that affects sensitivity to oil exposure because it provides a barrier that limits oil penetration of sub-surface sediment and hence, limits long-term retention of oil. Trans Mountain said that in contrast, coarse (pebble, cobble or boulder) shorelines that are highly exposed may be coarse to considerable depth, increasing permeability and the potential for retention or sequestration of stranded oil.

Trans Mountain said that tidal marshes are often associated with river mouths and estuaries, behind barrier islands, or on tidal flats where low-energy wave action and fine-grained sediment accumulation provides an elevated surface where marsh vegetation can become established. It said that eelgrass beds are also typically found in soft sediments of protected bays, inlets and lagoons.

Trans Mountain said the ecological risk assessment indicates that while shoreline habitats would be affected by spilled oil along the marine transportation route, the affected areas generally represent a small fraction of total amount of shoreline belonging to each shoreline sensitivity class within the RSA. Tran Mountain said that very little of the potentially affected shoreline habitat is of a type that would tend to sequester spilled oil. It said that although salt marsh and eelgrass habitats are considered to be highly sensitive to oil exposure, these habitats have a very low probability of oiling for these representative scenarios. Shoreline classes with low exposure cobble/boulder veneer over sand would be most affected, but shorelines of this type are more readily restored if oiled, and would recover in a relatively short period of time.

Trans Mountain said that it is expected that shoreline cleanup and assessment techniques would be applied to the spilled oil that reached the shore, and that most of this oil would be recovered. It said that biological recovery from spilled oil, where shoreline communities were contacted by and harmed by the oil or by subsequent cleanup efforts, would be expected to lead to recovery of the affected habitat within two to five years. Trans Mountain said that by comparison, whether cleaned or not, intertidal communities had recovered within five years after the Exxon Valdez oil spill.

Numerous intervenors raised concerns over spilled oil impacting shorelines. Living Oceans Society said that shoreline oiling following a major oil spill would inflict serious injuries to biological communities inhabiting them in the short term, and lingering effects could persist for decades to a century on porous beaches (gravel, sand and mud) and in intertidal marshes if oil becomes associated with hypoxic sediments or accumulations of organic matter. These lingering reservoirs of oil pose long-term threats to intertidal organisms, predators that consume them, and to marsh-dwelling birds and mammals. Metro Vancouver said that the large tidal range in Burrard Inlet, along with a shallow, sloping coastline, would result in large areas of intertidal and shoreline habitat being exposed, contaminating oysters, barnacles, and other intertidal invertebrates and shellfish species that are relatively immobile, indiscriminate filter feeders. Trans Mountain said that it does not dispute that small amounts of crude oil can become sequestered and remain in deep, porous beach deposits, or brackish marshes following an oil spill, and that such oil could remain following a Net Environmental Benefits Assessment. Trans Mountain further noted that sequestered oil along shorelines can persist in a relatively fresh state and that small amounts of this oil can get released exposing marine organisms present in the vicinity. However, the isolated nature and low levels of such exposures render the likelihood of population-level effects low.

ECCC said that, depending on the volume, location, time of year, and other factors, an oil spill could have serious, long-lasting effects on important habitats such as eelgrass. Numerous participants expressed concerns about the effects of oil spills on particularly productive and sensitive marine vegetation communities, such as the freshwater, brackish and salt marshes and eelgrass beds on Sturgeon and Roberts banks and upriver on the islands of the Fraser River South Arm; and the eelgrass and kelp beds throughout

the Gulf and San Juan Islands. Elaine Leckie filed a report which said that an oil spill could result in long term chronic contamination of eelgrass beds. Cowichan Tribes said that because kelp canopies float, they are subject to oiling in a spill, and that bull kelp is particularly vulnerable.

Trans Mountain said that the level of exposure to spilled oil for eelgrass beds and for kelps, being found in the lower intertidal and subtidal areas, is generally lower than for other ecotypes. It said that based on previous spills, effects are expected to be relatively minor.

Trans Mountain said that eelgrass beds generally recover on their own within one or two growing seasons after light to moderate oiling, and that plants that grow from rhizomes in the soil or sediment usually regenerate, even if the aboveground portions exhibit die-back. Trans Mountain said that, with the implementation of appropriate oil spill response activities, recovery of oiled shoreline habitat within two to five years following a large spill is a reasonable expectation, and referenced studies from a number of previous spills. Cowichan Tribes questioned the assertion of complete recovery within two to five years, and said that Trans Mountain did not discuss the potential for residual effects resulting from disruption of biological community structure. This process can in turn free up habitat space which can be utilized by opportunistic species that can slow or inhibit the recovery of the original community.

A number of participants noted the potential for terrestrial vegetation close to shorelines to be effected by a marine spill. The Board of the Friends of Ecological Reserves, for example, said there are numerous rare plants and lichens in the spray zone of terrestrial ecological reserves along the marine shipping lanes that would be susceptible when storms are blowing sea spray laden with toxic oil, and that this would very likely lead to local extirpations. Trans Mountain said that 43 SARA-listed plant and lichen species, and their critical habitat, have the potential to occur in the supratidal zone; and that high wind and wave conditions leading to the formation of sea spay could result in oiling and death of vascular plants, mosses or lichens. Trans Mountain said with regard to SARA-listed terrestrial plant and lichen species in the supratidal zone that could be affected by oiled sea spray, that although the recovery potential of such communities following oiling is unknown, in consideration of their SARA status and the documented sensitivity of some lichen species to air pollution, it must be assumed that the prognosis for recovery would be poor.

Marine fish and fish habitat

Trans Mountain said that acute effects of spilled oil on marine fish and invertebrates are rarely observed, except in situations where oil is confined and dispersed into shallow water. It noted that acute toxicity is most likely to occur in the initial 24 to 48 hours following an oil spill as compounds associated with acute toxicity tend to be volatile during that period and are rapidly lost to the atmosphere. Trans Mountain identified non-polar narcosis and Blue sac disease as the two major mechanisms of toxicity to marine fish.

Trans Mountain said that the potential for toxicity to the marine fish community is greatest near the surface where more soluble hydrocarbons can dissolve from the floating fresh oil or form droplets that can be temporarily dispersed down in to the water column by wave action. It also said that extensive formation and dispersion of oil droplets into the water column is unlikely to occur in sheltered waters and that the potential for acutely toxic concentrations of hydrocarbons to extend down into deep water is very low, due to the limited solubility of hydrocarbons, and the dilution that would accompany mixing into deep water.

Trans Mountain said that its ecological risk assessment indicates that fish habitat would be affected by spilled oil along the marine transportation route for all oil spill scenarios and seasonal conditions. It said that the potential for negative effects to the marine fish community is generally low as a result of the low potential for dissolved hydrocarbon concentrations in water to reach thresholds that would cause mortality of fish or other aquatic life. Trans Mountain said that the potential for dissolved hydrocarbon concentrations to reach toxic levels would be greatest in shallow water areas, under weather conditions that caused spilled oil to be driven into shallow areas with wave action, leading to localized high concentrations of dissolved hydrocarbons in the water. This could result in the death of fish and invertebrates as a result of narcosis, or could cause abnormalities in developing embryos if spawn was present.

Trans Mountain said that due to the generally low potential for the spill scenarios to cause wide spread mortality of fish, recovery of the marine fish community would be expected to be rapid. It said that even under a worst-case outcome where localized fish kills might be observed, it is expected that the lost biological productivity would be compensated for by natural processes within one to two years. Trans Mountain said that effects of this type were seen following Exxon Valdez oil spill, but large-scale

effects at the population level were not observed. It noted that the effects of the Exxon Valdez oil spill on marine fish populations, were either not significant to begin with or recovery occurred within one or two years at most.

Trans Mountain said that effects of the Exxon Valdez oil spill on marine fish and fish habitat were generally limited to areas where oil was driven into near-shore areas, and these effects were for the most part short-term (days to weeks, rather than years). Trans Mountain said that evidence has been presented for longer-term effects on some habitats, such as intertidal pink salmon spawning areas, where sequestered oil may have leached into spawning gravels up to several years after the spill, causing mortality and developmental effects. However, this did not result in effects at the population level for pink salmon. Trans Mountain indicated the most controversial recovery assessment for the Marine Fish Community aquatic receptor after the Exxon Valdez oil spill is the Pacific herring, as there is debate among scientists on the overall impact of spilled oil and the effect it had on Pacific herring populations.

Numerous participants expressed concern over the recovery of marine fish resources resulting from a Project-related marine vessel. Raincoast Conservation Foundation indicated that Trans Mountain's claim that natural processes would compensate for the lost biological productivity within one to two years potentially misrepresents and minimizes the consequences of an oil spill in the RSA on Pacific herring and other forage fishes. It said that Pacific herring in the RSA recruit to the commercially valuable adult population at age three. Theoretically, if there was an oil spill that caused significant mortality to adult, juvenile and larval herring in the RSA, it would take a minimum of three years for the first generation of post-spill herring to recruit to the adult population and represents the earliest possible timeframe for recovery following significant mortality of adult, juvenile and larval herring.

Raincoast Conservation Foundation also said that cumulatively, chronic small discharges of oil contribute more oil to marine environments than the larger, catastrophic oils spills. It said that due to the documented responses of Pacific herring and other fishes to chronic exposures of oil, even relatively small discharges of oil pose a substantial risk to Pacific herring, other forage fish and marine ecosystems in the RSA. Raincoast Conservation Foundation said that Trans Mountain's failure to include chronic oil spills as an existing habitat disturbance to marine wildlife in the RSA represents a substantial omission and serves to minimize the existing hazards that negatively impact wildlife and their habitats in the RSA.

Marine mammals

Trans Mountain said that aquatic mammals, such as otters and mink that rely upon fur for insulation in cold ocean water, are extremely sensitive to oiling, as well as having potentially high exposure to oil ingestion. It said that mammals that rely upon blubber for insulation are less sensitive to external oiling, although the potential for mortality cannot be ruled out due to other exposure pathways or mechanisms. Trans Mountain said that oil ingestion remains a potentially important exposure pathway, and fouling of baleen plates can have adverse effects on baleen whales, although this would not be a problem for toothed whales.

Trans Mountain said that its ecological risk assessment indicates that marine mammal habitat would be affected by spilled oil along the marine transportation route for all oil spill scenarios and seasonal conditions. Trans Mountain said that there is clearly potential for oiling of marine mammal habitat following an accidental spill of oil along the marine transportation route. It said that the degree to which this potential is realized would depend upon the size of the oil spill, the efficacy of measures intended to promptly contain and recover spilled oil, the ability of oil spill responders to capture and treat oiled animals, and the intrinsic sensitivity of the animals to exposure.

Trans Mountain said that while there is a relatively high probability of exposure for seals and sea lions in the event of an oil spill, and some level of negative effect would be expected for animals exposed to oil, the effects would not likely be lethal, except in the case of weaker animals such as pups or older and diseased animals. Trans Mountain said that there is also a high probability of exposure for whales and that while some level of negative effect would be expected for animals exposed to oil, the effects would not likely be lethal, except in the case of weaker animals, such as calves or older and diseased animals, or animals that were exposed to heavy surface oiling and inhalation of vapours from fresh oil as could occur in the immediate vicinity of the spill location. Trans Mountain said that for mammals with very high sensitivity to oil exposure, such as otters, there is a medium probability of exposure along the marine transportation route in the event of an accidental oil spill. It said that some level of negative effect would be expected for

animals exposed to oil and exposure during the winter season would be more stressful than exposure during the summer, but in either case, the combination of hypothermia and damage to the gastro-intestinal system caused by oil ingested through grooming the fur would have the potential to cause death.

Trans Mountain said that, in the event of a spill, the recovery of marine mammals would depend upon the nature of the injuries received. For some mammal species, recovery may occur at a population level within two to five years. However, for populations such as Southern resident killer whale, the loss of a single animal would constitute an effect at the population level and recovery could take a decade or longer.

Trans Mountain said that despite the intensive studies that followed the Exxon Valdez oil spill, findings on the actual effects and recovery remain controversial. Trans Mountain said that recovery conclusions of the Exxon Valdez oil spill for killer whales are complicated by a focus on specific whale groups that are subject to additional stressors and have not recovered, in contrast with population-level trends which are increasing.

Trans Mountain said that many sea otters were severely affected by the Exxon Valdez oil spill and that a large number of carcasses were collected throughout the spill area. Trans Mountain also said that the sea otter population has been slow to recover, although river otters were deemed to have recovered within 10 years after the spill.

Numerous participants raised concern over spilled oil impacting marine mammals, specifically the Southern resident killer whale. Living Oceans Society said that a large diluted bitumen spill anywhere along the tanker route through the Gulf Islands and the Strait of Juan de Fuca would almost certainly kill substantial numbers of marine mammals, especially harbour seals and harbour porpoises, because of their relative abundance in the Salish Sea. It said that exposure of individual killer whales, however, could have adverse population level consequences for this already endangered stock, where premature loss of just one individual could significantly contribute to the jeopardy of this stock.

Raincoast Conservation Foundation said that Pacific herring and other forage fishes represent a crucial conduit of energy and nutrients from lower trophic levels to upper level predators, such as salmon, marine birds, and mammals. It said that because certain contaminants bio magnify up the foodweb, any increased contamination of Pacific herring could potentially influence the contamination load of upper-level predators, including Southern resident killer whale and other species. Trans Mountain said that the exposure of marine mammals to PAHs was generally found to be low, indicating that chronic exposure to PAHs following a crude oil spill under the conditions assessed is not likely to be harmful to species such as the Southern resident killer whale, humpback whale, harbor porpoise, harbor seal or Steller sea lion. In particular, the chronic exposure of Southern resident killer whale, which are protected at the individual level under the SARA, was low due to the low and temporary level of bioaccumulation of PAHs by its prey (i.e., salmon and other fish). These low levels of exposure are not expected to result in adverse effects, such as death or injury.

Marine birds

Various participants raised concerns about oil spill effects on marine birds and their habitat.

B.C. Nature and Nature Canada said that Trans Mountain's assessment approach has the potential to inaccurately estimate potential ecological consequences on marine birds and their habitat. B.C. Nature and Nature Canada also said that marine bird species at risk were not granted due consideration.

Trans Mountain said it used a habitat-based approach that stems from the assumption that if habitat is protected, then species that use that habitat will also be protected; and conversely, that if habitat is damaged, then species that use that habitat may be harmed. Trans Mountain said that the habitat-based approach provides an estimate of all areas that could be affected by spilled crude oil and therefore, all birds using such habitat are addressed in the assessment, including any federally- or provincially-listed species of concern.

Trans Mountain said that shorebirds have a generally low sensitivity to oiling; however, some shorebirds would be sufficiently oiled to result in mortality of adult or juvenile birds, or that eggs would become oiled resulting in embryo mortality. It further noted that oil exposure could extend to affect a large number of known breeding or colony sites for seabirds, as well as a large number of Important Bird Areas in the Strait of Georgia, Gulf Islands, and Juan de Fuca Strait region. Trans Mountain said that there is a high probability

of exposure for seabirds in the unlikely event of a crude oil spill, and some level of negative effect would be expected for birds exposed to crude oil up to and including death as a result of hypothermia, loss of buoyancy, and / or oil ingestion.

B.C. Nature and Nature Canada raised concerns about effects of chronic oil spills on marine birds. Trans Mountain said that as part of its Tanker Acceptance Standard, it would require Project vessels to not discharge any bilge water while within the territorial waters of Canada. Trans Mountain said that escort tugs would discharge bilge water, if required, in compliance with the *Canada Shipping Act, 2001, Vessel Pollution and Dangerous Chemicals Regulations*, which states that discharged bilge water must contain no more than 15 mg/L oil and discharges must be made when the vessel is underway. Trans Mountain said that the requirement to treat bilge water is contained in the International Maritime Organization's International Convention for the Prevention of Pollution from Ships (MARPOL) and in Canada is enforced through the *Canada Shipping Act, 2001, Vessel Pollution and Dangerous Chemicals Regulations.*

The City of Vancouver, Tsleil-Waututh Nation, and Living Oceans submitted a report by JWS Consulting LLC on the fate and effect of oil spills from the Trans Mountain Expansion Project on Burrard Inlet and the Fraser River Estuary. The report noted that a major spill could result in a large scale mortality of sea- and shorebirds.

Trans Mountain said that any mortality of birds caused by a crude oil spill would be a significant adverse environmental effect, and no such mortality is acceptable under any circumstances.

The Lyackson First Nation stated that if diluted bitumen made it to shore at Roberts Bank, it could potentially adversely affect migratory birds and/or the biofilm and biomat on which they rely. ECCC noted the importance of biofilm to sandpipers and said that in the event of a spill where oil reached the Fraser River estuary, changes to important food supplies, such as biofilm, could have population effects on Western sandpiper and other shorebirds. It recommended a certificate condition that would require Trans Mountain undertake studies on the effects of oil on biofilm with the focus on crude oil, that would fill identified data gaps and would inform emergency response.

Trans Mountain said that oil fate modelling showed that probability of oiling on Sturgeon and Roberts Bank is very low, and stochastic oil spill modelling results indicate that oiling potential along mudflats in the Fraser River Delta is limited. Trans Mountain said that any such effects would be reversible and therefore, it was not proposing to undertake studies to investigate potential effects of oil on biofilm.

Trans Mountain said that recovery of marine birds following the Exxon Valdez Oil Spill was generally rapid and uncomplicated. Trans Mountain said that it is reasonable to expect marine bird recovery at a population level within two to five years following a large oil spill. Trans Mountain further said that populations of alcid birds, which are considered to be most sensitive to spilled oil, could take longer to recover, on the order of 10 years or longer.

B.C. Nature and Nature Canada raised concerns about the post-spill recovery times estimated by Trans Mountain and suggested that Trans Mountain consider other spill events in addition to the Exxon Valdez oil spill. ECCC said that Trans Mountain's characterization of the Exxon Valdez oil spill recovery and application of recovery times to potential spill impacts from the Project do not reflect the full breadth of conclusions in the literature regarding recovery times for marine birds. It also said that some studies suggest longer impacts to certain species than what Trans Mountain suggested. Trans Mountain said that its recovery assessments are considered to be realistic.

Views of the Board

As with potential spills from the pipeline and from the Westridge Marine Terminal discussed in Chapter 10, section 10.2.17, the Board is of the view that the environmental effects of a spill from a tanker would be highly dependent on the particular circumstances, such as the amount and the type of product(s) spilled, location of the spill, response time, the effectiveness of containment and clean up, the valued components that are impacted, and the weather and time of year of the spill.

For example, a small spill that is quickly contained could have adverse effects of low magnitude, whereas a credible worst-case spill could have adverse effects of larger geographic extent and longer duration, and such effects would probably be significant. Moreover, spills could impact key marine habitats, such as salt marshes, eelgrass beds and kelp forests, which could, in turn, affect the

numerous species that rely upon them. Spills could also affect terrestrial species along the coastline, including SARA-listed terrestrial plant species.

The Board is of the view that although impacts from a credible worst-case spill would probably be adverse and significant, natural recovery of the impacted areas and species would likely return most biological conditions to a state generally similar to pre-spill conditions. Such recovery may be as quick as a year or two for some valued components, or may take as long as a decade or more for others. Valuable environmental values and uses could be lost or diminished in the interim. For some valued components, including certain SARA-species, recovery to pre-spill conditions may not occur.

In the Board's view, mortality of individuals of SARA-listed species could result in population level impacts and could jeopardize recovery. For example, the Recovery Strategy of the Northern and Southern Resident Killer Whales (Orcinus orca) in Canada states that while the probability of either Northern or Southern resident killer whales being exposed to an oil spill is low, the impact of such an event is potentially catastrophic.

14.6.2 Socio-economic effects

Marine commercial, recreational and tourism use

Trans Mountain said that, while potential socio-economic effects of worst-case and smaller spills will vary depending on the exact location and nature of the incident, particular patterns of resource use in the vicinity and key economic activities in areas that may be reached by a spill, a worst-case spill from a marine vessel could have potentially large impacts on marine commercial, recreational and tourism use.

Trans Mountain said that a marine spill, particularly a large spill that affects one or more important commercial fishing areas, would likely result in loss of commercial fishing income due to regulated or voluntary closures and possibly reduced demand due to concerns about fish quality. It said a Project-related tanker spill could affect the tourism and recreation industry by directly disrupting the activities of tourists and recreationalists, and by causing economic effects to recreation or tourism-based businesses as a result of activities being restricted or prohibited near the spill site and in cleanup areas. Marine spills could potentially damage marinas, boats, and business or commercial establishments and infrastructure, resulting in costs for individuals and municipalities and lost income for affected businesses. Trans Mountain said that in such cases, the vessel responsible for the spill would be responsible for compensating those who suffered damage.

Both Aboriginal and non-Aboriginal participants noted the significant economic value commercial fishing provides to B.C.'s coastal communities and stressed the very serious risks to the livelihood of those who depend upon it should a spill occur. Aboriginal groups, including the First Nations of Maa-nulth Treaty Society, Lyackson First Nation, Cowichan Tribes, Musqueam Indian Band, Tsawout First Nation, T'Sou-ke First Nation, and the Swinomish, Tulalip, Suquamish, and Lummi Indian Nations, expressed concern regarding the impact a spill would have on their economic development interests and commercial harvesting rights.

Several participants raised concerns about the impact a spill would have on recreational and tourism use, either by causing disruption to tourist and recreation activities, or economic loss to local businesses and tourism. Both the City of Vancouver and the City of Victoria noted the contribution tourism and commercial activities serve for the local population and economy, and expressed concern that an oil spill would result in both short-term and long-term impacts to local businesses and tourism.

Numerous letters of comment described the pristine beauty of the coastal waters of B.C. and the value the natural resources bring to the writers, their families and all visitors to the region through recreational activities and artist endeavors. Many said that if a spill were to occur, there would be a loss in activities such as recreational fishing, whale-watching, ocean kayaking, and recreational boating and sailing, as these are all dependent on clean waters.

The City of Vancouver said it undertook an assessment of the value of the City of Vancouver brand to determine what impact, if any, a small, medium or large oil spill in the Metro Vancouver area would have on the brand value from an economic standpoint. The City of Vancouver concluded that an oil spill would result in the impairment of the Vancouver brand and a reduction in brand value ranging between USD $1 billion for a small spill and USD $3 billion for large spill.

The Wilderness Tourism Association of B.C. said that any spill in B.C. would have an impact on B.C.'s Super, Natural British Columbia® brand, and affect both provincial and Canadian tourism industries.

Views of the Board

The Board is of the view that the effects of a spill from a tanker would be highly dependent on the particular circumstances, such as the amount and the type of product(s) spilled, location of the spill, response time to contain and recover the spill, the effectiveness of containment and clean up, the valued components that are impacted, and the weather and time of year of the spill. For example, a small spill that is quickly contained could have adverse effects but of low magnitude, whereas credible worst-case spills would have adverse effects of larger geographic extent and longer duration, and such effects would probably be significant.

The Board acknowledges that many parties expressed concerns about potential short-term and long-term spill effects on resources that they use or depend on. The Board finds that a large oil spill would cause disruptions in people's lives, especially those people who depend on the marine environment for commercial and recreational activities and other uses. As discussed in section 14.6.1, the Board finds that although impacts from a credible worst-case spill would probably be adverse and significant, natural recovery of the impacted areas and species would likely return most biological conditions to a state generally similar to pre-spill conditions. Certain values and uses could be lost or diminished in the interim. The Board views recovery of the socio-economic environment as the time when immediate impacts and interruption to people's lives are no longer evident, and the natural resources upon which people depend are available for use and consumption. The Board notes Trans Mountain's commitment to use available spill response technologies to mitigate spill impacts to ecosystems and assist in species recovery. The Board is of the view that implementation of an appropriate spill response, and measures such as compensation and harvest restrictions or closures would lessen the effects experienced until resource-dependent species recover.

The Board finds that there is a very low probability of a credible worst-case event.

For all socio-economic elements, the Board has incorporated the potential consequences of a spill into its discussion on Spill Risks in Chapter 1, and considered them in its overall weighing of the benefits and burdens of the Project in Chapter 2.

Heritage resources

Trans Mountain said that heritage resources could be affected by a spill in a number of ways. Oil and cleanup activities can directly damage artifacts and sites or disturb their context, which may result in permanent loss of information critical to scientific interpretation.

Several intervenors expressed concerns regarding the impacts an oil spill would have on heritage resources along the marine coastline. Pauquachin Nation said it conducted an Archaeological Overview Assessment of the marine shipping component of the Project and found that there are potentially hundreds of sites at theoretical risk. Pauquachin Nation recommended that a general archaeological specific spill response plan be developed and include protocols and procedures to ensure protection of archaeological sites where possible, and mitigation of impacts where these are unavoidable.

Scia'new First Nation said the coast is dotted with registered archaeological sites, burial sites and sacred sites that may be affected by oil contamination from small or large mishaps, and impacts associated with cleanup measures following a spill.

Views of the Board

The Board acknowledges the high degree of concern Aboriginal groups have regarding potential spills or contamination of the ocean, and how it would impact archaeological sites located on the shoreline. The Board is of the view that the effects of a spill from a tanker would be highly dependent on the particular circumstances, such as the amount and the type of product(s) spilled, location of the spill, response time to contain and recover the spill, the effectiveness of containment and clean up, and the weather and time of year of the spill. A credible worst-case spill would have adverse effects.

The Board is of the view that the effects of a credible worst-case spill on heritage resources could be adverse and significant. However, the Board is of the view that the probability of such an event is very low.

The Board encourages Aboriginal groups to participate in the spill response planning process with regulatory authorities such as the Canadian Coast Guard and Transport Canada, and the certified response organization WCMRC. The Board also encourages Aboriginal groups to share information regarding potential archaeological and cultural heritage sites with the B.C. Ministry of Forests, Lands & Natural Resource Operations.

Community well-being

Trans Mountain said that marine oil spills may adversely affect community well-being by affecting cultural and heritage resources, traditional lands, culture, and practices and psychological well-being.

Several participants raised concerns about the impact a spill would have on their quality and enjoyment of life, and community well-being.

Numerous letters of comment explained personal attachments the authors have with the land and water, and described how life would change in the event of a spill. Many commenters described a sense of devastation and incalculable loss at the thought of a spill.

The Village of Belcarra said that an oil spill of any size into Central Burrard Inlet would irreparably harm the social fabric of the Belcarra community which includes fishing, tourism and recreation.

Mr. Guy McDannold said that an oil spill would cause socio-economic devastation, the destruction of the fishery, tourism and the established way of life so important to the communities in the area. The result would be a catastrophic loss of the foundation upon which the communities and the lives of those on the south west coast of Vancouver Island are built. Mr. McDannold said that an oil tanker spill would kill the small coastal communities, and that people would no longer have a reason or ability to live there.

Ms. Sara Steil said that, along with the unknown physical effects attributable to an oil spill, there would also be mental health effects. Job and income loss, and the loss of the attributes of unspoiled natural beauty of the area could deeply affect the members of a community, whose identities have been formed around living in close proximity to these attributes. As an island community; the sea and shorelines are part of the fabric of its existence.

Views of the Board

The Board considered all of the evidence regarding the value that people and communities place on a healthy natural environment. The Board is not able to quantify how a spill could affect people's values and perceptions, given that it would be highly dependent on the particular circumstances. The Board finds that any large spill would be likely to have short-term negative effects on people's values, perceptions and sense of well-being. The Board is of the view that implementation of appropriate mitigation and compensation following a spill would lessen these effects over time. The Board is also of the view that appropriate engagement of communities in determining spill response priorities, identifying community impacts, and developing associated community mitigation plans can also lessen effects on communities. The Board finds the probability of a credible worst-case event is very low.

Local infrastructure and services

Trans Mountain said that in the event of a spill, particularly a credible worst-case incident, demands are likely to be placed on local, municipal, regional and independent emergency responders, hospitals, clinics, social service and relief organizations, and local, municipal, regional and federal government officials and staff.

Traditional Marine Resource Use

Trans Mountain said that Aboriginal peoples have historically used or presently use the shipping route to maintain a traditional lifestyle and continue to use marine resources throughout the Salish Sea region for a variety of purposes, including fish, shell-fish, mammal and bird harvesting, aquatic plant gathering, and

spiritual/cultural pursuits, as well as through the use of waters within the region to access subsistence resources, neighbouring communities and coastal settlements.

Trans Mountain said that although the risk of a Project-related oil spill risk was shown to be low, evidence from the Exxon Valdez Oil Spill indicates that subsistence harvesting by Aboriginal communities and individuals would be affected. Trans Mountain said that adverse effects resulted from reduced availability of fish and wildlife, concern about possible health effects of eating fish and wildlife, and disruption of traditional lifestyle due to participation in, or disturbance by, cleanup activities. The company said fears about food safety diminished over time and harvest levels increased since the spill, but the increase has been variable, and composition of harvested species has changed. Trans Mountain noted that other factors have influenced this change and discerning what is spill-related is difficult.

Aboriginal groups in the marine corridor expressed concerns about the impacts of spills. Several Aboriginal groups, including Tsawout First Nation, the First Nations of Maa-nulth Treaty Society, and Musqueam First Nation, said that rights were not being accommodated and that if a spill occurred, it would impact their ability to exercise harvesting rights as a result of access restrictions due to regulated or voluntary spill-related closures, or damage to vessels or gear. They also expressed concern that an oil spill may damage culturally or spiritually sensitive areas, or cause interruption of traditional ceremonies during the cleanup period.

A number of Aboriginal groups, including Musqueam First Nation and Scia'new First Nation, described the importance and value of aquatic resources for their subsistence activities and culture. Many Aboriginal groups, including Snuneymuxw First Nation and the First Nations of Maa-nulth Treaty Society, expressed concerns that an oil spill may reduce the quantity and quality of marine resources and wildlife. They said this impact could extend beyond when closures are lifted. They noted that just because the probability of a spill is small, that is not sufficient reason to determine the effects of a spill are not significant. They also noted concern that there is no adequate compensation for loss of marine resources in the event of large spill.

Several Aboriginal groups, including Tsleil-Waututh First Nation and Stz'uminus First Nation, noted that an oil spill would affect integral aspects of their culture including their subsistence, economy, social activities, ceremonial activities, cultural transmission, and water based travel. Tsleil-Waututh Nation said that there is not one single negative effect to Tsleil-Waututh culture from the potential spills associated with the Project, but rather a number of effects and cascading effects that reach all aspects of Tsleil-Waututh culture. The most certain negative effect would be further dislocation from their territory and the resources of that territory. Many Aboriginal groups said that that if there is an oil spill, the adverse effects could be catastrophic and devastating, causing severe and irreparable harm, and remain for many years as a result of loss of cultural knowledge.

Through its extensive engagement activities, Trans Mountain said that it understands that an oil spill into the marine environment, arising from an incident involving a tanker is a major concern for Aboriginal communities. Trans Mountain said it recognizes that an unmitigated oil spill from a tanker could have immediate to long-term effects on the biophysical and human environment of the Salish Sea. Trans Mountain committed to enhanced navigation and safety measures and to the continued identification of improvements to the existing oil spill response preparedness and response capacity, in consultation with Aboriginal groups. Trans Mountain also committed to invite all Aboriginal groups to attend regional workshops where mitigation measures and monitoring programs will be discussed.

Views of the Board

The Board acknowledges the high degree of concern Aboriginal groups have regarding potential spills or contamination of the rivers and ocean, and how it would affect their traditional use and cultural identity. The Board has considered all the evidence placed on the record, including that related to marine shipping safety and navigation.

The Board is of the view that the effects of a credible worst-case spill on the current use of lands, waters and resources for traditional purposes by Aboriginal people would likely be adverse and significant.

As discussed in section 14.6.1, the Board finds that although impacts from a credible worst case spill would probably be adverse and significant, natural recovery of the impacted areas and species

would likely return most biological conditions to a state generally similar to pre-spill conditions. Certain values and uses could be lost or diminished in the interim. The Board notes Trans Mountain's commitment to use available spill response technologies to mitigate spill impacts to ecosystems and assist in species recovery. The Board is of the view that implementation of an appropriate spill response, and measures such as compensation and harvest restrictions or closures would lessen the effects experienced until resource-dependent species recover. The Board finds the probability of a worst-case event is very low.

The Board has incorporated the potential consequences of a spill into its discussion on Spill Risks in Chapter 1, and considered them in its overall weighing of the benefits and burdens of the Project in Chapter 2. .

Human health effects of marine spills

Trans Mountain said for the credible worse-case marine spill scenario (16 500 m^3 of spilled oil), comparison of the predicted maximum one-hour average concentrations of the chemicals of potential concern (COPC) to corresponding acute inhalation exposure limits revealed exceedances of the exposure limits were predicted for the following COPC: aliphatic C_1-C_4, aliphatic C_5-C_8, and aromatic C_9-C_{16} groups, benzene, toluene, and xylenes. The exceedances indicate the possibility that people exposed to each of these COPC during the early stages of the spill incident could potentially experience adverse health effects.

Trans Mountain said the exceedances were spatially predicted to occur predominantly over water, but in some instances, extended over land, including island communities along the marine shipping route. The areal extent and coverage was greatest for the aromatic C_9-C_{16} group and benzene, with exceedances extending up to approximately 20 km from the spill source. Coverage across this area was nearly complete with a number of island communities located within the affected area. In the case of the aliphatic C_5-C_8 group, toluene, and xylenes, the areal extent of the exceedances was similar to that of the aromatic C_9-C_{16} group and benzene. However, coverage was much sparser and confined predominantly to areas over water, with fewer island communities likely to be affected. In the case of the aliphatic C_1-C_4 group, the predicted areal extent of exceedances did not extend beyond three kilometres from the spill source.

Trans Mountain said the temporal extent of the exceedances followed a biphasic pattern, with the second phase extending out to approximately 20 to 30 hours after the start of the spill event, regardless of the spill size. It is conceivable that these exceedances could occur before the arrival of first responders and the implementation of emergency and spill response measures.

Trans Mountain said a comparison of the predicted maximum one-hour average airborne concentrations of the COPC against the corresponding one-hour Acute Exposure Guideline Levels (AEGL) and Emergency Response Planning Guidelines (ERPG) reveals that the predicted concentrations were consistently lower than these guidelines, including the Tier-1 values, indicating that people in the area would not be expected to experience health effects other than mild, transient sensory and/or non-sensory effects.

Trans Mountain said that, based on the weight-of-evidence, there is no obvious indication that human health would be seriously adversely affected by acute inhalation exposure to the chemical vapours released during the early stages of a spill under any of the simulated and unmitigated oil spill scenarios examined. The health effects that could be experienced by people in the area would likely be confined to mild, transient sensory and/or non-sensory effects, attributable largely to the irritant and central nervous system depressant properties of the chemicals. Odours also might be noticed, which could contribute to added discomfort and irritability.

Trans Mountain said these mild, transient health effects could be experienced under all of the simulated and unmitigated oil spill scenarios examined. However, the intensity of the effects would be greatest for the larger-sized spills because of the higher concentrations of the chemical vapours that could be encountered and the longer durations of exposure. The absence of any serious adverse health effects from exposure to the chemical vapours released from the surface of the oil slick during the early stages of the spill scenarios applies to people in general, including the general public as well as first responders arriving on scene. First responders could remain on scene for some time while working to isolate, contain and recover the spilled oil, and could face the prospect of direct physical contact with the oil and/or more prolonged exposure to the vapours.

A number of intervenors, including Aboriginal groups, and municipal and federal governments, raised a range of concerns regarding potential effects on human health that may result from a spill or accident in the marine environment.

Metro Vancouver and Tsleil-Waututh Nation said the results from their own air quality modelling assessment were based on hypothetical large spills of 16 000 m^3 at English Bay, First and Second Narrows, and a spill of 8 000 m3 in Burrard Inlet. The scenarios predicted exceedances for a number of COPC for areas where people may be present (but not permanently living), including Stanley Park, Lions Gate Bridge and Second Narrows Bridge. Tsleil-Waututh Nation said that, based on the simulated scenarios considered, the greatest human health risk from benzene and i-butane is likely to occur during the first hour following an oil spill.

