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National Energy Board
Trans Mountain Expansion Project Reconsideration

DIRECT EVIDENCE
OF THE INTERVENOR GEORGIA STRAIT ALLIANCE

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1. Executive Summary

This report is the direct evidence of the Georgia Strait Alliance in the National Energy Board's reconsideration proceeding regarding the Trans Mountain Expansion Project. The purpose of this report is to provide information on developments in the marine oil spill response regime since the May 2016 NEB report that are applicable to Project-related marine shipping; and to assess whether these developments constitute a world-class marine spill response regime that provides capacity that is sufficient and effective for the environmental conditions in the Project marine area and the type of product (diluted bitumen) being shipped.

Methodology

To conduct this assessment, we:

- Assessed progress made under the Oceans Protection Plan, together with response capacity enhancements funded by Trans Mountain, against 38 features of a world-class spill response system identified in the 2013 report *West Coast Spill Response Study, Volume 3: World-Class Spill Prevention, Preparedness, Response & Recovery System*, prepared by Nuka Research.
- Compared operational limits of containment boom to observed wind and wave conditions and current predictions in the Project marine area.
- Reviewed the federal government's 2018 *Status Report on the Knowledge of the Fate and Behaviour of Diluted Bitumen in the Aquatic Ecosystems* and assessed the report's claim that "no new response countermeasures are specifically required to address diluted bitumen."

Findings

Our review of commitments made under the Oceans Protection Plan, together with response capacity enhancements funded by Trans Mountain, identifies many significant remaining deficiencies relative to the world-class standards identified in the 2013 Nuka report. The most significant deficiencies include:

- The planned 20,000 tonnes of enhanced WCMRC response capacity is not sufficient to respond effectively to a true worst-case spill.
- Lack of assessment or prescription of the amount or type of response capacity (equipment, personnel) required for an effective response.
- Lack of assessment of response limitations due to environmental conditions.
- No plans to ensure that contingency plans of all levels and held by all agencies are made available in the public domain; or to clarify how government audits industry plans.
- No mechanism to formally involve a range of communities, stakeholders and members of the public in spill planning and preparedness.

- Reliance on public rather than industry funding to fully implement planning, response and recovery.

These deficiencies lead us to conclude that proposed WMCRC enhancements (vessels, personnel, equipment) do not provide sufficient capacity to respond to a true worst-case spill, and that the spill response regime applicable to the Project marine area does not meet world-class standards.

We compared containment boom failure limits derived from oil spill response literature against wind and wave observations and surface current predictions along the Project tanker route. We found that routine coastal conditions frequently exceed the operating limits of the equipment currently in WCMRC's inventory. For example:

- In 2017 at Neah Bay, at the mouth of the Strait of Juan de Fuca, there were 337 days where wind speed and wave height combined would cause response to be impaired for at least two hours of the day. Response would have been impossible on 198 days.
- Currents at full ebb and flood tide at Race Passage (near Victoria) routinely breach the maximum operating limits of WCMRC's booms. Kepner boom is breached 70% of the time. Even the most robust booms fail frequently: Current Buster 4 fails 19% of the time, and Ro-Boom 2000 39%.

Our results led us to conclude that containment boom, as the most fundamental equipment unit of mechanical oil recovery, does not allow for an effective response for the environmental conditions that occur regularly at points along the Project tanker route.

The federal government's justification for approving TMX depends significantly on its claims that bitumen is likely to float for up to three to four weeks when spilled in the ocean, and that existing spill response techniques are sufficient to effectively clean up a dilbit spill. However, the research summarized in the 2018 status report relies almost exclusively on laboratory experiments that cannot adequately reflect real world conditions in the Salish Sea. The status report itself glosses over findings that suggest that dilbit may sink in the ocean under certain conditions, and that spill countermeasures may not work in the same way for dilbit as for conventional crude.

Conclusion

Changes proposed under the OPP, together with Trans Mountain funded enhancements to WCMRC's capacity, represent welcome progress from the current state of marine spill response planning, preparedness and response on the West Coast. However, they do not constitute a world-class system, they are not sufficient to respond to a worst-case spill, and they rely on equipment that fails in environmental conditions that frequently occur along the Project tanker route. The federal government's own science identifies too many remaining questions about the

fate and behaviour of diluted bitumen to conclude that existing spill countermeasures can be relied upon to successfully recover spilled dilbit.

As a result, we conclude that changes to the marine spill prevention, preparedness and response regime since the 2016 NEB cannot be relied upon by the Board to determine that the adverse impacts of the Project are justified in the circumstances.

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2. Introduction

2.1 Purpose and approach

The purpose of this report is to provide information on developments in the marine oil spill response regime since the May 2016 NEB report that are applicable to Project-related marine shipping between Westridge Marine Terminal and the 12 Nautical Mile territorial sea limit; and to assess whether these developments constitute a world-class marine spill response regime that provides adequate capacity to effectively respond to a spill of diluted bitumen.

The research was guided by the following questions:

1. Do commitments made under the Oceans Protection Plan, together with response capacity enhancements funded by Trans Mountain, constitute a world-class marine spill response regime?
2. Is spill response equipment effective for the environmental conditions in the Project marine area and the type of product being shipped?

To answer these questions, we provide a short background on the marine oil spill regime applicable to Project-related shipping in Section 3.

In Section 4, we assess the progress made under the Oceans Protection Plan, together with response capacity enhancements funded by Trans Mountain, against 38 features of a world-class spill response system identified in the 2013 report *West Coast Spill Response Study, Volume 3: World-Class Spill Prevention, Preparedness, Response & Recovery System, prepared by Nuka Research.*[1]

In Section 5, we compare the operational limits of containment boom to observed wind and wave conditions and current predictions in the Project marine area.

In Section 6, we review the federal government's 2018 *Status Report on the Knowledge of the Fate and Behaviour of Diluted Bitumen in the Aquatic Ecosystems* and assess the report's claim that "no new response countermeasures are specifically required to address diluted bitumen."[2]

2.2 About Georgia Strait Alliance

[1] Nuka Research and Planning, 2013, WEST COAST SPILL RESPONSE STUDY, VOLUME 3: World-Class Spill Prevention, Preparedness, Response & Recovery System
[2] Fisheries and Oceans Canada, 2018, STATUS REPORT ON THE KNOWLEDGE OF THE FATE AND BEHAVIOUR OF DILUTED BITUMEN IN THE AQUATIC ECOSYSTEMS

Georgia Strait Alliance (GSA) is a registered charity established in 1990. GSA is the only organization focused on protecting and restoring the marine environment and promoting the sustainability of the Georgia Strait, its adjoining waters and communities. GSA is committed to a future for the region that includes clean water and air, healthy wild salmon runs, rich marine life and natural areas, and sustainable communities. GSA has developed deep expertise on the marine environment of the Georgia Strait, with a particular focus on species at risk and their habitat, and on oil spill response policy and impacts.