The City of Burnaby said even if a large oil spill in Burrard Inlet is extremely unlikely, the public health consequences could be very significant, given the large and densely populated communities surrounding Burrard Inlet. It said health authorities do not have the capacity for monitoring chemicals released following a large oil spill, and that local public health authorities should be included in incident notification protocols. The City of Burnaby said Trans Mountain has not described how it intends to communicate with health authorities and other agencies, and how it intends to assess and monitor exposure in the event of a spill and to share information necessary to make timely public health decisions.

The City of Burnaby and the Fraser Valley Regional District said Trans Mountain's HHRA results potentially underestimate the predicted health risks The Cities said the exclusion of possible large spills of gasoline or jet fuel, and potential post-spill health risks associated with all plausible pathways of exposure were not considered.

Health Canada said the effects of oils spills into the marine environment are a major concern of area residents, including Aboriginal people, due to effects on marine country foods, the environment and recreation activities. Health Canada said country foods are major components of the Aboriginal traditional lifestyle, and it is important to consider potential impacts of a spill on the contamination of, access to, and availability of marine country foods consumed by Aboriginal communities.

Health Canada said eliminating or minimizing exposure is of utmost importance to protect the health of a population located in the vicinity of a spill. Health Canada suggested a number of considerations for the development of mitigation measures and spill management plans, including measures to quickly and effectively limit human exposure, the possible time lags for contaminants to appear in country foods, and communications plans and health advisories developed with communities and health authorities. Health Canada said the magnitude of air quality impacts of spills into the marine environment may be greater than was presented in Trans Mountain's HHRA.

North Shore No Pipeline Expansion (NS NOPE) said there is evidence of appreciable but reversible short-term impacts for residents living in spill impact zones. There is an extended range of impacts with potentially longer duration for workers (resident and non-resident volunteers and paid professionals) engaged in clean up. Although long-term studies are lacking, there is some evidence of respiratory, endocrine, immunological and genotoxic effects persisting for years in highly exposed cleanup workers. NS NOPE said these short- and long-term physical impacts can be mitigated to some extent through the use of appropriate personal protective equipment, and effective health and safety training.

NS NOPE also said mental health impacts were more sensitive indicators of harm than physical impacts, and were most often related to income loss or financial uncertainty. Mental health and community impacts can be mitigated, in some cases, by easing financial uncertainty through timely and satisfactory compensation and through mechanisms that encourage or utilize social support.

Living Oceans said Trans Mountain's two evaluated spill scenarios represent a very small subset of possible failures, environmental conditions and other factors that might affect human health, and therefore do not represent the magnitude of human health risks resulting from a maximum credible worst-case spill. Living Oceans said even considering the limitations of the two scenarios, the modeled releases pose inhalation risks to nearby populations, as well as the potential for significant dermal and ingestion exposures.

Tsleil-Waututh Nation raised a number of concerns about the potential impacts of an oil spill on Tsleil-Waututh Nation's practices and customs. Tsleil-Waututh Nation said, depending on the location, extent and timing of a spill, it could have major impacts on Tsleil-Waututh Nation's practice and custom

of relying on salmon for subsistence, would limit Tsleil-Waututh Nation's potential to harvest seabirds and shorebirds, and would severely limit their ability to re-start clam harvesting. Tsleil-Waututh Nation said if their traditional foods sources are negatively affected by a spill, this affects their ability to harvest them, and hence Tsleil-Waututh's primary context for cultural transmission is also negatively impacted.

Matsqui First Nation provided an assessment of the potential impacts of a number of hypothetical spill scenarios (including a marine spill in the Strait of Georgia). Matsqui said the predicted impacts on physical health in each scenario are characterized as severe, including impact outcomes such as higher rates of illness (from lower nutrition due to limited consumption of fish after spill), high stress, and reduced pre-natal health and youth development. Matsqui First Nation said immediate and long-term health related issues from a spill affecting Matsqui reserve lands, the Fraser River or Burrard Inlet were rated as 'extremely significant'.

Pacheedaht said a number of elements were missing from Trans Mountain's assessment of the Project, including potential health effects based on specific consumption patterns, potential health effects associated with abandonment of traditional diet, and a determination of significance of these potential effects.

Pauquachin Nation and Tsawout First Nation raised a number of general concerns about potential impacts on the health of community members, including loss of access to marine resources, and concerns about the potential health effects related to the replacement of traditional foods with store-bought foods.

Trans Mountain said planning and preparedness around emergency and spill response are critical to ensure timely and adequate response to any spill event, to limit opportunities for chemical exposures, such that public health is not threatened or compromised.

Trans Mountain said, to mitigate human health impacts in the event of a spill, environmental monitoring and surveillance programs would be initiated to help guide decision-making. Once a spill has occurred, DFO would be notified, and it, working with other government authorities (e.g., ECCC and the Canadian Food Inspection Agency) and in consultation with other appropriate network resources, would assess the spill. Based on spill location, size and the potential opportunities for people to be exposed to the spilled oil through different exposure pathways, they would determine if additional spill response measures may be needed to protect public health. Trans Mountain said this determination would extend to measures required to ensure the safety of the public food supply, and if warranted, could include controls such as the closure of commercial and recreational fisheries and the issuance of fish, shellfish and/or other seafood consumption advisories.

Trans Mountain said as part of overall emergency and spill response, notification of the public of the spill would include notice to avoid contact with the spilled oil, with examples provided of precautions to take to prevent both direct and incidental exposure. If people might be exposed to the oil through direct skin contact, consultation with the appropriate network resources and public health authorities would be undertaken on measures to be implemented beyond recovery and clean up. Trans Mountain said closure of public waterways, beaches or shorelines could be ordered by the appropriate authorities if public health or safety were threatened.

Views of the Board

The Board is of the view that, in the event of a spill in the marine environment during shipping, including a large spill, there would be adverse effects on human health. These effects would vary over time and space depending on the location and extent of the spill, and there would likely be exceedances of certain short-term exposure limits for some chemicals of potential concern, including both carcinogenic and non-carcinogenic chemicals, but these would be expected to diminish in the hours following a spill. Some people would likely experience health effects, including a range of transient effects. These health effects could be experienced in all spills, but the intensity of the effects would be greatest for the larger-sized spills because of the higher concentrations of the chemical vapours that could be encountered and the longer durations of exposure. As noted by Trans Mountain, first responders could face the prospect of direct physical contact with spilled oil, and may have more prolonged exposure to the vapours. Trans Mountain has described its emergency response measures that would be initiated in the event of a spill, including those intended to protect human health.

The Board assessed all the evidence placed on the record, including that related to marine shipping safety and navigation. The Board is of the view that although a credible worst case spill from a tanker associated with the Project would result in significant adverse environmental and socio-economic effects, the probability of such an event is very low. As discussed further in this chapter and Chapter 9, the Board finds that based on evidence filed by Trans Mountain and intervenors, a large spill in Burrard Inlet would result in significant adverse environmental and socio-economic effects. Evidence filed by parties such as the City of Vancouver, City of Burnaby and the Tsleil-Waututh Nation indicate the potential extent of such effects. However, based on the evidence before it, the Board finds that a large spill in Burrard Inlet is not a likely event. The Board is therefore of the view that the potential effects on human health that are predicted to result from such spill scenarios are also not likely to occur.

14.7 Financial responsibility, liability and insurance

14.7.1 Marine Liability Act - Financial responsibility and compensation

Transport Canada and Trans Mountain said that the Marine Liability Act establishes the framework for marine liability and compensation in Canada and reflects Canada's role as a signatory to the International Oil Pollution Compensation Funds and the Civil Liability Convention. The Marine Liability Act also establishes the Ship-source Oil Pollution Fund that provides funding for spills from all classes of vessels in Canadian waters. The Ship-source Oil Pollution Fund provides funding in addition to the funding available under the international funds. The classes of claims for which the Ship-source Oil Pollution Fund may be liable include:

- claims for oil pollution damage;
- claims for costs and expenses of oil spill cleanup, preventive measures and monitoring; and
- claims for oil pollution damage and cleanup costs where the cause of the oil pollution damage is unknown.

Trans Mountain said that there is also a widely defined class of parties in the Canadian fishing industry that may claim against the Ship-source Oil Pollution Fund for loss of otherwise unrecoverable income caused by an oil spill from a vessel under the Marine Liability Act.

Transport Canada and Trans Mountain said that both the Canadian and international frameworks are based on the "polluter pays" principle, which makes the polluter liable for all response costs and damages associated with an oil spill. In the event of an oil spill from a tanker in Canadian waters, the owner of a tanker (i.e., the Responsible Party) would be liable for the cost of cleanup and compensation to affected parties subject to the limits of their liability. The responsible party's liability is limited based on vessel tonnage to a maximum of about $136.76 million. Beyond that liability limit, compensation is available through a tiered funding system in the event of an oil spill in a marine environment. The funding includes approximately $1 billion through the International Oil Pollution Compensation Fund and the Supplementary Fund Protocol, and up to approximately $161 million from Canada's Ship-source Oil Pollution Fund. In total, there is approximately $1.3 billion in funding available to address the costs of emergency response, cleanup and compensation in the event of an oil spill from a tanker.

Trans Mountain described co-insurance or cost-sharing provisions that may apply in the circumstances of a spill at WMT where there is ambiguity as to the source of the spill. Trans Mountain said that co-insurance refers to the sharing of costs associated with a spill event among responsible parties, insurers, and others. It said that co-insurance does not affect or complicate response to the spill but cost sharing among insurers may not be settled until long after claimants have been paid compensation or damages.

Transport Canada said that as part of the World Class Tanker Safety System initiative, the Government of Canada announced that it would introduce legislative and regulatory amendments to the Marine Liability Act to enhance the Ship-source Oil Pollution Fund. These amendments, if put into force, would:

- remove the existing per-incident liability limit to make an unlimited amount of compensation available;

- in the unlikely event that all domestic and international funds have been exhausted, allow the Ship-source Oil Pollution Fund to:
  - receive temporary loans from the federal government to ensure eligible claimants receive compensation;
  - recover these costs from the industry through a modernized levy; and
- further align Ship-source Oil Pollution Fund coverage with the International Oil Pollution Compensation Funds to cover all damages.

Trans Mountain acknowledged the concern raised by several intervenors, that tanker spills would have long-term to permanent effects on their resource-based economy, commercial and traditional harvest activities, culture, and community well-being. It also said that intervenors expressed concern that tanker spills would affect city parks and public spaces, recreational marine use, human health, cultural and historic resources, municipal services, and community well-being. Trans Mountain noted that some intervenors provided estimates of potential spill related damages. Trans Mountain said that the estimates of magnitude and duration provided by intervenors appear to reflect worst-case assumptions and that the effects of a spill would depend on the unique circumstances of a spill, were one to occur.

Trans Mountain said that it is not liable for a tanker-based marine spill and that it had not estimated any costs associated with such a spill. It said that the responsibility for a tanker-based marine spill lies with the tanker owner. Trans Mountain said that, because each spill is different, it is not possible to provide breakdowns or aggregates of costs for a hypothetical event.

Trans Mountain noted the NEB's September 2013 filing requirements regarding environment and socio-economic effects for increased marine shipping activities that specified: "The assessment of accidents and malfunctions must also provide a description of the liability and compensation regime that would apply in the case of a spill." It noted where this information could be found in its application (summarized in sections 14.2.1 and 14.7). Trans Mountain submitted that Canada's marine shipping liability and compensation regime is among the most robust in the world and it would be further improved through proposed amendments.

The City of Vancouver said there are a number of potential costs to the City arising from a catastrophic spill. It concluded that a catastrophic spill could present significant costs to the City government of close to $1 billion. In addition, Vancouver said that ocean-economic activities could suffer total losses in excess of $1 billion in the event of a 16 000 m^3 oil spill at the First or Second Narrows within Burrard Inlet.

The City of Vancouver critiqued a number of gaps in the existing national and international compensation regimes, as well as several factors which limit the regime's effectiveness in compensating for the full socio-economic costs of an oil spill. It said that in the event of a large oil spill in Burrard Inlet, the existing compensation regime would be inadequate to fully compensate Vancouver, its businesses and residents, for the associated socio-economic impacts. It said that Vancouver would be only one of many claimants who would be submitting significant compensation claims.

The Tsawout First Nation said costs of tanker spills can vary significantly depending on the characteristics of the area impacted, the conditions at the time of the spill, the spill response and the characteristics of the oil spilled. The Tsawout estimated costs of tanker spills associated with the Project and said that tanker spills from the project could result in significant damage costs that exceed existing compensation schemes. For a tanker spill, it estimated a worst-case spill of 103,782 bbl and that such a spill could exceed available compensation from domestic and international spill compensation funds by $2.9 billion.

Conversations for Responsible Economic Development said that in the case of a major tanker spill, taxpayers would likely be responsible for the burden of costs, as a company's liability is limited to $1.3 billion and a major spill could easily cost ten times this amount.

Trans Mountain reviewed the spill cost estimate reports provided by intervenors and submitted that none of the reports should be used to provide reliable costs potentially associated with a tanker spill. Among other reasons for this conclusion, Trans Mountain said:

- the past incidents used in estimating spill costs were not appropriate;
- inappropriate methods and assumptions were used for estimating spill costs;

- Passive use values and ecosystem goods and services were overestimated and inappropriately included in spill cost estimates; and
- Spill costs were based on potential spill volumes which were deemed to not be credible.

Views of the Board

The Board finds that Trans Mountain's application met the requirements outlined in the Board's 10 September 2013 "Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increased Marine Shipping Activities" which required a description of the liability and compensation regime that would apply in the case of a spill.

As outlined in sections 14.2.1 and 14.7, there is an existing regulatory regime in place related to marine financial liability and compensation in the event of a spill event. In the event of a tanker-based spill, there is approximately $1.3 billion of compensation available. As stated throughout this hearing process, this area is not under the Board's regulatory jurisdiction. The evidence before the Board indicates that there are competent authorities responsible for this regime, and the Board has no reason to believe that this regime is not functioning as designed. The evidence indicates that the regime is reviewed periodically and there is currently a review of the regulatory regime occurring with the intention to strengthen the regime. Any changes to the existing regime would be the responsibility of the Government of Canada.

In the event of a spill originating at the Westridge Marine Terminal (WMT), Trans Mountain would be responsible for costs associated with the spill. Pipeline-related spill costs and compensation, including those related to the WMT, are discussed in Chapter 13.

The Board accepts Trans Mountain's evidence that there were inappropriate methodological and technical assumptions associated with intervenor evidence which resulted in overly hypothetical or inflated potential spill costs. These include the reliance on costs associated with past spill incidents that were not tanker-based spills; the assumption that a large spill event is likely to occur; the use of hypothetical passive use values; and emphasis on extreme spill events. Although not impossible, the Board is of the view that such costs are unlikely considering potential spill size and marine safety and spill response mitigation, as discussed in sections 14.4 and 14.5.

Appendix 1

List of Issues

The Board has decided on a list of 12 issues it will consider during the hearing process.

1. The need for the proposed project.
2. The economic feasibility of the proposed project.
3. The potential commercial impacts of the proposed project.
4. The potential environmental and socio-economic effects of the proposed project, including any cumulative environmental effects that are likely to result from the project, including those required to be considered by the NEB's *Filing Manual*.
5. The potential environmental and socio-economic effects of marine shipping activities that would result from the proposed Project, including the potential effects of accidents or malfunctions that may occur.
6. The appropriateness of the general route and land requirements for the proposed project.
7. The suitability of the design of the proposed project.
8. The terms and conditions to be included in any approval the Board may issue.
9. Potential impacts of the project on Aboriginal interests.
10. Potential impacts of the project on landowners and land use.
11. Contingency planning for spills, accidents or malfunctions, during construction and operation of the project.
12. Safety and security during construction of the proposed project and operation of the project, including emergency response planning and third-party damage prevention.

The Board does not intend to consider the environmental and socio-economic effects associated with upstream activities, the development of oil sands, or the downstream use of the oil transported by the pipeline.

Appendix 2

Overview of work/activity authorized by individual legal instruments

This table is provided as an overview and guide only. The legal instruments themselves provide the actual authorizations. Appendix 3 sets out the list of 157 conditions and illustrates which conditions would attach to each instrument.

	Instrument	Action with respect to instrument	Work/activity being authorized
1	New CPCN (CPCN)	New	**Add to New CPCN (transfer from existing Trans Mountain Pipeline system and put into service on Line 2):** • active 150 km NPS 36 pipeline segment from Hinton to Hargreaves • active 43 km NPS 30 pipeline segment from Darfield to Black Pines **Authorization to expand the Westridge Marine Terminal (WMT):** • tanker loading dock complex at the WMT, with a total of three Aframax-capable berth faces and a utility dock **Authorization to construct and operate:** • two new parallel NPS 30 delivery pipelines from the Burnaby Terminal to the Westridge Marine Terminal **Authorization to construct and operate:** • 339 km NPS 36 pipeline from Edmonton to Hinton • 121 km NPS 42 pipeline from Hargreaves to Blue River • 158 km NPS 36 pipeline from Blue River to Darfield • 368 km NPS 36 pipeline from Black Pines to the Burnaby Terminal
2	CPCN OC-2 (OC2)	Amend	**Authorization to Decommission:** • one existing tank at the Edmonton Terminal West Tank Area • one existing tank at the Burnaby Terminal **Authorization to Reactivate:** • 150 km NPS 24 pipeline segment from Hinton to Hargreaves • 43 km NPS 24 pipeline segment from Darfield to Black Pines • Niton Pump Station **Remove from CPCN OC-2 (transfer from Line 1 and put into service on Line 2):** • 43 km NPS 30 pipeline segment from Darfield to Black Pines

3	CPCN OC-49 (OC49)	Amend	**Remove from CPCN OC-49 (transfer from Line 1 and put into service on Line 2):** • 150 km NPS 36 pipeline segment from Hinton to Hargreaves **Deactivate** • Wolf Pump Station
4	NEB Act, s.58 Order (Temp)	New	**Authorization for temporary construction lands and infrastructure:** • development of camp locations, stockpile sites, • contractor staging areas (i.e., co-located with camps or stockpile sites), • construction yards, borrow pits, and • access roads for the first 10 km of each pipeline spread (including temporary, clear-span bridges associated with these access roads)
5	NEB Act, s.58 Order (Pump1)	New	**Line 1 Pump Stations** **Authorization to construct and operate:** • Black Pines Pump Station on Line 1 **Authorization to:** • drag reducing agent (DRA) injection at Jasper Pump Station • add one pump unit to Kamloops Pump Station • add one pump unit to Sumas Pump Station
6	NEB Act, s.58 Order (Pump2)	New	**Line 2 Pump Stations** **Authorization to construct and operate:** • Edmonton Pump Station • Gainford Pump Station • Wolf Pump Station • Edson Pump Station • Hinton Pump Station • Blue River Pump Station • Blackpool Pump Station • Black Pines Pump Station • Kamloops Pump Station • Kingsvale Pump Station
7	NEB Act, s.58 Order (Tanks)	New	**New Tanks (Line 1 and Line 2)** **Authorization to construct and operate:** • five new tanks at the Edmonton Terminal West Tank Area • one new tank at the Sumas Terminal • 14 new tanks at the Burnaby Terminal
8	Deactivation order (Deact)	New	**Authorization to deactivate:** • Blue River Pump Station

Appendix 3

Conditions applied to legal instruments

In these conditions, the following terms are defined as:

Appropriate Government Authorities	Federal, Provincial, Regional or Municipal government departments or agencies with jurisdiction, statutory obligations, regulatory oversight or a decision-making role in relation to the subject-matter of the specific condition. For location-specific conditions or phased filings, this is limited to those with such a role in relation to the geographic location to which the condition filing applies. (Aboriginal groups are treated separately and listed separately in each applicable condition.)
Commencing operations	The Project is opened for oil storage and transmission. Unless otherwise specified, "prior to commencing operations" means an action must be completed prior to commencing operation of any component of the Project, and "after commencing operations" means an action must be completed after all components of the Project are operating.
Construction	Any in-field activity that may have an effect on the environment and that is necessary for installing, deactivating, reactivating[83] or decommissioning, or preparing to install, deactivate, reactivate[83] or decommission, any component of the Project. Construction activities include, clearing, mowing, grading, trenching, drilling, boring, and blasting. Construction activities do not include activities associated with routine surveying operations or data collection activities, such as geotechnical investigations (e.g., geophysical surveys, bore holes, and test pits), activities required to obtain integrity information on the reactivation pipeline segments, or operations and maintenance activities (to which NEB "Operations and Maintenance Activities on Pipelines under the National Energy Board Act – Requirements and Guidance Notes" apply). Construction at the Westridge Marine Terminal also includes construction activities occurring in the marine environment that are necessary for installing, or preparing to install, any component of the Westridge Marine Terminal expansion. This includes dredging, blasting, and pile drilling.
Consultation	Unless otherwise specified in a condition, Trans Mountain's consultation must be carried out in a manner that: a) provides, to those to be consulted: i) notice of the matter in sufficient form and detail to allow them to prepare their views or information on the matter; ii) a reasonable period for them to prepare those views or information; and iii) an opportunity to present those views or information to Trans Mountain; and b) considers, fully and impartially, the views or information presented; c) provides, to those in a) who request it, a draft summary of the consultation undertaken with that party, and a reasonable period for them to provide feedback to Trans Mountain; and d) provides, to those in a) who request it, a copy of the NEB filing receipt for, or notice of, the condition filing to which the consultation pertained.

83 Excluding engineering assessment and operations and maintenance activities required to meet Conditions 19 and 31.

Dry commissioning	Dry commissioning involves the systematic inspection and testing of mechanical, piping, electrical, instrumentation, control, and communications systems, **prior to the introduction of process fluids**, to ensure that they are ready for the introduction of fluids and are expected to function as intended.
For approval	Where a condition requires a filing or filings for NEB approval, Trans Mountain must not commence the indicated activity until the NEB issues its written approval of that filing or filings.
Including	Use of this term, or any variant of it, is not intended to limit the elements to just those listed. Rather, it implies minimum requirements with the potential for augmentation, as appropriate.
Line 1	After the expansion, the 1,147 km Line 1 pipeline will consist of, combined, the following pipeline segments, including segments to be reactivated and currently operating TMPL segments: • the existing 229 km of 609.6 mm outside diameter (NPS 24) and 89 km of 762.0 mm outside diameter (NPS 30) pipeline segments from Edmonton, AB, to Hinton, AB; • the reactivated 150 km of NPS 24 pipeline segment from Hinton, AB, to Hargreaves, B.C. (built in 1957); • the existing 273 km of NPS 24 pipeline segment from Hargreaves, B.C., to Darfield, B.C.; • the reactivated 43 km of NPS 24 pipeline segment from Darfield, B.C., to Black Pines, B.C. (built in 1953); • the existing 325 km of NPS 24 and 38 km of NPS 30 pipeline segments from Black Pines, B.C., to the Burnaby Terminal, B.C..
Line 2	After the expansion, the approximately 1,180 km Line 2 pipeline will consist of, combined, the new transmission pipeline segments and the two currently operating TMPL segments transferring to Line 2 service: • approximately 339 km of new 914 mm outside diameter (NPS 36) pipeline from Edmonton, AB, to Hinton, AB; • the existing 150 km of NPS 36 pipeline segment from Hinton. AB, to Hargreaves, B.C. (built in 2008); • approximately 121 km of new 1067 mm outside diameter (NPS 42) pipeline from Hargreaves, B.C., to Blue River, B.C.; • approximately 158 km of new NPS 36 pipeline from Blue River, B.C., to Darfield, B.C.; • the existing 43 km of NPS 30 pipeline segment from Darfield to Black Pines (built in 1957); and • approximately 368 km of new NPS 36 pipeline from Black Pines, B.C., to the Burnaby Terminal.
Monitoring	Observing the environmental and socio-economic effects of the Project for the purposes of assessing and measuring the effectiveness of mitigation measures undertaken, identifying unanticipated environmental and socio-economic issues, and, based on the results of these activities, determining any remedial actions required. From an engineering perspective, monitoring involves regularly observing pipelines, terminals and pump stations (e.g., through surveys, patrols, inspections, testing, instrumentation) to ensure their operation is within defined parameters, with the goal of identifying any issues or potential concerns (e.g., pipeline integrity, geohazards, erosion, security) that may compromise the protection of the pipelines, terminals, pump stations, property, persons, and the environment.
Monthly (in relation to a condition filing or posting)	Unless otherwise specified in a condition, a monthly filing shall be made on the 5th working day of the calendar month following the month to which the filing pertains.
NEB or Board	National Energy Board
New delivery pipelines	Collectively, the two new NPS 30 oil delivery lines between Trans Mountain's Burnaby Terminal and its Westridge Marine Terminal (approximately 2.6 km for the tunnel option and 3.6 km for the street option).
Officer of the company	Where a condition requires a filing to be signed by an officer of the company, the filing must include a statement confirming that the signatory to the filing is an officer of the company duly authorized for that purpose.

Project	The Trans Mountain Expansion Project in all its components, including pipeline construction, reactivation, and changes to operating conditions resulting in operation as Line 1 and Line 2; deactivation, reactivation, construction and operation of or at the respective pump stations; decommissioning of 2 tanks and construction and expanded operation at the existing Edmonton, Sumas and Burnaby Terminals and the Westridge Marine Terminal; construction and operation of the new delivery pipelines; and all infrastructure. The Project does **not** include Project-related marine shipping.
Quarterly (in relation to a condition filing or posting)	Unless otherwise specified in a condition, a quarterly filing shall be made on the 10th working day of the quarter following the quarter to which the filing pertains.
Temporary infrastructure	All structures or sites necessary for pipeline, terminal and pump station construction, reactivation, deactivation, modification and expansion approved as part of the Project. Examples of infrastructure include construction camps, stockpile sites, contractor yards, laydown areas, temporary work space, borrow pits, roads, bridges, snow pads, and temporary power supply lines necessary for operating infrastructure and equipment during the construction phase.
Third party (in relation to a report, review or assessment)	An independent consultant, expert, or contractor that, except for receiving payment for acting as a third party, is unaffiliated with Trans Mountain, Kinder Morgan Canada Inc., the principal consultants of either, or any other corporate entity with a financial interest in the Project. A third party is, because of their knowledge, training, and experience, qualified and competent to perform an assessment or review, and was not involved in developing the manual, report, plan, program, or policy being assessed or reviewed.
TMPL	The existing operating Trans Mountain Pipeline system.
Trans Mountain	Trans Mountain Pipeline ULC, as general partner of Trans Mountain Pipeline L.P.

Government authorities are mentioned in certain conditions. If a particular authority's name changes in the future, Trans Mountain's requirements relating to that authority would rest with its successor. Similarly, if a particular authority's function is assumed by another authority, Trans Mountain's requirements relating to that function would rest with the new authority.

Note: Appendix 2 provides a summary of work/activities authorized under each legal instrument.

No.	Overarching conditions	CPCN	OC2	OC49	Temp	Pump 1	Pump2	Tanks	Deact
1	**Condition compliance** Trans Mountain must comply with all of the [certificate/order] conditions, unless the NEB otherwise directs.	X	X	X	X	X	X	X	X
2	**Compliance with commitments** Without limiting Conditions 3, 4 and 6, Trans Mountain must implement all of the commitments it made in its Project application or to which it otherwise committed on the record of the OH-001-2014 proceeding.	X	X	X	X	X	X	X	X
3	**Environmental protection** Trans Mountain must implement or cause to be implemented, at a minimum, all of the policies, practices, programs, mitigation measures, recommendations, and procedures for the protection of the environment included or referred to in its Project application or to which it otherwise committed on the record of the OH-001-2014 proceeding.	X	X	X	X	X	X	X	X
4	**Engineering and safety** Trans Mountain must cause the Project to be designed, located, constructed, installed, and operated in accordance with, at a minimum, the specifications, standards, policies, mitigation measures, procedures, and other information included or referred to in its Project application or to which it otherwise committed on the record of the OH-001-2014 proceeding.	X	X	X	X	X	X	X	X
5	**Certificate expiration (sunset clause)** Unless the NEB otherwise directs **prior to 30 September 2021**, this [certificate/order] will expire on **30 September 2021**, unless construction of the Project has commenced by that date.	X	X	X	X	X	X	X	X
No.	**Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)**	**CPCN**	**OC2**	**OC49**	**Temp**	**Pump 1**	**Pump2**	**Tanks**	**Deact**
6	**Commitments tracking table** Without limiting Conditions 2, 3 and 4, Trans Mountain must implement the commitments contained within its commitments tracking table and must: a) file with the NEB, at the following times, an updated commitments tracking table including the status of each commitment: **i) within 3 months after the [certificate/order] date;** **ii) at least 30 days prior to commencing construction;** **iii) monthly, from the commencement of construction until the first month after commencing operations; and** **iv) quarterly thereafter until:** 1. all commitments on the table are satisfied (superseded, complete or otherwise closed), at which time Trans Mountain must file confirmation, signed by an officer of the company, that the commitments on the table have been satisfied; or 2. 6 years after commencing operations, at which time Trans Mountain must file with the NEB a summary of any outstanding commitments and a plan and implementation timeline for addressing these commitments; whichever comes earlier; and b) post on its company website the same information required by a), using the same indicated timeframes; and	X	X	X	X	X	X	X	X

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
6 (cont)	c) maintain at each of its construction offices: i) the relevant environmental portion of the commitments tracking table listing all of Trans Mountain's regulatory commitments, including those from the Project application and subsequent filings, and environmental conditions or site-specific mitigation or monitoring measures from permits, authorizations, and approvals for the Project issued by federal, provincial, or other permitting authorities; ii) copies of any permits, authorizations, and approvals referenced in i); and iii) copies of any subsequent variances to permits, authorizations, and approvals referenced in i).								
7	**Environmental and socio-economic assessment - route re-alignments** As applicable, Trans Mountain must file with the NEB for approval, **concurrent with its filing of the Plan, Profile and Book of Reference pursuant to section 33 of the *National Energy Board Act***, an environmental and socio-economic assessment for each proposed detailed route re-alignment that extends beyond the applied-for corridor width of Trans Mountain's preferred route in proximity to: • Ohamil Indian Reserve 1; • Tzeachten Indian Reserve 13; and • Surrey Bend Regional Park. Any assessment must include: a) environmental alignment sheets at an appropriate scale, clearly depicting the proposed route re-alignments; b) results of any pre-construction surveys within the areas that were not previously subject to such surveys, and an indication of potential residual effects; c) all associated mitigation measures that are beyond those identified during the OH-001-2014 proceeding; d) analysis supporting the use of the measures in c), including any supplementary reports; e) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include any relevant information based on any supplemental surveys completed; and f) a summary of consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants, as well as copies of all written comments that may be provided to Trans Mountain by those consulted. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the assessment.	X			X				
8	**Design temperatures – terminals and pump stations** Trans Mountain must file with the NEB, **at least 3 months prior to ordering pipe for terminals and pump stations**, confirmation, with rationale, that: a) the selected maximum and minimum design temperatures are in accordance with CSA Z662-15, Clause 5.2.1; b) the selected design temperatures are based on historical, location-specific extreme daily maximum and minimum temperatures, as opposed to average temperatures; and c) the extent of the historical weather data used is commensurate with the expected operational life of the Project.	X				X	X	X	

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
9	**Quality Management Plan** Trans Mountain must file with the NEB, **at least 4 months prior to manufacturing any pipe and major components for the Project**, a Project-specific Quality Management Plan that includes: a) material/vendor qualification requirements; b) quality control and assurance of pipe, fittings, and components that ensure all materials meet Trans Mountain's specifications (i.e., processes, procedures, specifications, random testing, inspection, and test reports); c) mandatory documentation of process conditions during manufacture and verification of the conformance of manufacturer material test reports with Trans Mountain's requirements; d) mandatory inspection requirements, inspector competency training, and qualifications; e) non-conformance reporting and correction procedures; f) change management process; g) commissioning requirements; and h) material handling requirements during transportation.	X				X	X	X	
10	**Phased filings** Due to the Project's large spatial extent, Trans Mountain may wish to commence Project construction activities at specific locations at different times (i.e., using a phased approach). This may entail doing so on the basis of pipeline spreads of defined lengths, or by regions, or work areas of Trans Mountain's choosing (such as terminals or pump stations). If Trans Mountain intends to use a phased approach for Project construction, it must undertake the following: a) Trans Mountain must file with the NEB, **at least 7 months prior to commencing construction**, a complete list of construction spreads, regions, or work areas that, for the duration of Project construction, will serve as the basis by which Trans Mountain may submit condition filings in a phased approach. Each spread, region, or work area must be clearly delineated (e.g., by kilometre posts). b) **As part of its filing for a)**, to aid the NEB in anticipating future submissions, Trans Mountain must indicate the specific conditions and related spread(s), region(s) or work area(s) for which it expects to apply this phased approach. Trans Mountain must file updates to this list **as they are available**. c) When submitting a filing for any condition using this phased approach, Trans Mountain must clearly indicate which spread(s), region(s), or work area(s) that filing applies to. d) Construction of a particular spread, region, or work area must not proceed until all pre-construction conditions using this phased approach have been satisfied for that spread, region, or work area. Prior to commencing construction of the initial spread, region, or work area, all applicable conditions with more general pre-construction timing elements must also be satisfied.	X	X	X	X	X	X	X	X

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
11	**Aboriginal, local, and regional skills and business capacity inventory** a) Trans Mountain must file with the NEB, **at least 6 months prior to commencing construction**, an Aboriginal, local, and regional skills and business capacity inventory for the Project. The skills and capacity inventory must include: i) a *description* of the information and data sources; ii) a summary of Aboriginal, local, and regional skills and business capacity; iii) an analysis of the Aboriginal, local and regional capacity for employment and business opportunities for the Project; iv) plans for communicating employment and business opportunities to Aboriginal, local, and regional communities; v) a description of identified or potential skills and business capacity gaps, and any proposed measures to address them or to support or increase skills or capacity; and vi) plans for communicating identified gaps regarding skills and business capacity with Aboriginal, local, and regional communities and businesses, and any proposed measures to support or increase skills or capacity. b) Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction**, any updates to the elements of the inventory described in a)i) through vi).	X							
12	**Training and Education Monitoring Plan** a) Trans Mountain must file with the NEB for approval, **at least 6 months prior to commencing construction**, a plan for monitoring the implementation and outcomes of Aboriginal, local, and regional training and education measures and opportunities for the Project. The plan must include: i) a description of, and rationale for selecting, the indicators that will be monitored to track the implementation of training and education measures and opportunities; ii) the monitoring methods and schedule, including information and data sources for the indicators being monitored; and iii) plans for consulting and reporting on the implementation and outcomes of training and education measures and opportunities with Appropriate Government Authorities, potentially affected Aboriginal groups, business, industry, and education and training organizations; and iv) a summary of consultations with Appropriate Government Authorities, potentially affected Aboriginal groups, business, industry, and education and training organizations on the development of the plan. b) Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction**, any updates to the elements of the Training and Education Monitoring Plan described in a)i) through iii) above.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
13	**Socio-Economic Effects Monitoring Plan** Trans Mountain must file with the NEB for approval, **at least 6 months prior to commencing construction**, a plan for monitoring potential adverse socio-economic effects of the Project during construction. The plan must include the following: a) the factors or indicators to be monitored; b) the methods and rationale for selecting the factors or indicators; c) a description of the baseline, pre-construction socio-economic conditions; d) the monitoring methods and schedule, including third party data source identification; e) data recording, assessment, and reporting details; f) a discussion of how measures will be implemented to address any identified adverse effects, including: i) the criteria or thresholds that will require measures to be implemented; ii) how monitoring methods and measures implementation to address adverse effects, as necessary, are incorporated into Construction Execution Plans; and iii) a description of the roles and responsibilities of construction prime contractors, sub-contractors, and community relations staff in monitoring socio-economic effects and implementing measures to address adverse effects; g) a summary of its consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the Plan; and h) plans for regular consultation and reporting on effects during construction with potentially affected communities, Aboriginal groups, local and regional authorities, and service providers.	X	X		X	X	X	X	
14	**Technical working group (TWG) – Terms of Reference** Trans Mountain must file with the NEB, **at least 6 months prior to commencing construction**, Terms of Reference for TWGs established in order to address specific technical and construction issues with affected municipalities. The terms of reference must be developed in consultation with participating municipalities, and facility owners and operators that will be affected by the Project. The Terms of Reference must, at a minimum: a) identify how TWG membership will be determined; b) identify the TWG structure; c) identify an officer of the company who will be accountable for implementing the Terms of Reference; and d) describe the scope and mandate to be addressed or implemented by the TWG, including: i) the TWG's goals; ii) the issues and activities that will be within the TWG's mandate; iii) the protocols and mechanisms for implementing TWG recommendations or decisions; and iv) the protocols for reporting and communicating with TWG members, and other potentially-affected or interested parties; and e) provide a summary of any outstanding concerns raised by participating municipalities, and facility owners and operators regarding the Terms of Reference.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
15	**Pipeline risk assessment** Trans Mountain must file with the NEB, **at least 6 months prior to commencing construction**, the following information for Line 2 and the new delivery pipelines: a) the results of the updated risk assessment in a tabular format similar to that provided in its Line 2 Consequence Report (Filing A3Z8G5). The risk assessment tables must also include: i) any updates to High Consequence Areas; ii) the risk mitigation method(s); iii) the mitigated Environmental Risk Scores; iv) pre-mitigation maximum outflow volumes; and v) the outflow volumes after mitigation; b) Environmental Risk Score acceptance criteria, with supporting rationale; and c) a detailed description of the adequacy of the following from its Line 2 Consequence Report (Filing A3Z8G5): i) the coefficients used in the scoring system equations; and ii) the values from the scoring tables.	X							
16	**Quantitative Geohazard Frequency Assessment** Trans Mountain must file with the NEB, **at least 6 months prior to commencing construction**, an updated Quantitative Geohazard Frequency Assessment for the new Line 2 and delivery pipeline segments that contains a re-assessment of the Frequency of Loss of Containment (FLoC) values based on the results of site-specific field assessments and any required mitigation as determined in the detailed engineering and design process. Trans Mountain must provide in the assessment a plan to manage and mitigate geohazards at any location where the FLoC value is greater than 10^{-5} events per year to reduce the level of risk to as low as reasonably practicable (ALARP), including a detailed explanation of how the ALARP level has been attained at each location.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
17	**Valve locations on Line 2** Trans Mountain must file with the NEB for approval, **at least 6 months prior to commencing construction**, its final valve location assessment for Line 2. This assessment must include: a) a table showing each valve's location, function, and description (the description must include valve type, valve closure time, and whether the valve can be remotely controlled by the control centre); b) confirmation that the valve closure times provided in a) will not cause unsafe transient pressures according to the final transient analysis, along with a summary of the analysis; c) calculated volume release and elevation plots in a format similar to that provided by Trans Mountain in its Oil Spill Outflow Model Results for Line 2 for May 2014 Route (Filing A3Z8G6); d) clarification of how the Outflow Volume Score for Non-Watercourse Intersects (Sv,Nonwatercourse) is considered in identifying and prioritizing pipeline segments for valve optimization; e) for each 5-kilometre-long section of Line 2, information demonstrating that the release volumes are minimized to manage risks within the section to a level that is As Low As Reasonably Practicable (ALARP), based on the valve locations provided in a); f) an outflow volume versus chainage graph illustrating the effectiveness of the valve locations provided in a) showing the outflow limit in a format similar to that provided in Figure 4 of Attachment 2 to Trans Mountain's response to NEB Information Request No. 3.050b) (Filing A4H2D7); g) mitigation measures for the locations shown to exceed the outflow limit in the graph provided in f); and h) full-bore release and spill extent mapping that identifies and plots all geohazards with a Frequency of Loss of Containment (FLoC) greater than 10^{-5} events per year after mitigation identified by Trans Mountain at the time of its submission, in a format and scale similar to the maps provided by Trans Mountain in Filing A3Z8G7	X							
18	**Valve locations and upgrades – Line 1** Trans Mountain must file with the NEB for approval, **at least 6 months prior to commencing construction**, its final valve location assessment for Line 1. This assessment must include: a) a plan for upgrading existing manual block valves to automated or remotely operable valves, and a plan for adding new valves, including initiation and completion dates for the required activities; b) a table showing each valve's location, function, and description (the description must include valve type, valve closure time, and whether the valve can be remotely controlled by the control centre); c) confirmation that the valve closure times provided in b) will not cause unsafe transient pressures according to the final transient analysis, along with a summary of the analysis; d) calculated volume release and elevation plots in a format similar to that provided by Trans Mountain in its Oil Spill Outflow Model Results for Line 2 for May 2014 Route (Filing A3Z8G6); e) an outflow volume versus chainage graph illustrating the effectiveness of the valve locations provided in b), in a format similar to that provided in Figure 4 of Attachment 2 to Trans Mountain's response to NEB Information Request No. 3.050b) (Filing A4H2D7); and f) full-bore release and spill extent mapping that identifies and plots all geohazards identified by Trans Mountain in its Natural Hazards Management Program or otherwise, at the time of its submission, in a format and scale similar to the maps provided by Trans Mountain in Filing A3Z8G7; and g) the associated Line 1 risk assessment used to determine the new valve locations and planned valve upgrades in (a).		X						

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
19	**Pipeline segment reactivation (Hinton to Hargreaves; Darfield to Black Pines) – engineering assessment and certificate** Trans Mountain must file with the NEB for approval, **at least 6 months prior to commencing construction**: a) an engineering assessment for the above two pipeline segments, in accordance with Canadian Standards Association (CSA) Z662-15, Clauses 3.3 and 10.15.2; and b) a certificate with a supporting report issued by an independent certification body,[84] stating unconditionally that the above two pipeline segments: i) are fit for service for the specified operating conditions;[85] ii) meet all applicable requirements of CSA Z662-15; and iii) will meet the hydrostatic test requirements outlined in CSA Z662-15, Clause 8, at any time during the certified period. The certificate must be valid for at least 5 years and be validated on an annual basis during the certified period. The supporting report must include the qualifications of the independent certification body, the justification used to grant the certificate, and the expiry date of the certificate.		X						
20	**Existing NPS 24 delivery pipeline location** Trans Mountain must file with the NEB, **at least 6 months prior to commencing construction**, its decision on whether it intends to "relocate" the existing NPS 24 delivery pipeline to the Burnaby Mountain tunnel (i.e., replace it with a new third pipeline in the Burnaby Mountain tunnel) and, if so, provide: a) details of any required changes to the design, construction, and operation of the proposed Burnaby Mountain tunnel; b) a discussion of the factors Trans Mountain considered in deciding to replace/relocate the existing NPS 24 delivery pipeline; and c) an indication of when Trans Mountain expects to apply for NEB approval to relocate/replace the existing NPS 24 delivery pipeline.	X							
21	**Transient hydraulic analysis on the existing NPS 24 delivery pipeline** Trans Mountain must file with the NEB, **at least 6 months prior to commencing construction**, the conclusions of the transient hydraulic analysis undertaken on the existing NPS 24 delivery pipeline from the Burnaby Terminal to the Westridge Marine Terminal. The filed conclusions must: a) demonstrate that the analysis considered the occurrences of maximum surge pressure in the existing NPS 24 delivery pipeline; and b) support Trans Mountain's decision to either retain or eliminate the proposed relief tank at the Westridge Marine Terminal.	X							

84 For Conditions 19, 122 and 152, an" independent certification body" is an internationally recognized company or organization, such as Lloyd's Register or Det Norske Veritas, which is able to certify compliance to statutory requirements. The independent certification body must have expertise in pipeline integrity. The NEB reserves the right to accept or reject the certificate. In addition, the NEB's decision is not contingent on the results of the certificate.

85 For Conditions 19, 122 and 152, "operating conditions" must include the Project-specific operating conditions, possible transient flow conditions, slack flow conditions, and effects on operating pressure due to temperature changes.

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
22	**Updated terminal risk assessments** Trans Mountain must file with the NEB for approval, **at least 6 months prior to commencing construction, and at the same time as Trans Mountain's filings for Conditions 23, 24 and 25**, updated risk assessments for the Edmonton Terminal West Tank Area, the Sumas Terminal, and the Burnaby Terminal. The updated risk assessments must quantify and/or include the following: a) the effect of any revised spill burn rates ; b) the potential consequences of a boil-over; c) the potential consequences of flash fires and vapour cloud explosions; d) the cumulative risk based on the total number of tanks in the terminal, considering all potential events (pool fire, boil-over, flash fire, vapour cloud explosion); e) the domino (knock-on) effect caused by a release of the contents of one tank on other tanks within the terminal's common impoundment area(s), or other tanks in adjacent impoundment areas; and f) risk mitigation measures, including ignition source control methods. For those risks that cannot be eliminated, Trans Mountain must demonstrate in each risk assessment that mitigation measures will reduce the risks to levels that are As Low As Reasonably Practicable (ALARP) while complying with the Major Industrial Accidents Council of Canada (MIACC) criteria for risk acceptability. The quantitative risk analysis must be based on recognized methodology, models, and software. Product release frequencies and event probabilities must be based on recent, documented data sources. The effect of mitigation measures on the risk results must be justified and documented.							X	
23	**Secondary containment – Edmonton Terminal** Trans Mountain must file with the NEB for approval, **at least 6 months prior to commencing construction**, the final design of the Edmonton Terminal West Tank Area, including a report demonstrating the following: a) the drainage system's capability to rapidly and safely channel a significant release from any tank in the West Tank Area Common Impoundment to the Remote Impoundment Annex and Remote Impoundment at the same time that a design precipitation event is occurring, without overtopping the diked areas. b) the adequacy of the design in mitigating the following consequences of an accidental release and/or ignition of hydrocarbons, both within and beyond the Edmonton Terminal property boundary: i) harm to personnel and the public; ii) environmental damage; and iii) damage to facilities; and c) the ability of the Common Impoundment, Remote Impoundment Annex, and Remote Impoundment to contain a release of hydrocarbons from a rupture of the largest tank within the West Tank Area concurrent with a 1-in-100 year, 24-hour storm event. The scenario must include an allowance for water generated from potential firefighting activities and the maximum potential amount of standing water in all areas of the secondary containment system.							X	

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
24	**Secondary containment – Burnaby Terminal** Trans Mountain must file with the NEB for approval, **at least 6 months prior to commencing construction**, the final design of the Burnaby Terminal, including a report demonstrating the following: a) the drainage system's capability to rapidly and safely channel a significant release from either Tank 96, 97, or 98 to the Partial Remote Impoundment at the same time that a design precipitation event is occurring, without overtopping the diked areas. b) the adequacy of the proposed design in mitigating the following consequences of an accidental release and/or ignition of hydrocarbons, both within and beyond the Burnaby Terminal property boundary: i) harm to personnel and the public; ii) environmental damage; and iii) damage to facilities; and c) the ability of the individual secondary containment areas, Common Impoundment areas, Intermediate Stormwater Retention, Partial Remote Impoundment, and Tertiary Containment to contain a release of hydrocarbons from a multiple-tank rupture scenario concurrent with a 1-in-100 year, 24-hour storm event. The scenario must include an allowance for water generated from potential firefighting activities and the maximum potential amount of standing water in all areas of the secondary containment system. The assessment may include a calculation of the probability of exceedance of on-site containment considering all possible tank rupture combinations, excluding those tanks with sufficient individual secondary containment. The calculation may be based on a tank utilization histogram most representative of the expanded terminal operations, similar to that provided in Attachment 1 of Trans Mountain's response to NEB Information Request No. 4.24a) (Filing A4K4X3).							X	
25	**Secondary containment – Sumas Terminal** Trans Mountain must file with the NEB for approval, **at least 6 months prior to commencing construction**, the final design of the Sumas Terminal, including a report demonstrating the following: a) the adequacy of the proposed design in preventing the following consequences of an accidental release and/or ignition of hydrocarbons, both within and beyond the Sumas Terminal property boundary: i) harm to personnel and the public; ii) environmental damage; and iii) damage to facilities; and b) the ability of the secondary containment system to contain a release of hydrocarbons from a multiple-tank rupture scenario concurrent with a 1-in-100 year, 24-hour storm event. The scenario must include an allowance for water generated from potential firefighting activities and the maximum potential amount of standing water in all areas of the secondary containment system. The assessment may include a calculation of the probability of exceedance of on-site containment considering all possible tank rupture combinations, excluding those tanks with sufficient individual secondary containment. The calculation may be based on a tank utilization histogram most representative of the expanded terminal operations, similar to that provided in Attachment 1 of Trans Mountain's response to NEB Information Request No. 4.24b) (Filing A4K4X4).							X	

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
26	**Burnaby Mountain tunnel option – design, construction, and operation** For the tunnel between the Burnaby Terminal and the Westridge Marine Terminal and related delivery pipelines, **at least 6 months prior to commencing Burnaby Mountain tunnel construction activities**, Trans Mountain must: a) file with the NEB for approval: i) a description of the selected tunnel lining method with the rationale for its selection; and ii) tunnel confined space entry procedures during construction and visual inspection, and, if applicable, following construction; and b) file with the NEB: i) the results of any geotechnical or geophysical feasibility surveys completed since the evidence filed in the OH-001-2014 hearing; ii) a description of the tunnel portals and permanent road access, if applicable; iii) a description of the selected tunnel excavation method with rationale for its selection; iv) a description of the tunnel backfilling method with rationale for its selection; v) a description of the methods to be used for pipe handling and welding; vi) a discussion on the adequacy of the pipe support methods for the new delivery pipelines during construction, commissioning, hydrostatic testing and operation, if applicable; vii) a discussion on the adequacy of the selected leak detection methods; viii) information demonstrating how the precautionary design of the new delivery pipelines would mitigate issues related to limited accessibility for future maintenance and repairs; and ix) the final tunnel cross-sectional design drawings.	X							
27	**Burnaby Mountain tunnel option – backfilling** Trans Mountain must file with the NEB, **at least 6 months prior to commencing Burnaby Mountain tunnel construction activities**, the following information on backfilling the tunnel between the Burnaby Terminal and the Westridge Marine Terminal: a) a discussion of the adequacy of the measures to be taken during tunnel backfilling to eliminate or mitigate potential damage to the delivery pipelines; b) the method(s) that will be used to confirm the consistency and continuity of the tunnel backfill (i.e., backfilling is completed without any spatial gaps); c) the method(s) that will be used for holiday detection and coating repair prior to backfilling; d) the methods that will be used to confirm the integrity of the delivery pipelines in the tunnel, both prior to and after backfilling, but prior to commissioning; and e) the methods that will be used for monitoring, maintaining, and repairing backfill during operations, considering conditions such as fill deterioration and a potential increase in permeability.	X							
28	**Burnaby Mountain tunnel option – cathodic protection** Trans Mountain must file with the NEB, **at least 6 months prior to commencing Burnaby Mountain tunnel construction activities**, the following information on the cathodic protection system for the delivery pipelines in the tunnel between the Burnaby Terminal and the Westridge Marine Terminal: a) a description of the cathodic protection system design; b) risk mitigation measures for all potential cathodic protection performance issues, such as shielding from the backfill material; and c) a method for verifying the effectiveness of the cathodic protection system during operations.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
29	Burnaby Mountain tunnel option – rock mass and waste rock management Trans Mountain must file with the NEB for approval, **at least 6 months prior to commencing Burnaby Mountain tunnel construction activities**, the following details on rock mass expected to be encountered during construction of the tunnel between the Burnaby Terminal and the Westridge Marine Terminal: a) the characterization of the rock mass quality; b) waste rock management methods during construction and operations, if applicable; c) proposed acid rock mitigation measures, such as the treatment or disposal of acid rock, if encountered; d) the locations, sizes, and designs of all confirmed waste rock disposal areas; and e) plans for disposing any waste rock that is not expected to be stored in the confirmed waste rock disposal areas.	X							
30	**Power system protection for pump stations and terminals** Trans Mountain must file with the NEB the following details of its electrical power system design for each pump station and each of the following: Westridge Marine Terminal, Burnaby Terminal, Edmonton Terminal, and Sumas Terminal: a) Descriptions of the overcurrent and ground fault protection schemes including: i) a summary of coordination studies between the upstream and downstream protective devices, **at least 3 months prior to commencing dry commissioning**; ii) relay settings and time-current curves, **at least 3 months prior to commencing dry commissioning**; iii) the specification of neutral grounding resistors, **at least 6 months prior to commencing construction**; iv) specifications of contactors, fuses, and circuit breakers, **at least 6 months prior to commencing construction**; and v) a description of other electrical protections, relay settings, and trip characteristics, **at least 3 months prior to commencing dry commissioning**. b) Consistent with the NEB's Safety Advisory SA-2015-03, dated 4 May 2015, **at least 6 months prior to commencing construction**, information confirming that Trans Mountain has performed the ground fault and arcing fault protection designs for each pump station and terminal, including: i) a means to clear ground faults without intentional time delay if the fault currents exceed the design limit set by the neutral grounding resistance; and ii) a means to block the stored energy from other running motors from feeding an electrical fault in another motor running from the same bus. This filing must include a description of the ground fault and arcing fault protection designs including the above measures. c) **At least 6 months prior to commencing construction**, either: i) a written confirmation that Trans Mountain determined during detailed design that electrical faults will not exceed their design limits and migrate to an arcing fault; or ii) for a station or a terminal for which Trans Mountain determined during detailed design that an electrical fault could exceed its design limit and migrate to an arcing fault, the electrical configuration of that station or terminal and the additional equipment and devices that will be used to mitigate the adverse effects of such arcing faults. d) Single-line diagrams of the electrical power systems, **at least 6 months prior to commencing construction**.	X				X	X	X	

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
31	**Reactivation of the Niton Pump Station** Trans Mountain must file with the NEB for approval, **at least 6 months prior to commencing any pump station construction**, an engineering assessment for the Niton Pump Station, in accordance with CSA Z662. The engineering assessment must demonstrate that the pump station is fit for its intended service, and meets all applicable requirements of CSA Z662.		X						
32	**Sumas Terminal Geotechnical Report** Trans Mountain must file with the NEB, **at least 6 months prior to commencing construction at the Sumas Terminal**, a geotechnical report that provides feasibility-level geotechnical design recommendations for the proposed expansion at the Sumas Terminal.							X	
33	**Westridge Marine Terminal Onshore Geotechnical Report** Trans Mountain must file with the NEB, **at least 6 months prior to commencing construction at the Westridge Marine Terminal**, a geotechnical report that provides feasibility-level geotechnical design recommendations for the proposed new onshore facilities at the Westridge Marine Terminal, including consideration of the potential for seismic damage.	X							
34	**Westridge Marine Terminal Offshore Geotechnical Report** Trans Mountain must file with the NEB, **at least 6 months prior to commencing construction at the Westridge Marine Terminal**, the final Preliminary Geotechnical Report on the offshore portion of the Westridge Marine Terminal, based on the selected pile design option, including consideration of the potential for seismic damage.	X							

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35	**Marine Sediment Management Plan** Trans Mountain must file with the NEB, **at least 6 months prior to commencing construction at the Westridge Marine Terminal**, confirmation whether or not dredging is required at the Westridge Marine Terminal. In the event that dredging is determined to be unavoidable during the expansion of the Westridge Marine Terminal, Trans Mountain must file with the NEB for approval, **at least 4 months prior to commencing construction**, and also include as part of its Westridge Marine Terminal Environmental Protection Plan, a Marine Sediment Management Plan. This plan must include: a) a summary of any supplemental marine sediment survey results; b) quantification of the area and the volume of marine sediment to be dredged along with an explanation of the measures that have been taken to eliminate or reduce the dredge footprint and volume proposed for disposal at sea; c) results of sediment plume modelling for any areas to be dredged; d) options for dredged sediment management, including the volumes of sediment that will be re-used or disposed of at sea or on land, as well the criteria and methods for determining how the dredged sediment will be disposed of at sea or on land; e) criteria and methods for determining how the dredged sediment will be managed recognizing that any proposed disposal at sea will only be considered for approval under the *Canadian Environment Protection Act, 1999*, if it is demonstrated to be the most technically and environmentally preferable option; f) confirmation that Trans Mountain will update the Westridge Marine Terminal Environmental Protection Plan to include any relevant information from the Marine Sediment Management Plan; g) details of monitoring that will be undertaken during construction; h) details of monitoring (both abiotic and biotic parameters) that will be undertaken during operations, including a discussion on evaluating the level of contaminants in the marine environment and any changes from pre-construction levels, as well as a proposed reporting schedule; and i) a summary of its consultations with Appropriate Government Authorities and potentially affected Aboriginal groups. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan.	X							

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36	**Pre-construction caribou habitat assessment** Trans Mountain must file with the NEB, **at least 6 months prior to commencing construction of any Project component potentially affecting each caribou range**, a detailed caribou habitat assessment of the Project right-of-way through each caribou range traversed by the Project, including a 500 metre buffer on either side. The framework of the habitat assessment must use the updated critical habitat polygons delineated by the Southern Mountain Caribou Recovery Team and components of critical habitat outlined in the *Recovery Strategy for the Woodland Caribou, Southern Mountain Population in Canada (2014).* The habitat assessment must include: a) map(s) indicating the location of the habitat; b) a description of the amount of habitat and the existing habitat alteration, in hectares; c) a description of how Trans Mountain has taken available and applicable Aboriginal traditional ecological knowledge into consideration into the assessment including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; d) a description of how Trans Mountain has incorporated input from Appropriate Government Authorities and species experts into the assessment methodology; and e) a description of the type of habitat characterized by the biophysical attributes of critical habitat, as defined in the applicable Recovery Strategy.	X	X		X	X	X		
37	**Caribou Habitat Restoration Plan (CHRP)** Trans Mountain must file with the NEB for approval, in accordance with the timelines below, preliminary and final versions of a CHRP for each caribou range potentially affected by the Project. a) Preliminary CHRP – to be filed **at least 6 months prior to commencing construction of any Project component potentially affecting each caribou range**. This version of the CHRP must include the following: i) the CHRP's goals and measureable targets for each caribou range, including the goal of avoidance of critical habitat destruction; ii) a detailed description of measures that will be used to avoid or lessen Project activities that impact critical habitat, and the rationale for selecting the measures; iii) a list of criteria used to identify potential caribou habitat restoration sites; iv) conceptual decision-making tree(s) or decision framework(s) that will be used to identify and prioritize potential caribou habitat restoration sites, and mitigative actions to be used at different types of sites, including consideration of typical site factors that may constrain implementation; v) a literature review upon which the decision-making tree(s) or decision framework(s) are based, including: 1) an identification of applicable temporal and spatial caribou habitat restoration methodologies; 2) an assessment of the relative effectiveness of the identified methodologies; and 3) a detailed methodology of how the literature review was conducted. vi) the quantifiable targets and performance measures that will be used to evaluate the extent of predicted residual effects, CHRP effectiveness, the extent to which the goals and measurable targets have been met, and the need for further measures to offset unavoidable and residual effects on caribou habitat; vii) a schedule indicating when mitigation measures will be initiated and their estimated completion dates;	X	X		X	X	X		

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37 (cont)	viii) a description of how Trans Mountain has taken available and applicable Aboriginal traditional ecological knowledge studies into consideration in identifying potential caribou habitat restoration sites including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; and ix) a summary of its consultations with Appropriate Government Authorities and any potentially affected Aboriginal groups. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the preliminary CHRP. b) Final CHRP – to be filed **on or before 1 November after the first complete growing season after completing final clean-up**. This version of the CHRP must include the following: i) the preliminary CHRP, with any updates identified in a revision log that includes the rationale for any changes to decision-making criteria; ii) a complete tabular list of caribou habitat restoration sites, including locations, spatial areas, habitat quality descriptions, site-specific restoration activities, and challenges; iii) a description of how selected restoration measures are consistent with the *Recovery Strategy for the Woodland Caribou, Southern Mountain Population in Canada (2014);* iv) maps or updated Environmental Alignment Sheets showing the site locations; v) specification drawings for the implementation of each restoration method; vi) a qualitative and quantitative and assessment of the total area of direct and indirect disturbance to caribou habitat that will be restored, the duration of spatial disturbance, and the area-based extent of the resulting unavoidable and residual effects to be offset, including indirect disturbance; and vii) a summary of its consultations with Appropriate Government Authorities and any potentially affected Aboriginal groups. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the final CHRP.	X	X		X	X	X		

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38	**Sowaqua Spotted Owl Mitigation Plan** Trans Mountain must file with the NEB for approval, **at least 6 months prior to commencing construction of any Project component within the Sowaqua spotted owl wildlife habitat area**, a Sowaqua Spotted Owl Mitigation Plan that includes: a) a summary of results from supplemental surveys conducted in the Sowaqua spotted owl wildlife habitat area; b) the area of habitat potentially directly and indirectly affected by the Project; c) a description of how an avoidance, mitigation, and offset hierarchy was considered in the plan; d) mitigation measures to be implemented, including all relevant measures committed to throughout the OH-001-2014 proceeding, any new mitigation measures resulting from supplementary surveys, detailed criteria using clear and unambiguous language that describes the circumstances under which each measure will be applied, and measurable goals for evaluating mitigation success; e) an evaluation of offset options within or outside of the Sowaqua spotted owl wildlife habitat area, an indication of the selected option, and the rationale for the selected option; f) details on post-construction monitoring of mitigation measures and offset measures, including survey methods, corrective measures, detailed criteria using clear and unambiguous language that describes the circumstances under which each measure will be applied, any adjustments to the offset measures, and a proposed reporting schedule; g) a commitment to include results of the monitoring in the post-construction environmental monitoring reports filed under Condition 151; h) details on how the mitigation and monitoring measures are consistent with applicable recovery strategies and action plans; i) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the mitigation plan including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; j) a summary of its consultations with Appropriate Government Authorities, any species experts and potentially affected Aboriginal groups. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the Mitigation Plan; and k) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include any relevant information from the mitigation plan.	X	X		X	X	X		

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
39	**Hydrogeological study at Coldwater Indian Reserve (IR) No. 1** Trans Mountain must file with the NEB, **at least 6 months prior to commencing construction between Veale Road and Kingsvale Pump Station**, a hydrogeological report relating to the aquifer at Coldwater IR No. 1 in British Columbia. The report must: a) describe the methodology and information sources used, including any field investigations; b) delineate the extent of the aquifer in the area of Coldwater IR No. 1; c) characterize the aquifer recharge sources and aquifer confinement; d) characterize the direction and speed of groundwater movement to wells on Coldwater IR 1; e) quantify the risks posed to groundwater supplies on Coldwater IR No. 1 in the event of leaks, accidents or malfunctions from the Project; f) based on the assessment of risks, describe proposed measures to address identified risks, including but not limited to considerations related to routing, project design, operational measures, or monitoring; g) provide justification for the measures proposed to address identified potential risks to groundwater supplies on Coldwater IR No. 1; and h) include a summary of consultations undertaken with the Coldwater First Nation and Appropriate Government Authorities, as well as copies of all written comments that may be provided to Trans Mountain by the Coldwater First Nation or Appropriate Government Authorities. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from the Coldwater First Nation or Appropriate Government Authorities, into the assessment.	X			X		X		
40	**Rare Ecological Community and Rare Plant Population Management Plan** Trans Mountain must file with the NEB for approval, **at least 5 months prior to commencing construction**, an updated Rare Ecological Community and Rare Plant Population Management Plan for ecological communities of concern, rare plants and lichens, and early draft, candidate, proposed, or final critical habitat for plant and lichen species under the *Species at Risk Act*, that are potentially affected directly or indirectly by the Project during construction or operations, that includes: a) a summary of supplementary survey results, and a demonstration of the overall adequacy of the rare ecological community and rare plant surveys, including the adequacy for the identification of biophysical attributes for any early draft, candidate, proposed, or final critical habitat under the *Species at Risk Act*; b) avoidance and mitigation measures to be implemented during construction and operations, including all relevant measures committed to throughout the OH-001-2014 proceeding and any new measures resulting from supplementary surveys, with rationales and unambiguous criteria explaining under what circumstances each measure will be applied, and measurable goals against which the success of each measure will be evaluated; c) a description of how the avoidance, mitigation, and offset hierarchy was considered in developing the plan, with rationales for progressing from avoidance to mitigation to offsets; d) details on post-construction monitoring, including survey methods, the appropriate number of years of monitoring to determine the success of each type of avoidance and mitigation measure, corrective actions that might be necessary, and the circumstances under which each such action would be taken; e) a Preliminary Rare Ecological Community and Rare Plant Population Offset Plan for any ecological communities and rare plant and lichen species that have an at-risk status of S1, S1S2 or S2, or that are listed under federal or provincial legislation for protection, and for any early draft, candidate, proposed, or final critical habitat under the *Species at Risk Act*, and that, after five years of operations, have ongoing effects. This preliminary plan must include:	X	X		X	X	X	X	

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40 (cont)	i) a rationale for why the community, species, or critical habitat cannot be avoided by a sufficient distance to avoid both direct and indirect residual effects; ii) the expected residual effects on that community, species, or critical habitat, including a discussion of the potential for time lags between when Project effects occur and when mitigation measures would become fully functional, and taking into account the success on past projects of the proposed mitigation and corrective measures in b) and d) above; iii) an analysis of the appropriateness of offsets for the community, species or critical habitat, taking their specific features into account, and of any potential limitations on offset effectiveness; iv) a description of how the avoidance, mitigation, monitoring, corrective and offset measures are consistent with any applicable recovery, action or management strategies or plans for the community, species or critical habitat; v) an explanation with rationales of how the need for offset measures will be determined and how quantitative offset objectives will be developed, including the use and selection of offset ratios, with the aim of achieving no-net-loss; vi) the potential types of offset measures, the process for selecting which will be implemented, an estimation of the probability of their success, and how compensation sites will be selected; and vii) a discussion of how the effectiveness of offset measures will be monitored, assessed, and reported on, and problems corrected; f) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; g) a summary of its consultations with Appropriate Government Authorities, any species experts and any potentially affected Aboriginal groups. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan; and h) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include any relevant information from the Rare Ecological Community and Rare Plant Population Management Plan, including confirmation that the avoidance, mitigation, monitoring, corrective, and offset measures in the Rare Ecological Community and Rare Plant Population Management Plan will be implemented to the extent feasible in the case of discovery via their inclusion in the Rare Ecological Communities or Rare Plant Species Discovery Contingency Plan.	X	X		X	X	X	X	
41	**Wetland Survey and Mitigation Plan** Trans Mountain must file with the NEB for approval, **at least 5 months prior to commencing construction**, a pre-construction Wetland Survey and Mitigation Plan for wetlands potentially affected directly or indirectly by the Project during construction or operations, that includes: a) a summary of supplementary survey results and a demonstration of the overall adequacy of the wetland surveys; b) a description of any wetlands for which ground-based surveys were not possible, an explanation as to why not, attempts made to obtain access, and what further information on each wetland will be collected immediately prior to or during construction;	X	X		X	X	X	X	

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
41 (cont)	c) a description of the functional condition of each wetland for comparison during post-construction monitoring, including individual functional conditions (e.g., habitat, hydrology and biogeochemistry, including the presence and abundance of migratory birds and species at risk), and a description of the methods used to determine the type and amount of each individual wetland function and the overall functional condition; d) a description of the crossing methods, mitigation measures and reclamation measures to be implemented during construction and operations, with rationales and unambiguous criteria explaining under what circumstances each such method and measure will be applied; e) measurable goals against which the success of wetland mitigation and reclamation will be evaluated, including a description of how such goals incorporate the aim of returning wetlands to their original functionality while allowing for reasonable natural variation, and including measurable goals for each of the first-, third- and fifth-year post-construction monitoring reporting stages for any wetland to which no-net-loss under the Federal Policy on Wetland Conservation applies; f) a description of how the i) avoidance, mitigation, and offset hierarchy, and ii) the goal of no-net-loss of wetland function, were considered in developing the plan, with rationales for progressing from avoidance to mitigation to offsets; g) details of the post-construction monitoring plan for wetlands for the first five years of operations, including corrective actions that might be necessary and the circumstances under which each such action would be taken; h) a Preliminary Wetland Offset Plan for any wetland that has not achieved reclamation success in terms of overall wetland function after five years of operations, and for any wetland to which no-net-loss under the Federal Policy on Wetland Conservation applies and that has had a temporary or ongoing loss in any individual functional condition – this plan must include: i) the expected residual effects on the wetland, including a discussion of the potential for time lags between when Project effects occur and when mitigation measures would become fully functional, taking into account the success on past projects of the proposed mitigation, reclamation and corrective measures in d) and g) above; ii) an analysis of the appropriateness of offsets for the wetland, taking its specific features into account, and of any potential limitations on offset effectiveness; iii) an explanation with rationales of how the need for offset measures will be determined and how quantitative offset objectives will be developed, including the use and selection of offset ratios and indicator species, with the aim of achieving no-net-loss; iv) the potential types of offset measures, the process for selecting which will be implemented, an estimation of the probability of their success, and how compensation sites will be selected; v) a discussion of how the effectiveness of offset measures will be monitored, assessed, and reported on, and problems corrected; and	X	X		X	X	X	X	
	vi) for any wetland to which no-net-loss under the Federal Policy on Wetland Conservation applies, details with rationales on the offset measures that will be implemented before or during the first five years of operations to compensate for expected temporary or ongoing losses to individual functional conditions, including the amount and type of offsets required, the selection of compensation sites, identification of the parties involved in planning and implementation and their respective roles and responsibilities, a timeline for implementation, and the methods and schedule for monitoring and reporting to demonstrate offset success;								

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
41 (cont)	i) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; j) a summary of its consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan; and k) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include any relevant information from the Wetland Survey and Mitigation Plan.	X	X		X	X	X	X	
42	**Grasslands Survey and Mitigation Plan** Trans Mountain must file with the NEB for approval, **at least 5 months prior to commencing construction**, a pre-construction Grasslands Survey and Mitigation Plan for native grasslands in the British Columbia interior that are potentially affected directly or indirectly by the Project during construction or operations, that includes: a) a summary of survey results for such grasslands, including but not limited to native plant species diversity, species at risk, the density and distribution of existing invasive plant species, and the presence of cryptogamic crust, together with a demonstration of the adequacy of such surveys and a summary of existing and ongoing land management impacts; b) a description (including quantification) of overlap of the Project with grasslands and of expected residual effects; c) a description of the mitigation and reclamation measures to be implemented for grasslands during construction and operations, including the extent to which native seed will be used, with rationales and unambiguous criteria explaining under what circumstances each such measure will be applied; d) measurable goals against which the success of grassland mitigation and reclamation will be evaluated, including goals related to cryptogamic crust recovery, invasive species control, and access control, and how existing and ongoing land management impacts and land-use changes by landowners outside the control of Trans Mountain will be taken into account; e) a description of how the i) avoidance, mitigation, and offset hierarchy, and ii) the goal of no-net-loss for grasslands, were considered in developing the plan, with rationales for progressing from avoidance to mitigation to offsets; f) details of the post-construction monitoring plan for grasslands for the first ten years of operations, including corrective actions that might be necessary and the circumstances under which each such action would be taken; g) a Preliminary Grasslands Offset Plan for those grasslands that, after ten years of operations, have not achieved reclamation success. This plan must include: i) expected residual effects on the grasslands, including a discussion of the potential for time lags between when Project effects occur and when mitigation measures would become fully functional, taking into account the success on past projects of the proposed mitigation, reclamation and corrective measures in c) and f) above; ii) an analysis of the appropriateness of offsets for the grasslands, taking their specific features into account, and of any potential limitations on offset effectiveness;	X	X		X	X	X		

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
42 (cont)	iii) an explanation with rationales of how the need for offset measures will be determined and how quantitative offset objectives will be developed, including the use and selection of offset ratios, with the aim of achieving no-net-loss; iv) the potential types of offset measures, the process for selecting which will be implemented, an estimation of the probability of their success, and how compensation sites will be selected; and v) a discussion of how the effectiveness of offsets measures will be monitored, assessed, and reported on, and problems corrected; h) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; i) a summary of its consultations with Appropriate Government Authorities, any species experts, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan; and j) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include any relevant information from the Grasslands Survey and Mitigation Plan.	X	X		X	X	X		