GSA's primary interest in the Project is the Project's potential impacts on the marine environment and communities of the Georgia Strait. GSA is concerned about the Project's cumulative impacts from day to day operations, as well as the impacts of a Project-related spill, accident or malfunction. GSA is particularly alarmed that Project-related marine shipping would have a significant adverse effect on the endangered southern resident killer whale population.

GSA has 1,427 members and over 18,000 supporters, based primarily in communities along the Georgia Strait. Many of GSA's members live and/or own property adjacent to the proposed tanker routes for the Project, including Burrard Inlet, the Gulf Islands and the south coast of Vancouver Island. GSA is supported by 42 businesses and associations that rely on the health of the Georgia Strait. These businesses include marinas, tour operators, guiding companies, and restaurant and hotel owners, among others. They would be seriously affected by a Project-related oil spill.

2.3 GSA's intervention in the Board's review of the Trans Mountain Expansion Project

GSA participated fully as an intervenor in the National Energy Board's review of the Trans Mountain Expansion Project, and in the Ministerial Panel process which followed. GSA's key arguments[3] were, and remain, as follows:

- The Project is not in the public interest under the NEB Act, and it should not be approved.
- Under CEAA 2012, the Project would have significant adverse environmental effects on the endangered southern resident killer whale population, and these effects cannot be justified in the circumstances.
- The Project would inevitably cause serious harm to BC's marine environment and coastal communities that is not outweighed by any potential benefits.
- A major oil spill resulting from Project-related shipping would devastate the marine environment, coastal communities, the regional economy and BC's international image for decades to come. The risks and impacts of a Project-related marine oil spill are unacceptable.

[3]Georgia Strait Alliance, 2016, Written Argument-in-Chief of the Intervenor Georgia Strait Alliance

- The West Coast marine oil spill response regime does not have sufficient capacity to respond adequately to a major spill of Project-related diluted bitumen. Furthermore, an effective response to any spill would be all but impossible during the adverse weather and sea conditions that occur frequently within the Project marine area.
- Construction of the proposed Project would 'lock in' transportation infrastructure for diluted bitumen and other carbon intensive fossil fuels. This would impede action to reduce greenhouse gas emissions from the extraction, transportation and combustion of fossil fuels. Approval of the Project would run counter to Canada's commitment to make the transition to a low-carbon economy that is necessary for our collective health, security, and prosperity.

In the Board's original proceeding, GSA filed expert evidence[4] outlining the deficit of local community involvement in oil spill planning and response in the Project marine area. This evidence demonstrated that local governments have crucial responsibilities and resources for preparing for, and responding to, a Project-related marine oil spill. However, the evidence was that local governments in the area are generally unprepared and unable to participate effectively in marine oil spill preparation and response activities due to weak engagement and a lack of transparency on the part of the Proponent and senior spill response partners such as WCMRC, the Coast Guard and Transport Canada.

In the original proceeding, GSA also filed the results of a web-based survey of the views of its members and supporters. The Board cited this evidence in its May 2016 Report, as follows:

> "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…. 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."[5]

[4]Copas, Jason; Waugh, Matthew; Graham, Scott; on behalf of GSA, 2015 "AN ASSESSMENT OF COASTAL LOCAL GOVERNMENT MARINE OIL SPILL PREPAREDNESS AND RESPONSE CAPABILITY IN THE GEORGIA STRAIT REGION"

[5] National Energy Board Report, Trans Mountain Expansion Project, May 2016. Emphasis added.

3. Background on the marine oil spill regime applicable to Project-related marine shipping

Canada's marine oil spill preparedness and response regime is regulated by Transport Canada, based on the 'polluter pays' principle. Oil-handling facilities and operators of vessels above a certain size are required to pay a regional Response Organization to provide spill response services. In the Project area, this is the Western Canada Marine Response Corporation (WCMRC). WCMRC maintains plans, staff and equipment to respond to marine spills, according to standards required by Transport Canada. The Canadian Coast Guard is responsible for overseeing industry's response to marine spills. When a spill happens and the source of the spill is identified, the Coast Guard advises the polluter of their responsibilities regarding oil spill response. If the polluter is willing and able to respond, the Coast Guard monitors the polluter's response, which typically involves the polluter activating their contract with WCMRC. If the source of the spill is unknown, or if the polluter's response is deemed inappropriate, the Coast Guard manages the response itself.

This regime was put in place following the *Exxon Valdez* and other high-profile oil spills during the 1980s. The basic tools and tactics available to attempt to respond to a spill have changed little in the intervening years: booms to contain the oil; skimmers and absorbent pads to remove it from the water; chemical dispersants to break it down; and fire to burn it off. Nor have the dismal clean-up rates improved: 10-15% is the current global average recovery of oil spilled on water.[6]

Decades of regulatory stasis and under-investment led to a crisis in spill response on BC's West Coast. In recent years, federal and provincial agencies repeatedly warned of the significant lack of preparedness for a major spill, and called for improvements in the regime.[7] As the Trans Mountain and other projects presented the prospect of increased tanker traffic and spill risk, public concern about inadequate oil spill preparedness grew dramatically. Contemplating these projects and long-overdue changes to the spill response regime, federal and provincial governments adopted the goal of 'world-class' or 'world-leading' spill response.[8]

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[6] ITOPF, accessed Nov 2018, Containment & Recovery

[7] Office of the Auditor General of Canada, 2010, Fall Report of the Commissioner of the Environment and Sustainable Development; Tanker Panel Safety Secretariat, Transport Canada, 2013, A REVIEW OF CANADA'S SHIP-SOURCE OIL SPILL PREPAREDNESS AND RESPONSE REGIME: Setting the Course for the Future; The Standing Senate Committee on Energy, the Environment and Natural Resources, 2013, Moving Energy Safely: A Study of the Safe Transport of Hydrocarbons by Pipelines, Tankers and Railcars in Canada

[8] For example, in 2012 the provincial government set out a requirement of "world-leading marine oil spill response, prevention and recovery systems" as one of its five conditions for the consideration of heavy oil pipelines. In 2014, the federal government announced a suite of measures intended to "achieve a world-class tanker safety system in Canada."

These concerns were brought to life by two real-world spills that occurred on the West Coast in the year leading up to the project's initial approval: the *Marathassa* fuel spill in English Bay in April 2015, and the sinking of the *Nathan E. Stewart* near Bella Bella in October 2016. These incidents were characterized by slow response and notification times, equipment failure, confusion over jurisdiction and command structure, poor communication with local communities, a balance of power overly weighted to the spiller and its contractors; and a host of other challenges.[9]

Finally, associated with its approval of the Trans Mountain project, the federal government announced the Oceans Protection Plan (OPP). The federal government takes the position that OPP initiatives apply to the Project's marine shipping components.[10] The federal government states that "the national Oceans Protection Plan will help Canada achieve a world-leading marine safety system for our country's unique context that will increase the Government of Canada's capacity to prevent and improve response to marine pollution incidents.[11] In addition, conditional upon the Project proceeding, Trans Mountain is funding a series of upgrades to WCMRC's spill response capacity.

Government and industry have billed these investments as the change that is needed to plug the gaps in the spill response regime, and protect the West Coast from the risk of a spill along the tanker route through the Salish Sea. For example, in August 2018, Prime Minister Trudeau said that he had faith in his government's ocean protection and emergency preparedness plans. He stated: "It's precisely because of these stringent measures that we can stand behind our approval of the Trans Mountain pipeline expansion with confidence. This project will be safe, jobs will be created and this pipeline will be built."[12]

What is the Oceans Protection Plan? What exactly has been committed to, and what has changed on the ground to date? Has the OPP led to a "world-leading marine safety system," and is that system adequate to respond effectively to a potential spill from Project-related shipping?

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[9] Nuka Research and Planning, 2015, English Bay Oil Spill Debrief and Tanker Scenario Planning Workshop; Canadian Coast Guard, 2015, Independent Review of the M/V Marathassa Fuel Oil Spill Environmental Response Operation; Heiltsuk Nation, 2017, Investigation Summary

[10] Environment and Climate Change Canada, Fisheries and Oceans Canada and Canadian Coast Guard, Health Canada, Natural Resources Canada, Parks Canada Agency, Transport Canada, 2018, DIRECT EVIDENCE AND INFORMATION REQUESTED BY THE NATIONAL ENERGY BOARD

[11] Justin Trudeau, Prime Minister of Canada, 2016, Canada's Ocean Protection Plan: A world-leading marine safety system that protects Canada's coasts

[12] CTV News, https://vancouverisland.ctvnews.ca/trudeau-defends-trans-mountain-pipeline-approval-at-coast-guard-base-in-victoria-1.3871719

4. Assessing developments in marine spill preparedness and response since the May 2016 NEB Report

In this section, we address whether commitments made under the Oceans Protection Plan, together with response capacity increases funded by Trans Mountain, constitute a world-class marine spill response regime.

4.1 Overview of the Oceans Protection Plan

In November 2016, the month leading up to Cabinet's erstwhile approval of the TMX Project, Prime Minister Trudeau announced the 5-year, $1.5 billion Oceans Protection Plan (OPP). The multi-department federal OPP has four priority areas:

1. Improving marine safety and responsible shipping, including new prevention, planning and response measures,
2. Protecting Canada's marine environment,
3. Strengthening partnerships with Indigenous communities, and
4. Investing in science for evidence-based decision-making.

The government has rolled 50 initiatives into the OPP, including some that were underway before the OPP was launched. Section 4 of this report focuses on the first OPP priority area. Section 5 focuses on diluted bitumen, which is encompassed within the fourth OPP priority area.

4.2 Approach to assessment

In 2013, the BC government commissioned Nuka Research to conduct a major report, titled *West Coast Spill Response Study, Volume 3: World-Class Spill Prevention, Preparedness, Response & Recovery System* (the 2013 Nuka report).[13] This report identified the key features of a world-class spill response system (see Table 1.1), and provided tangible examples of best practices from other jurisdictions around the world. The report did an in-depth analysis of the state of the West Coast spill preparedness and response regime and found that, as of 2013, only one of 38 measures of these key features was present, with the rest either absent or requiring enhancements.

[13] Nuka, 2013

Table 1. Elements of a world-class marine spill prevention and response system, adapted from Nuka 2013

PREVENTION ELEMENTS
1. Vessel operations surpass international safety and spill prevention standards
2. Vessel traffic is monitored and, in higher-risk areas, actively managed to prevent accidents
3. Rescue and salvage resources can be on-scene quickly enough to be effective after an incident or spill
PREPAREDNESS AND RESPONSE ELEMENTS
4. Geographic areas are prioritized for protection from oil spills
5. Contingency planning is comprehensive, integrated, and well understood by all relevant parties
6. Sufficient equipment can be deployed quickly to respond to a worst-case spill
7. Sufficient personnel are available to respond to a worst-case spill
8. A process is in place to restore damaged resources and to promote ecosystem recovery after a spill
SYSTEM ELEMENTS
9. Government ensures compliance and transparency
10. All parties actively pursue continuous improvement through research and development and the testing of planning assumptions
11. Financial mechanisms and resources meet needs from initiating the response through recovery

The 2013 Nuka report provides a benchmark against which the existing, and proposed, oil spill regime on the West Coast can be assessed. In this section, we use the framework set out in the 2013 Nuka report to assess developments in the spill preparedness and response regime since the 2016 NEB report, paying particular attention to initiatives announced under the OPP. We briefly summarize developments under the prevention and system categories in the Nuka report, and we examine most closely the preparedness and response category.

The OPP is a complex, multi-departmental and rapidly changing initiative. The assessment that follows is based on information available in the public domain, generally as of October 31, 2018. [14] Key documents relied upon include the November 2018 Report to Canadians on the OPP

[14] Due to time constraints, we have not reviewed in detail the evidence filed by federal agencies and Trans Mountain on October 31, 2018.

website[15], presentations[16] and the summary report[17] from the OPP Pacific Dialogue Forum held in March 2018, and Transport Canada's OPP Initiatives Map.[18] To supplement these high level documents we conducted a review of federal government media releases mentioning the OPP, keyword web searches, and keyword searches of regulatory filings from the first NEB review and the reconsideration proceedings. There is no shortage of marketing material and high level public portals being created for the OPP. However, it is difficult to find comprehensive, detailed, publicly available information about the specifics and status of the many OPP initiatives. It is possible that work is taking place under the OPP initiatives that we are unaware of; however, if so it is happening in an opaque manner that cannot be assessed by public interest stakeholders.

In the assessment that follows, we identify the 38 world-class features from the 2013 Nuka report and discuss any progress toward each in light of OPP commitments. With respect to response capacity (equipment and personnel) we also consider TMX funded enhancements. At the end of each section (Prevention; Preparedness & Response; and System) we identify key deficiencies from world-class standards that remain in the spill response regime applicable to Project-related marine traffic.

4.3 World-class prevention elements

4.3.1 "Vessel operations surpass international safety and spill prevention standards"

World-class features
Vessels meet or surpass international requirements; Vessels operate in a corporate safety culture that goes beyond compliance

Vague references have been made to increasing vessel inspections under the OPP,[19] but no details are publicly available. Other world-class features in this category, such as strengthening Port State Control and vessel operator incentive/recognition programs, do not appear to be addressed by OPP initiatives.