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
43	**Watercourse crossing inventory** Trans Mountain must file with the NEB, **at least 5 months prior to commencing any watercourse crossing construction activities**, the following: a) an updated inventory of all watercourses to be crossed, including, for each crossing: i) the name of the watercourse being crossed and an identifier for the crossing; ii) the location of the crossing; iii) the primary and contingency crossing methods; iv) planned construction timing; v) information on the presence of fish and fish habitat; vi) information on the composition of riparian habitat; vii) the provincial instream work window ; viii) the proposed least risk biological window and the rationale to support the proposed least risk biological window if it differs from the provincial instream work window; and ix) an indication of whether any of Fisheries and Oceans Canada's applicable "Measures to Avoid Causing Harm to Fish and Fish Habitat" cannot be implemented; b) detailed generic design drawings of trenchless, dry open-cut, frozen open-cut, and isolation crossings of various watercourse types; c) site-specific information for each watercourse crossing where **any** of Fisheries and Oceans Canada's applicable "Measures to Avoid Causing Harm to Fish and Fish Habitat" cannot be implemented for the primary pipeline construction method: i) detailed crossing-specific design drawings; ii) photographs up-stream, down-stream, and at the crossing location; iii) a description of the fish species and habitat that is present at the crossing location, and if fish spawning is likely to occur within the immediate area; iv) a description of the composition of the riparian habitat at the crossing location and an indication if the riparian habitat has a limiting effect on the productive capacity of the watercourse, and if its removal or disturbance represents a potential influence on fish communities; v) the site-specific mitigation and habitat enhancement measures to be used to minimize impacts; vi) any potential residual effects; vii) proposed reclamation measures; and viii) a discussion of the potential impacts to local fisheries resources within the immediate area as a result of the crossing's construction; d) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the inventory, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; and e) a summary of consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted.	X	X						

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
44	**Wildlife Species at Risk Mitigation and Habitat Restoration Plans** Trans Mountain must file with the NEB for approval, at least 4 months prior to commencing construction, Wildlife Species at Risk Mitigation and Habitat Restoration Plans for each species whose draft, candidate, proposed, or final critical habitat is directly or indirectly affected by the Project. Each plan must include: a) a summary of supplementary pre-construction survey results, including surveys for biophysical attributes of critical habitat; b) the location and type of critical habitat, for those wildlife species with early draft and candidate critical habitat, including a description of the biophysical attributes, potentially directly and indirectly affected by the Project; c) the location, types and total spatial area for each type of critical habitat for those wildlife species with proposed or final critical habitat, including a description of the biophysical attributes, potentially directly and indirectly affected by the Project; d) a detailed description of measures that will be used to avoid the destruction of critical habitat; e) a detailed description of mitigation and habitat restoration measures to be implemented to reduce direct and indirect Project effects on critical habitat, including all relevant measures committed to throughout the OH-001-2014 proceeding, any new mitigation measures resulting from supplementary surveys, detailed criteria using clear and unambiguous language that describes the circumstances under which each measure will be applied, and measurable targets for evaluating mitigation and critical habitat restoration success; f) identification and review of alternative mitigation and habitat restoration measures to avoid or lessen direct and indirect Project effects on critical habitat, and the rationale for the selected measure(s); g) detailed description of how selected mitigation and critical habitat restoration measures address the potential for time lags between when the Project impacts occur and when mitigation and critical habitat restoration measures are implemented and are fully functional; h) details on post-construction monitoring of mitigation measures and critical habitat restoration measures, including survey methods, corrective measures, detailed criteria using clear and unambiguous language that describes the circumstances under which each measure will be applied, and a proposed reporting schedule; i) details on how the mitigation, critical habitat restoration measures, and monitoring measures are consistent with applicable recovery strategies and action plans; j) a commitment to include the results of the monitoring in the post-construction environmental monitoring reports filed under Condition 151; k) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plans including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; l) a summary of its consultations with Appropriate Government Authorities, any species experts, potentially affected Aboriginal groups and affected landowner/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan; and m) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include any relevant information from the Wildlife Species at Risk Mitigation and Habitat Restoration Plans.	X	X		X	X	X		

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
45	**Weed and Vegetation Management Plan** Trans Mountain must file with the NEB for approval, **at least 4 months prior to commencing construction**, an updated Weed and Vegetation Management Plan for the Project that includes: a) a summary of supplementary survey results, including pre-construction weed surveys, and a demonstration of the adequacy of such surveys; b) measurable goals; c) criteria describing when and where problem vegetation will be managed for each project phase, including pre-construction, construction, post-construction, and operations; d) a description of potential adverse effects related to treatment measures; e) management procedures and a decision-making framework for selecting appropriate prevention and treatment measures, including a description of relevant specific habitats, land uses and land management plans and how each will be considered and kept up-to-date in selecting prevention and treatment measures; f) the methods and schedule for short- and long-term vegetation monitoring; g) a summary of its consultations with Appropriate Government Authorities, invasive plant councils or committees, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan; and h) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include any relevant information from the Weed and Vegetation Management Plan.	X	X	X	X	X	X	X	X
46	**Contamination Identification and Assessment Plan** Trans Mountain must file with the NEB for approval, **at least 4 months prior to commencing construction**, a Contamination Identification and Assessment Plan that includes: a) a description of the procedures that have been implemented to-date, and that will be implemented prior to or during construction, to identify and assess pre-existing solid, liquid or gaseous contamination that could be disturbed by, or affect, the Project, including whether site investigations have been or will be undertaken; b) a demonstration of the adequacy of the procedures in a) with reference to relevant standards, guidelines, and best practices, including how historical land use has been taken into account and a discussion of the potential for chemicals of concern to not be detectable by smell or by sight; c) the information that has been or will be reported by Trans Mountain, including to whom and when, concerning pre-existing contamination; and d) a summary of its consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan; and e) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include any relevant information from the Contamination Identification and Assessment Plan.	X	X	X	X	X	X	X	X

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
47	**Access Management Plan(s)** Trans Mountain must file with the NEB for approval, **at least 4 months prior to commencing construction**, an Access Management Plan(s) to be included within the updated Environmental Protection Plans required by Conditions 72 and 78. Each plan must address issues related to soil, vegetation, fish and fish habitat, and wildlife and wildlife habitat. Each plan must also describe access control measures proposed to control both human and predator access during construction and operations, and include: a) objectives of the plan; b) measurable goals for evaluating the plan's success in achieving its objectives; c) a summary of any related baseline information that has been or will be collected to aid in evaluating the plan's success, and justification of the adequacy of this baseline information, or a rationale if no baseline information has or will be collected; d) a list of sites where access control measures will be implemented for construction and those that will remain in place throughout operations, the control measure(s) proposed at those sites, and the rationale for selecting those sites and measures; e) the methods for monitoring the effectiveness of access control measures implemented during construction and operations, and justification of the adequacy of such monitoring; f) a description of available adaptive management measures and of the criteria Trans Mountain will use to determine if and when adaptive management measures are warranted based on monitoring results; g) a commitment to report, as part of Trans Mountain's post-construction environmental monitoring reports (required by Condition 151), on the control measures implemented, monitoring undertaken, and the success of control measures in meeting Access Management Plan goals and objectives, as well as a schedule, with rationale, for reporting throughout operations; h) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge studies into consideration including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; and i) a summary of its consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the Plan/Report.	X	X		X	X	X		

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
48	**Navigation and navigation safety plan** Trans Mountain must file with the NEB, for approval, **at least 4 months prior to commencing construction**, a Navigation and Navigation Safety Plan that includes: a) an updated list of navigable waterways to be crossed by or affected by the Project (including power lines, marine terminal, temporary or permanent bridge crossings, or other ancillary works that are physically or operationally connected to the Project); b) an updated listing of effects of the Project on navigation and navigation safety for each of the identified waterways identified in a); c) proposed mitigation measures to address Project effects on navigation and navigation safety for each of the identified waterways, including adherence to codes and standards (such as the Canadian Standards Association); and d) a summary of its consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and waterway users, regarding their navigational use of each of the identified waterways. In its summary, Trans Mountain must: i) describe the Appropriate Government Authorities, potentially affected Aboriginal groups, and commercial and recreational waterway users consulted; ii) describe how Trans Mountain identified those consulted; and iii) provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan.	X	X		X	X	X		
49	**Technical working group (TWG) reports** Trans Mountain must file with the NEB, **at least 4 months prior to commencing construction and every 6 months thereafter until after commencing operations**, a report describing the activities undertaken by the TWGs during the reporting period and the outcomes of these activities. The reports must include, at a minimum: a) a list of all members of each TWG; b) the methods, dates and location of all TWG activities or meetings; c) a summary of all issues or concerns raised or addressed during the TWG activities; d) a description of outcomes or measures that were or will be implemented to address the issues identified or concerns raised; or, if any measures will not be implemented, a rationale for why not; and e) a description of any unresolved issues or concerns, and a description of how these will be addressed, or a rationale for why no further measures will be required.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
50	**High-voltage alternating current (AC) interference** Trans Mountain must file with the NEB, **at least 4 months prior to commencing construction**: a) a report confirming that Trans Mountain has achieved an engineered solution to mitigate possible damage to pipeline segments caused by the power line fault current from power line footings and other below ground fault current discharge facilities of B.C. Hydro's unshielded transmission power lines that are located less than 30 metres from those segments. The report must include: i) a summary of the above-mentioned engineered solution and an explanation of how the engineered solution adequately mitigates possible damage to the pipeline; ii) a list of pipeline segments where mitigation will be applied; and iii) an explanation of measures taken by Trans Mountain to reach an agreement with B.C. Hydro towards implementing the engineered solution. Trans Mountain must provide a copy of the report to B.C. Hydro at the same time that it is filed with the NEB; b) a report detailing how Trans Mountain's design reduces hazardous induced voltages on its pipeline segments to meet a maximum 15 VAC under all steady state operating conditions; and c) a report demonstrating how Trans Mountain would comply with the requirements of IEEE Standard 80 to limit touch and step potentials to all points of contacts to pipeline segments due to power line faults or switching surges, and include a list of affected pipeline segments.	X							
51	**Field changes manual for geohazard mitigation** Trans Mountain must file with the NEB for approval, **at least 4 months prior to commencing construction**, a field changes manual for geohazard mitigation. This manual must include: a) decision criteria for implementing mitigation for any geohazards identified during construction; b) specific criteria for implementing changes to the designs, grading, special materials, protective structures, burial depth, installation procedures, erosion mitigation measures, and monitoring; and c) details regarding the required qualifications of the field staff that will implement the manual.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
52	**Air Emissions Management Plan for the Westridge Marine Terminal** Trans Mountain must file with the NEB for approval, **at least 4 months prior to commencing construction at the Westridge Marine Terminal**, an Air Emissions Management Plan for the Westridge Marine Terminal that includes: a) locations of air monitoring sites (on a map or diagram), including the rationale for the locations selected; b) confirmation that the new fixed air monitoring stations will be installed and operating at least one year prior to commencing operations at the Westridge Marine Terminal to establish robust local baseline data; c) the methods and schedule for ambient monitoring of contaminants of potential concern in air (e.g., particulate matter [including diesel particulate matter and speciation of $PM_{2.5}$], nitrogen oxides (including NO_2), sulphur dioxide, hydrogen sulphide, ozone, mercaptans, reduced visibility and volatile organic compounds) following a recognized protocol (e.g. National Air Pollution Surveillance program or U.S. Environmental Protection Agency), and emissions source tracking; d) representative meteorological data (e.g. wind speed, wind direction, air temperature and relative humidity) for the monitoring period; e) description of monitoring equipment and procedures for monitoring station data recording, assessment, quality assurance and reporting details, including a description of how the real time and non-continuous air quality monitoring data will be made available to the public; f) a particulate matter management plan; g) a description of the public and Aboriginal communication and complaint response processes; h) the criteria or thresholds that, if triggered or exceeded, would require implementing additional mitigation measures; i) a description of additional mitigation measures that would be implemented as a result of the monitoring data or ongoing concerns; and j) a summary of its consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
53	**Fugitive Emissions Management Plan for the Westridge Marine Terminal** Trans Mountain must file with the NEB for approval, **at least 4 months prior to commencing construction at the Westridge Marine Terminal**, a Fugitive Emissions Management Plan for the Westridge Marine Terminal that includes: a) a description of the sources of the fugitive emissions that will be generated from the Westridge Marine Terminal during construction and operations; b) a description of the emission and odour controls that will be employed to reduce fugitive emissions during tanker loading and other sources identified in a); c) procedures for verifying, tracking, and reporting on: i) fugitive emissions during tanker loading; ii) volatile organic compound collection efficiency; iii) the vapour recovery unit's hydrogen sulphide and mercaptan removal efficiency, as well as its BTEX reduction efficiency; and iv) the vapour combustion unit's hydrogen sulphide and mercaptan; removal efficiency, as well as its combustion efficiency; d) procedures for identifying any leaks or equipment malfunctions during operation of the vapour recovery and vapour combustion units; e) methods for quantifying emissions of particulate matter and volatile organic compounds (with vapour recovery and vapour combustion units in operation); f) any additional mitigation measures that will be employed to further reduce fugitive emissions; g) a description of Trans Mountain's program for addressing complaints with respect to fugitive emissions, including a communication and notification plan; and h) a summary of its consultations with Appropriate Government Authorities. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan.	X							
54	**Fugitive Emissions Management Plan for Edmonton, Sumas and Burnaby Terminals** Trans Mountain must file with the NEB for approval, **at least 4 months prior to commencing construction at each Terminal**, a Fugitive Emissions Management Plan for the Edmonton, Sumas, and Burnaby Terminals. This plan must include: a) a description of the fugitive emission sources within the terminals during construction and operations; b) a description of the emission and odour controls that will be employed to reduce fugitive emissions from the tanks, and any other sources identified in a); c) procedures for verifying the capture and destruction efficiency of tank vapour activation units or any other emission or odour control units at the terminals; d) quantification of fugitive emissions during operations, including the methods used; e) any additional mitigation measures that will be employed to further reduce the fugitive emissions; f) a description of Trans Mountain's program for addressing complaints with respect to fugitive emissions, including a public and Aboriginal communication and complaint response process; and g) a summary of its consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan.							X	

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
55	**Fugitive Emissions Management Plan for pump stations** Trans Mountain must file with the NEB for approval, **at least 4 months prior to commencing construction at any pump stations**, a Fugitive Emissions Management Plan for the pump stations associated with the Project that includes: a) a description of the procedures implemented for leak detection and the criteria used in selecting target leaking components; b) quantification methods considered and the rationale for the selected method(s); c) monitoring frequency for each target leaking component and the parameters that will be measured; d) a decision framework that will be implemented to repair or replace leaking components; e) a description of record-keeping procedures; and f) a discussion of additional mitigation measures that will be employed to minimize fugitive emissions.		X			X	X		
56	**Grizzly Bear Mitigation Plan** Trans Mountain must file with the NEB for approval, **at least 4 months prior to commencing construction in each vulnerable grizzly bear population unit / grizzly bear management area**, a Grizzly Bear Mitigation Plan for each of these areas. Trans Mountain must provide a rationale for why any vulnerable grizzly bear population units / grizzly bear management units potentially affected by the Project are not addressed in the plan. The Grizzly Bear Mitigation Plan(s) must include: a) a summary of results from any supplemental surveys conducted; b) potential direct and indirect effects of Project activities on vulnerable grizzly bear population units and grizzly bear management units; c) mitigation measures to be implemented, including all relevant measures committed to throughout the OH-001-2014 proceeding, any new mitigation measures resulting from supplementary surveys, detailed criteria using clear and unambiguous language that describes the circumstances under which each measure will be applied, and measurable targets for evaluating mitigation success; d) details on post-construction monitoring of mitigation measures, including survey methods, corrective measures, detailed criteria using clear and unambiguous language that describes the circumstances under which each measure will be applied, and a proposed reporting schedule; e) a commitment to include results of the monitoring in the post-construction environmental monitoring reports filed under Condition 151; f) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plan including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; g) a summary of its consultations with Appropriate Government Authorities, any species experts and potentially affected Aboriginal groups. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the Plan; and h) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include any relevant information from the Grizzly Bear Mitigation Plan, including confirmation that the mitigation, monitoring, and corrective measures in this plan will be implemented in the case of discovery via their inclusion in Trans Mountain's Wildlife Species of Concern Discovery Contingency Plan.	X	X		X	X	X		

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
57	**Commercial Support for the Project** Trans Mountain must file with the Board, **at least 3 months prior to commencing construction**, confirmation, signed by an officer of the company, that: a) the Project has secured agreements or contracts that remain in force with shippers for a minimum term of 15-years for no less than 60 per cent of its total capacity (890,000 barrels per day); and b) any rights to terminate held by shippers that may have existed in any agreements or contracts between Trans Mountain and shippers (which may have reduced the Project's contracted total capacity to less than 60 per cent for a minimum term of 15 years) have lapsed and or expired because their conditions precedent have been satisfied or waived.	X							
58	**Training and education monitoring reports** a) Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction, and every 6 months thereafter until after commencing operations**, monitoring reports for the implementation and outcomes of Aboriginal, local, and regional training and education measures and opportunities for the Project. The reports must include the following: i) A description of each training and education measure and opportunity indicator that was monitored, including duration, participant groups, education and training organization, and intended outcomes. ii) A summary and analysis of the progress made toward achieving intended outcomes of each training and education measure and opportunity, including an explanation for why any intended outcomes were not achieve. iii) A description of identified or potential training or education gaps, and any proposed measures to address them or to support or increase training and education measures and opportunities. b) Trans Mountain must file with the NEB, **within 6 months after commencing operations**, a final report.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
59	**Worker accommodation strategy** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing construction**, a worker accommodation strategy, developed in consultation with appropriate municipal or provincial authorities. The strategy must include: a) a final summary of all proposed accommodations, including the location of any temporary camp(s); b) the number of workers that will be housed; and c) a description of how the strategy addresses any concerns or requests raised in consultation with municipal or provincial authorities. In the event that temporary camp(s) are to be used, the strategy must also include: i) a description of how the potential environmental and socio-economic impacts have been assessed, and a description of all associated mitigation measures; ii) copies of, or reference to, any mitigation or operational plans that will be required or implemented for the camp(s), including a description of how Trans Mountain has incorporated any additional mitigation measures into relevant Environmental Protection Plan(s); iii) copies of any necessary municipal or provincial permits for any camp(s) that have been received 3 months prior to construction. If camp permits are not yet in place 3 months prior to commencing construction, provide: 1) a list of the outstanding camp permits and a schedule for when these camp permits will be in place; and 2) copies of any outstanding camp permits prior to commencing construction; iv) copies or excerpts of all policies relating to the rules of conduct for workers housed at the camp(s); v) confirmation that all policies relating to the camp(s) will be provided to workers; vi) confirmation that all policies relating to the camp(s) were made available to all local communities and other relevant service providers in proximity to any camp(s) that will be used for the Project; and vii) a summary of its consultations with affected landowners/tenants where any camp(s) will be located. Trans Mountain must provide: 1) a description of the information provided to landowners/tenants; and 2) description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the Strategy.	X	X		X	X	X	X	

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
60	**Environmental and socio-economic assessment - s.58 temporary construction lands and infrastructure** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing construction**, an environmental and socio-economic assessment for all temporary construction lands and infrastructure approved pursuant to this Order. The assessments must include: a) a list of the locations and dimensions of all temporary construction lands and infrastructure; b) environmental alignment sheets or as-built drawings at an appropriate scale, clearly depicting temporary construction lands and infrastructure; c) results of any pre-construction surveys within the areas that were not previously subject to such surveys, and an indication of potential residual effects; d) all associated mitigation measures that are beyond those identified during the OH-001-2014 proceeding; e) analysis supporting the use of the measures in d), including any supplementary reports; f) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include any relevant information based on any supplemental surveys completed; and g) a summary of consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants, as well as copies of all written comments that may be provided to Trans Mountain by those consulted. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the assessment.				X				
61	**List of temporary infrastructure sites** Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction**, a complete list of all temporary infrastructure sites to be constructed for the Project, and must file any **updates as they become available**. This list must include information on each site's location, structures to be installed, the anticipated date for commencing construction, and activities involved in its construction. The initial list and any updates must also include the condition numbers (those under the "prior to commencing construction" phase heading) that are applicable to each site and an indication of whether each of those conditions has been or remains to be satisfied.				X				
62	**Construction schedule** Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction**, a construction schedule identifying the major construction activities expected and, on a monthly basis, on the first working day of each calendar month from the commencement of construction until after commencing operations, updated detailed construction schedules.	X	X	X	X	X	X	X	X
63	**Security Management Programs** Trans Mountain must file confirmation, signed by an officer of the company: a) **at least 3 months prior to commencing construction**, that it has developed a Security Management Program for the construction phase of the Project; and b) **at least 3 months prior to commencing operations**, that it has amended its operations phase Security Management Program to include operation of the Project; pursuant to the *National Energy Board Onshore Pipeline Regulations* and CSA Z246.1 (as amended from time to time).	X	X	X	X	X	X	X	X

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
64	**Construction safety manuals** Trans Mountain must file with the NEB: a) **at least 3 months prior to commencing construction**, the Health and Safety Management Plan for the Project; and b) **at least 2 months prior to commencing construction**, Construction Safety Manuals (Project-Specific Safety Plans) for the applicable Project components. These must include separate Construction Safety Manuals for pipeline construction, terminal and pump station construction, Burnaby Mountain tunnel construction, and Westridge Marine Terminal construction. These manuals must address routine construction activities, as well as blasting, tunneling, avalanche safety, safe work in proximity to operational pipelines and facilities, and special access procedures that may be required in areas subject to activities other than Project construction.	X	X	X	X	X	X	X	X
65	**Hydrology – notable watercourse crossings** Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction**, revised flood frequency estimates for all notable watercourse crossings, as defined by Trans Mountain in its application. These estimates must incorporate the results of field investigations and bathymetric surveys completed since the Project application was filed, and be presented in a format similar to that presented in Application Volume 4A, Appendix I – Route Physiography and Hydrology Report, Appendix B – Notable Water Crossing Catchment Details (Filing A56000).	X							
66	**Risk Management Plan for geohazards** Trans Mountain must develop and file with the NEB, **at least 3 months prior to commencing construction**, an updated Risk Management Plan for addressing the threats of existing and potential geohazards during construction of the Project. This plan must be updated as additional site-specific geotechnical information is obtained through detailed investigations, and modified as geohazards are encountered during construction. Trans Mountain must make any updates or modifications available to the NEB upon request.	X			X				
67	**Outstanding horizontal directional drilling geotechnical and feasibility reports** Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction**, Geotechnical Reports and Horizontal Directional Drilling Feasibility and Design Reports, along with final design drawings, for each of the following crossings: a) Coldwater River 4 crossing; b) North Thompson River 6 crossing; c) North Thompson River 7 crossing; d) Pembina River crossing. e) Raft River crossing; f) Sumas River crossing (suitability for Direct Pipe® installation); g) any additional river crossing along the new Line 2 pipeline segments where horizontal directional drilling or other trenchless crossing method is being considered; and h) the Coquitlam Landfill, if Horizontal Directional Drilling or other trenchless crossing method is being considered.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
68	**Seismic reports – liquefaction potential** Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction**, a final report that identifies all sites along the Project , that have "Very High," "High," and "Moderate" liquefaction-triggered ground movement potential, and that describes how the potential for liquefaction-triggered ground movement will be mitigated at each site.	X							
69	**Fault studies** Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction**, the results of fault-mapping studies that were ongoing during or undertaken after the OH-001-2014 proceeding, for use in the detailed design of the Project. This filing must include conclusions regarding possible seismic activity during the Holocene epoch for Sumas Fault, Vedder Mountain Fault, Fraser River-Straight Creek Fault and Rocky Mountain Trench, and other possible hidden faults, as well as the potential for compounding risks due to the proximity of the Vedder Mountain and Sumas Faults.	X							
70	**Strain-based design** Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction**, the following information related to strain-based design, where it is applied: a) the location and rationale for selecting strain-based design in each location; b) a report summarizing the adequacy of the strain-based design for various loading scenarios during pipeline construction and operation for each location provided in a); and c) a list of standards and Project-specific specifications, including testing procedures, used in the strain-based design.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
71	**Riparian Habitat Management Plan** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing construction**, a Riparian Habitat Management Plan that would apply to all defined watercourses crossed by the Project. The plan must be supported with rationales and unambiguous criteria explaining under what circumstances each such measure and strategy would apply, and must include the following. a) a description of the methods used to determine pre-construction functionality (e.g., for fish, wildlife, and rare plants) of the riparian habitat, including a justification how such functionality is assessed; b) a description of the mitigation measures and the watercourse reclamation strategies (reclamation method, reclamation measures, and application criteria) for the range of defined watercourses crossed by the Project; c) a description of the generalized vegetation planting plans for the range of defined watercourses crossed by the Project; that includes the diversity and density of species to be planted, planting locations, and application criteria; d) clearly defined measureable reclamation goals and targets for years 1, 3, and 5, post-construction, to determine whether riparian habitat has returned, or is on a sufficient trajectory to return, to pre-construction functionality; e) a discussion of how the mitigation measures, reclamation strategies, and vegetation planting plans are anticipated to return riparian habitat to pre-construction functionality, using the goals and targets provided in d); f) a summary of the information in a)-d) for each defined watercourse crossing, that includes: i) watercourse crossing ID; ii) a defined riparian habitat buffer; iii) a catalogue of the pre-construction species diversity and density of the riparian habitat; iv) classification of riparian habitat functionality; v) area of the riparian habitat to be impacted; vi) the mitigation measures, reclamation strategy, and vegetation planting plan to be implemented; and vii) the measureable goals and targets. g) details of the post-construction monitoring plan for the first five years of operations, including evaluations of reclamation activities, and potential corrective actions and enhancement measures that might be necessary and the circumstances under which each such action would be taken; h) a Preliminary Riparian Habitat Offset Plan, that would apply to all defined watercourse crossings located in watersheds identified as being above the riparian habitat disturbance threshold (>18 per cent of riparian habitat disturbed in the watershed) or classified as High Sensitive fish-bearing by Trans Mountain during the OH-001-2014 proceeding, and, where, after the fifth complete growing season, riparian habitat has not returned, or is not trending towards sufficient pre-construction functionality. The plan must include: i) how the need for offset measures will be determined, including offset ratios; ii) potential offset measures, the process for selecting which will be implemented, and an evaluation of the probability of their success; and iii) how the effectiveness of offset measures will be assessed, monitored, and reported on;	X	X						

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
71 (cont)	i) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; and j) a summary of consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its plan, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan of updates.	**X**	**X**						
72	**Pipeline Environmental Protection Plan** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing construction**, an updated Project-specific Pipeline Environmental Protection Plan for the construction of the pipeline. The updated Environmental Protection Plan must be a comprehensive compilation of all environmental protection procedures, mitigation measures, and monitoring commitments, as set out in Trans Mountain's Project application, its subsequent filings, or as otherwise committed to during the OH-001-2014 proceeding. The updated plan must describe the criteria for implementing all procedures and measures using clear and unambiguous language that confirms Trans Mountain's intention to implement all of its commitments. The updated Environmental Protection Plan must include the following: a) environmental procedures (including site-specific plans), criteria for implementing these procedures, mitigation measures, and monitoring applicable to all Project phases and activities; b) policies and procedures for environmental training and the reporting structure for environmental management during construction, including the qualifications, roles, responsibilities, and decision-making authority for each job title identified in the updated Environmental Protection Plan; c) any additional measures arising from supplemental pre-construction studies and surveys; d) updated contingency plans and management plans; e) updated alignment sheets; f) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; and g) a summary of its consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan.	**X**	**X**						

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
73	**Traffic Control Plans for public roadways** Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction of the pipeline and at least 2 months prior to commencing construction at each terminal and pump station**, traffic control plans for the use of public roadways for the Project. The plans must include: a) information regarding the timing and location of key construction activities (including equipment mobilization and staging, pipe stockpiling, pipeline and pump station construction, and equipment demobilization); b) current traffic volumes and anticipated traffic volumes during the construction period for both day and night times; c) a description of the predicted traffic flows, including vehicle types and volumes, at key construction points, marshalling areas, access roads, and public roadways; d) an assessment of the potential impacts associated with the increased volume of construction-related traffic (e.g., safety hazards, noise, light, dust, etc.) and associated mitigation measures; and e) a summary of its consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the Plans.	X	X	X	X	X	X	X	X
74	**Horizontal directional drilling (HDD) Noise Management Plan** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing construction of each HDD crossing**, a site-specific HDD Noise Management Plan that includes: a) proposed hours of daytime and nighttime work; b) baseline daytime and nighttime ambient sound levels at noise sensitive areas within 500 metres of the HDD entry and exit sites; c) predicted noise levels caused by HDD at the most affected receptors without mitigation measures implemented; d) proposed HDD noise mitigation measures, including all technologically and economically feasible mitigation measures; e) predicted noise levels at the most affected receptors with mitigation measures implemented, including noise contour map(s) showing potentially affected receptors; f) an HDD noise monitoring program, including locations, methodology, and schedule; g) a description of the public and Aboriginal communication and complaint response process; h) a contingency plan that contains proposed mitigation measures for addressing noise complaints, which may include the temporary relocation of specific residents; and i) confirmation that Trans Mountain will provide notice to nearby residents in the event that a planned blowdown is required, and that the planned blowdown will be completed during daytime hours whenever possible.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
75	**Nooksack Dace and Salish Sucker Management Plan** a) Trans Mountain must construct all watercourse crossings located within nooksack dace or salish sucker proposed or final critical habitat, as defined by Fisheries and Oceans Canada Recovery Strategies for the species, using trenchless crossing methods with entry and exit points located outside of the riparian habitat area, unless demonstrated to be not feasible. b) **At least 3 months prior to commencing construction of any watercourse crossing located within nooksack dace or salish sucker proposed or final critical habitat**, Trans Mountain must file a list of these watercourse crossings, and, for each, indicate whether or not a trenchless crossing method is feasible. c) For each watercourse crossing in b) where a trenchless crossing method is not feasible, **at least 3 months prior to commencing construction of that crossing**, Trans Mountain must file the following with the NEB for approval: i) a summary of the trenchless crossing feasibility studies completed and a discussion of the risks and constraints associated with the trenchless watercourse crossing, and the rationale for not employing a trenchless method; ii) the updated watercourse crossing method, location of crossing, planned construction timing, and the provincial instream work window; iii) any site-specific mitigation and reclamation measures, and species-specific habitat enhancement measures; iv) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include measures listed in iii); v) a discussion of how the site-specific mitigation and reclamation measures, and species-specific enhancement measures, relate to Fisheries and Oceans Canada Recovery Strategies and Action Plans; vi) details on any monitoring to be undertaken and a commitment to include any results in the post-construction environmental monitoring reports filed under Condition 151; vii) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; and viii) a summary of consultations with Appropriate Government Authorities and any species experts. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan. d) For any watercourse crossing identified in b) where Trans Mountain will employ a trenched contingency crossing method, Trans Mountain must file with the NEB, for approval, the information listed in c), **at least 30 days prior to commencing construction of the contingency watercourse crossing**.	X							

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76	**Old Growth Management Areas Mitigation and Replacement Plan** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing construction within old growth management areas**, an Old Growth Management Areas Mitigation and Replacement Plan for these areas that are potentially affected directly or indirectly by the Project during construction or operations, that includes: a) avoidance and mitigation measures to be implemented during construction and operations, with rationales and unambiguous criteria explaining under what circumstances each measure will be applied, and measurable goals against which the success of each measure will be evaluated; b) a description of how the avoidance, mitigation, and offset hierarchy was considered in developing the plan, with rationales for progressing from avoidance to mitigation to offsets; c) details on post-construction monitoring, including corrective actions that might be necessary and the circumstances under which each such action would be taken; d) the expected residual effects (including quantification) on old growth management areas, including a discussion of the potential for time lags between when Project effects occur and when mitigation measures would become fully functional; e) replacement or other offset measures that will be implemented to compensate for residual effects with the aim of no-net-loss to old growth forests within old growth management areas overall, including: i) discussion of the appropriateness of compensation for the old growth management area, taking its specific features into account, and of any potential limitations of the effectiveness of such replacement or offset measures; ii) an explanation with rationales on the amount and type of replacements or other offsets required; iii) a timeline for their implementation; iv) the selection of compensation sites; v) identification of the parties involved in planning and implementation and their respective roles and responsibilities, and vi) a description of the methods and schedule for monitoring and reporting to demonstrate compensation success; f) a summary of its consultations with Appropriate Government Authorities and any potentially affected Aboriginal groups. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan; and g) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include any relevant information from the Old Growth Management Areas Mitigation and Replacement Plan.	X			X	X	X		

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
77	**Archaeological and cultural heritage assessment – Lightening Rock** Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction of the pipeline between the Sumas Terminal and the Sumas Pump Station**, a report on archaeological and cultural heritage field investigations undertaken to assess the potential impacts of Project construction and operations on the Lightening Rock site at Sumas, British Columbia. The report must include: a) a detailed description of the assessment plan that was developed, in consultation with the Stó:lō Collective, for the involvement of the Stó:lō Collective in designing and undertaking surveys; b) a description of the pre-construction archaeological and cultural heritage surveys conducted at the site, including: i) survey methodologies used; and ii) data and information sources, including information and Aboriginal traditional knowledge provided by the Stó:lō Collective; c) a site description, including maps at appropriate scales and levels of detail, confirming the site boundaries; d) an assessment of the potential environmental and socio-economic impacts of project construction and operations on the archaeological resources and cultural heritage of the site; e) all associated mitigation measures that are beyond those identified during the OH-001-2014 proceeding to address any identified impacts; f) analysis supporting the use of the measures in e), including any additional relevant reports; g) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) and Environmental Alignment Sheets to include any relevant information based on the surveys completed; and h) a summary of consultations undertaken with the Stó:lō Collective, and Appropriate Government Authorities, as well as copies of all written comments that may be provided to Trans Mountain by the Stó:lō Collective or government authorities. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from the Stó:lō Collective or government authorities, into the assessment.	X			X				

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78	**Facilities Environmental Protection Plan** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing construction at the facilities (terminals, pump stations, temporary facilities, and associated infrastructure),** an updated Project-specific Facilities Environmental Protection Plan for the construction at the facilities. The updated Environmental Protection Plan must be a comprehensive compilation of all environmental protection procedures, mitigation measures, and monitoring commitments, as set out in Trans Mountain's Project application, its subsequent filings, or as otherwise committed to during the OH-001-2014 proceeding. The updated plan must describe the criteria for implementing all procedures and measures using clear and unambiguous language that confirms Trans Mountain's intention to implement all of its commitments. The updated Environmental Protection Plan must include the following: a) environmental procedures (including site-specific plans), criteria for implementing these procedures, mitigation measures, and monitoring applicable to all Project phases and activities; b) policies and procedures for environmental training and the reporting structure for environmental management during construction, including the qualifications, roles, responsibilities, and decision-making authority for each job title identified in the updated Environmental Protection Plan; c) any additional measures arising from supplemental pre-construction studies and surveys; d) updated contingency plans and management plans; e) updated facility drawings including relevant site-specific resources and mitigations; f) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; and g) a summary of its consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan.		X	X	X	X	X	X	X

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
79	**Air Emissions Management Plan for the Edmonton, Sumas and Burnaby Terminals** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing construction at each of the Edmonton, Sumas, and Burnaby Terminals,** an Air Emissions Management Plan for each of those terminals that includes: a) a description of the baseline, pre-construction conditions informed by relevant modelling results and recent existing monitoring data; b) descriptions of the locations of air monitoring sites (on a map or diagram), including the rationale for the locations selected; c) the timing for installing air monitoring stations; d) the methods and schedule for monitoring ambient ground-level concentrations of potential concern (e.g., volatile organic compounds, ozone, hydrogen sulphide, mercaptans, criteria air contaminants, secondary ozone and particulate matter, and reduced visibility) and emissions source tracking; e) procedures for monitoring station data recording, assessment, and reporting details, including a description of how the real time and non-continuous air quality monitoring data will be made available to the public; f) a description of the public and Aboriginal communication and complaint response process; g) the criteria or thresholds that, if triggered or exceeded, will require implementing additional emissions reduction measures; h) possible measures that will be implemented as a result of the monitoring data or ongoing concerns; and i) a summary of its consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan.							X	
80	**Noise Management Plan for construction at terminals and pump stations** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing construction at each terminal and pump station**, a Noise Management Plan for construction, where residences are within 300 metres of the proposed construction activities. The plan must include: a) proposed hours of daytime and nighttime work; b) noise mitigation measures, including all technologically and economically feasible mitigation measures; c) a noise monitoring program, including locations, methodology, and schedule; d) a description of the public and Aboriginal communication and noise complaint response process; and e) a contingency plan that contains proposed mitigation measures for addressing noise complaints, which may include the temporary relocation of specific residents.	X				X	X	X	