[15] Transport Canada, 2018, Report to Canadians: Investing in our coasts through the Oceans Protection Plan
[16] Oceans Protection Plan Pacific, 2018, Spring 2018 OPP South Coast Dialogue Forum Materials
[17] Chiarelli, Lynn, and Dale, Jacquie, 2018, OCEANS PROTECTION PLAN PACIFIC REGION DIALOGUE FORUMS
[18] Transport Canada, accessed Nov 2018, Oceans Protection Plan initiatives map
[19] Government of Canada, 2018, Oceans Protection Plan Pacific Dialogue Forum Overview

4.3.2 “Vessel traffic is monitored and, in higher risk areas, actively managed to prevent accidents”

World-class features
Vessel movement data is compiled and archived for analysis; Vessel traffic is actively managed in high-risk areas; Marine pilots are required for large vessels transiting certain waterways; Escort vessels accompany certain vessels in high-risk operating areas

Consultation on a proactive vessel management framework is underway, and has potential to reduce risk through measures such as speed restrictions, changes to shipping routes and lanes, and creation of areas to be avoided. However, it is too early to determine the extent to which this framework will reduce accidents and impacts associated with shipping. The proposed principle of directly involving Indigenous and community groups in decision-making is laudable. However, other proposed principles directly support business as usual, such as:

- Traffic management measures will not unduly impede legitimate shipping movements.
- Decisions will consider the national interest and economic drivers as well as safety, environmental and cultural interests.[20]

These latter two principles could justify industry-driven trade-offs and constraints that could undermine stronger proactive management of vessel traffic.

The review of the *Pilotage Authority Act* taking place under the OPP does have potential to address long-standing gaps in the pilotage regime. These gaps were starkly demonstrated recently by the *Nathan E Stewart* spill, in which the tug was operating under a waiver from the Pacific Pilotage Authority. The incident occured in a major traditional and commercial marine harvesting area relied on by Heiltsuk Nation. The Heiltsuk Nation reports that post-incident investigations exposed inadequate safety practices and negligent conduct on board the tug, in the context of an under-regulated operational environment permitted by the pilotage authority.[21] Some recommendations from the Chair of the PPA review offer potential, such as bringing in stiffer penalties and giving the federal government stronger regulatory and oversight powers.[22] The extent to which these recommendations are adopted remains to be seen, and measures of improvement - such as whether compulsory pilotage areas are extended to protect sensitive areas, and whether enough qualified pilots are available to meet the demands of future traffic levels - can only be assessed following implementation.

[20] Government of Canada, 2018, Proactive Vessel Management Presentation
[21] Heiltsuk Nation, 2018, Submissions on the *Pilotage Act*
[22] Transport Canada, 2018, Pilotage Act Review

Promised OPP upgrades to maritime awareness information and marine traffic systems, new weather buoys, and additional charting of priority marine areas are welcome,[23] as they would provide data to improve navigational safety and to use during an emergency response. However, the OPP does not address key features such as public availability of data on vessel movement, spill causality and accident/near-miss reports.
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4.3.3 "Rescue and salvage resources can be on-scene quickly enough to be effective after an incident or spill"

World-class features
Emergency towing resources are available for rapid deployment; Marine firefighting resources are available for rapid deployment; Salvage resources are available for deployment as needed to be effective; Potential places of refuge are identified in advance

Long overdue increases to emergency towing capacity are taking place under the OPP. The Canadian Coast Guard has leased two new towing vessels to assist large ships in distress. These are intended to be in operation by late 2018. One of the Canadian towing vessels will be stationed on the south coast. Coast Guard also plans to install tow kits on all major Coast Guard vessels, including five on the West Coast.[24]

A pilot project to determine places of refuge (sheltered areas where ships in distress can attempt to stabilize their condition) in Haida Gwaii took place before the launch of the OPP. The government plans to extend this initiative to other regions of BC's West Coast.

However, the OPP is silent on two other world-class features: marine firefighting, and salvage resources.

Prevention summary: Key deficiencies relative to world-class standards

- No plans to strengthen marine firefighting and salvage resources.
- No plans to review the national escort vessel regime.
- The potential offered by proactive vessel management and changes to the *Pilotage Authority Act* is vulnerable to efforts to preserve business as usual.

[23] Transport Canada, 2018, news release
[24] Ibid.

4.4 World-class preparedness and response elements

4.4.1 "Geographic areas are prioritized for protection from oil spills"

World-class features
Marine and coastal resources are inventoried; A process is in place to prioritize areas for spill protection; Areas to be avoided are established as appropriate; Geographic response plans are developed as appropriate

The OPP's Coastal Environmental Baseline Program intends to collect data on marine ecosystems in the geographical areas under the jurisdiction of the Port of Vancouver and Port of Prince Rupert,[25] and there is environmental sensitivity data being gathered as part of a Regional Response Planning pilot project for the North Coast.[26] However, it is unclear if or how other data gaps and other geographical areas will be addressed.

In 2014, Transport Canada and the Coast Guard embarked on an Area Response Planning pilot project, which included developing an Area Risk Assessment methodology. The concept of assessing risks and creating response plans that are locally-specific rather than 'one-size-fits-all' is long-overdue on BC's coast. This is a central feature of a world-class spill response system. However, the Area Risk Assessment (ARA) development process was beset with a number of significant challenges. The official Transport Canada report on lessons learned from the pilot project included the following observations:[27]

- The ARA methodology was developed by an external contractor, and there were limited opportunities for stakeholders and community-based input and review.
- The methodology focused on high-probability events.
- Due to contract limitations, only one year of historical data for vessel types and cargo was used as an input for the ARA, which meant that the outputs were not representative of historical trends.
- Due to timeline pressure, much of the data submitted was at the wrong scale and did not include seasonal information and could not be easily included in the ARA.

Georgia Strait Alliance participated in the ARP process and experienced a number of these challenges first-hand. GSA and numerous other stakeholders were very concerned that the methodology failed to adequately consider low-probability/high consequence events. The

[25]Fisheries and Oceans Canada, accessed Nov 2018, Coastal Environmental Baseline Program
[26] Government of Canada, 2018, Regional Response Planning presentation
[27] Transport Canada and Canadian Coast Guard, 2018, Lessons learned report for the Area Response Planning

methodology selected only high-probability events to model. Without addressing low-probability/high consequence events, the move to risk-based planning and resource allocation will be hamstrung from the start. This will continue to leave the West Coast without adequate plans or resources to respond to a catastrophic-scale oil spill.

4.4.2 “Contingency planning is comprehensive, integrated, and understood by all relevant parties”

In this section we assess each world-class feature individually.

4.4.2.1 World-class feature: Planning is integrated across jurisdictions and sectors

Currently on the West Coast, planning for spills is split among different spill response partners. The Coast Guard maintains a broad-scope national plan with regional chapters (one for the West Coast), while the tactical plans that detail equipment, personnel, response strategies, etc. are held by WCMRC. Other federal departments, and other levels of government, also maintain plans which reference response to marine oil spills.

In practice, official reviews of the spills regime and incident reports have flagged conflict and confusion between jurisdictions involved in responding to marine spills on the West Coast. Better integration of planning and operations across jurisdictions and agencies is needed.

Unfortunately, the major overhauls to spill planning embarked upon by the federal and provincial government in recent years - including the Area Response Planning process that was intended to address some of these challenges by developing area specific plans - have taken place largely in isolation from one another. The federal and provincial processes provided no apparent mechanisms for coordination, beyond both levels of government inviting one another to participate in their respective consultation process.[28] The result is a missed opportunity to correct the fragmentation of the planning process by, for example, harmonizing planning boundaries, clarifying roles and responsibilities, and building a shared ‘concept of operations.’

The Area Response Planning pilot project exposed challenges in regards to integration, stakeholder and community involvement, and response planning scope. These are recognized in Transport Canada’s review of lessons learned.[29] The lessons learned document contains excellent recommendations to inform the next phase, which is a pilot Regional Response Plan (RRP) to be developed under OPP for the North Coast of BC. A South Coast RPP is intended to be developed in the future, which would presumably cover the project marine area. Initial high

[28] Nuka Research, 2016, Integrated Area Response Planning in BC Best Practices for Engaging Communities and Harmonizing Oil and Hazardous Materials Spill Planning and Response
[29] TC and CCG, 2018

level documents outlining plans for the pilot project suggest that many of these lessons learned are being considered. However, it is far too early to assess whether they will be implemented, and if so, how well, either on the North Coast or in the other regions which will eventually follow. It is also unclear if and how the federal and provincial governments intend to tackle harmonization of planning outside the RRP areas.

4.4.2.2 World-class features: Contingency plans address all major spill response functions; Operational tactics are defined

The Coast Guard and WCMRC both maintain contingency plans specific to the West Coast, as well as sub-regional geographically specific response plans. These plans house the critical tactical details that will guide response to a spill. However, none of these plans are available in the public domain, nor were they made available upon request.[30] As a result, neither researchers nor the public can assess the adequacy of the strategies, resources, and data that will be relied upon in the event of a spill. The OPP contains no commitments to address this fundamental failure of transparency (see section 4.5.1 for more on this critical deficiency).

4.4.2.3 World-class feature: Response planning standards ensure sufficient response capacity to respond to a worst-case spill

Currently, the maximum spill size that WCMRC is required by Transport Canada to have the capability to respond to is 10,000 tonnes.[31] This is a tenth of the maximum capacity of the class of tankers that would travel the tanker route to and from Westridge Marine terminal, and a quarter of the volume spilled by the *Exxon Valdez*. Required response times range from 6 hours after notification of a spill within a designated port, to 72 hours plus travel time outside of WCMRC's core response area.[32] If the TMX project proceeds, Trans Mountain will be required to fund enhancements to allow WCMRC to deliver 20,000 tonnes of response capacity within 36 hours for large spills.[33]

A fully-loaded Aframax tanker carries 120,000 tonnes of oil; Project-related tankers are expected to operate at 80% capacity, or 96,000 tonnes.[34] However, Trans Mountain's estimate of a worst-case spill is only 16,000 tonnes, or 17% of a tanker's total cargo. This is based on an

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[30] Researchers working on behalf of the province of BC, local governments, and NGOs have all requested copies of the WCMRC contingency plan, without success. WCMRC's coastal mapping program, outlining site-specific geographic response strategies, represents only part of the picture. The information contained on the public website is not the same as the operational plans that will be used by responders. We are aware that the Coast Guard's Western Region plan is under review, however the current plan that remains in force until the updated plan is completed is also not available in the public domain, and was not made available in response to a request we made in the course of preparing this evidence.
[31] WCMRC has voluntarily acquired resources that allow it to respond to higher volumes. WCMRC, 2015, MARINE SPILL RESPONSE ON THE WEST COAST
[32] Transport Canada, 1995, RESPONSE ORGANIZATIONS STANDARDS
[33] National Energy Board, 2018, TRANS MOUNTAIN DIRECT EVIDENCE
[34] Trans Mountain, 2015, 3 Things You Need To Know About Tankers

assumption that an accident would not cause more than two of the self-contained cargo tanks to suffer a complete loss of oil. Trans Mountain's 'credible worst case spill' is much smaller than the approach used in neighbouring jurisdictions. In Alaska, oil spill contingency plans submitted by operators of vessels of the same size would be required to plan for worst case scenario spill volumes of 47,000 tonnes. In the State of Washington, responders must plan for a spill of the entire 120,000 tonne maximum cargo of an Aframax vessel, plus bunker fuels, under adverse weather conditions.[35]

A Nuka Research study modelled projected oil recovery rates (recovered oil as a percentage of spilled oil) including the WCMRC enhancements that would allow for a 20,000 tonne response capacity. The study estimated that recovery rates would range from 16% to 43%. The study predicted that on-water remaining spill volumes would range from 36% to 63%.[36] This is further discussed with respect to equipment enhancements in section 4.4.3.

We suggest that neither the current Canada-wide 10,000 tonne requirement, nor the enhanced 20,000 WCMRC capacity, is sufficient. At minimum, responders should plan for a worst-case scenario defined as loss of the entire cargo, plus fuel, in adverse weather conditions. To be truly world-class, the government should mandate a minimum threshold for removing spilled oil from the environment of 80%.[37] The clean-up standard should make clear that spilled petroleum products must be removed from the environment. This means directly accounting for recovery and removal, factoring in the best independent estimates regarding evaporation and biodegradation. This standard must apply to the environment as a whole, meaning that stranded or sunken oil would be characterized as a failure of clean up. If shippers are unable to meet this standard in all seasons, locations and weather conditions, transits should be limited to conditions in which they are able to operate safely.

4.4.2.4 World-class feature: Response operating limitations are identified and mitigation measures established

A 'response gap analysis' identifies how often ships are moving through areas where an effective response could not occur due to environmental conditions. The response gap is defined as the estimated percentage of vessel-movement time during which on-water oil spill recovery operations would be impeded or completely shut down because of weather or environmental conditions. A Nuka Research study concluded that the response gap in the project marine area ranges from 34% for a summer spill in the Vancouver's Central Harbour to 78% for a winter spill in open water at the entrance to the Strait Of Juan de Fuca. This is a conservative estimate, in that the analysis does not consider the full range of factors that could

[35] DeCola, Elise of Nuka Planning and Research, for Tsleil-Waututh Nation, 2016, Evaluation of the National Energy Board's Trans Mountain Expansion Project Report in relation to Oil Spill Planning and Response

[36] Nuka, 2015. The percentages do not add up to 100% because the remaining balance of oil is estimated to have evaporated, see p. 49 % 61.

[37] See here for a fuller discussion of Georgia Strait Alliance's proposal for an 80% oil recovery threshold.

impair response, such as currents, fog, precipitation, extreme temperatures, or other factors. [38] We consider the impacts of currents, along with wind and wave conditions, on spill response equipment in Section 5.

The federal government has not conducted such a response gap analysis for the busy south coast shipping routes, and has announced no plans to do so under the OPP. This is a major omission. World-class regimes acknowledge that response limitations exist in planning, and identify mitigation measures or alternatives that will be employed when those limits are exceeded.