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
81	**Westridge Marine Terminal Environmental Protection Plan** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing construction at the Westridge Marine Terminal**, an updated Project-specific Westridge Marine Terminal Environmental Protection Plan for the construction at the Terminal. The updated Environmental Protection Plan must be a comprehensive compilation of all environmental protection procedures, mitigation measures, and monitoring commitments, as set out in Trans Mountain's Project application, its subsequent filings, or as otherwise committed to during the OH-001-2014 proceeding. The updated plan must describe the criteria for implementing all procedures and measures using clear and unambiguous language that confirms Trans Mountain's intention to implement all of its commitments. The updated Environmental Protection Plan must include the following: a) environmental procedures (including site-specific plans), criteria for implementing these procedures, mitigation measures, and monitoring applicable to all Project phases and activities; b) policies and procedures for environmental training and the reporting structure for environmental management during construction, including the qualifications, roles, responsibilities, and decision-making authority for each job title identified in the updated Environmental Protection Plan; c) any additional measures arising from supplemental pre-construction studies and surveys; d) updated contingency plans and management plans; e) updated facility drawings including relevant site-specific resources and mitigations; f) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; and g) a summary of its consultations with Appropriate Government authorities and any potentially affected Aboriginal groups. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the plan.	X							
82	**Light Emissions Management Plan for the Westridge Marine Terminal** Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction at the Westridge Marine Terminal**, a Light Emissions Management Plan for the Westridge Marine Terminal that includes: a) a summary of the results of an area lighting study, including how potential impacts on surrounding communities and safety and operational requirements were considered; b) a description of the mitigation and best practice measures considered for the terminal lighting design and how the proposed design and operation will minimize the impacts from light on land-based residents and marine users; c) a summary of its consultations with Port Metro Vancouver, as well as copies of all written comments that may be provided to Trans Mountain by Port Metro Vancouver. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from Port Metro Vancouver, into the Plan; and d) a plan for how Trans Mountain will communicate its proposed terminal lighting design and associated mitigation measures to limit any nuisance lighting disturbances to land-based residents and marine users.	X							

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83	**Westridge Marine Terminal (offshore) – pile design** Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction at the Westridge Marine Terminal**, the final design basis for the offshore pile foundation layout of the Westridge Marine Terminal.	X							
84	**Emergency release system at the Westridge Marine Terminal** Trans Mountain must file with the NEB, **at least 3 months prior to commencing construction at the Westridge Marine Terminal**, its conclusions on the necessity of an emergency release system for the loading arms at the Westridge Marine Terminal. The conclusions must be supported by a comprehensive study describing the advantages and disadvantages of incorporating an emergency release system. This study must: a) consider the application of i) emergency release couplers; and ii) an emergency release system, during both normal operating conditions and under abnormal conditions such as seismic events; and b) include a description of the final emergency release system design, if applicable.	X							
85	**Air Emissions Management Plan – Burnaby Mountain tunnel construction** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing Burnaby Mountain tunnel construction activities**, an Air Emissions Management Plan for tunnel construction. The plan must include: a) proposed hours for daytime and nighttime work; b) sources that would generate air emissions; c) an Air Emissions and Dust Emissions Management Plan that includes mitigation measures, their predicted effectiveness, and implementation timeframes; and d) a description of Trans Mountain's program for addressing complaints received during tunnel construction with respect to air and dust emissions, including a communication and notification plan.	X							

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86	**Burnaby Mountain Tunnel Construction Noise Management Plan** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing Burnaby Mountain tunnel construction activities**, a Burnaby Mountain Tunnel Construction Noise Management Plan that includes: a) proposed hours of daytime and nighttime work; b) baseline daytime and nighttime ambient sound levels at noise sensitive areas within 500 metres of the entry and exit sites for the tunnel; c) predicted noise levels at the most affected receptors caused by tunnel construction without mitigation measures implemented; d) proposed noise mitigation measures, including all technologically and economically feasible mitigation measures; e) predicted noise levels at the most affected receptors with mitigation measures implemented, including noise contour map(s) showing the potentially affected receptors; f) a tunnel construction noise monitoring program, including locations, methodology, and schedule; g) criteria that will be used to determine when tunnel construction would be shut down due to noise; h) a summary of its consultations with Appropriate Government Authorities and any potentially affected receptors (residences and businesses), as well as copies of all written comments that may be provided to Trans Mountain by those consulted. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the Plan; i) a description of the public and Aboriginal communication and noise complaint response processes; and j) a contingency plan that contains proposed mitigation measures for addressing noise complaints, which may include the temporary relocation of specific residents.	X							
87	**Groundwater Seepage Management Plan – Burnaby Mountain tunnel construction** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing Burnaby Mountain tunnel construction activities**, a Groundwater Seepage Management Plan for tunnel construction. The plan must include: a) an estimate quantifying the anticipated average and maximum amounts of groundwater seepage into the tunnel, and an assessment of any potential impacts on the water table; b) a discussion of Trans Mountain's proposed pumping, treatment, and disposal options; c) a description of the potential effects of dewatering of bedrock aquifers, springs and streams on local groundwater and surface water resources, and of measures that Trans Mountain would implement to mitigate such effects; and d) a description of measures that Trans Mountain would implement during the operations phase in the event that there is groundwater seepage into the tunnel.	X							
88	**Project organizational structure for Project construction** Trans Mountain must file with the NEB, **at least 2 months prior to commencing construction**, a diagram of the Project's organizational structure (i.e., project management, design, and field staff) that clearly identifies roles, accountabilities, responsibilities, and reporting relationships for construction of the applicable Project components.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
89	**Emergency Response Plans for construction** Trans Mountain must file with the NEB, **at least 2 months prior to commencing construction**, a Project-specific Emergency Response Plan, including the Trans Mountain Expansion Project Emergency Response Plan and site-specific Emergency Response Plans as referenced in Volume 4B, Section 5.4.2 of its Project application (Filing A3S1K6), that would be implemented during the construction phase. The plan(s) must include spill contingency measures that Trans Mountain will employ in response to accidental spills attributable to construction activities, 24-hour medical evacuation, fire response, and security.	X	X	X	X	X	X	X	X
90	**Consultation on improvements to Trans Mountain's Emergency Management Program** Trans Mountain must file with the NEB, **at least 2 months prior to commencing construction**, a consultation plan for its review of its Emergency Response Plans and equipment (including its availability), as referenced in Volume 7, Section 4.8.2 of its Project application (Filing A3S4V5). This plan must include: a) the consultation plan's scope; b) the consultation plan's objectives; c) a preliminary list of Appropriate Government Authorities, first responders, potentially affected Aboriginal groups and affected landowners/tenants with whom Trans Mountain will consult; d) a preliminary list of consultation locations and timing; and e) the methods that will be used to track commitments made during consultations and to incorporate them into Trans Mountain's Emergency Management Program, including its Emergency Response Plans.	X					X	X	
91	**Plan for implementing, monitoring, and complying with marine shipping-related commitments** Trans Mountain must file with the NEB, **at least 2 months prior to commencing construction**, a plan describing how it will implement, monitor, and ensure compliance with its marine shipping-related commitments identified in Condition 133. The plan must be prepared in consultation with Transport Canada, the Canadian Coast Guard, the Pacific Pilotage Authority, Port Metro Vancouver, British Columbia Coast Pilots, Western Canada Marine Response Corporation, Fisheries and Oceans Canada and the Province of British Columbia, and must identify any issues or concerns raised and how Trans Mountain has addressed or responded to them. Trans Mountain must provide the plan to the above-mentioned parties at the same time as it is filed with the NEB.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
92	**Updates under the Species at Risk Act** Trans Mountain must file with the NEB, **at least 2 months prior to commencing construction**, a summary of any relevant updates under the *Species at Risk Act*, including new Schedule 1 listings and new or amended Recovery Strategies, Action Plans, and Management Plans for species that have the potential to be affected by the Project. For each species-specific update, the summary must include: a) a discussion of the Project activities' potential effects on the listed species or its critical habitat, including an explanation as to whether additional surveys are required to locate such critical habitat; b) identification of all reasonable alternatives to the Project activities referred to in a), including avoidance measures, and a discussion on the potential effects of the alternatives, the chosen approach, and the rationale for selecting the chosen approach; c) any additional site-specific mitigation; d) any monitoring to be undertaken and a commitment to include monitoring results as part of the post-construction environmental monitoring reports filed under Condition 151; e) an explanation as to how the responses to b), c) and d) above are consistent with applicable recovery strategies and actions plans; and f) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the summary of updates, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information.	X	X		X	X	X		
93	**Water well inventory** Trans Mountain must file with the NEB, **at least 2 months prior to commencing construction**, an inventory of physically verified ("ground-truthed") water wells that are within 150 metres of either side of the centre of the pipeline right-of-way. The filing must contain confirmation that Trans Mountain will maintain and update the inventory until the Project is abandoned or decommissioned pursuant to the NEB Act. The inventory must include a description of the methods used to identify and physically verify wells, including: a) each well's location in proximity to the right-of-way, including its GPS coordinates; b) a description of each well's type or use (e.g., drinking water, agricultural use, use by Aboriginal groups, any other uses); c) each well's tenure or ownership (e.g., private, municipal, Aboriginal community); d) each well's operational status, including abandoned or decommissioned wells, and information about each well, including well depth, lithology, and water depth, if available; e) a plan for updating the inventory over the life of the Project, including: i) the methods for identifying and verifying abandoned or decommissioned wells, and new or replacement wells; and ii) the frequency of inventory updates; f) a list of any properties or sections of the right-of-way that were not physically verified, including; i) the reason why properties or right-of-way sections were not physically accessed; ii) an estimate of the potential number of wells that have not been physically verified; and iii) a proposed schedule for accessing properties or right-of-way sections; and g) a description of Trans Mountain's plans for communicating information about the locations of water wells to owners or affected users.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
94	**Consultation reports – protection of municipal water sources** Trans Mountain must file with the NEB, **at least 2 months prior to commencing construction, and on or before 31 January of each year during construction and of the first 5 years after commencing operations**, a report on Trans Mountain's consultations with municipalities and regional districts, communities, and Aboriginal groups related to the protection of municipal and community water sources, including those sources currently relied upon and sources identified for potential future use. Each report must include: a) the name of the municipality, regional district, community, or Aboriginal group consulted; b) the methods, dates, and locations of all meetings or consultations; c) a summary of all issues or concerns raised; and d) a summary of any steps or measures that have been or will be undertaken, including groundwater modelling or monitoring, as a result of consultations with municipalities, regional districts, communities, or Aboriginal groups. This summary must include: i) any updates or amendments to maintenance policies, systems, programs, procedures, practices, and activities aimed at preventing pipeline releases; ii) the criteria used to identify and select modelling or monitoring locations and parameters; iii) results of any modelling or monitoring; iv) any measures that have been taken to address modelling or monitoring results; and v) any measures to share or to make accessible to municipalities, regional districts, communities, or Aboriginal groups data or issues that arise regarding drinking water (aquifers, groundwater, and well water supplies); or in the alternative to i)-v) above, an explanation why no further action is required to address or respond to issues or concerns raised.	X	X			X	X	X	
95	**Visual Impact Plan** Trans Mountain must file with the NEB, **at least 2 months prior to commencing construction**, a Visual Impact Plan that includes: a) the results of any supplemental visual modelling surveys conducted of select locations that are highly visible to the public, identified in consultation with Appropriate Government Authorities, and potentially affected Aboriginal groups and affected landowners/tenants, where the proposed pipeline corridor deviates from the existing TMPL system right-of-way; and b) mitigation measures to be implemented, including all relevant measures committed to throughout the OH-001-2014 proceeding, and any new mitigation measures resulting from supplementary surveys.	X							
96	**Reports on engagement with Aboriginal groups – construction** Trans Mountain must file with the NEB, **at least 2 months prior to commencing construction and every 6 months thereafter until after commencing operations**, a report on the engagement activities it has undertaken with potentially affected Aboriginal groups. Each report must include, at a minimum, for each Aboriginal group engaged: a) the name of the group; b) the method(s), date(s), and location(s) of engagement activities; c) a summary of any issues or concerns raised; and d) the measures taken, or that will be taken, to address or respond to issues or concerns, or an explanation why no further action is required to address or respond to issues or concerns. Trans Mountain must provide a copy of each report to each group engaged (and identified in a) above) at the same time that it is filed with the NEB.	X	X	X	X	X	X	X	X

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
97	**Traditional Land Use (TLU) and Traditional Marine Resource Use (TMRU) Investigation Report** Trans Mountain must file with the NEB for approval, **at least 2 months prior to commencing construction**, a report describing pre-construction TLU and TMRU investigations that were not reported during the OH-001-2014 proceeding and that relate specifically to the Project (up to and including the foreshore lands and boundaries of the water lease for the Westridge Marine Terminal). The report must include: a) the name of the potentially affected Aboriginal group to which each investigation pertains; b) a description of any identified potentially affected TLU or TMRU sites, resources, or activities; c) the methods used to identify the potentially affected TLU or TMRU sites, resources or activities; d) a summary of any mitigation measures that Trans Mountain will implement to reduce or eliminate (to the extent possible) Project effects on TLU or TMRU sites, resources or activities; e) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include mitigation measures (summarized in (d)) to reduce or eliminate (to the extent possible) Project effects on TLU or TMRU sites, resources or activities; f) a summary of consultations undertaken with or concerns raised by potentially affected Aboriginal groups regarding investigations on Project effects on the current use of lands and resources or marine resource use for traditional purposes, as well as copies of all written comments provided to Trans Mountain by potentially affected Aboriginal groups to which each investigation pertains. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those Aboriginal groups to which each investigation pertains, into the report; g) a description of any outstanding concerns raised regarding potential Project effects on the current use of lands and resources or marine resource use for traditional purposes, including a description of how Trans Mountain will or address or respond to them, or an explanation why it will not address or respond to them; and h) a summary of any outstanding TLU or TMRU investigations or follow-up activities that will not be completed prior to commencing construction, including estimated completion date(s), if applicable, and a description of how Trans Mountain has already identified, or will identify, any potentially affected TLU and TMRU sites, resources or activities for these outstanding investigations. Trans Mountain must provide a copy of the report to each potentially affected group identified in a) at the same time that it is filed with the NEB.	X							

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
98	**Plan for Aboriginal group participation in construction monitoring** Trans Mountain must file with the NEB, **at least 2 months prior to commencing construction**, a plan describing participation by Aboriginal groups in monitoring activities during construction for the protection of traditional land and resource use for the pipelines, terminals and pump stations, and traditional marine resource use at the Westridge Marine Terminal. The plan must include: a) a summary of engagement activities undertaken with Aboriginal groups to determine opportunities for their participation in monitoring activities; b) a list of potentially affected Aboriginal groups, if any, that have reached agreement with Trans Mountain to participate in monitoring activities; c) the scope, methodology, and justification for monitoring activities to be undertaken by Trans Mountain and each participating Aboriginal group identified in b), including those elements of construction and geographic locations that will involve Aboriginal Monitors; d) a description of how Trans Mountain will use the information gathered through the participation of Aboriginal Monitors; and e) a description of how Trans Mountain will provide the information gathered through the participation of Aboriginal Monitors to the participating Aboriginal group. Trans Mountain must provide a copy of the report to each potentially affected group identified in b) above at the same time that it is filed with the NEB.	X	X		X	X	X	X	
99	**Landowner and tenant consultation reports** Trans Mountain must file with the NEB, **at least 2 months prior to commencing construction, and every 6 months thereafter until 5 years after commencing Project operations**: a) a description of landowner and tenant consultations, including the consultation methods, dates, and a summary of any issues or concerns raised by landowners and tenants; b) a summary of actions that Trans Mountain has undertaken to address or respond to each of the issues or concerns raised, or an explanation for why no actions were taken, and any outstanding concerns; and c) confirmation that Trans Mountain will make available to a landowner or tenant, upon request, a copy of the consultation records related to that landowner or tenant.	X							
100	**Heritage resources** Trans Mountain must file with the NEB, **at least 2 months prior to commencing construction of individual Project components** as described in Condition 10(a): a) confirmation, signed by an officer of the company, that it has obtained all of the required archaeological and heritage resource permits and clearances from the Alberta Department of Culture and the British Columbia Ministry of Forests, Lands and Natural Resource Operations; b) confirmation that it has consulted with the British Columbia Ministry of Forests, Lands and Natural Resource Operations, and that the Ministry has reviewed and approved the mitigation measures for disturbance to impacted palaeontological sites within British Columbia; c) a description of how Trans Mountain will meet any conditions and respond to any comments and recommendations contained in the permits and clearances referred to in a) or obtained through the consultation referred to in b); and d) confirmation that Trans Mountain will update the relevant Environmental Protection Plan(s) to include any relevant information from the conditions or recommendations referred to in c).	X	X	X	X	X	X	X	X

No.	Conditions with initial filings due prior to commencing construction, or prior to commencing construction of specified Project component(s)	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
101	**Uninterruptible Power Supply (UPS) and battery systems** Trans Mountain must file with the NEB, **at least 2 months prior to commencing construction at each terminal and pump station**, confirmation that the UPS system design and planned operation related to that facility, is in compliance with the requirements of Canadian Standards Association (CSA) 22.1 – No. 15 or other applicable standard(s) that exceeds the requirements of CSA 22.1 – No. 15. If another standard is used, this filing must include the name of the standard and an explanation of why the standard was used and how it meets or exceeds the requirements of CSA 22.1 No. 15.	X				X	X	X	
102	**Landowner and tenant complaint process/system** Trans Mountain must file with the Board, **at least 30 days prior to commencing construction**, confirmation that it has created and will maintain, up until the Project is abandoned or decommissioned pursuant to the NEB Act, a process/system that chronologically tracks landowner and tenant complaints related to the Project. The filing must contain confirmation that the process/system will track: a) a description of each complaint; b) how each complaint was received (e.g., telephone, letter, email); c) the date each complaint was received; d) subsequent dates of all contact or correspondence with each complainant; e) records of any site visits, monitoring, or inspections; f) contact information for all parties involved in each complaint; g) the date of each complaint's resolution; and h) if a complaint remains unresolved, a description of any further actions to be taken or an explanation for why no further action is required. Trans Mountain must make available to a landowner or tenant, **upon request**, the records related to the complaint(s) that the landowner or tenant made to Trans Mountain, including any investigations, reports or surveys conducted in relation to the complaint.	X							
103	**Utility crossings** Trans Mountain must file with the Board, **at least 30 days prior to commencing construction**, a list of all underground utilities to be crossed by the Project. The list must include the location and owners of the utilities to be crossed, as well as confirmation that all the agreements or crossing permits for those utilities to be crossed have been acquired or will be acquired prior to construction.	X			X				
No.	**Conditions with initial filings due during construction / prior to commencing operations**	**CPCN**	**OC2**	**OC49**	**Temp**	**Pump 1**	**Pump2**	**Tanks**	**Deact**
104	**Updated engineering alignment sheets and drawings** Trans Mountain must file with the NEB, **at least 3 months prior to commencing pipe installation**, updated engineering alignment sheets and drawings and, as they become available and prior to their implementation, any modifications to those sheets and drawings.	X							
105	**Quality assurance verification** Trans Mountain must file monthly summary reports, **from commencing construction until after commencing operations**, outlining non-conformances with its design, materials, and construction specifications and the disposition of these non-conformances.	X				X	X	X	

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
106	**Construction progress reports** Trans Mountain must file with the NEB **monthly construction progress reports from commencing construction until after commencing operations**. The reports must include information on the progress of activities carried out during the reporting period, including: a) safety, environmental and security issues or non-compliances that occurred during the reporting period; b) measures undertaken to resolve safety and environmental issues or non-compliances identified in a); c) confirmation that security issues identified in a) have been addressed; d) a description and the location of any change made to geohazard mitigation measures pursuant to Condition 51; and e) the location of any pressure tests carried out during the reporting period and a description of any unsuccessful pressure tests, including the reasons for the lack of success of each.	X	X	X	X	X	X	X	X
107	**Aboriginal, local, and regional employment and business opportunity monitoring reports** a) Trans Mountain must file with the NEB, **within 3 months after commencing construction, and every 6 months thereafter until after commencing operations**, monitoring reports for Aboriginal, local, and regional employment and business opportunities for the Project. The reports must include: i) a summary of the elements or indicators monitored; ii) a summary and analysis of Aboriginal, local, and regional employment and business opportunities during the reporting period; and iii) a summary of Trans Mountain's consultation, undertaken during the reporting period, with relevant Aboriginal groups and local, regional, community and industry groups or representatives, regarding employment and business opportunities. This summary must include any issues or concerns raised regarding employment and business opportunities and how Trans Mountain has addressed or responded to them. b) Trans Mountain must file with the NEB, **within 6 months after commencing operations**, a final report on employment during the construction phase.	X							

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
108	**Contingency watercourse crossings** a) For any watercourse crossing where Trans Mountain will employ a contingency crossing method instead of its proposed primary method, and where **any** of Fisheries and Oceans Canada's applicable "Measures to Avoid Causing Harm to Fish and Fish Habitat" cannot be implemented, Trans Mountain must file with the NEB **at least 30 days prior to commencing construction of the contingency watercourse crossing:** i) confirmation of the contingency watercourse crossing method that will be employed, the rationale for employing that method, and a summary of the differences between the primary and contingency watercourse crossing methods; and ii) the following site-specific information: 1. detailed crossing-specific design drawings; 2. photographs up-stream, down-stream, and at the crossing location; 3. a description of the fish species and habitat that is present at the crossing location, and if fish spawning is likely to occur within the immediate area; 4. a description of the composition of the riparian habitat at the crossing location and an indication if the riparian habitat has a limiting effect on the productive capacity of the watercourse, and if its removal or disturbance represents a potential influence on fish communities; 5. the site-specific mitigation and habitat enhancement measures to be used to minimize impacts; 6. any potential residual effects; 7. proposed reclamation measures; and 8. a discussion of the potential impacts to local fisheries resources within the immediate area as a result of the crossing's construction; and b) For all other instances where a contingency crossing method will be employed and all of Fisheries and Oceans Canada's applicable "Measures to Avoid Causing Harm to Fish and Fish Habitat" will be implemented, Trans Mountain must file with the NEB a notification, **at least 15 days prior to commencing the contingency crossing**, that the contingency method will be employed. With this notification, Trans Mountain must explain why the contingency method is being employed and provide a summary of the differences between the primary and contingency watercourse crossing methods. c) Trans Mountain must confirm, **within 30 days after commencing operations**, that any contingency watercourse crossing(s) identified to the NEB pursuant to a) and b) were the only contingency watercourse crossing(s) implemented for the construction of the pipeline.	**X**							
109	**Authorization(s) under paragraph 35(2)(b) of the Fisheries Act – Westridge Marine Terminal** a) In the event that Fisheries and Oceans Canada determines that the Westridge Marine Terminal expansion requires Authorization under paragraph 35(2)(b) of the *Fisheries Act*, Trans Mountain must file with the NEB, **at least 10 days prior to commencing works specified in the respective Authorization(s),** a copy of that Authorization; and b) Trans Mountain must confirm, **within 30 days after commencing operations**, that any *Fisheries Act* Authorization(s) required for the Westridge Marine Terminal expansion were obtained from Fisheries and Oceans Canada and filed with the NEB pursuant to a), or notify the Board if no Authorization(s) was required.	**X**							

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
110	**Authorizations under paragraph 35(2)(b) of the Fisheries Act and Species at Risk permits – pipeline** For instream activities, except for those related to the Westridge Marine Terminal: a) for any instream activities that will require Authorization under paragraph 35(2)(b) of the *Fisheries Act*, Trans Mountain must file with the NEB, **at least 10 days prior to commencing the respective instream activities**, a copy of the Authorization *under* paragraph 35(2)(b) of the *Fisheries Act*. b) for any instream activities that will require a permit under the *Species at Risk Act*, Trans Mountain must file with the NEB, **at least 10 days prior to commencing the respective instream activities**, a copy of the permit issued under the *Species at Risk Act*. c) Trans Mountain must confirm, **within 30 days after commencing operations**, that: i) any required *Fisheries Act* Authorizations were obtained from Fisheries and Oceans Canada and filed with the NEB pursuant to a), or notify the Board if no Authorizations were required; and ii) any required *Species at Risk Act* permits were obtained from the competent minister under the *Species at Risk Act* and filed with the NEB pursuant to b), or notify the Board if no permits were required.	X	X						
111	**Joining Programs** Trans Mountain must develop Joining Programs and file them with the NEB **at least 45 days prior to commencing welding of, respectively:** a) field circumferential production, tie-in, and repair pipeline welds, including the tie-in welds between existing segments and Line 1 or Line 2; and b) terminals and pump stations. The Joining Programs must include: i) welder qualification requirements; ii) requirements for welding inspector qualifications and duties; iii) welding procedure specifications; iv) non-destructive examination (NDE) specifications; v) procedure qualification records for welding procedure specifications and NDE specifications; vi) a quality assurance program for field welds and welding procedures; and vii) any additional information that supports the Joining Program.	X	X			X	X	X	
112	**Pressure testing** a) Trans Mountain must pressure test the new and reactivated pipeline segments, terminals, and pump stations with a liquid medium. b) Trans Mountain must file with the NEB, **at least 3 months prior to commencing pressure testing**, a Pressure Testing Program that demonstrates compliance with applicable codes, standards, and regulatory requirements.	X	X			X	X	X	

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
113	**Hydrostatic Testing Plan** Trans Mountain must file with the NEB, **at least 3 months prior to commencing pressure testing of any Project component**, a Hydrostatic Testing Plan for the Project that includes: a) the locations of all water withdrawal and discharge sites; b) a discussion of any clearing activities or any other associated works, if required, that will allow for the transportation of the hydrostatic test water; c) water withdrawal rates; d) water withdrawal volumes; e) the flow rate/volume of water at the withdrawal sites; and f) site-specific mitigation measures to be implemented at the water withdrawal and discharge sites or at any other locations required to allow for the transportation of hydrostatic test water, including a description of the water quality monitoring methods to be used on hydrostatic testing water prior to discharge; and g) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information.	X	X			X	X	X	
114	**NDE of final tie-in welds** Trans Mountain must delay NDE of final tie-in welds (i.e.: welds which will not be subjected to hydrostatic testing) and any repairs to them **for at least 48 hours following weld completion**. Trans Mountain must include this requirement in the NDE specification of its Joining Program required by Condition 111.	X	X			X	X	X	

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
115	**SCADA and leak detection system design** Trans Mountain must file with the NEB, reports describing the final design of the expanded Trans Mountain Pipeline System's SCADA and leak detection systems. These reports must include: a) for the commercially available external leak detection systems resulting from Trans Mountain's participation in joint industry projects, **at least 45 days prior to commencing backfilling on Line 2 and the new delivery pipelines**, a status update, including a timeline for implementation; and b) **at least 3 months prior applying for leave to open the Project:** i) a status update for the following complementary leak detection technologies that Trans Mountain is considering, including a timeline for implementation: 1. a secondary Computational Pipeline Monitoring (CPM) system operating in parallel with the Project's proposed CPM; and 2. aerial surveillance systems resulting from Trans Mountain's participation in joint industry projects; ii) an explanation of how Trans Mountain's complementary leak detection system(s) supports the leak detection capabilities of the primary CPM system(s); iii) for all leak detection systems applicable to the Project, performance targets for: 1. sensitivity; 2. accuracy; 3. reliability; and 4. robustness; iv) a validation plan for the performance targets in iii), including alarm testing, to be implemented within the first year of Project operation; v) rationale for the selected time windows(s) (i.e. averaging periods) for the CPM system(s); vi) a copy of Trans Mountain's public awareness program on recognizing and reporting leaks; vii) a description of how the leak detection system and its relevant procedures comply with CSA Z662 Annex E; viii) a list of other best practices such as API (American Petroleum Institute) recommended practices related to leak detection and control centre management; ix) a description of how Trans Mountain's revised procedures have introduced a rule directing the Control Centre Operator to perform a controlled shut down of the pipeline when a leak cannot be ruled out in a given time period; and x) a plan, including a timeline for implementation, for upgrading the existing measurement and data acquisition instrumentation to improve the leak detection performance of Line 1.	X	X						

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
116	**Control system, SCADA, instruments, and communication** Trans Mountain must file with the NEB, **at least 2 months prior to completing dry commissioning activities**, the block diagrams of the control system for its proposed pipeline that include the interconnection between various devices and components such as: a) programmable logic controllers (PLCs); b) flow meters, and pressure and temperature measuring devices; c) critical protective elements; d) emergency shut-down systems (ESD); e) variable frequency drives (VFDs); f) control valves; g) block valves; and h) local human machine interface (HMI). The block diagrams must demonstrate the primary and backup communication systems, supervisory and control layers of software, firewalls, and how all elements are integrated with the SCADA system.	X							
117	**Reporting on improvements to Trans Mountain's Emergency Management Program** Trans Mountain must file with the NEB, **at least 2 years and 1 year prior to commencing operations**, detailed updates for the company's review of its Emergency Management Program (toward meeting the requirements of Condition 124). This filing must include: a) a summary of work undertaken to-date; b) the approximate timing for completing remaining work; and c) a summary of parties that were consulted (Condition 90) and how their comments and feedback were considered in improving the program.	X					X	X	
118	**Firefighting capacity at terminals** Trans Mountain must file with the NEB, **at least 1 year prior to commencing operations** at the terminals: a) the following information regarding developing appropriate firefighting capacity for a safe, timely, and effective response to a credible worst-case fire at the Westridge Marine Terminal and at the Edmonton, Sumas, and Burnaby Terminals: i) an assessment of necessary resources and equipment, including an explanation of how the assessment was informed by Trans Mountain's terminal risk assessments; ii) a summary of Trans Mountain's consultation with appropriate municipal authorities and first responders, that includes any issues or concerns raised regarding each municipality's respective firefighting capacity and how Trans Mountain has addressed or responded to them; iii) a Firefighting Capacity Framework, informed by the assessment in i) and consultation in ii), and that includes a list of and timeline for completing key activities and milestones leading to the establishment of appropriate firefighting capacity; and b) a plan for responding to a fire exceeding a credible worst case scenario.	X						X	

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
119	**Emergency Preparedness and Response Exercise and Training Program** Trans Mountain must file with the NEB, **at least 1 year prior to commencing operations**, an Emergency Preparedness and Response Exercise and Training Program for the pipeline; the Edmonton, Sumas, and Burnaby Terminals; and the Westridge Marine Terminal. The program's objective is to demonstrate the continual improvement of responder competencies (including control centre personnel) at all levels of the company to prepare for, respond to, recover from, and mitigate the potential effects of emergencies of any type, including tank fires and earthquakes. The program must include the following: a) a defined scope, other objectives in addition to those noted above, and program targets that address responder turn-over and ensure responders' ongoing training and practice; b) a list of mandatory courses for responders; c) a discussion of how Trans Mountain will train its personnel to respond to all hydrocarbon spill scenarios in various seasons, including releases of hydrocarbons in mountain regions during winter conditions, into ice covered watercourses, into watercourses under varying flow conditions and into waterbodies (aquifers or streams) that are used as municipal water supply sources; d) a description of, and schedule for, all emergency response exercises (full-scale, tabletop, drills, functional) that Trans Mountain will conduct prior to operations to test a variety of scenarios; e) a plan, including rationales, for determining the schedule and frequency of all emergency response exercises (full-scale, tabletop, drills, functional) to test a variety of scenarios during the Project's operational life; f) a discussion of how emergency response exercises will meet the objectives of testing Trans Mountain's: i) emergency response procedures; ii) company personnel training; iii) communications systems; iv) response equipment; v) safety procedures; and vi) the effectiveness of its liaison and continuing education programs; g) a learnings implementation plan for exercises that considers how Trans Mountain will update and amend its Emergency Response Plans and related documents following exercises. The learnings implementation plan must consider three main purposes: i) to validate plans; ii) to develop Trans Mountain responder competencies (including control centre personnel) and provide them with the opportunity to carry out and understand their roles in emergency response; iii) to test Project-specific emergency response procedures; h) a plan for addressing the training requirements contained within the *National Energy Board Onshore Pipeline Regulations*; and i) confirmation that an independent third party has reviewed and assessed the Emergency Preparedness and Response Exercise and Training Program and that Trans Mountain has considered and incorporated the comments generated by that review and assessment into the program.	X					X	X	

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
120	**Notification and reporting on emergency response exercises** For any tabletop, functional, and full-scale emergency response exercises undertaken as part of its Emergency Preparedness and Response Exercise and Training Program required by Condition 119: a) Trans Mountain must notify the NEB and all potential exercise participants and observers, including Appropriate Government Authorities, first responders and potentially affected Aboriginal groups, **at least 45 days prior to the date of each exercise**, of: i) the exercise's date and location(s); ii) the exercise's objectives; iii) the participants in the exercise; and iv) the scenario for the exercise. b) Trans Mountain must file with the NEB, and provide to Appropriate Government Authorities, first responders and potentially affected Aboriginal groups, **within 3 months after completing each** full-scale exercise, a report on the exercise that includes: i) the results of the completed exercise; ii) areas for improvement; and iii) steps to be taken to correct deficiencies.	X					X	X	
121	**Financial Assurances Plan – operations phase** a) Trans Mountain must file with the NEB for approval, **at least 6 months prior to applying for leave to open Line 2**, a Financial Assurances Plan that includes details of the financial resources and secured sources of funds that will be necessary to pay, without limitation, all actual loss or damage, costs and expenses, including cleanup and remediation, and loss of non-use value relating to non-use of a public resource associated with an unintended or uncontrolled release from the Project during the operations phase.[86] These costs may arise from, among other things, potential accidents, malfunctions, and failures during the Project operations phase, including all spills originating from the pipeline and the terminals. The Financial Assurances Plan must be signed by an officer of the company, verifying that it is accurate, complete, and, at a minimum, meets the criteria and coverage levels described below: i) Criteria for financial assurance instruments and plan: 1) Any letter of credit that forms part of the Financial Assurances Plan must be unconditional and irrevocable, segregated from Trans Mountain's day-to-day business activities, and be dedicated to providing funds to cover the costs described in sub a) above, without limitation. 2) Third party liability insurance must be current, and broad, respecting the scope of environmental damages covered by the policy; the policy will be consistent with provisions available in the insurance market (i.e., only exceptional/non-standard perils, taking into account the Project's nature and scope, would be excluded from coverage). Such insurance must be structured on a multi-year basis, recognizing potential loss of income by persons sustaining damage caused by Trans Mountain, over a reasonable number of years after the event. 3) A portion of cash reserves or a portion of future cash flows of the Project may be included as instruments in the Financial Assurances Plan, provided they are secured by a commitment letter from an officer of the company confirming that the funds will be dedicated to the Financial Assurances Plan without restrictions for the period specified by the officer.	X	X			X	X	X	

86 In the context of this condition, "operations phase" refers to the period after the Project receives leave to open approval and prior to it being fully abandoned.