4.4.3 "Sufficient equipment can be deployed quickly to respond to a worst-case spill"

World-class features
Response inventories are up-to-date, accessible and accurate, and resources are tracked during a response; Response caches are strategically located, stocked, and maintained; Equipment is the best available for the operating environments, environmental conditions, and potential spilled substances; Logistical support is in place to support the response; Spills can be detected, tracked, and modeled as needed to perform the response

Insufficient resources to respond to a spill and inadequate geographic placement of resources have been repeatedly identified as a leading cause of the lack of spill preparedness on the West Coast. A recent study conducted by Nuka Research submitted as evidence during the first review of the TMX project found that existing response forces (vessels, equipment, personnel) available in southern BC have the capacity to recover only 10-20% of a worst case oil spill under favourable conditions.[39]

In its TMX project application, Trans Mountain committed to fund enhanced WCMRC response capacity, through tolling fees charged to TMX shippers. The upgrades include eight new response bases, 120 new employees and 43 new vessels, as well as additional spill response equipment. To date, 21 staff have been hired, eight new vessels have been delivered, and leases have been signed on four new bases.[40]

Under the OPP, the Coast Guard is also increasing its spill response capacity. Upgrades introduced to date include:

- one new emergency response vessel, in Vancouver,[41]

[38] Nuka, 2015
[39] DeCola, 2016
[40] NEB, 2018
[41] Fisheries and Oceans Canada, 2017, news release

- one new search and rescue station, in Victoria (of 3 more planned in BC, in Port Renfrew, Tahsis and Hartley Bay),[42] and
- new environmental response equipment including curtain boom and portable skimmers, in Victoria and Richmond.[43]

The following upgrades are also planned:

- 3 new search and rescue lifeboats (Victoria, Prince Rupert, Port Hardy),[44] and
- new equipment and infrastructure to 20 Coast Guard locations in BC. (No further details on the type or quantity of equipment are currently available.[45])

Currently, the regulations governing Response Organizations such as WCMRC are broad rather than prescriptive, and do not set out the amount and type of resources that WCMRC must maintain.[46] In terms of environmental conditions, the regulations are limited to requiring that equipment must be able to operate in Beaufort Force 4 conditions. However, the ability to operate in other response contexts, such as fast currents or sub-surface recovery, is not specified.

There are also no prescriptions in the National Marine Spills Contingency Plan[47] or the Coast Guard's Levels of Service[48] document as to the type or amount of equipment the agency must maintain.

In addition, there is no central database of the kind maintained by Washington State[49] that shows the total equipment inventory available, including both Coast Guard and WCMRC assets, so as to facilitate the most efficient deployment during a response.

Therefore, while the Canadian Coast Guard and WCMRC enhancements are a long-overdue improvement in spill response capacity and geographical distribution, it is unclear how the agencies arrived at the amount and type of equipment being rolled out. There are no criteria by which to assess whether these resources are sufficient to respond effectively to existing or additional levels of traffic, or to the type of oil being shipped by Project-related tankers. Transport Canada noted this challenge in its summary of lessons learned from the Area Response Planning project:

> "The ARP methodology was to be used to determine the amount of response resources that should be allocated to each ARP area based on the outcomes of the risk analysis. The ultimate goal was to identify opportunities to re-establish levels of service based on

[42] Fisheries and Oceans Canada, 2018, news release
[43] Fisheries and Oceans Canada, 2018, news release
[44] Fisheries and Oceans Canada, Pacific Region, 2018, news release
[45] Fisheries and Oceans Canada (DFO), 2018, news release
[46] Transport Canada and Canadian Coast Guard, 2018
[47] Canadian Coast Guard, accessed Nov 2018, Marine Spills Contingency Plan - National Chapter
[48] Fisheries and Oceans Canada and Canadian Coast Guard, 2010, Levels of Service
[49] Washington State Department of Ecology, accessed Nov 2018, Worldwide Response Resource List

> the risks identified as part of ARP. However, the existing regulatory regime does not explicitly identify how much recovery capacity is required for a response. This lack of regulatory prescription presented challenges when discussing resident capacity requirements." [50]

Nuka Research assessed current and future response capacity to model projected oil recovery rates including the proposed WCMRC enhancements. The study found that even including the proposed WCMRC capacity additions, recovery rates would range from 16% to 43%. The Nuka study predicted that on-water remaining spill volumes would range from 36% to 63%.[51] This is a conservative estimate, in that it assumes smooth operations with no mistakes, equipment failures, or logistical issues that slow down deployment - many of which have plagued recent real-world incidents. The estimated recovery rates would likely be slightly higher if the planned additional Coast Guard resources were included in the modeling. However, the enhanced WCMRC response resources represent the majority of the total increased capacity.

This raises a serious doubt that the amount and type of available spill response resources is adequate. World-class systems require "equipment that is the best available for the operating environments, environmental conditions, and potential spilled substances". This is examined in section 5 below.

With respect to modeling spills, the OPP is funding the development of ocean modelling of wind, waves and currents to facilitate more accurate tracking and prediction of spills.[52]

4.4.4 "Sufficient personnel are available to respond to a worst-case spill"

World-class features
Trained responders are available to staff a significant, prolonged response; All responders and response managers use the same incident management system; Responders are well-trained and regularly exercised; Volunteers are managed to maximize their effectiveness

Although it is not taking place under the OPP, the Canadian Coast Guard has moved towards implementing the Incident Command System, which has been used for some time by industry and other government responders. This alignment is welcome and has potential to reduce some of the challenges relating to command structure that have plagued past incidents.

[50] Transport Canada and Canadian Coast Guard, 2018
[51] Nuka 2015. The percentages do not add up to 100% because the remaining balance of oil is estimated to have evaporated.
[52] Transport Canada, 2018, Report to Canadians: Investing in our coasts through the Oceans Protection Plan

In addition, the Coast Guard is training members of Indigenous communities in marine search and rescue and environmental response.[53] It plans to create a new chapter of the Coast Guard Auxiliary (volunteers) in BC to support Indigenous communities.[54]

Given that local and Indigenous communities are often the first responders to a spill, particularly in remote locations, this is a welcome initiative. The fact that the Coast Guard rather than industry is delivering the training is also positive. However, there appear to be no plans to review the adequacy of industry training - something which was questioned by the Heiltsuk Nation following the Nathan E Stewart incident:

> *Images...of the spill response to the NES incident...show that the vessels, booms and skimmers were positioned incorrectly to contain and pick up the diesel fuel slicks... these examples of a poor response are most likely due to a lack of training about the use of the spill equipment.*[55]

Currently WCMRC must describe the training it provides to its personnel in the plan it submits to Transport Canada as part of the certification process, but it is unclear if or by what criteria this is assessed.[56]

WCMRC plans to hire 120 new employees as part of the TMX upgrades. However, WCMRC does not identify the roles these new hires would play or where they would come from. The Coast Guard has increased its 24/7 staffing, and in the Western Region six personnel have been added, four in Victoria and two in Prince Rupert.[57] The Coast Guard is planning to hire new emergency response officers,[58] although numbers for these future hires are not available.

As with equipment, there are no prescriptions or regulations in the Canadian regime setting out the minimum number or qualifications of government or industry personnel that must be available to mount a response in a given area. The OPP initiatives do not currently intend to address this critical gap. The OPP is also silent on any plans to manage the large number of volunteers that frequently converge during a major spill, by maximizing their potential contribution while ensuring their safety.

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[53] Ibid
[54] Fisheries and Oceans Canada, 2018, news release
[55] Heiltsuk Tribal Council, 2018. Indigenous Marine Response Centre (IMRC): Creating a World-leading Response System.
[56] Department of Justice, 2001, Canada Shipping Act, Response Organizations and Oil Handling Facilities Regulations
[57] NEB 2018
[58] Transport Canada, 2018, Report to Canadians: Investing in our coasts through the Oceans Protection Plan

4.4.5 “A process is in place to restore damaged resources and to promote ecosystem recovery after a spill”

World-class feature
A process is in place to restore damaged resources and promote ecosystem recovery after a spill

The 2013 Nuka report states that world-class systems “identify, prioritize, develop, and monitor restoration projects and ensure that there is funding available for their full implementation.” With the exception of a baseline data gathering initiative, which is a necessary precursor to being able to assess the impacts of a spill, the OPP is silent on the critical issue of developing a fair, transparent process to oversee post-spill restoration and recovery.

A collaborative process that includes First Nations, all levels of government, and community stakeholders should be put in place to determine appropriate clean-up and recovery end-points. For fossil fuel transit routes, this should be done before a spill happens. The process should oversee post-spill damage assessment and compensation in order to assess residual impacts, determine who needs to be compensated and what form compensation should take, and monitor the delivery and outcomes of recovery efforts and compensation awards.[59]

Preparedness & response summary: Key deficiencies relative to world-class standards

- The proposed risk assessment methodology does not consider low-probability / high-consequence events.
- It is not possible to assess the WCMRC or Coast Guard contingency plans that contain the critical operational detail that would guide response to a spill in the Project marine area because these plans are not available in the public domain.
- The planned 20,000 tonnes of enhanced WCMRC response capacity is not sufficient to effectively respond to a true worst-case spill.
- Lack of assessment of response limitations due to environmental conditions.
- Lack of assessment or prescription of the amount or type of response capacity (equipment, personnel) required for an effective response.
- Lack of a fair, transparent process to oversee post-spill restoration and recovery.

[59] Georgia Strait Alliance; Living Oceans; West Coast Environmental Law; 2016, OIL SPILLS IN BC: WILL WE BE READY?

4.5 World-class system elements

4.5.1 "Government ensures compliance and transparency"

World-class features
Effective enforcement mechanisms are in place; government authorities review and audit industry contingency plans; other stakeholders are actively engaged

Under the OPP, the government is currently considering raising the maximum fine for those who do not comply with shipping laws, from the current limit of $25,000. Given the resources at the disposal of the shipping industry and its clients, $25,000 is an inconsequential penalty, and this should be raised substantially. For example, Washington State issues penalties of up to $100,000 per day of operation for illegal operation of a covered vessel.[60]

Beyond this mechanism, the OPP is silent on several critical system-wide features of a world-class spill response regime, including transparency, community and stakeholder engagement, and government and public oversight of industry.

The polluter pay principle is foundational to the oil spill preparedness and response regime. This is as it should be. The industries whose activities pose a risk must cover the costs of preparing for and responding to any accidents, and not the public. However, 'polluter pay' must not be allowed to mutate into 'polluter decide,' either before, during or after an emergency.

Past spills have suffered from tension over which agency has ultimate authority in a multi-organization Unified Command structure which includes the spiller. This has created serious confusion over who is in charge during the early hours of an incident, and a conflict of interest between the government's duty to ensure that the public interest is protected, and the spiller's need to minimize the appearance of damages to people and the environment.

For example, in the official incident report of the *Marathassa* spill it was noted that "a private company hired by the Responsible Party and participating in the EU [Environmental Unit], was viewed as being in conflict of interest" and that the private company's "efforts appeared focused on minimizing costs to the polluter rather than trying to reach an appropriate standard of assessment and remedial actions."[61]

The OPP is contemplating legislative changes to allow the Canadian Coast Guard to issue mandatory directions, on a precautionary basis, to avoid the escalation of a potential pollution incident; and to clarify that the Canadian Coast Guard is the lead federal agency responsible for

[60] Washington State Department of Ecology, 2016. FAQs on Enforcement.
[61] Canadian Coast Guard, 2015

responding to marine pollution incidents.[62] However, the current consultation documents do not provide details as to if or how this will cement Coast Guard's role at the top of the hierarchy in a Unified Command structure and provide the Coast Guard with the necessary authority over the polluter.

Potential spillers fund Canada's Response Organizations, and it is these ROs that maintain the plans and response capacity that will be relied upon in the event of a spill. This creates tension between industry and the public interest in the realm of preparedness and planning as well as in regards to response. Industry's lack of transparency in its contingency planning is a major example. WCMRC continues to refuse to make its spill contingency plans public. And, Trans Mountain has failed to provide an unredacted copy of its emergency response plan to the provincial government, let alone to the public.[63] There are also instances where there is at least an appearance of industry having undue influence on the development of regulations governing the spill regime: for example, large sections of language from a submission by the Canadian Association of Petroleum Producers made its way into regulations governing the use of chemical dispersants.[64]

The Coast Guard's local contingency plans are not available in the public domain. The criteria by which the federal government audits industry's readiness (plans, equipment, personnel) are opaque to the public.

This lack of transparency around readiness played out to devastating effect during the *Nathan E Stewart* incident. The wind, wave and current conditions that caused many of the operational challenges in the *Nathan E Stewart* response were well known to the Heiltsuk Nation. If they were known to WCMRC's responders, they were not acted upon. A thorough, local vetting of contingency plans could have prevented the operational issues that plagued that response.

Given the stakes of a spill, local communities and concerned citizens should be able to evaluate the measures in place to protect the ecosystem they call home. Risk assessments, oil spill models, resource inventories, contingency plans and incident reports held by all agencies involved in spill response should be made public. Currently, there are no plans under the OPP to address the significant deficiencies surrounding transparency.

This lack of transparency and public oversight guarding against undue industry influence, in combination with high profile spill response failures, has resulted in a collapse of public trust in the spill response regime on the West Coast. In response, the concept of Regional Citizens

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[62] Transport Canada, 2018, Potential legislative amendments to strengthen marine environmental protection and response

[63] The Proponent would not be able to keep such details a secret in the United States. Linda Pilkey-Jarvis, preparedness manager for Washington State's Spill Prevention, Preparedness and Response Program, said in an interview. "How are people expected to have any confidence in the system, if that information is not readily available?"