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
121 (cont)	4) Parental and other third party guarantors must be registered within a Canadian jurisdiction and must have financial strength that is demonstrated in balance sheet values and ratios and credit ratings. For example, total assets less total liabilities of the guarantor should be several multiples of the liability assumed in the Trans Mountain guarantee. ii) Financial assurance components and coverage levels: Trans Mountain's Financial Assurances Plan must provide a total coverage, for the Project as a whole, of $1.1 billion[87] for the costs described in sub a) above, without limitation. The plan should include the following components and minimum coverage levels: 1) Ready cash: Trans Mountain must have unfettered access to at least $100 million to cover costs, including compensation to third parties for losses and damages in the near term, while insurance claims are being processed. Once used, this source of cash must be replenished immediately to cover the costs of a potential future spill. This can be in the form of a letter of credit, surety bond or other form acceptable to the NEB. 2) Core coverage: Trans Mountain must put in effect and maintain current at all times a core financial coverage of at least $1 billion that includes third party liability insurance and other financial assurance instruments that comply with the criteria. Core coverage must be a portfolio approach with multiple financial instruments used and may not be composed of a single financial instrument (e.g., only third party liability insurance). At least one component of core coverage must be funds that are readily accessible to Trans Mountain (e.g., cash reserves held by the general partner and not distributed to the limited partners).								
	Trans Mountain may use a number of financial and insurance instruments in its Financial Assurances Plan. However, sales of Project assets used for transporting hydrocarbon commodities will not be eligible candidates. Below are some illustrative financial and insurance instruments that could be potential candidates for the Financial Assurances Plan: • Irrevocable, unfettered letter of credit. • Secured line of credit. • Cash reserves held by the general partner and not distributed to the limited partners (and verifiable on Trans Mountain Pipelines Limited Partnership's balance sheet). • Internal cash flow, committed by Trans Mountain to financial assurances. • Industry pooled fund. • Third party liability insurance with exclusions for only exceptional/non-standard perils. • No fault third party liability insurance. • Parental and other third party guarantees provided by parties demonstrating financial strength through balance sheets and credit ratings. • Other instruments developed by Trans Mountain and the insurance and financial markets.	X	X			X	X	X	
	b) Trans Mountain must file the following with the NEB: i) **At least 6 months prior to applying for leave to open Line 2**, a report from an independent third party that has assessed the Financial Assurances Plan and its key components against the criteria and actual experiences of industry damage claims. The report must summarize the key features of each financial and insurance instrument proposed for inclusion in the Financial Assurances Plan.								

87 The NEB's basis for any final coverage level is described in its report to Governor in Council.

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
121 (cont)	ii) **At least 3 months prior to applying for leave to open Line 2**, a supplement to the report described in b)i) that provides verification of any third party liability insurance coverage, a copy of the insurance certificate, and a summary of the insurance policy's key features. This summary must include: limits on insurance coverage, deductible amounts, the risks and perils and properties covered by the insurance policy, the exclusions from coverage, Trans Mountain's obligations, effective dates, and names of insurers and reinsurers. iii) **With its first leave to open application for Line 2**, a report describing the steps it took to eliminate any deficiencies in its Financial Assurances Plan that were identified in the independent third party report referenced in b)i) and the NEB's subsequent review. iv) **On or before 31 January of each year after commencing operations**, a letter signed by an officer of the company verifying that all components of the Financial Assurances Plan remain as the NEB approved and sufficient to meet the financial assurance coverage levels described in ii). v) **At least 2 months prior to any intended change(s) to the Financial Assurances Plan during the Projects operations phase**, a letter, for approval, detailing the intended change(s) and how the change(s) provides the same or greater level of protection. vi) **Within 30 days after accessing any component of the Financial Assurances Plan**, a report detailing the component accessed, the reason for accessing it, and Trans Mountain's plan to ensure that it continues to meet the requirements of its NEB-approved Financial Assurances Plan.	X	X			X	X	X	
122	**Changing pipeline segment operating conditions (Hinton to Hargreaves; Darfield to Black Pines)** Trans Mountain must file with the NEB for approval, **at least 6 months prior to applying for leave to open Line 2**, the following: a) An engineering assessment in accordance with CSA Z662 for the above two pipeline segments which Trans Mountain proposes to change from operating on the existing TMPL to the proposed Line 2. The engineering assessment must demonstrate that the two pipeline segments are fit for their intended service under the operating conditions of Line 2, and that they meet all relevant requirements of CSA Z662. The engineering assessment must include a schedule of planned integrity monitoring activities. b) A certificate with a supporting report issued by an independent certification body,[88] stating unconditionally that the 43-kilometre-long, 762 millimetre outside diameter (NPS 30) pipeline segment from Darfield to Black Pines, British Columbia is fit for its intended service under the operating conditions[89] of Line 2. The supporting report must include the qualifications of the independent certification body and the justification used to grant the certificate	X							

88 For Conditions 19, 122 and 152, an" independent certification body" is an internationally recognized company or organization, such as Lloyd's Register or Det Norske Veritas, which is able to certify compliance to statutory requirements. The independent certification body must have expertise in pipeline integrity. The NEB reserves the right to accept or reject the certificate. In addition, the NEB's decision is not contingent on the results of the certificate.

89 For Conditions 19, 122 and 152, "operating conditions" must include the Project-specific operating conditions, possible transient flow conditions, slack flow conditions, and effects on operating pressure due to temperature changes.

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
123	**Evacuation Plans** a) Trans Mountain must file with the NEB, **at least 6 months prior to commencing operations at the terminals**, an Evacuation Plan for people present in areas potentially affected by an incident at each of Trans Mountain's Edmonton, Sumas, and Burnaby Terminals as well as at the Westridge Marine Terminal. Each Evacuation Plan must, at a minimum: i) describe how areas for evacuation were determined; ii) describe the circumstances under which evacuation may be required, as well as the respective methods and procedures for public notification; iii) describe specific evacuation routes, methods, and destinations; iv) be prepared in consultation with Appropriate Government Authorities, first responders and potentially affected Aboriginal groups with the authority to issue evacuation or shelter in place orders during an emergency; v) state how input from Appropriate Government Authorities, first responders and potentially affected Aboriginal groups, with the authority to issue evacuation or shelter in place orders during an emergency, was considered in preparing the plan; vi) define the roles, responsibilities, and jurisdictional authority of all parties involved in implementing an evacuation; and vii) confirm that an independent third party has reviewed and assessed the plan and that Trans Mountain has considered and incorporated comments generated by the review and assessment into the plan. b) Trans Mountain must include with its Evacuation Plan for the Burnaby Terminal, a plan specific to Simon Fraser University that includes the requirements in a) i) to vii), above.	X						X	
124	**Implementing improvements to Trans Mountain's Emergency Management Program** Trans Mountain must file with the NEB, **at least 6 months prior to commencing operations**, a detailed summary of its review of its Emergency Response Plans (as noted in Conditions 125 and 126) and equipment (including its availability), as referenced in Volume 7, Section 4.8.2 of its Project application (Filing A3S4V5). This filing must include a description of changes made to Trans Mountain's Emergency Management Program, as required under the *National Energy Board Onshore Pipeline Regulations*, including changes to: a) the Pipeline Emergency Response Plan; b) Emergency Response Plans for the Edmonton, Sumas, and Burnaby Terminals, as well as the Westridge Marine Terminal; and c) site-specific plans and documents related to a) and b), such as Geographic Response Plans, Geographical Response Strategies, control point mapping, tactical plans for submerged and sunken oil and tactical plans for high consequence areas. The summary must demonstrate Trans Mountain's ability to prepare for, respond to, recover from, and mitigate the potential effects of emergencies of any type and in any geographic region or season and must include the following: i) a discussion of how the updated plans conform to the requirements contained within the ***National Energy Board Onshore Pipeline Regulations;*** ii) a discussion of how the plans consider, and would allow coordination with relevant federal, provincial, municipal and Aboriginal community emergency response plans; iii) a discussion of how the results of research initiatives, such as the Scientific Advisory Committee work noted in Trans Mountain's response to NEB Information Request No. 1.63 (Filing A3W9H8) and other research noted during the OH-001-2014 proceeding, have been considered and incorporated into Trans Mountain's emergency response planning; iv) a description of the models used in response planning, including oil trajectory, fate and behavior, and air dispersion models; and v) confirmation that an independent third party has reviewed and assessed the Emergency Response Plans and that Trans Mountain has considered and incorporated the comments generated by the review and assessment into the plans.	X					X	X	

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
125	**Emergency Response Plans for the Pipeline and for the Edmonton, Sumas and Burnaby Terminals** Trans Mountain must file with the NEB, **at least 6 months prior to commencing operations**, updated Emergency Response Plans which must include: a) the following relevant emergency preparedness and response documents: i) an Emergency Response Plan to include the pipeline expansion; ii) updated Emergency Response Plans for the Edmonton, Sumas, and Burnaby Terminals; and iii) all related and accompanying site-specific plans and documents, such as control point mapping, Geographic Response Plans, tactical response plans, volunteer management plans, and fire safety plans; b) an emergency response and preparedness table for the pipeline (including facilities) indicating which plans and documents referenced in a) will be referred to in an emergency response for each 10-kilometre-long pipeline segment. For each pipeline segment, the table must also identify, at a minimum: i) high consequence areas, including environmentally sensitive areas (e.g. wetlands), heritage sites and water supply wells (Condition 93); ii) potentially affected persons or groups; iii) available access to the right-of-way and high consequence areas; iv) nearest control point(s); v) nearest available equipment cache(s); vi) response times for deployment of equipment and Trans Mountain personnel, mutual aid personnel, and third party contractors; vii) the available equipment and trained personnel, whether employed by Trans Mountain, contracted, or available through mutual aid (including contact information); and viii) geological, meteorological, and geographical hazards (e.g., snow avalanche, mud slides, rock slides, and steep slopes); and c) maps depicting the information identified in b).	X				X	X	X	
126	**Emergency Response Plan for the Westridge Marine Terminal** Trans Mountain must file with the NEB, **at least 6 months prior to commencing operations at Westridge Marine Terminal**, an updated Emergency Response Plan for the Westridge Marine Terminal which must include: a) all related and accompanying site-specific plans and documents, such as Geographic Response Plans, Geographic Response Strategies, tactical response plans, volunteer management plans, and fire safety plans; b) a list of high consequence areas, including environmentally sensitive areas; c) a list of potentially affected persons or groups; d) nearest available equipment cache(s); e) response times for deployment of equipment and personnel to the incident location and high consequence areas; f) maps depicting the information identified in a) to e).	X							

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
127	**Terminal fire protection and firefighting systems** a) Trans Mountain must file with the NEB for approval, **at least 3 months prior to applying for leave to open of any Project component at each respective terminal**, an independent third party report confirming the adequacy of the proposed fire protection and firefighting systems implemented or planned to be implemented at the Edmonton Terminal West Tank Area, the Burnaby Terminal, the Sumas Terminal, and the Westridge Marine Terminal. The report must demonstrate that the resources and firefighting systems are capable of suppressing fires associated with all scenarios identified in the above-mentioned terminals' final risk assessments (required by Condition 129). b) Trans Mountain must file with the NEB for approval, **at least 2 months prior to beginning the assessment leading to the report in a),** the name and qualifications of the proposed independent third party that will prepare the report in a).	X						X	
128	**Offset Measures Plan for residual effects on caribou habitat** Trans Mountain must file with the NEB for approval, in accordance with the timelines below, an Offset Measures Plan for each affected caribou range, the goal of which is to offset all unavoidable and residual direct and indirect Project related effects on caribou habitat, after taking into account the implementation of the measures identified in the relevant Environmental Protection Plan(s) for the Project and the Caribou Habitat Restoration Plan (see Condition 37) measures. The Offset Measures Plan must include: a) A preliminary version, to be filed **at least 3 months prior to applying for leave to open**, with the plan's criteria and measurable goals and that includes: i) an initial quantification of the area of caribou habitat directly and indirectly disturbed by the Project; ii) a list of the potential on-the-ground offset measures available; iii) each potential offset measure's appropriate offset ratio, based on consultation with expert federal and provincial authorities and on a review of the scientific literature on conservation offsets; iv) each potential offset measure's expected effectiveness including a discussion of uncertainty and how measures align with criteria specified in the scientific literature specific to conservation offsets; v) each potential offset measure's relative qualitative and quantitative value toward achieving the offset; and vi) a conceptual decision-making tree(s) or decision framework(s) that will be used to select which specific potential offset measures and accompanying offset ratios will be used under what circumstances. b) A final version, to be filed **on or before 31 January after the second complete growing season after completing final clean-up**, including: i) the contents of the preliminary Offset Measures Plan, with any updates identified in a revision log that includes the rationale for any changes; ii) a tabular list of the potential offset measures and appropriate offset ratios to be implemented or already underway, including site-specific details and maps showing the locations, and an explanation of how they meet criteria in the scientific literature for offsets; iii) a description of factors considered when determining the location of offset measures, including consideration of how the measures could maximize benefits to landscape variables; iv) a schedule indicating when potential offset measures will be initiated and their estimated completion dates; v) either an assessment of the predicted offset measures' effectiveness including a discussion of uncertainty and a quantitative compilation showing how the measures would offset the previously determined residual effects, or a plan for completing an assessment of the potential offset measures' effectiveness and value; and	X	X		X	X	X		

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
128 (cont)	vi) an update on the restoration success to support offset measure decisions. Both the preliminary and final versions of the plan must also include the following: 1) a summary of its consultations with Appropriate Government Authorities and potentially affected Aboriginal groups. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the Offset Measures Plan; 2) a description of how Trans Mountain has taken any available and applicable Aboriginal traditional land use and traditional ecological knowledge studies into consideration in developing the plan including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; and 3) evidence of Trans Mountain's consideration of any updates to the applicable Recovery Strategy, as well as to range boundaries and identified critical habitat made prior and up to the date on which leave to open is granted.	X	X		X	X	X		
129	**Final terminal risk assessments** Trans Mountain must file with the NEB for approval, **at least 3 months prior to applying for leave to open for each terminal**, final risk assessments for the Edmonton Terminal West Tank Area, the Sumas Terminal, the Burnaby Terminal, and the Westridge Marine Terminal, respectively, including all implemented mitigation measures. Trans Mountain must demonstrate in each risk assessment that mitigation measures will reduce the risks to levels that are As Low As Reasonably Practicable (ALARP) while complying with the Major Industrial Accidents Council of Canada (MIACC) criteria for risk acceptability. The Edmonton Terminal West Tank Area, Sumas Terminal, and Burnaby Terminal must include the elements listed in Condition 22.	X						X	
130	**Groundwater Monitoring Program** Trans Mountain must file with the NEB for approval, **at least 3 months prior to commencing operations**, a Groundwater Monitoring Program that pertains to all terminals and pump stations, and for any vulnerable aquifers along the pipeline route. The program must include, at a minimum: a) locations of groundwater monitoring wells, their depths, the rationales for well locations (including how groundwater flow direction was considered), groundwater flow velocity, parameters to be monitored and frequency of monitoring; b) a description of any program changes required to meet this condition for facilities with an existing Groundwater Monitoring Program; c) methods, criteria and rationale for identifying vulnerable aquifers along the pipeline route; d) applicable regulatory criteria for comparing monitoring results, and a process outlining what steps will be followed should monitoring results indicate a negative change in groundwater quality; and e) a summary of its consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the program.	X	X			X	X	X	

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
131	**Marine Public Outreach Program** Trans Mountain must file with the NEB, **at least 3 months prior to commencing operations**, a report describing completed activities and observed outcomes of Trans Mountain's Marine Public Outreach Program, and any further planned activities for this program. The report must also include: a) a summary of Trans Mountain's consultation with the Pacific Pilotage Authority regarding the scope of work and activities to be undertaken through the program, including: i) the resources and information that Trans Mountain has provided or will provide to the Pacific Pilotage Authority to addresses the impacts of increased Project-related tanker traffic in the Salish Sea; ii) the activities or actions that Trans Mountain will undertake to communicate applicable information on Project-related vessel timing and scheduling to fishing industry organizations, commercial and recreational vessel operators, Aboriginal groups, and other affected , in conjunction with the Pacific Pilotage Authority's activities; and iii) any issues or concerns raised by the Pacific Pilotage Authority and how Trans Mountain has or will address them; b) a description of the actions or activities that Trans Mountain has or will undertake to incorporate into its own public engagement efforts the activities of the Pacific Pilotage Authority and Transport Canada regarding enhanced safe boating practice education for small vessel operators; c) a plan and schedule for all ongoing and future activities and actions under the program, including anticipated completion dates; and d) a summary of its consultations with Transport Canada, the Canadian Coast Guard, the Chamber of Shipping for British Columbia, commercial and tourism associations and potentially affected Aboriginal groups.	X							
132	**Marine Mammal Protection Program** Trans Mountain must file with the NEB, **at least 3 months prior to commencing operations**, a Marine Mammal Protection Program that focuses on effects from the operations of Project-related marine vessels. The program must include: a) the goals and objectives of the program, including a discussion on how they align with the objectives of applicable Fisheries and Oceans marine mammal Recovery Strategies and Action Plans; b) a summary of the issues related to marine mammals from Project-related marine vessels; c) a summary of the initiatives that Trans Mountain has supported or undertaken to-date, including the goals of each initiative and how they relate to the objectives of the program; d) a discussion of the outcomes or progress updates of the initiatives identified in c), and how these outcomes have met or are contributing to the objectives of the program; e) a discussion of how any relevant outcomes of the initiatives identified in c) are being or will be applied to Project-related marine vessels; f) a summary of relevant initiatives that have been implemented or proposed from other national or international relevant jurisdictions to reduce effects from marine shipping on marine mammals, and an analysis or rationale for why these initiatives will or will not be incorporated into the program; g) any other initiatives that Trans Mountain intends to undertake or support in the future that are relevant to the program; and h) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the Program, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information.	X							

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
133	**Marine shipping-related commitments** Trans Mountain must file with the NEB, **at least 3 months prior to loading the first tanker at the Westridge Marine Terminal with oil transported by the Project**, confirmation, signed by an officer of the company, that it has implemented or caused to be implemented the following commitments related to oil tanker traffic and enhanced oil spill response: a) Enhanced tug escort through developing a tug matrix and including it as part of Trans Mountain's Tanker Acceptance Standard. The tug matrix would prescribe minimum tug capabilities required to escort outbound laden tankers between the Westridge Marine Terminal and Buoy Juliet, as described in Section 5.3.2.1 of Volume 8A of Trans Mountain's Project application (Filing A3S4Y4), Trans Mountain's response to NEB Information Request No. 1.59 (Filing A60392), and Trans Mountain's response to the NEB's Information Request regarding the TERMPOL report (Filing A65273). b) An enhanced marine oil spill response regime capable of delivering 20,000 tonnes of capacity within 36 hours of notification, with dedicated resources staged within the study area, as described in Volume 8A of Trans Mountain's application and Trans Mountain's response to NEB Information Request No. 1.64 (Filing A3W9H8). Trans Mountain must also include and report on the above-noted marine shipping-related commitments in its commitments tracking table (required by Condition 6).	X							
134	**Updated Tanker Acceptance Standard** Trans Mountain must file with the NEB, **at least 3 months prior to loading the first tanker at the Westridge Marine Terminal with oil transported by the Project, and thereafter on or before 31 January of each of the first five years after commencing operations**, an updated Tanker Acceptance Standard and a summary of any revisions made to the Standard.	X							
135	**Slack line flow conditions** Trans Mountain must file with the NEB, **at least 2 months prior to commencing operation of Line 1, and at least 2 months prior to applying for leave to open Line 2, respectively**, the following: a) a list of locations having potential for slack line flow when each of the pipelines is operated at 100 per cent of its maximum operating pressure (MOP), 80 per cent of its MOP, and 50 per cent of its MOP; and b) a description of the following regarding detecting and preventing slack line flow conditions: i) operational measures on Line 1 and Line 2; and ii) design measures on Line 2.	X	X						

No.	Conditions with initial filings due during construction / prior to commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
136	**Pre-operations full-scale emergency response exercises** a) **Prior to commencing operations**, Trans Mountain must complete a full-scale exercise for each of the following scenarios: i) a 160-cubic-metre diluted bitumen release into Burrard Inlet as a result of a release from the Westridge Marine Terminal. The exercise must also consider emergency preparedness and response planning for a release that exceeds a credible worst case scenario spill event; and ii) a credible worst-case release volume at the Burnaby Terminal. b) Trans Mountain must notify the NEB and all potential exercise participants and observers, including Appropriate Government Authorities, first responders, and potentially affected Aboriginal groups, **at least 45 days prior to the date of each exercise in a),** of: i) the exercise's date(s) and location(s); ii) the exercise's objectives; iii) the participants in the exercise; and iv) the scenario for the exercise. c) Trans Mountain must file with the NEB and provide to Appropriate Government Authorities, first responders and potentially affected Aboriginal groups, **within 3 months after completing each exercise in a),** a report on the exercise that includes: i) the results of the completed exercise; ii) areas for improvement; iii) steps to be taken to correct deficiencies; and iv) confirmation that an independent third party has evaluated and assessed the emergency response exercises and that Trans Mountain will consider the comments generated for future exercises.	X						X	
137	**Tank roof design for tanks at the Edmonton Terminal** Trans Mountain must install steel pontoon internal floating roofs and fixed roofs with odour control systems on all of its five proposed tanks at the Edmonton Terminal. Trans Mountain must file with the NEB, **at least 30 days prior to applying for leave to open the five proposed tanks**, a letter signed by an officer of the company that confirms that these roofs were installed.							X	
138	**Confirmation of firefighting capacity at terminals** Trans Mountain must file with the NEB, **at least 30 days prior to commencing operations at the terminals**, confirmation that appropriate firefighting capacity, in accordance with Condition 118, is in place.	X						X	

No.	Conditions with initial filings due after commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
139	**Project completion** Trans Mountain must file with the NEB, **within 30 days after commencing operations**, confirmation, signed by an officer of the company, that the Project was completed and constructed in compliance with all applicable [certificate/order] conditions. If compliance with any of the conditions cannot be confirmed, the officer of the company must include the reason(s) for this and the proposed course of action to achieve compliance.	X	X	X	X	X	X	X	X
140	**Post-construction greenhouse gas (GHG) assessment report** Trans Mountain must file with the NEB for approval, **within 2 months after commencing operations**, an updated GHG assessment report specific to the Project. The report must include: a) the methodology used for the assessment, including the sources of GHG emissions, assumptions, and methods of estimation; b) the total direct GHG emissions generated from Project construction, including land-clearing; c) a breakdown of direct GHG emissions generated by the construction of individual Project components (pipeline, pump stations, tank terminals and Westridge Marine Terminal) and by land-clearing activities; and d) a comparison and discussion of the direct GHG emissions calculated in b) with the predicted emissions in Trans Mountain's application and subsequent submissions.	X			X	X	X	X	
141	**Post-construction noise surveys** Trans Mountain must file with the NEB, **within 3 months after commencing operations**, the results of post-construction noise surveys conducted at the Sumas and Burnaby Terminals and at the Westridge Marine Terminal, demonstrating compliance with the British Columbia Oil and Gas Commission's *British Columbia Noise Control Best Practices Guideline (2009),* and any further mitigation that Trans Mountain will undertake to achieve compliance.	X						X	
142	**GHG Emissions Offset Plan – Project construction** Trans Mountain must file with the NEB for approval, **within 4 months after commencing operations**, a plan for providing offsets for all direct GHG emissions generated from Project construction, as determined in Condition 140. The plan must include: a) a list and discussion of all possible offset options considered; b) the criteria against which each option was assessed for viability; c) a description of the offset option(s) selected for direct GHG emissions generated from Project construction, and the rationale for selecting the option(s); d) confirmation that the selected offset option is registered under the approved quantification protocols and has been verified by an accredited "verification body[90]"; e) a schedule indicating when the selected offset options(s) will be initiated; and f) an accounting of offsets confirming no net GHG emissions from Project construction.	X			X	X	X	X	

90 In these conditions, "verification body" means a competent and independent person, or persons, with responsibility for performing and reporting on the verification process (as defined by ISO 14064).

No.	Conditions with initial filings due after commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
143	**Baseline inspections** a) Trans Mountain must conduct the following pipeline inspections on Line 2 and the new delivery pipelines, at the times indicated: i) a high-resolution in-line caliper inspection (i.e., a GEOPIG™ inspection) **within 6 months after commencing operations** to establish accurate pipeline position and to detect pipe deformations; ii) an in-line ultrasonic crack detection inspection **within 2 years after commencing operations**; iii) an in-line corrosion magnetic flux leakage inspection in both the circumferential and longitudinal directions **within 2 years after commencing operations**; iv) an in-line ultrasonic wall measurement inspection **within 2 years after commencing operations**; and v) a close interval survey **within 2 years after commencing operations**. b) Trans Mountain must file with the NEB, **within 6 months after completing each inspection in a),** a report that includes a summary of the inspection results, the proposed re-inspection interval, and mitigation measures for the anomalies detected through any of the inspections, if required.	X							
144	**Ongoing implementation of marine shipping-related commitments** Trans Mountain must file with the NEB, **on or before 31 January of each year after commencing operations**, a report, signed by an officer of the company, documenting the continued implementation of Trans Mountain's marine shipping-related commitments noted in Condition 133, any non-compliances with the requirements of these commitments, and the actions taken to correct these non-compliances. Trans Mountain must provide each report to Transport Canada, the Canadian Coast Guard, the Pacific Pilotage Authority, Port Metro Vancouver, British Columbia Coast Pilots, Western Canada Marine Response Corporation, Fisheries and Oceans Canada and the Province of British Columbia at the same time as it is filed with the NEB. If a particular party mentioned above requests that it not be provided the annual report, Trans Mountain may cease providing it to that party.	X							
145	**Community Benefit Program progress reports** Trans Mountain must file with the NEB, **on or before 31 January of each of the first 5 years after commencing operations**, a progress report summarizing the initiatives and activities undertaken as benefits that are in addition to compensation for access and potential impacts to community lands, and/or that exceed regulatory requirements. The report must summarize initiatives supported, at a minimum, in the areas of community programs and infrastructure improvements, environmental stewardship, and education and training during the reporting period, including local emergency management enhancements, improvements to community parks, as well as support for events. The filing must contain a commitment from Trans Mountain, and a description of how Trans Mountain will make progress reports publicly available until the Project is abandoned or decommissioned pursuant to the NEB Act. The progress reports must include: a) a description of the initiatives undertaken or supported; b) a list of participants or beneficiaries, including Aboriginal groups, local and regional communities, service providers, or others; c) an update on the timing, status, and outcomes of each initiative, including its estimated completion date, if applicable; and d) a summary of Trans Mountain's consultation activities regarding the Community Benefit Program initiatives.	X							

No.	Conditions with initial filings due after commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
146	**Reports on engagement with Aboriginal groups – operations** Trans Mountain must file with the NEB, **on or before 31 January of each of the first 5 years after commencing operations**, a report on the engagement activities it has undertaken with Aboriginal groups. Each report must include, at a minimum, for each Aboriginal group engaged: a) the name of the group; b) the method(s), date(s), and location(s) of engagement activities; c) a summary of any issues or concerns raised; and d) the measures taken, or that will be taken, to address or respond to issues or concerns, or an explanation why no further action is required to address or respond to issues or concerns. Trans Mountain must provide a copy of each report to each group engaged (and identified in a) above) at the same time that it is filed with the NEB.	X	X		X	X	X	X	
147	**Natural hazard assessment** Trans Mountain must file with the NEB, **within 1 year after commencing operations**: a) the results of the baseline natural hazard assessment for the Project; and b) confirmation that the natural hazard assessment will be: i) updated at intervals not exceeding 5 years; and ii) integrated into the existing Natural Hazard Management Program for the Trans Mountain Pipeline system.	X				X	X	X	
148	**Pipeline Geographic Information System (radio) data** Trans Mountain must file with the NEB, **within 1 year after commencing operations**, Geographic Information System data in the form of an Esri® shape file that contains pipeline segment centre lines and right-of-way boundaries, where each pipeline segment has a unique outside diameter, wall thickness, MOP, external coating, field-applied girth weld coating, and pipe manufacturing specification. If the above values of the pipeline change at any point along the length of the Project, the pipeline(s) should be segmented at that point. Trans Mountain must also provide Geographic Information System locations and names of all Project pump stations, terminals, custody transfer meters, tunnel entrances, pipeline bridges, check valves, and block valves, as applicable. The datum must be NAD83 and projection must be geographic (latitudes and longitudes).	X							
149	**Caribou Habitat Restoration and Offset Measures Monitoring Program** Trans Mountain must file with the NEB for approval, **on or before 31 January after the first complete growing season after commencing operations**, a program for monitoring and verifying the effectiveness of caribou habitat restoration and offset measures implemented as part of the final Caribou Habitat Restoration Plan (Condition 37) and the final Offset Measures Plan (Condition 128). This program must include: a) the scientific methods or protocols for short- and long-term monitoring of the restoration and offset measures, and effectiveness of the measures; b) monitoring frequency, timing, and locations, and the rationale for each; c) protocols for how restoration and offset measures will be adapted, as required, based on the monitoring results from the program's implementation; d) a summary of Trans Mountain's consultation with Appropriate Government Authorities and any species experts on the design of the monitoring program; and e) a proposed schedule for filing reports on monitoring results and adaptive management measures to the NEB, Environment and Climate Change Canada, and appropriate provincial authorities to be contained in the Caribou Habitat Restoration and Offset Measures Monitoring Program as well as at the beginning of each report filed.	X	X		X	X	X		

No.	Conditions with initial filings due after commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
150	**Caribou habitat restoration and offset measures monitoring report(s)** Trans Mountain must file with the NEB, **based on the approved schedule for the Caribou Habitat Restoration and Offset Measures Monitoring Program** (required by Condition 149), a report(s) outlining the monitoring program's results, including the observed effectiveness of habitat restoration and offset measures for each affected caribou range, and how those measures will be adapted, as required, based on monitoring results. Any proposed changes to the NEB-approved reporting schedule must be included within the relevant report prior to any reporting on a revised schedule.	X	X		X	X	X		
151	**Post-construction environmental monitoring reports** Trans Mountain must file with the NEB, **on or before 31 January following the first, third, and fifth complete growing seasons after completing final clean-up**, a post-construction environmental monitoring report for the Project that must include: a) a description of the valued components or issues that were assessed or monitored; b) measurable goals for each valued component or issue; c) monitoring methods for each valued component or issue, results of the monitoring, and a comparison to the defined measurable goals; d) corrective actions taken, their observed success, and their current status; e) identification on a map or diagram of the locations where corrective actions were taken; f) any further corrective actions planned and a schedule for monitoring and reporting; and g) a summary of its consultations with appropriate government authorities and any potentially affected Aboriginal groups and affected landowners/tenants. In the environmental monitoring report filed after the fifth full growing season after completing clean-up, Trans Mountain must include: i) an assessment of the effectiveness of mitigative and corrective actions and how learnings have been or will be applied to Trans Mountain's Environmental Protection Program; ii) a detailed description of all valued components or issues for which the measurable goals have not been achieved during the duration of the post-construction monitoring program; and iii) an evaluation of the need for any further corrective actions, measurable goals, assessments, or monitoring of valued components or issues, including a schedule for those. All filed post-construction environmental monitoring reports must address issues related, but not limited, to: soils; weeds; watercourse crossings; riparian vegetation; wetlands; rare plants, lichens and ecological communities; municipal tree replacement; wildlife and wildlife habitat; fish and fish habitat; marine fish and fish habitat; marine mammals; marine birds; and species at risk.	X	X	X	X	X	X	X	X

No.	Conditions with initial filings due after commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
152	**Pipeline segment reactivation (Hinton to Hargreaves; Darfield to Black Pines) – new certificate and certificate validation** Trans Mountain must file with the NEB, **before expiry of the previous certificate identified in Condition 19**, a new certificate with a supporting report issued by an independent certification body[91] for the two pipeline segments identified in Condition 19. The certificate and report must demonstrate that the two pipeline segments: a) are fit for service for the specified operating conditions;[92] b) meet all applicable requirements of CSA Z662; and c) will meet the hydrostatic test requirements outlined in CSA Z662, at any time during the certified period. The certificate must be valid for at least 5 years and be validated on an annual basis during the certified period. The supporting report must include the qualifications of the independent certification body, the justification used to grant the certificate, and the expiry date of the certificate.		X						
153	**Full-scale emergency response exercises during operations** a) **Within 5 years after commencing operations**, Trans Mountain must complete full-scale exercises to test each of the following five scenarios: i) a full-bore rupture under ice and snow conditions in the Coquihalla Mountain Range; ii) a full-bore rupture into the Athabasca River during high spring flow conditions; iii) a full-bore rupture into Fraser River at the Port Mann Bridge, under peak flow conditions; iv) a full-bore rupture into the North Thompson River during high spring flow conditions; and v) a tank fire at the Burnaby Terminal. b) Trans Mountain must notify the NEB and all potential exercise participants and observers, including Appropriate Government Authorities, first responders and potentially affected Aboriginal groups **at least 45 days prior to the date of each exercise in a),** of: i) the exercise's date and location(s); ii) the exercise's objectives; iii) the participants in the exercise; and iv) the scenario for the exercise. c) Trans Mountain must file with the NEB, and provide to Appropriate Government Authorities, first responders and potentially affected Aboriginal groups, **within 3 months after completing each exercise in a),** a report on the exercise that includes: i) the results of the completed exercise; ii) areas for improvement; iii) steps to be taken to correct deficiencies; and iv) confirmation that an independent third party has evaluated and assessed the emergency response exercises and that Trans Mountain will consider the comments generated for future exercises.	X						X	

91 For Conditions 19, 122 and 152, an" independent certification body" is an internationally recognized company or organization, such as Lloyd's Register or Det Norske Veritas, which is able to certify compliance to statutory requirements. The independent certification body must have expertise in pipeline integrity. The NEB reserves the right to accept or reject the certificate. In addition, the NEB's decision is not contingent on the results of the certificate.

92 For Conditions 19, 122 and 152, "operating conditions" must include the Project-specific operating conditions, possible transient flow conditions, slack flow conditions, and effects on operating pressure due to temperature changes.

No.	Conditions with initial filings due after commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
154	**Riparian Habitat Reclamation Evaluation Report and Offset Plan** Trans Mountain must file with the NEB for approval, **on or before 31 January after the fifth complete growing season after completing final clean-up**, a Riparian Habitat Reclamation Evaluation Report and Offset Plan. a) The report must include, for each defined watercourse crossed by the Project: i) an evaluation of performed reclamation activities against the identified measureable goals and targets (required by Condition 71), that includes an identification of the defined watercourses where riparian habitat that has not returned to, or trending towards a sufficient, pre-construction functionality; ii) a description of the proposed enhancement measures and corrective actions selected and the rationale for the selected option(s); and iii) a schedule for when the enhancement measures and corrective actions will be initiated and an estimated timeline for completion, including any monitoring that will be required. b) The plan must include, for defined watercourses crossed by the Project located in watersheds identified as being above the riparian habitat disturbance threshold (>18 per cent of riparian habitat disturbed in the watershed) or classified as High Sensitive fish-bearing by Trans Mountain, during the OH-001-2014 proceeding, and, where, after the fifth complete growing season, riparian habitat has not returned, or is not trending towards sufficient pre-construction functionality: i) a description of the proposed offset measures selected that includes details with rationales on the amount and type of offsets required, how the offset measures would be implemented, and the location of offset sites; ii) a schedule for when the offset measures will be initiated, an estimated timeline for completion, including any monitoring that will be required, and a schedule for when the results of the offsets monitoring will be filed with the Board that demonstrate offset success. iii) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the report/plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; and iv) a summary of consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the report/plan.	X	X						

No.	Conditions with initial filings due after commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
155	**Rare Ecological Community and Rare Plant Population Mitigation Evaluation Report and Offset Plan** Trans Mountain must file with the NEB for approval, **on or before 31 January after the fifth complete growing season after completing final clean-up**, a Rare Ecological Community and Rare Plant Population Mitigation Evaluation Report and Offset Plan for ecological communities of concern, rare plants and lichens, and early draft, candidate, proposed, or final critical habitat for plant and lichen species under the *Species at Risk Act*, that includes: a) an evaluation of avoidance and mitigation success with reference to the measurable goals outlined in the Rare Ecological Community and Rare Plant Population Management Plan required by Condition 40; b) identification of communities, species, and critical habitats that have not yet achieved the intended degree of reclamation success, and an evaluation of the need for ongoing monitoring, reporting and corrective actions; c) identification of any ongoing effects to ecological communities and rare plant and lichen species that have an at-risk status of S1, S1S2 or S2, or that are listed under federal or provincial legislation for protection, or on any early draft, candidate, proposed, or final critical habitat under the *Species at Risk Act*; d) for the ongoing effects identified in c), a Final Rare Ecological Community and Rare Plant Population Offset Plan that updates the Preliminary Rare Ecological Community and Rare Plant Population Offset Plan required by Condition 40, and that also includes details with rationales on the amount and type of offsets required, the offset measures to be implemented, the selection of compensation sites, identification of the parties involved in planning and implementation and their respective roles and responsibilities, a timeline for implementation, and the methods and schedule for monitoring and reporting to demonstrate offset success; e) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; and f) a summary of its consultations with Appropriate Government Authorities, any species experts and potentially affected Aboriginal groups. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the report/plan.	X	X		X	X	X	X	

No.	Conditions with initial filings due after commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
156	**Wetland Reclamation Evaluation Report and Offset Plan** Trans Mountain must file with the NEB for approval, **on or before 31 January after the fifth complete growing season after completing final clean-up**, a Wetland Reclamation Evaluation Report and Offset Plan that includes: a) the extent (in hectares), by wetland type, that was impacted by Project construction and associated activities; b) for each wetland impacted, an evaluation of mitigation and reclamation success with reference to the measurable goals outlined in the Wetland Survey and Mitigation Plan required by Condition 41; c) identification of any wetlands that have not yet achieved the intended degree of reclamation success, and an evaluation of the need for ongoing monitoring, reporting and corrective actions; d) for any wetland to which no-net-loss under the Federal Policy on Wetland Conservation applies, an evaluation of any temporary or ongoing loss of any individual functional condition (e.g., habitat, hydrology and biogeochemistry); e) for any wetland that has not achieved reclamation success in terms of overall wetland function, and for any wetland to which no-net-loss under the Federal Policy on Wetland Conservation applies and that has had a temporary or ongoing loss in any individual functional condition, a Final Wetland Offset Plan that updates the Preliminary Wetland Offset Plan required by Condition 41, and that also includes details with rationales on the amount and type of offsets required, the offset measures to be implemented, the selection of compensation sites, identification of the parties involved in planning and implementation and their respective roles and responsibilities, a timeline for implementation, and the methods and schedule for monitoring and reporting to demonstrate offset success; f) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; and g) a summary of its consultations with Appropriate Government Authorities, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the report/plan.	X	X		X	X	X	X	

No.	Conditions with initial filings due after commencing operations	CPCN	OC2	OC49	Temp	Pump1	Pump2	Tanks	Deact
157	**Grasslands Reclamation Evaluation Report and Offset Plan** Trans Mountain must file with the NEB for approval, **on or before 31 January after the tenth complete growing season after completing final clean-up**, a Grasslands Reclamation Evaluation Report and Offset Plan that applies to native grasslands in the British Columbia interior and that includes: a) the extent (in hectares) of grasslands that were impacted by Project construction and associated activities; b) an evaluation of reclamation success with reference to the measurable goals outlined in the Grasslands Survey and Mitigation Plan required by Condition 42; c) an identification of any grasslands that have not yet achieved the intended degree of reclamation success, and an evaluation of the need for ongoing monitoring, reporting and corrective actions; d) for those grasslands that have not yet achieved reclamation success, a Final Grasslands Offset Plan that updates the preliminary plan required by Condition 42, and that also includes details with rationales on the amount and type of offsets required, the offset measures to be implemented, the selection of compensation sites, identification of the parties involved in planning and implementation and their respective roles and responsibilities, a timeline for implementation, and the methods and schedule for monitoring and reporting to demonstrate offset success; e) a description of how Trans Mountain has taken available and applicable Aboriginal traditional land use and traditional ecological knowledge into consideration in developing the plan, including demonstration that those Aboriginal persons and groups that provided Aboriginal traditional land use information and traditional ecological knowledge, as reported during the OH-001-2014 proceeding and/or pursuant to Condition 97, had the opportunity to review and comment on the information; and f) a summary of its consultations with Appropriate Government Authorities, species experts, potentially affected Aboriginal groups and affected landowners/tenants. In its summary, Trans Mountain must provide a description and justification for how Trans Mountain has incorporated the results of its consultation, including any recommendations from those consulted, into the report/plan.	X	X		X	X	X		

Appendix 4

Technical details about the Project

Project Overview

The general overview of the Project is found in Chapter 1 of this Report. Additional details are provided here:

The existing Trans Mountain Pipeline system transports a range of crude petroleum and refined products to multiple locations in B.C. These include refined product deliveries to Kamloops and Port Moody, and crude petroleum deliveries to Burnaby, the Westridge Marine Terminal (WMT) for offshore export, and Sumas for deliveries on the Trans Mountain Pipeline (Puget Sound) LLC pipeline to Anacortes, Ferndale, and Cherry Point in Washington State. The existing system has an operating capacity of approximately 47 690 m^3/day (300,000 barrels/day) shipping 20 per cent heavy crude and 80 per cent light crude and refined products.

Trans Mountain proposes to ship a larger volume of these oils on the expanded system. Line 1 is expected to transport batches of primarily light crude oils and refined products while Line 2 will transport batches of primarily heavy crude oil.

After the expansion, the 1 147 km Line 1 pipeline will consist of:

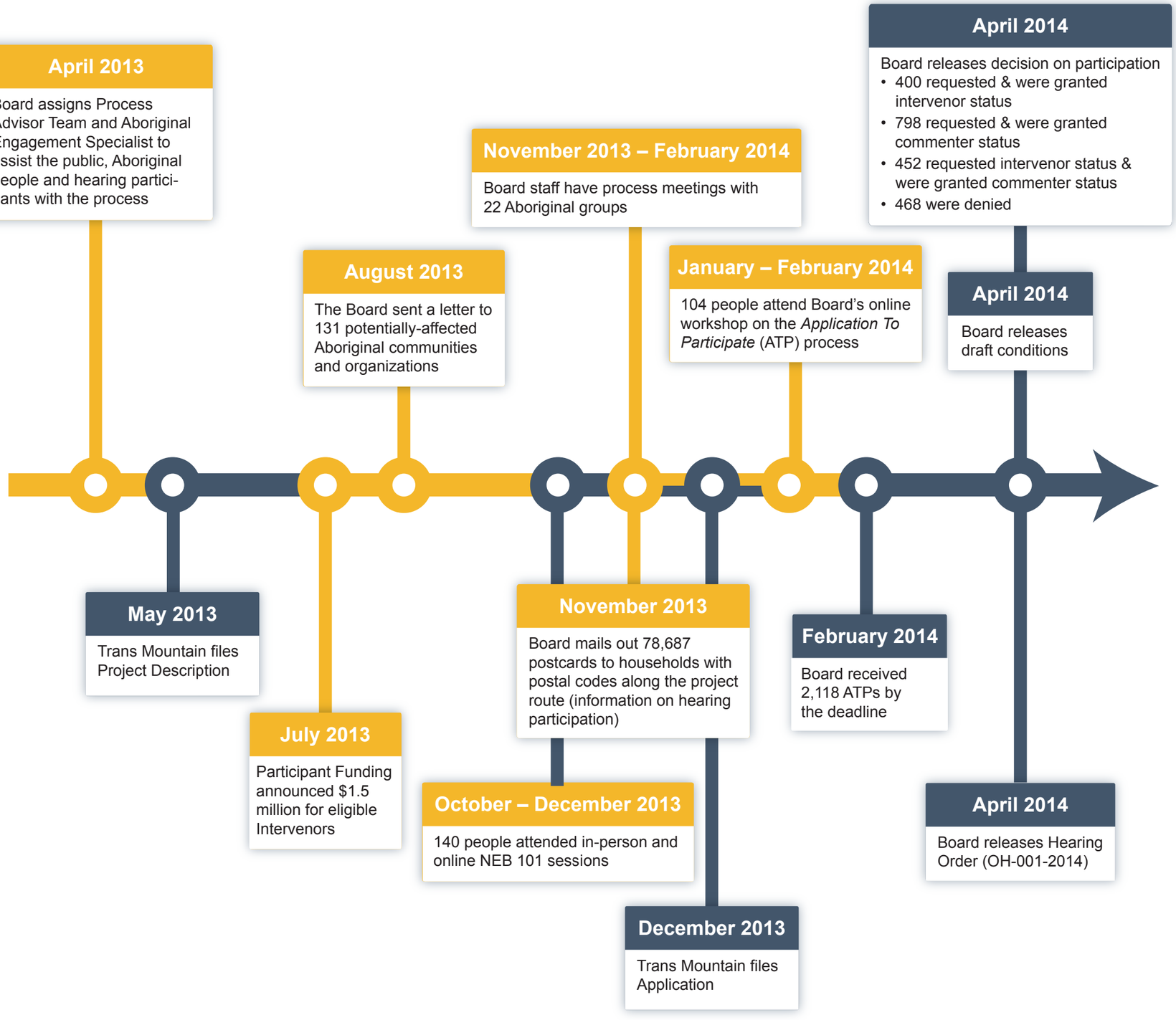
- the existing 229 km of 610 mm outside diameter (NPS 24) and 89 km of 762 mm outside diameter (NPS 30) pipeline segments from Edmonton, AB to Hinton, AB;
- a reactivated 150 km of 610 mm outside diameter (NPS 24) pipeline segment from Hinton, AB, to Hargreaves, B.C. (built in 1957);
- the existing 273 km of 610 mm outside diameter (NPS 24) pipeline segment from Hargreaves, B.C., to Darfield, B.C.;
- a reactivated 43 km of 610 mm outside diameter (NPS 24) 4 pipeline segment from Darfield, B.C., to Black Pines, B.C. (built in 1953); and
- the existing 38 km of 762 mm outside diameter (NPS 30) and 325 km of 610 mm outside diameter (NPS 24) pipeline segments from Black Pines, B.C., to the Burnaby Terminal, B.C.

After the expansion, the approximately 1 180 km Line 2 pipeline will consist of:

- approximately 339 km of new 914 mm outside diameter (NPS 36) pipeline from Edmonton, AB, to Hinton, AB;
- the existing 150 km of 914 mm outside diameter (NPS 36) pipeline segment from Hinton. AB, to Hargreaves, B.C. (built in 2008);
- approximately 121 km of new 1067 mm outside diameter (NPS 42) pipeline from Hargreaves, B.C., to Blue River, B.C.;
- approximately 158 km of new 914 mm outside diameter (NPS 36) pipeline from Blue River, B.C., to Darfield, B.C.;
- the existing 43 km of 762 mm outside diameter (NPS 30) pipeline segment from Darfield, B.C. to Black Pines, B.C. (built in 1957); and
- approximately 368 km of new 914 mm outside diameter (NPS 36) pipeline from Black Pines, B.C., to the Burnaby Terminal.

Other major components of the Project would include:

- two 762 mm outside diameter (NPS 30) delivery lines from the Burnaby Terminal to the WMT (Westridge Delivery Pipelines) in B.C. (lengths are approximately 2.6 km for the tunnel option and 3.6 km for the street option);
- adding 12 new pump stations, 10 at existing pump station sites and 2 at a new common pump station site at Black Pines;
- adding 34 new pump units at the new pump stations;
- reactivated existing pump station at Niton, AB;
- re-connecting Jasper Pump Station to Line 1 and adding drag-reducing agent (DRA) injection capability;
- adding one new pump unit at Sumas Pump Station to support additional deliveries to the Puget Sound Pipeline;
- 20 new tanks at the Edmonton (5), Sumas (1) and Burnaby (14) Terminals, preceded by the demolition of two existing tanks, one each at Edmonton and Burnaby, for a net total of 18 additional tanks;
- 25 new sending or receiving traps;
- deactivate and decommission several components of its existing facilities;
- constructing one new dock complex with a total of three Aframax-capable berth faces and a utility dock; and
- ancillary components and appurtenances, including mainline block valves, scraper traps, pressure reduction or relief stations, containment, power lines, and access roads, and temporary infrastructure.



Appendix 5

National Energy Board Report

Trans Mountain Expansion Project

May 2016

Hearing Steps

Engagement / Participation steps

Oral hearing steps

Extensions to the timeline

April – May 2014

170 people attended online workshop on written submissions

August 2014 – January 2015

Over 20 days in 5 locations, Board hears oral traditional evidence from 35 Aboriginal intervenors

September 2014

YouTube video on ATP (supplemental) was viewed 193 times

July 2014

Board letter announces first excluded period (new corridor through Burnaby)

October 2014

Board hears constitutional argument from City of Burnaby & Trans Mountain (results in Board Ruling 40)

March 2015

Intervenor Information Requests to Trans Mountain on TERMPOL report (Ruling 51)

May 2015

Intervenors file evidence

June 2015

Information Requests to intervenors on their evidence

August 2015

Board received 378 letters of comment by the deadline

December 2015

Trans Mountain files written argument-in-chief

December 2015

Intervenors file replacement evidence (related to stricken evidence)

October 2015

Intervenor Information Requests to Trans Mountain on replacement evidence (Procedural Direction 18)

February 2016

Trans Mountain files reply argument

September 2015

Special Participant Funding offered for replacement evidence (up to $10,000 per applicant)

January 2016

Intervenors file written argument-in-chief

May 2014

Intervenor Information Requests round 1 to Trans Mountain

May 2014 – March 2015

YouTube video on letters of comment was viewed 1,124 times

July 2014

Participant Funding doubled to $3 million

October 2014

Board releases supplemental decision on participation (new corridor through Burnaby)

- 4 requested & were granted intervenor status
- 6 requested & were granted commenter status
- 23 requested intervenor status & were granted commenter status
- 13 were denied

September 2014

Board received 48 ATPs for the new corridor through Burnaby

January 2015

Intervenor Information Requests round 2 to Trans Mountain

April 2015

Information Requests to Trans Mountain on late evidence – crossings (Ruling 56)

May 2015

Intervenor Information Requests to Trans Mountain on late evidence – seismic (Ruling 61)

August 2015

Board releases draft conditions for intervenors and Trans Mountain to comment on in argument

September 2015

Board announces second excluded period (Ruling 92 – replace stricken evidence)

December 2015

Information Requests to intervenors on their replacement evidence

December 2015 – February 2016

Over 14 days in 2 locations, Board hears oral summary argument from Trans Mountain & 68 intervenors

November 2015

Intervenor Information Requests to Trans Mountain on reply evidence (Ruling 96)

May 2016

Board sends Report with recommendation to Governor in Council

Appendix 6

List of Intervenors

Intervenors (not including registrants who subsequently withdrew their involvement):

16580-104th Ave (Owners)
Adams Lake Indian Band
Mr. Allan Aikman
Alberta Federation of Labour
Alexander First Nation
Alexis Nakota Sioux Nation
Mr. Marc Alfonso
Mr. Chris Amy
Ms. Janice Antoine
Aseniwuche Winewak Nation
Ashcroft Indian Band
Asini Wachi Nehiyawak Traditional Band
Mr. Rupinder Aulakh
Ms. Andhra Azevedo
Ms. Julieta Banerjee
Ms. Daniela Barazzuol
Ms. Nancy Bart
Ms. Kata Basic
B.C. Building Trades
B.C. Electoral District of Oak Bay Gordon Head
B.C. Nature and Nature Canada
B.C. Wildlife Federation
Mr. Ed Bereziak
Ms. Pat Berrettoni
Mr. Eric Bickle
Mr. William E. Bilton
Mr. Robert Black
Board of the Friends of Ecological Reserves
Mr. Hartwig Boecking
Ms. Ursula Bolivar
Mr. Thomas Borle
BP Canada Energy Group ULC
British Columbia Hydro and Power Authority
British Columbia Métis Federation Society
Ms. Doris Brooke
Burnaby Residents Opposing Kinder Morgan Expansion
Burnaby Teachers' Association
Burrard Inlet Marine Enhancement Society
Burrard Inlet Oil Moratorium (BIOM)
Mr. Bruce Burton
Mr. Michael Byers
C.G.L.A.P
Canadian Association of Petroleum Producers (CAPP)
Canadian Natural Resources Limited
Canadian Oil Sands Partnership #1
Canadian Parks and Wilderness Society - B.C. Chapter
Ms. Goldie Z. Carr
Ms. Erika Castellanos
CCEC Credit Union
Cenovus Energy Inc.
Mr. Don Chalmers
Ms. Sheila Chalmers
Chamber of Shipping of British Columbia
Mr. William James Chambers
Mr. Cedric Chan
Ms. Sik Chan Wong
Ms. Li Chuan Chang
Mr. Paul Chateauneuf
Cheam First Nation and Chawathil First Nation
Mr. Simon Chen
Ms. Galandie Cheryl
Chevron
Mr. Scott Choi
Mr. Paul Christensen

City of Abbotsford
City of Burnaby
City of Coquitlam
City of Kamloops
City of New Westminster
City of North Vancouver
City of Port Moody
City of Richmond
City of Surrey
City of Vancouver
Coldwater Indian Band
Concerned Citizens of Henley Estates
Concerned Owners of Village del Ponte
Concerned Residents of Forest Knolls
Ms. Karen Corcoran
Mr. Ward Corcoran
Corporation of the City of Victoria
Corpus Management Group
Costco Wholesale Canada Ltd.
Cowichan Tribes
Ms. Lisa Craig
Mr. Mike Crane
Mr. John S. Cressey
Mr. Yubin Cui
Ms. Christine (Christy) Cunningham
Ms. Joy Dalla-Tina
Ms. Maria Danysh
Ms. Aubrey Davelaar
Mr. Larry Dean
Mr. Lucio Degrassi
Ms. Tianmei Deng
Ms. Shauna Dennert
Department Fisheries and Oceans
Ms. Ruth Deshaies
Devon Canada Corp
Mr. Mike Dimarzo
Ms. Apollonia DiNunzio
District of Clearwater
District of Hope
District of North Vancouver
District of West Vancouver
Ditidaht First Nation
Ms. Dorothy Doherty
Mr. Noam Dolgin
Mr. Karim Dossa
Ms. Catherine Douglas
Ms. Jean Drummond
Ms. Sheri Dubuc
Mr. Stephane Dubuc
Mr. Thomas Earle
Edmonton Chamber of Commerce
Ms. Karen English
Enoch Cree Nation
Environment and Climate Change Canada
Ermineskin Cree Nation
Esquimalt Nation
Mr. David Farmer
Mr. Edward Farquhar
Ms. Denise Finamore
Mr. Christopher Fofonoff
Ms. Cecilia Follette
Ms. Lily Ford
ForestEthics Advocacy
Fraser River Sturgeon Conservation Society
Fraser Valley Regional District
Fraser Valley Watersheds Coalition
Ms. Anne Fredette
Friends of the Earth-US
Mr. Thomas Fung
Ms. Barbara Gard
Georgia Strait Alliance
Mr. Terry Gibson
Ms. Sharon Ginetz
Ms. Sandy Goettler
Mr. Elliott Gordon
Government of Alberta
Grasslands Conservation Council of B.C.
Ms. Hui Guan
Ms. Angelika Hackett
Mr. Robert Hackett
Mr. Michael Hale
Mr. Graham Hallson
Halston Hills Co-op
Ms. Laura Hansen
Ms. Sabrina Hardie
Hastings Crossing Business Improvement Association
Ms. Mary Hatch
Ms. Frances Hawes
Mr. Maurice Hayden
Ms. Carlin Hayden
Ms. Cheryl Healey
Ms. Kerri Heard
Hennig Farms
Ms. Helen Hilstad

Mr. Xing Hong
Horse Lake First Nation
Ms. Pat Howard
Mr. Owen Hsu
Ms. Kathryn Hunter-Tate
Husky Oil Operations Limited
Mr. Ron Hykaway
Imperial Oil
Independent Contractors and Businesses Association of B.C.
Indigenous and Northern Affairs Canada (INAC)
Mr. Terence Inskip
Mr. Kelly Izzard
Mr. Art Jackson O/A Alpine Art
Mr. David Jan
Mr. Derrick Jan
Ms. Sandy Jan
Ms. Catherine Jensen
Mr. Nizaralli Jessa
Ms. Rashida Jessa
Mr. Willmer Ji
Ms. Patricia Johannesen
John Black and Andrea Paetow
Ms. Michelle Johnson
Mr. Olav Josok
Mr. Petar Jukic
Mr. Ha Sung Jung
Ms. Waltraud Kain
Ms. Jeysoca T. Kardell
Katzie First Nation
Mr. Carole Katzmann
Kelly Lake Cree Nation
Ms. Terry Kennedy
Ms. Kandace Kerr
KGHM International
Mr. Brian Kingman
Mr. Chris Klaassen
Mr. Ken Klakowich
Mr. Juergen Koessler
Ms. Anita Kripalani
Kwantlen First Nation
Kwikwetlem First Nation
Lake Cowichan First Nation
Mr. Jing Cheng Lang
Ms. Karen Larson
Ms. Betty Lau
Ms. Maria Lau
Mr. Matthew Lau
Ledgeview Golf Club
Mr. John C. Y. Lee
Mr. Kevin Lee
Ms. Naome Lee
Ms. Michelle Leon Black
Lheidli T'enneh First Nation
Mr. Bei Li
Mr. Long Li
Mr. Ping Lin
Little Fort Group
Living Oceans Society
Mr. Eric Loeffler
Lotus Sports Club
Lower Nicola Indian Band
Ms. Helen Luk
Lyackson First Nation
Ms. Sheilagh MacDonald
Mr. Rod MacVicar
Mr. Abdul Majid
Makah Tribal Council
Ms. Joyce Mancinelli
Mr. Kevin Mathias
Ms. Louella Mathias
Matsqui First Nation
Ms. Elizabeth May
Mr. Kenneth McDonald
Member of Parliament (Victoria), House of Commons
Metis Nation British Columbia (MNBC)
Metis Nation of Alberta Gunn Metis Local 55
Metis Regional Council - Zone IV of the Metis Nation of Alberta
Metro Vancouver
Ms. Lihong Meung
Michel First Nation
Mike Wiegele Helicopter Skiing
Ms. Teresa Milillo
Mr. Richard Millar
Mr. Brahm Miller
Ms. Bonnie Moncada
Mr. Jorge Moncada
Montana First Nation
Ms. Kyung-Mee Moon
Mr. Marco Antonio Murillo
Ms. Karen Murray
Musqueam Indian Band
Mr. Ed Nagy

Natural Resources Canada
Neskonlith Indian Band
New Democratic Party of Canada
Nexen Marketing
Mr. Phuoc Tat Nguyen
Nicola Tribal Association
Mr. Ralf Niemzik
Mr. Peter Nix
Ms. Silvia Nonis
Nooaitch Indian Band
North Shore NOPE
Northern Gateway Pipeline Inc.
Northern Health
NWNA
Mr. Doug Oakey
Ms. Brooke O'Byrne
O'Chiese First Nation
Okanagan Nation Alliance
Mr. Adam Olsen
Ms. Joni Olsen
Pacheedaht First Nation
Ms. Qing Pan
Mr. Alex Pannu
Mr. Antonio Pantusa
Ms. Jessica Pao
Parents from Cameron Elementary School Burnaby
Mr. Raminder Parhar
Mr. Dayson Paul
Pauquachin Nation
Mr. Don Pavlovich
Penelakut Tribe
Peters Band
Pine Ridge Housing Co-operative
Mr. Aidan Pitt-Brooke
Popkum Indian Band
Mr. Glen Porter
Mr. Doug Porterfield
Ms. Jennifer Portillo
Mr. Kevin Potvin
Mr. Daniel Preston
Pro Information Pro Environment United People Network
Province of British Columbia
Ms. Elizabeth Punnett
Rainbow Beach Developments Inc.
Raincoast Conservation Foundation
Redwoods Golf Course
Regional District of Fraser-Fort George
Ms. Leilani Riddle
Mr. Jeremy Roberts
Mr. Tony Roberts
Mr. Adam Rosen
Mr. Enio Sacilotto
Ms. Jeanne Sacilotto
Salmon River Enhancement Society
Samson Cree Nation
Ms. Antonietta Sartori
Ms. Clodine Sartori
Mr. Serafino Sartori
Mr. Carlo Sayo
Mr. Ted Schrauwen
Scia'new First Nation
Shackan Indian Band
Mr. Masanobu Shoji
Shxw'ōwhámel First Nation
Simon Fraser Student Society (SFSS)
Simon Fraser University
Simpcw First Nation
Mr. Graham Simpson
Mr. Oeds Smid
Mr. Gary Smith
Snuneymuxw First Nation
Squamish Nation
Ms. Merle St. Pierre
Ms. Tarah Stafford
Stanley Park Ecology Society
Statoil Canada Ltd.
Ms. Marie Stewart
Stk'emlupsemc te Secwepemc
Stó:lō Collective
Ms. Andrée Stow
Strata Council NW655
Strata NW313
Stz'uminus First Nation
Sucker Creek First Nation
Sugarloaf Ranches Ltd.
Sunchild First Nation
Suncor Energy Marketing Inc. and Suncor Energy Products Partnership (collectively, "Suncor Energy")
Surrey Teachers' Association
Swinomish, Tulalip, Suquamish, and Lummi Indian Nations
Mr. Neil Syme
T. Buck Suzuki Environmental Foundation
Ms. Sylvia Tang

Mr. Calvin Taplay
Ms. Gina Tartini
Mr. Andrew M Taylor
Mr. B. Taylor
Tesoro Canada Supply & Distribution Ltd
The City of Edmonton
The City of White Rock
The First Nations of the Maa-nulth Treaty Society
The Graduate Student Society at Simon Fraser University
The Parks Canada Agency
Thompson Drive Water Society
TNRD
Tofino Long-Beach Chamber of Commerce
Total E&P Canada Ltd.
Township of Langley
Transport Canada
Tsartlip First Nation
Tsawout First Nation
Tsawwassen First Nation
Tseycum First Nation
Tsleil-Waututh Nation
T'Sou-ke Nation
Mr. Greg Tunner
UFAWU-Unifor
Unifor
Upper Nicola Band
Vancouver Board of Trade
Vancouver Fraser Port Authority DBA
Port Metro Vancouver
Ms. Hannah Varto
Mr. Val Veirs
Ms. Danielle Vezina
Village of Belcarra
Vincent Chung & Family
Mr. Milillo Vincenzo
Mr. Thomas Vogel
Ms. Jackie Walker
Ms. Janice Walling
Ms. Wendy Wang
Washington State Department of Ecology
WaterWealth Project
Mr. Andrew Weaver
Mr. Peter Webb
Wembley Estate Strata Council
Mr. Baichang Weng
Westcoast Energy Inc., carrying on business as Spectra
Energy Transmission ("Westcoast")
Whispering Pines/Clinton Indian Band
Mr. Ryan White
Whitefish (Goodfish) Lake First Nation #128
Williams Lake Indian Band
Mr. Kitson Wong
Ms. Miki Wong
Mr. T.W. Wong
Mr. Ken Wright
Yarrow Ecovillage
Ms. Aiping Zhang
Mr. Willie Zhang
Ms. Alison Zheng
Zhou and family

Appendix 7

Overview of notices of motion and rulings on other requests

Overview of notices of motion

Each notice of motion (motion) was decided on its own merit based on a review of the applicable legal test, evidence or information filed with the motion (or in response to the motion) and the arguments in favour or opposed to the motion. Specific motion decisions are located on the Board's hearing record.

In total the Board received approximately 291 motions and review applications as of 31 March 2016. During the course of the Board's review process it issued 121 rulings on motions or review and variance applications. In some instances, such as motions to compel, there were numerous motions, and only one aggregate ruling.

The Board also responded to a number of letters and suggestions (not included in the numbers below). These letters included issues raised by Aboriginal groups regarding Aboriginal oral traditional evidence and section 18 *Canadian Environmental Assessment Act, 2012*. The descriptions below are meant to be summary only and numbers provided should be considered approximate in nature.

Motion category	General description	Number of motions
Late Applications to Participate (ATP) or requests to review and vary participation decisions	Request for an extension to the deadline of the ATP(4); Late application for ATP to request Intervenors/Commenters standing(18); review of the Board's ruling on participation denying intervenor status(3).	25
Extend Statutory timelines and excluded period or request to take no further steps in hearing process	Request to the Board to seek the Chairperson's approval to extend statutory timeline until Trans Mountain file detailed Quantitative Human Health Risk Assessments(2); request for an extension request until full details on selected and alternative corridors are received(1); section 74 determination – regarding the need for leave to transfer ownership (1); request to withhold issuing a certificate of public convenience and necessity and related approval for the Project until certain specified issues are corrected(1); request to dismiss certificate because no "company" hold the operating certificate(1); various other time to fulfil several requests(5)	11
List of Issues and Completeness of Application	Clarification request on the List of Issues and claim that the Application was incomplete (1); requests to expand List of Issues to include environmental and socio-economic effects associated with upstream and downstream activities(2).	3
Meeting request	One-on-one meeting request for the purpose of discussing issues related to the application.	1
Administrative matters	Replacement of documents with corrected version (2); request to supplement responses to Information requests(IRs) with filing ID number (1); visual aids(1); late filing of affidavit(1)	5
Oral Cross Examination	Requests to amend the Hearing Order to include a phase for the oral cross examination of witnesses on all evidence(2); request (after Trans Mountain reply argument filed) to have cross examination on certain evidence (1).	3

Information Requests (IRs) and letters of comment (LOC)	Several requests to extend(5) and further(4) extend the deadline of IRs of intervenors to Trans Mountain; disclosure from Trans Mountain for characteristics of product used in the Gainford study(1); Trans Mountain's request to extend deadline for response to IRs #1 from Intervenors(1), striking of IRs(1); Extension of filing deadline for LOC(3), filing of late LOC(9); intervenor seeking leave to direct IRs to another intervenor (1); late filing of IR(1).	26
Requests to expand participation in Oct. 9 hearing regarding whether the Board should issue an access Order regarding Trans Mountain's access to City of Burnaby land	Request that the Board reconsider its decision to preclude intervenors from providing submissions regarding access to City of Burnaby lands.	3
Review of ruling	Review of Ruling 101 dated 7 December 2015	1
Constitutional matters	Request seeking a declaration that s. 55.2 of the NEBA in unconstitutional as it is alleged to violate freedom of expression and notice of constitutional question and request an oral hearing of the Charter motion on procedural fairness and evidentiary grounds (1); Trans Mountain's rights under paragraph 73(a) of the NEB Act with respect to accessing lands for survey and examination purposes and Notices of Constitutional Question (1); review List of Issues on basis of infringement of section 7 of the *Canadian Charter of Rights and Freedoms*(1); motion on limited public access with freedom of expression raised (1); motion on independence of temporary Board Members(1).	5
Amending hearing/Oral Traditional Evidence dates	Requests that the Board reschedule the hearing of their oral traditional evidence to a late date.	4
Section 74	Ownership and certificate issue.	1
Evidence	Requests to remove certain evidence from the record(3); requests to file new evidence(6); filing of late evidence(7); extend the evidence filing deadline(2); replacement of evidence (5);	23
Compel further and better responses	Various requests that the Board compel full and adequate IR responses for first round IRs and second round IRs from Trans Mountain and on the TERMPOL Report by Transport Canada; late motion to compel for round 2 IRs; several motions to compel full and adequate responses from intervenors to IRs from other intervenors, late motion to compel(3).	129
Confidentiality	Various requests to file certain documents confidentially (15) and a request to identified information that was redacted (1).	16
Participant Funding Program concerns	Request to add a round of Information Request if funding is provided and reconsider funding allocation.	4
Advertising Costs	Request that Trans Mountain file its advertising costs for the project, that Firm Service Fees collected not go towards advertisement etc.	1
Oral Traditional Evidence - audio recordings	Make audio recordings public and free.	1
Community benefits	Request to nullify and cease Trans Mountain from making Community Benefit Program Agreements with participants.	1
Hearing on argument	Request to attend hearing as a non-participant(1), request to have additional representatives(24), late oral summary argument request(1), motion on limited public access(1).	27
Panel	Allegation of apprehension of bias of Panel Chair – Mr. David Hamilton; request to recuse the Panel, quash the hearing, prevent Mr. Steven Kelly from communicating with Panel and a request to assign a new Panel.	2

Other relief requested and Board rulings

As part of closing argument, a number of intervenors made requests for relief other than requests that specifically addressed the intervenors' positions on the recommendation that the Board ought to make to Governor in Council under the NEB Act or specific findings under the provisions of the *Canadian Environmental Assessment Act*, 2012 (CEAA) or the *Species at Risk Act* (SARA).

In some cases, these requests were presented as alternative requests to the intervenor's primary request that the Board recommend denial of the Project application. In other cases, the relief was advanced as the intervenor's primary position.

In Hearing Order OH-001-2014, issued on 2 April 2014, the Board provided direction that if a party wished to raise question of procedure or substance requiring a Board decision, it was required to file a notice of motion. The Hearing Order described the process for filing a notice of motion and also referenced section 35 of the *National Energy Board Rules of Practice and Procedure, 1995* for further information. In addition, in Procedural Direction No. 20 (PD No. 20), the Board provided direction with respect to motions and preliminary matters that could be raised during oral summary argument. The Board stated that matters should not be raised during oral summary argument which could have been raised with the Board in writing prior to the oral portions of the hearing.

Notwithstanding the Board's prior directions and the *National Energy Board Rules of Practice and Procedure, 1995*, a number of parties made requests for procedural and or substantive decisions within their written closing argument and/or oral summary argument without filing a notice of motion.

These relief requests, submitted as part of closing argument, were made in relation to:

a) Completeness.

b) Procedural requests relating to cross examination and time extensions.

c) Abandonment of the existing TMPL and changes in the scope of the proposed Project, if approved.

In addition, several intervenors made specific relief requests in relation to Aboriginal consultation matters. Aboriginal matters are discussed in detail in Chapter 5 of this Report and, as such, the Board's views in relation to Aboriginal consultation are addressed within the Board's views in Chapter 5.

As part of its Reply Evidence, Trans Mountain requested approval for proposed route re alignments in proximity to the Lewis Estates community in Edmonton, AB, and United Boulevard and Hartley Avenue in Coquitlam, B.C. For the reasons provided in Chapter 11, the Board denies this late request without prejudice to Trans Mountain filing an application for a variance under section 21 of the NEB Act.

In its Reply Evidence, Trans Mountain also sought an exemption from the detailed route approval process, under section 58 of the NEB Act, for clearing activities associated with the first 10 km of each Line 2 spread.

Views of the Board

With respect to Trans Mountain's request that clearing activities associated with the first 10 km of each Line 2 spread be exempt from the detailed route approval process, the Board finds that such clearing activities would not be temporary in nature. They would have lasting consequences and should therefore not take place unless and until a detailed route for Line 2 is approved. As a result, the Board denies this request.

With the exception of PIPE UP, none of the requests for other relief were consistent with the Hearing Order direction requiring a notice of motion. In PIPE UP's case where it filed a notice of motion, this occurred after the hearing record was closed.[93] Most of the requests for other relief were also inconsistent with PD No. 20. For these reasons, all the requests for additional relief are dismissed.

Additional reasons for denying specific requests for other relief are as follows.

a) Completeness

As part of closing argument, several parties made requests that the Board find the Application incomplete and that the Board therefore either decline to forward a recommendation on that basis, or that it dismiss the Application on the basis of being incomplete.

93 Pursuant to Procedural Direction No. 18, the hearing record closed immediately after Trans Mountain filed its written argument.

On 2 April 2014, the Board made its finding in relation to completeness of the Application and found it to be complete. No party sought review of this determination. A finding of completeness is a prerequisite for the Board to be able to proceed with the assessment of an application for the purposes of preparing a report in accordance with s.52 of the NEB Act. The final argument stage is well beyond the appropriate time to raise questions about the completeness of a project application. The determination of completeness has already been made by the Board. The Board denies these requests.

b) Procedural requests relating to cross examination and time extensions

As part of closing argument, the Board also received new requests for cross examination and time extensions. B.C. Nature and Nature Canada requested that the Board amend its Hearing Order to allow for cross examination and order Trans Mountain to provide oral testimony and be subject to cross examination with a declaration that s.52(5) of the NEB Act applies for these purposes; or request to Minister or GIC to issue order under s.52(7) to extend time for NEB report to complete cross.

PIPE UP, as its alternative relief request in its closing argument, asked for cross examination of experts by parties who have submitted evidence in key areas where expert evidence conflicts or there is uncertainty in respect of severe or irreversible harm. In addition, following the close of argument, on 18 February 2016, PIPE UP also filed a motion seeking this same relief. In its motion, PIPE UP stated that it was seeking a reconsideration of the Board's Ruling No. 14, the Board's ruling with respect to two motions requesting the Board amend its Hearing Order to allow for cross examination.

In Ruling No. 14, dated 7 May 2014, the Board stated:

In the Board's view, the legislation makes it clear that the Board is master of its own procedure and can establish its own procedures for each public hearing with regard to the conduct of hearings. This includes the authority to determine for a particular public hearing the manner in which evidence will be received and tested. In the circumstances of this hearing, where there are 400 intervenors and much of the information is technical in nature, the Board has determined that it is appropriate to test the evidence through written processes. All written evidence submitted will be subject to written questioning by up to 400 parties, and the Board.

B.C. Nature and Nature Canada stated that there were deficiencies in Trans Mountain's responses to IRs and that as a result, cross examination was necessary to test the evidence.

PIPE UP argued that it had now emerged that there was conflicting expert evidence in areas which requires the Panel to re-consider its decision to proceed without cross examination. PIPE UP cited, as examples, conflicting evidence in Muse Stancil and Gunton Reports; conflicting evidence respecting Tank Fire and Boilover; conflicting evidence respecting Trans Mountain's Environmental Record; conflicting evidence respecting the risk and cost of spill events; and Trans Mountain's ability and willingness to finance a credible worst case scenario.

Trans Mountain provided a response to the PIPE UP motion on 29 February 2016. Trans Mountain stated that the hearing record was closed, that PIPE UP's late request was not properly before the Board, was without basis, and should be denied.

PIPE UP did not provide a reply.

Neither B.C. Nature and Nature Canada nor PIPE UP provided explanation for the delay in their bringing these requests. The appropriate application in the case of concerns that answers to IRs are deficient is a motion to compel full and adequate response, which B.C. Nature and Nature Canada brought, and upon which the Board ruled on 27 April 2015 in Ruling No. 63, denying B.C. Nature and Nature Canada's motion. Now, many months later, and after the close of the evidentiary record, B.C. Nature and Nature Canada say that Trans Mountain's responses to IRs should support their late request for cross examination. With respect to PIPE UP's argument respecting conflicting evidence, the fact that there is conflicting evidence on the record on various technical issues has not recently emerged. It was apparent with the filing of intervenor evidence in May 2015 that there was

conflicting evidence on various topics. PIPE UP does not explain why it waited until after the closing of the record to bring its motion requesting a reconsideration of Ruling No. 14.

The Board finds that these requests for re-opening of the hearing were filed too late and no explanation was given for the late filing. The Board also finds that considering these requests at this late date would result in significant prejudice to Trans Mountain.

In considering the conflicts in evidence, much of which is scientific or technical in nature and none of which involved the credibility of the person providing the sworn evidence, the Board is of the view it is able to determine the weight to give to various evidence filed on the hearing record.

The Board declines B.C. Nature and Nature Canada's request to amend the Hearing Order to allow for cross examination, and declines PIPE UP's request for a reconsideration of Ruling No. 14.

c) Abandonment of the existing TMPL and changes in the scope of the proposed Project, if approved

The City of Surrey made these requests. In particular, it requested that if the Board recommended approval of the Project, that it also direct that the existing TMPL that runs through Surrey should be abandoned. The City of Surrey further requested that there be an order that the Project should be either twinned or upsized through Surrey.

These requests by the City of Surrey amount to requests that the Board change the scope of the application before it.

There is no application for leave to abandon a portion of the existing TMPL before the Board. Similarly, the Project proposal does not contemplate being twinned or upsized through the City of Surrey.

Such applications, if they were to come before the Board, would be considered on their merits and would require notice to potentially affected parties.

The Board declines to approve the City of Surrey's requests that if it recommends approval of the Project, that the Board direct abandonment of the existing TMPL that runs through Surrey, and that the Project be twinned or upsized for the portion of it that runs through the City of Surrey.

Appendix 8

Sources of information and evidence from Aboriginal participants

The table below identifies the sources of information provided by Aboriginal participants that participated in this hearing, either as intervenors or commenters. All information listed can be found in the Project's folder within the Board's online public registry. To fully understand the context of the information filed, please consult the entire public record.

Aboriginal group[94]	As intervenors			As commenters
	Written submissions[95] (Exhibit No.)	Oral traditional evidence (transcript volume)	Oral summary argument (transcript volume)	Letter of comment
Adams Lake Indian Band	C003	15	-	
Alexander First Nation	C006	24	37	
Alexis Nakota Sioux Nation	C007	-	-	
Antoine, Janice	C011	13	-	
Aseniwuche Winewak Nation of Canada	C013	-	-	
Ashcroft Indian Band	C014	-	-	
Asini Wachi Nehiyawak Traditional Band	C015	-	-	
British Columbia Métis Federation Society	C039	-	-	
Canim Lake Band				A65490
Chawathil First Nation	C400	-	29	
Cheam First Nation	C400	-	29	
Coldwater Indian Band	C078	14	27	
Cowichan Tribes	C086	-	33	
Ditidaht First Nation	C108	-	-	

94 Groups that participated as a single intervenor are listed together.

95 Exhibit numbers in this column represent each intervenor's main folder that includes all evidence filed (e.g., written evidence, responses to information requests) and written argument-in-chief.

Aboriginal group[94]	As intervenors			As commenters
	Written submissions[95] (Exhibit No.)	Oral traditional evidence (transcript volume)	Oral summary argument (transcript volume)	Letter of comment
Enoch Cree Nation	C120	-	-	
Ermineskin Cree Nation	C122	-	-	
Esquimalt Nation	C123	-	-	
Horse Lake First Nation	C406	22	-	
Hwlitsum First Nation	C166	12	-	
Katzie First Nation	C187	10	27	
Kelly Lake Cree Nation	C189	-	-	
Kwantlen First Nation	C198	7	35	
Kwikwetlem First Nation	C199	-	-	
Lake Cowichan First Nation	C409	-	-	
Lheidli T'enneh First Nation	C209	18	-	
Lower Nicola Indian Band	C217	14	-	
Lyackson First Nation	C219	21	31	
Makah Tribal Council	C223	-	-	
Malahat Nation				-
Matsqui First Nation	C227	-	-	
Métis Nation of Alberta Gunn Métis Local 55	C232	1	-	
Métis Nation British Columbia	C231	-	-	
Métis Regional Council Zone IV of the Métis Nation of Alberta	C233	-	-	
Michel First Nation	C236	3	-	
Montana First Nation	C243	-	-	
Musqueam Indian Band	C246	8	26	
Nakcowinewak Nation of Canada	C248	-	-	
Neskonlith Indian Band	C250	16	-	
Nicola Tribal Association	C254	-	-	
Nooaitch Indian Band	C258	15	-	
O'Chiese First Nation	C265	4	-	
Okanagan Nation Alliance	C266	-	-	
Olsen, Adam	C267	20	29	
Olsen, Joni	C268	19	-	
Pacheedaht First Nation	C269	22	-	
Paul First Nation				A59856

94 Groups that participated as a single intervenor are listed together.

95 Exhibit numbers in this column represent each intervenor's main folder that includes all evidence filed (e.g., written evidence, responses to information requests) and written argument-in-chief.

Aboriginal group[94]	As intervenors			As commenters
	Written submissions[95] (Exhibit No.)	Oral traditional evidence (transcript volume)	Oral summary argument (transcript volume)	Letter of comment
Pauquachin First Nation	C277	-	-	
Penelakut Tribe	C279	-	-	
Peters Band	C399	9	-	
Popkum Indian Band	C282	-	-	
Samson Cree Nation	C302	3	-	
Scia'new First Nation	C308	-	-	
Shackan Indian Band	C310	13	34	
Shxw'ow'hamel First Nation	C312	6	-	
Simpcw First Nation	C313	17	-	
Snuneymuxw First Nation	C318	-	-	
Squamish Nation	C319	12	28	
Stó:lō Collective	C326	-	28	
Stz'uminus First Nation	C330	20	27	
Sucker Creek First Nation	C331	-	-	
Sunchild First Nation	C333	2	38	
Swinomish, Tulalip, Suquamish, and Lummi Indian Nations	C336	10, 11	29	
The First Nations of Maa-nulth Treaty Society	C411	-	-	
Stk'emlups te Secwepemc	C325	16	-	
Tsartlip First Nation	C354	19	-	
Tsawout First Nation	C355	23	34	
Tsawwassen First Nation	C356	-	-	
Tseycum First Nation	C357	21	-	
Tsleil-Waututh Nation	C358	6	32	
T'Sou-ke Nation	C359	19	32	
Upper Nicola Band	C363	18	34	
Whispering Pines/Clinton Indian Band	C384	-	-	
Whitefish (Goodfish) Lake First Nation #128	C386	-	-	
Williams Lake Indian Band	C388	-	-	

94 Groups that participated as a single intervenor are listed together.

95 Exhibit numbers in this column represent each intervenor's main folder that includes all evidence filed (e.g., written evidence, responses to information requests) and written argument-in-chief.

Appendix 9

List of Aboriginal groups engaged by Trans Mountain

Edmonton to Alberta/British Columbia Border Region

Alexander First Nation
Alexis Nakota Sioux Nation
Aseniwuche Winewak Nation Canada
Asini Wachi Nehiyawak Traditional Band
Enoch Cree Nation
Ermineskin Cree Nation
Foothills Ojibway First Nation
Horse Lake First Nation
Louis Bull Tribe
Métis Nation of Alberta Gunn Métis Local 55
Métis Regional Council Zone IV of the Métis Nation of Alberta
Michel First Nation
Montana First Nation
Nakcowinewak Nation of Canada
O'Chiese First Nation
Paul First Nation
Saddle Lake Cree
Samson Cree Nation
Stoney Nakoda First Nation
Sturgeon Lake Cree Nation
Sucker Creek First Nation
Sunchild First Nation
Tsuu T'ina Nation
Whitefish (Goodfish) First Nation

Alberta/British Columbia Border to Kamloops Region

Adams Lake Indian Band
Ashcroft Indian Band
Canim Lake Band
Kelly Lake Cree Nation
Kelly Lake First Nation
Kelly Lake Métis Settlement Society
Ktunaxa Nation
Little Shuswap Indian Band
Lheidli T'enneh First Nation
Lhtako Dene Nation
Llenlleney'ten First Nation (High Bar)
Neskonlith Indian Band
Oregon Jack Creek Band
Shuswap Indian Band
Simpcw First Nation
Skeetchestn First Nation
Splatsin First Nation
Sts'wecem'cXgat'tem (Canoe Creek/Dog Creek)
Tk'emlups te Secwepemc
Toosey Indian Band
Whispering Pines/Clinton Band
Williams Lake (T'exelc) Band
Xat'sull First Nation (Soda Creek)

Kamloops to Hope Region

Boothroyd Band
Boston Bar Band
Coldwater Indian Bar
Cook's Ferry Indian Band
Kanaka Bar
Lower Nicola Indian Band
Lower Similkameen Indian Band
Lytton First Nation
Nicomen Indian Band
Nooaitch Indian Band
Penticton Indian Band
Shackan Indian Band
Siska Indian Band
Skuppah Indian Band
Spuzzum First Nation
St'uxwtews (Bonaparte Indian Band)
Upper Nicola Indian Band
Upper Similkameen Indian Band

Hope to Burnaby Terminal/Burrard Inlet Region

Aitchelitz First Nation
Chawathil First Nation
Cheam First Nation
Katzie First Nation
Kwantlen First Nation
Kwaw-kwaw-aplit First Nation
Kwikwetlem First Nation
Leq'a:mel First Nation
Matsqui First Nation
Musqueam Indian Band
Peters Band
Popkum First Nation
Qayqayt First Nation (New Westminster)
Scowlitz First Nation
Seabird Island Band
Semiahmoo First Nation
Shxw'ow'hamel First Nation
Shxwha:y Village
Skawahlook First Nation
Skowkale First Nation
Skwah First Nation
Soowahlie Indian Band
Squamish Nation
Squiala First Nation
Sts'ailes Band (Chehalis Indian Band)
Sumas First Nation
Ts'kwaylaxw (Pavillion Indian Band)
Tsawwassen First Nation
Tsleil-Waututh Nation
Tzeachten First Nation
Union Bar First Nations
Yakweakwioose Band
Yale First Nation

Marine Corridor

Cowichan Tribes
Ditidaht First Nation
Esquimalt Nation
Halalt First Nation
Huu-ay-aht First Nation
Hwlitsum First Nation
Lake Cowichan First Nation
Lyackson First Nation
Malahat First Nation
Pacheedaht First Nation
Pauquachin First Nation
Penelakut First Nation
Scia'new Indian Band (Beecher Bay)
Sechelt Indian Band
Snaw-Naw-As (Nanoose)
Snuneymuxw First Nation
Songhees Nation
Stz'uminus First Nation (Chemainus)
T'Sou-ke First Nation
Tsartlip First Nation
Tsawout First Nation
Tseycum First Nation

Non-Boundary Specific

B.C. Métis Federation
Métis Nation of B.C.

Associations, Councils and Tribes

Cowichan Nation Alliance
Maa Nulth First Nations
Nicola Tribal Association
Nuu-chah-nulth Tribal Council
Okanagan Nation Alliance
Sencot'en Alliance
Shuswap Nation Tribal Council
St'at'imc Chiefs Councils
Stk'emlupsemc te Secwepemc Nation (SSN)
Ts'elxweyeqw Tribe Management Limited (TTML)
Tsilhoqot'n National Government

Appendix 10

Factors and scope of the factors for the environmental assessment pursuant to the *Canadian Environmental Assessment Act, 2012* (released on 2 April 2014)

Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
Application dated 16 December 2013

Factors and Scope of the Factors for the Environmental Assessment pursuant to the Canadian Environmental Assessment Act, 2012

1.0 Introduction

On 16 December 2013, Trans Mountain Pipeline ULC (Trans Mountain) filed an application with the National Energy Board (Board or NEB) proposing to construct and operate the Trans Mountain Expansion Project (Project). As the Project would require more than 40 kilometres of new pipeline and would be regulated under the National Energy Board Act (NEB Act), it is a designated project under the Canadian Environmental Assessment Act, 2012 (CEAA 2012) and requires a CEAA 2012 environmental assessment for which the NEB is the Responsible Authority.

For the purposes of the environmental assessment under the CEAA 2012, the designated project includes the various components and physical activities as described by Trans Mountain in its 16 December 2013 application submitted to the NEB. The Board has determined that the potential environmental and socio-economic effects of increased marine shipping activities to and from the Westridge Marine Terminal that would result from the designated project, including the potential effects of accidents or malfunctions that may occur, will be considered under the NEB Act (see the NEB's Letter of 10 September 2013 for filing requirements specific to these marine shipping activities). To the extent that there is potential for environmental effects of the designated project to interact with the effects of the marine shipping, the Board will consider those effects under the cumulative effects portion of the CEAA 2012 environmental assessment.

As noted in the List of Issues (attached to Hearing Order OH-001-2014), the Board does not intend to consider the environmental and socio-economic effects associated with upstream activities, the development of oil sands, or the downstream use of the oil transported by the pipeline.

In accordance with paragraph 79(2)(b) of the CEAA 2012, the following provides a description of the factors to be taken into account in the environmental assessment under the CEAA 2012 and of the scope of those factors.

2.0 Factors and scope of the factors

2.1 Factors to be considered

The CEAA 2012 environmental assessment for the designated project will take into account the factors described in paragraphs 19(1)(a) through (h) of the CEAA 2012:

(a) the environmental effects[96] of the designated project, including the environmental effects of malfunctions or accidents that may occur in connection with the designated project and any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out;

(b) the significance of the effects referred to in paragraph (a);

(c) comments from the public or any interested party received in accordance with the CEAA 2012;

(d) mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the designated project;

(e) the requirements of the follow-up program in respect of the designated project;

(f) the purpose of the designated project;

(g) alternative means of carrying out the designated project that are technically and economically feasible and the environmental effects of any such alternative means; and

(h) any change to the designated project that may be caused by the environment.

In addition, the environmental assessment will also consider community knowledge and Aboriginal traditional knowledge.

2.2 Scope of the factors to be considered

The environmental assessment will consider the potential effects of the designated project within spatial and temporal boundaries within which the designated project may potentially interact with and have an effect on components of the environment. These boundaries will vary with the issues and factors considered, and will include, but not be limited to:

- construction, operation and maintenance, foreseeable changes, and site reclamation, as well as any other undertakings proposed by the proponent or that are likely to be carried out in relation to the physical works proposed by the proponent, including mitigation and habitat replacement measures;
- seasonal or other natural variations of a population or ecological component;
- any sensitive lifecycle phases of species (e.g., wildlife, vegetation) in relation to the timing of Project activities;
- the time required for an effect to become evident;
- the area within which a population or ecological component functions; and
- the area affected by the Project.

Any works and activities associated with additional modifications or associated with the decommissioning or abandonment phase of the Project would be subject to a future application under the NEB Act and assessed in detail at that time. Therefore, at this time, any works or activities associated with these phases of the Project will be examined in a broad context only.

As indicated above, the environmental assessment will consider cumulative environmental effects that are likely to result from the designated project in combination with effects from other physical activities that have been or will be carried out.

96 Section 5 of the CEAA 2012 further describes the environmental effects that are to be taken into account.

Subsection 2(1) of the CEAA 2012 provides definitions potentially relevant to the scope of the factors, including:

"environment" which means the components of the Earth, including

(a) land, water and air, including all layers of the atmosphere;

(b) all organic and inorganic matter and living organisms; and

(c) the interacting natural systems that include components referred to in paragraphs (a) and (b); and

"mitigation measures", which means measures for the elimination, reduction or control of the adverse environmental effects of a designated project, and includes restitution for any damage to the environment caused by those effects through replacement, restoration, compensation or any other means.

Appendix 11

Study area boundaries for the Environmental and Socio-Economic Assessment

The following describes the study areas that Trans Mountain used in its Environmental and Socio-Economic Assessment of the Project, and which the Board adopted for its own assessment.

Study area boundaries are defined for both the terrestrial and marine aspects considered. Generally, three different study areas were used in assessing the potential effects on each valued component:

- **Footprint study area (FSA)** – The FSA is the fixed area that would be directly disturbed by the Project facilities and associated physical works and activities. This includes the 45-metre-wide construction right-of-way, permanent and temporary access roads, camp and stockpile sites, valves and power lines, pump stations, tanks, and the Westridge Marine Terminal.
- **Local study area (LSA)** – The LSA typically varies depending on the valued component assessed. The LSA is larger than the FSA. It reflects the area where Project construction and operations activities are most likely to affect the valued component assessed. The LSA is sometimes referred to as the "zone of influence."
- **Regional study area (RSA)** – The RSA typically varies depending on the valued component assessed. The RSA is larger than the LSA. It covers the area where potential effects on the valued component assessed might overlap with the direct and indirect effects of other activities on that valued component, causing cumulative effects.

Valued component	LSA	RSA
Terrestrial		
Soil and soil productivity	Extends 500 metres on either side of the pipeline centreline and surrounding facilities.	n/a (potential effects not expected to extend beyond the LSA).
Wetland loss and alteration	Extends 150 metres on either side of the pipeline centreline, with site-specific tailoring to extend around larger wetland complexes.	Generally the same as the Aquatics RSA, which includes all watersheds affected by the Project.
Vegetation	Extends 150 metres on either side of the pipeline centerline.	Extends 1 kilometre on either side of the pipeline centreline.
Wildlife	Area within a 1 kilometre buffer of the centre of the pipeline corridor and power lines, and around the boundary of facilities (pump stations/terminals).	Area within a 15 kilometre buffer of the centre of the pipeline corridor and power lines, and around the boundary of facilities (pump stations/terminals).
Grizzly bear		Defined by the Grizzly Bear Population Units traversed by the pipeline corridor.
Caribou		The area where direct and indirect influence of other activities could overlap with Project-specific effects and cause cumulative effects on caribou. Includes the Wells Gray and Groundhog caribou ranges, associated ungulate winter ranges and wildlife habitat areas.
Surface water quality and quantity Fish and fish habitat	Zone of influence likely to be affected by direct disturbance and sediment deposition during construction and operations. Also includes the area of riparian vegetation to a width of 30 metres back from each bank edge within the width of the construction right-of-way. Each watercourse to be crossed has an individually determined LSA.	Area where the direct and indirect influence of other land uses and activities could overlap with Project-specific potential effects and cause cumulative effects on fish and fish habitat indicators (includes all watersheds directly affected by the Project).
Atmospheric environment (criteria air contaminants, volatile organic compounds)	Extends 500 metres on either side of the pipeline corridor and 5 kilometres in all directions around tank terminals (due to their proximity, the Westridge Marine Terminal and Burnaby Terminal are combined into one LSA).	Extends 2.5 kilometres on either side of the pipeline corridor and 10 kilometres in all directions around tank terminals (due to their proximity, the Westridge Marine Terminal and Burnaby Terminal are combined into one RSA).
Atmospheric environment (ozone, secondary particulate matter) and visibility	No LSA and RSA defined. Instead, a Lower Fraser Valley study area was used. Emission scenarios were implemented over the inner 4 kilometre domain (boundary: 36 x 12 kilometres) centred on the Lower Fraser Valley.	
Atmospheric environment (greenhouse gas emissions)	International	

Valued component	LSA	RSA
Westridge Marine Terminal		
Marine sediment and water quality	Extends 500 metres from the proposed water lease expansion.	Area of Burrard Inlet east of the First Narrows, including Indian Arm and Port Moody Arm.
Marine fish and fish habitat		
Marine mammals		
Marine birds	Extends 300 metres from the proposed water lease expansion.	
Marine transportation		
Marine birds	Extends 1 kilometre on either side of the shipping lanes.	Generally centred on the shipping lanes, which extend from the Westridge Marine Terminal through Burrard Inlet; south through the southern part of the Strait of Georgia, the Gulf Islands, and Haro Strait; westward past Victoria and through Juan de Fuca Strait out to the 12-nautical-mile limit of Canada's territorial sea.
Marine fish and fish habitat	Extends 2 kilometres on either side of the shipping lanes.	
Marine mammals	n/a (all residual effects assessed within the RSA).	
Atmospheric environment (criteria air contaminants, volatile organic compounds)		150 x 150 km – includes the shipping lanes from the Westridge Marine Terminal in Burnaby, through the Burrard Inlet, south through the Strait of Georgia, Boundary passage and Haro Strait, then westward past Victoria to the end of the Juan de Fuca Strait, close to the 12 nautical mile limit.
Atmospheric environment (ozone, secondary particulate matter) and visibility	No LSA and RSA defined. Instead, a Lower Fraser Valley study area was used. Emission scenarios were implemented over the inner 4 kilometre domain (boundary: 36 x 12 kilometres) centred on the Lower Fraser Valley.	
Atmospheric environment (greenhouse gas emissions)	International	

Valued component	LSA	RSA
Terrestrial		
Human occupancy and resource use	For the proposed pipeline and facilities, the spatial boundary of the LSA is defined by a 2 km wide band extending from the proposed Footprint (i.e., the Footprint plus 1 km on each side) and is based on the area that could be directly affected by localized, Project-specific effects. The LSA was established to provide adequate consideration to existing land and resource uses (e.g., farming, livestock grazing, hunting, fishing, protected areas) in the Project area which may experience direct effects associated with the Project beyond the Footprint.	The spatial boundary for the RSA consists of the area extending beyond the LSA boundary and is defined as the area where the direct and indirect influence of other land uses and activities could overlap with Project-specific effects and cause cumulative effects on the HORU indicators. This includes the RSA boundaries of fish and fish habitat, wetlands, vegetation and wildlife. The RSA was selected to reflect the general Project setting and to describe resource use related elements that could be indirectly affected by the Project (e.g., consumptive and non-consumptive recreation, hunting, trapping and fishing).
Infrastructure and services	No LSA was considered for infrastructure and services. The relevant study area is defined by the areas potentially directly disturbed by Project activities (i.e., Footprint Study Area) and communities and regions in which people potentially affected by and benefitting from the Project reside.	The area where the direct and indirect influences of other land uses and activities could overlap with Project-related effects and cause cumulative effects on the social and cultural well-being indicators. The Socio-economic RSA considers communities close enough to the Project to potentially be a: source of labour; source of procured goods or services; location of community infrastructure/services influenced by the Project; accommodation or camp location for Project workers; or Project construction office location. This area includes the counties and regional districts crossed by the proposed pipeline corridor (or certain regional sub-areas) and communities approximately 50 km from the proposed pipeline corridor that could participate in or be affected by the Project. It also includes Aboriginal communities whose reserves or traditional territory is crossed by the proposed pipeline corridor.
Social and cultural well-being	N/A. The relevant study area is defined by communities and regions where people are potentially affected by and are potentially benefitting from the Project, not by a specific land area.	
Employment and economy	No LSA was considered for employment and economy. The relevant study area is defined by communities and regions in which people potentially directly and indirectly affected by and benefitting from the Project reside (not by a particular land area), as well as at the Provincial and National level.	
Heritage resources	The zone of influence in which heritage resources are most likely to be affected during construction and operations is the Footprint, including any temporary workspace. The potential for impacting archaeological, palaeontological or historical resources is limited to areas of potential clearing or ground disturbance (i.e., the Footprint). A separate Heritage Resources LSA has not been defined for the Project.	The spatial boundaries of the Heritage Resources RSA for the Project comprise an area extending beyond the Footprint and are defined as an area of intersecting Borden Blocks. A Borden Block measures 10 minutes of latitude by 10 minutes of longitude which is the accepted standard division of land used by archaeologists across Canada. For the Project, the Borden Blocks intersected by the proposed pipeline corridor measure approximately 12 km east-west by 18 km north-south.

Valued component	LSA	RSA
Traditional land and resource use (TLRU)	The TLRU LSA encompasses and extends beyond the Footprint to include the zones of influence of water quality and quantity, air emissions, acoustic environment, fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat and heritage resources since TLRU is dependent on these resources. The TLRU LSA is the area where there is a reasonable potential for localized Project-related effects to affect existing uses of the land for traditional purposes (e.g., trapping, hunting, fishing and gathering areas). The potential effects of the Project are primarily assessed within the Footprint and the TLRU LSA.	The TLRU RSA is the area where the direct and indirect influences of other land uses and activities could overlap with Project-related effects and cause cumulative effects on the TLRU indicators. The TLRU RSA includes the RSA boundaries of water quality and quantity, air emissions, acoustic environment, fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat and heritage resources. Since in some cases, the focus of TLRU may be on lands within a few hundred metres of the Footprint, and in other cases broader territorial uses are identified extending several kilometres from the Footprint, the potential effects of the Project on TLRU are also assessed within the TLRU RSA.
Human health	Tank terminals: the area within a 5 km radius of each of the terminals. The SLHHRA LSA represents the predicted spatial extent of the chemical emissions from the additional tanks to be installed to which people might be exposed.	Separate Air Quality RSAs apply to each of the existing tank terminals, each comprised of a 24 km x 24 km area centred on the terminal. The Burnaby Terminal Air Quality RSA was combined with the Westridge Marine Terminal Air Quality RSA due to the close proximity of the two terminals to one another (i.e., less than 3 km apart).
Westridge Marine Terminal		
Human occupancy and resource use Extends 500 metres from the proposed water lease expansion. Traditional land and resource use	Extends 500 metres from the proposed water lease expansion.	Area east of the First Narrows, including Indian Arm and Port Moody Arm.
Human health	The area in the immediate vicinity of the Westridge Marine Terminal where exposure to the chemical emissions from the terminal might be expected to occur. The SLHHRA LSA represents the predicted spatial extent of the chemical emissions from the expansion of the Westridge Marine Terminal to which people might be exposed. The SLHHRA LSA extends over a 5 km radius centred on the Westridge Marine Terminal.	The Air Quality RSA for the Westridge Marine Terminal is a 24 km by 24 km area. The Burnaby Terminal Air Quality RSA was combined with the Westridge Marine Terminal Air Quality RSA due to the close proximity of the two terminals to one another (i.e., less than 3 km apart).

Marine transportation		
Marine commercial, recreational and tourism use	Extends 2 kilometres on either side of the shipping lanes.	Generally centred on the shipping lanes, which extend from the Westridge Marine Terminal through Burrard Inlet; south through the southern part of the Strait of Georgia, the Gulf Islands, and Haro Strait; westward past Victoria and through Juan de Fuca Strait out to the 12-nautical-mile limit of Canada's territorial sea.
Traditional marine resource use	Generally the same as the LSA boundaries of marine fish and fish habitat, marine mammals and marine birds since TMRU is dependent on these resources.	Marine RSA encompasses a large portion of the Salish Sea and it generally extends from the western to eastern boundaries of the Salish Sea; however, it confines the northern and southern extents to exclude the central and northern Strait of Georgia and Puget Sound, respectively. Major waterways in the Marine RSA that overlap with the marine shipping lanes extending from the Westridge Marine Terminal through Burrard Inlet, south through the southern part of the Strait of Georgia, the Gulf Islands and Haro Strait, westward past Victoria and Juan de Fuca Strait out to the 12 nautical mile limit of Canada's territorial sea.
Human health	Includes the inbound and outbound marine shipping lanes, the area between the shipping lanes, where it exists, and a 5 km buffer extending from the outermost edge of each shipping lane. The shipping lanes extend from the Westridge Marine Terminal in Burnaby, through Burrard Inlet, south through the southern part of the Strait of Georgia, the Gulf Islands and Haro Strait, then westward past Victoria and through the Juan de Fuca Strait out to the 12 nautical mile limit of Canada's territorial sea. The LSA represents the predicted spatial extent of the chemical emissions from the Project-related marine vessel traffic to which people along the shipping lanes might be exposed.	A 150 km x 150 km area, generally centered on the marine shipping lanes, which extend from the Westridge Marine Terminal through Burrard Inlet, south through the southern part of the Strait of Georgia, the Gulf Islands and Haro Strait, westward past Victoria and the Juan de Fuca Strait out to the 12 nautical mile limit of Canada's territorial sea. The Marine Air Quality RSA was used for the purposes of assessing the cumulative health effects associated with the chemical emissions from the increased Project-related marine vessel traffic.

Appendix 12

Criteria, Ratings and Definitions Used in Evaluating the Likelihood of Significant Effects

Criteria	Rating	Definition
All criteria	Uncertain	When no other criteria rating descriptor is applicable due to either lack of information or inability to predict.
Temporal Extent	Short-term	An effect, either resulting from a single project interaction or from infrequent multiple ones, whose total duration is usually relatively short-term and limited to or less than the duration of construction, or one that usually recovers immediately after construction. An effect usually lasting in the order of weeks or months.
	Medium-term	An effect, either resulting from a single or infrequent project interaction or from multiple project interactions each of short duration and whose total duration may not be long-term but for which the resulting effect may last in the order of months or years.
	Long-term	An effect, either resulting from a single project interaction of long lasting effect; or from multiple project interactions each of short duration but whose total results in a long lasting effect; or from continuous interaction throughout the life of the project. An effect usually lasting in the order of years or decades.
Reversibility	Reversible	An effect expected to, at a minimum, return to baseline conditions within the life of the Project.
	Permanent	An effect that would persist beyond the life of the project, or last in the order of decades or generations. Some social or cultural effects that persist beyond a single generation may become permanent.
Geographic Extent	Project Footprint	Effect would be limited to the area directly disturbed by the Project facilities and associated physical works and activities, including the width of the right-of-way and temporary work space.
	Local Study Area	Effect would generally be limited to the area in relation to the Project where direct interaction with the biophysical and human environment could occur as a result of construction or operation activities. This area varies relative to the receptor being considered (e.g., 150 metres on either side of the pipeline centerline for Wetlands and Vegetation).
	Regional Study Area	Effect would be recognized in the area beyond the Local Study Area that might be affected on the landscape level. This area also varies relative to the receptor being considered (e.g., for vegetation, the Regional Study Area extends 1 kilometre on either side of the pipeline centreline).
Magnitude	Low	Effect is minimal, if any; restricted to a few individuals/species or only slightly affects the resource or parties involved; and would impact quality of life for some, but individuals commonly adapt or become habituated, and the effect is widely accepted by society.
	Moderate	Effect would impact many individuals/species or noticeably affect the resource or parties involved; is detectable but below environmental, regulatory or social standards or tolerance; and would impact quality of life but the effect is normally accepted by society.
	High	Effect would affect numerous individuals or affect the resource or parties involved in a substantial manner; is beyond environmental, regulatory or social standards or tolerance; and would impact quality of life, result in lasting stress and is generally not accepted by society.
Evaluation of Significance	Likely to be significant	Effects that are either: (1) of high magnitude; or (2) long-term, permanent, and of regional/global in extent.
	Not likely to be significant	Any adverse effect that does not meet the above criteria for "significant".

Appendix 13

Federally-listed wildlife species at risk potentially affected by the Project

Species listed under Schedule 1 of the *Species at Risk Act*	Status	Status of critical habitat under the Species at Risk Act				
		Final	Proposed	Candidate	Early draft	Not yet identified by ECCC
American badger (jeffersonii subspecies)	Endangered				✓	
Little brown myotis	Endangered					✓
Northern myotis	Endangered					✓
Townsend's mole	Endangered		✓			
Pacific water shrew	Endangered	✓				
Western screech-owl *(macfarlanei subspecies)*	Endangered				✓	
Spotted owl	Endangered					✓[97]
Burrowing owl	Endangered	✓ (none identified in Regional Study Area)				
Williamson's sapsucker	Endangered	✓				
Horned lark (strigata subspecies)	Endangered					✓
Vesper sparrow (affinis subspecies)	Endangered		✓ (none identified in Regional Study Area)			
Western painted turtle (Pacific coast population)	Endangered					✓
Oregon spotted frog	Endangered		✓[98]		✓	
Oregon forestsnail	Endangered		✓			
Woodland caribou (southern mountain population)	Threatened	✓				
Northern goshawk *(laingi subspecies)*	Threatened					✓

97 As proposed, the Project would cross the Sowaqua Spotted Owl Wildlife Habitat Area (Long-term Owl Habitat Area).

98 Proposed recovery strategy exists however, at the time of this report, Environment and Climate Change Canada had identified two new sites as early draft critical habitat.

Species listed under Schedule 1 of the *Species at Risk Act*	Status	Status of critical habitat under the *Species at Risk Act*				
		Final	Proposed	Candidate	Early draft	Not yet identified by ECCC
Ferruginous hawk	Threatened					✓
Red knot (roselaari subspecies)	Threatened					✓
Common nighthawk	Threatened					✓
Lewis's woodpecker	Threatened			✓		
Olive-sided flycatcher	Threatened					✓
Loggerhead shrike (prairie population)	Threatened	✓ (none identified in Regional Study Area)				
Sprague's pipit	Threatened	✓ (none identified in Regional Study Area)				
Canada warbler	Threatened					✓
Western rattlesnake	Threatened				✓	
Great basin gophersnake *(deserticola subspecies)*	Threatened				✓	
Coastal giant salamander	Threatened				✓	
Great basin spadefoot	Threatened				✓	
Dun skipper	Threatened					✓
Mountain beaver *(rufa subspecies)*	Special concern					✓
Spotted bat	Special concern					✓
Great blue heron *(fannini subspecies)*	Special concern					✓
Peregrine falcon *(anatum subspecies)*	Special concern					✓
Yellow rail	Special concern					✓
Long-billed curlew	Special concern					✓
Band-tailed pigeon	Special concern					✓
Barn owl (western population)	Special concern			✓		
Flammulated owl	Special concern					✓
Western screech owl *(kennicottii subspecies)*	Special concern				✓	
Short-eared owl	Special concern					✓
Rusty blackbird	Special concern					✓
Western painted turtle (Intermountain – Rocky Mountain population)	Special concern					✓

Species listed under Schedule 1 of the *Species at Risk Act*	Status	Status of critical habitat under the *Species at Risk Act*				
		Final	Proposed	Candidate	Early draft	Not yet identified by ECCC
Western yellow-bellied racer	Special concern					✓
Northern rubber boa	Special concern					✓
Western toad	Special concern					✓
Coastal tailed frog	Special concern					✓
Northern red-legged frog	Special concern					✓
Monarch	Special concern					✓