[64] Nikiforuk, Andrew, for The Tyee, "Ottawa Approves Controversial Chemical for Ocean Oil Spills"

Advisory Councils has been proposed as a formal mechanism to engage communities and provide public oversight of, and build trust in, the spill regime. The OPP makes high level commitments to community and stakeholder engagement, and there are several initiatives making strides towards collaborating with Indigenous coastal communities. However, mechanisms to formally involve other communities, stakeholders and members of the public in spill planning and preparedness are largely absent.

Taken together, Regional Response Planning, the review of the Response Organization regulations, and the intention of stronger Coast Guard leadership provide an opportunity to work towards stronger public and government oversight of the spill regime and industry's role within it. It is also an opportunity to move towards genuine collaboration with the coastal communities and stakeholders who have the most to lose in the event of a spill. However, industry still has a great deal of power in this regime and more broadly in government. It is as yet unclear where political direction will lead these initiatives, and whether their potential will be seized or suppressed.

4.5.2 "All parties actively pursue continuous improvement through research and development and the testing of planning"

World-class features
A research and development program is in place; Planning assumptions are verified through drills and exercises and plans are updated to reflect lessons learned; Incident reviews support continuous improvement; Data on spill causality and "near misses" are compiled, analyzed, and used to inform system changes

Research is a key component of the OPP. A number of valuable projects are in progress on topics such as oil spill fate and behaviour (reviewed in section 6 below), ocean modelling, alternative spill response measures, and underwater noise and other marine mammal stressors.[65] The Coast Guard, WCMRC and Trans Mountain each have their own separate program of conducting spill response exercises. Government oversight of WCMRC's program occurs through the re-certification process. However, the largest on-water exercise required is for a spill of only 2,500 tonnes.[66] There are no provisions under the OPP to bring in federally-run unannounced drills that test all agencies involved in a spill response, or that test specific planning assumptions.

The Coast Guard's recently updated (2018) National Marine Spills Contingency Plan now includes provisions for post-incident reviews. However, these are to be carried out by the

[65] Transport Canada, 2018, Report to Canadians: Investing in our coasts through the Oceans Protection Plan
[66] NEB, 2018

Incident Commander only if local Coast Guard officials deem warranted.[67] In contrast, world-class systems require that incident reviews be carried out after each incident by an independent party who was not involved in the response, and to be made public, neither of which is specified in the contingency plan.

4.5.3 ”Financial mechanisms and resources meet needs from initiating the response through recovery”

World-class features
Sufficient funds are available from industry and/or government to fully implement planning, response, and recovery; Fair compensation is given for environmental, fiscal, and/or social impacts

Shippers of oil have not paid contributions to Canada’s Ship-Source Oil Pollution fund (SOPF) since 1976. Revenue for the fund is largely provided via interest payments from Canadian general revenues, which undermines the ‘polluter pay’ principle.[68] Under current liability limits, the SOPF is considered fully capitalized, but under proposed changes is not sufficient to cover the costs of a significant spill[69]. Communities that have been affected by past spills have not always been compensated for their spill-related costs. For example, Vancouver is still struggling to recover the $569,053 the city spent on response measures for the *Marathassa* incident in 2015.[70] Efforts by the Heiltsuk Nation to be compensated for losses due to the *Nathan E Stewart* sinking are currently the subject of a civil claim.[71] The claim includes traditional, commercial and cultural harvesting losses; costs associated with oil spill response activities; and Heiltsuk efforts to assess the environmental impact of the spill.

The OPP intends to update the SOPF, including removing the per-incident liability limit and requiring a guaranteed top up by industry should the fund be depleted. Proposed changes also intend to make provision for funds to be made available more rapidly to responders and victims. [72] If implemented as envisioned, these changes would help to address a long-standing gap in Canada’s spill response regime.

The mechanism by which future losses would be assessed and compensation awarded is yet to be decided. It is this that will determine whether all parties would be fairly compensated for the full range of environmental, social and financial impacts. These changes also do not address applying the polluter-pay principle to require industry to fund the full costs of spill preparedness

[67] Canadian Coast Guard, accessed Nov 2018, Marine Spills Contingency Plan - National Chapter
[68] Ship-source Oil Pollution Fund, 2018, The Administrator’s Annual Report 2017-2018
[69] Transport Canada, 2013
[70] Ship-source Oil Pollution Fund, accessed Nov 2018, Case number: 120-673-C1-2
[71] Heiltsuk Nation, 2018, News Release
[72] Office of the Prime Minister, accessed Nov 2018, Canada’s Oceans Protection Plan

and planning. In fact, the OPP itself does the opposite, by investing the better part of $1.5 billion of public money towards the marine spill response regime. This is a significant public subsidy of the fossil fuel industry.

System summary: Key deficiencies relative to world-class standards

- No plans to ensure that contingency plans of all levels and held by all agencies are made available in the public domain; or to clarify how government audits industry plans.
- Unclear if or how intentions to strengthen the Coast Guard's leadership role will resolve challenges surrounding the spiller's influence over decision-making in Unified Command.
- No mechanism such as a Regional Citizens Advisory Council to formally involve a range of communities, stakeholders and members of the public in spill planning and preparedness.
- No provisions for federally-run unannounced drills that test all agencies involved in a spill response, or to test specific planning assumptions.
- Reliance on public rather than industry funding to fully implement planning, response and recovery.

4.6 Conclusion: Changes under the OPP are inadequate

In this section, we explored the following question: Do commitments made under the Oceans Protection Plan, together with response capacity increases funded by Trans Mountain, constitute a world-class marine spill response regime?

Many of the changes proposed under the OPP are long-overdue, and are an improvement upon the status quo. However, numerous significant deficiencies remain, as summarized in the table below. This means that the marine spill regime applicable to the Project marine area does not meet world-class standards as defined by the 2013 Nuka report.

Key deficiencies relative to world-class standards

Prevention

- No plans to strengthen marine firefighting and salvage resources.
- No plans to review the national escort vessel regime.
- The potential offered by proactive vessel management and changes to the *Pilotage Authority Act* is vulnerable to efforts to preserve business as usual.

Preparedness & response

- The proposed risk assessment methodology does not consider low-probability/high-consequence events.

- It is not possible to assess the WCMRC or Coast Guard contingency plans that contain the critical operational detail that would guide response to a spill in the Project marine area because these plans are not available in the public domain.
- The planned 20,000 tonnes of enhanced WCMRC response capacity is not sufficient to effectively respond to a true worst-case spill.
- Lack of assessment of response limitations due to environmental conditions.
- Lack of assessment or prescription of the amount or type of response capacity (equipment, personnel) required for an effective response.
- Lack of a fair, transparent process to oversee post-spill restoration and recovery.

System

- No plans to ensure that contingency plans of all levels and held by all agencies are made available in the public domain; or to clarify how government audits industry plans.
- Unclear if or how intentions to strengthen the Coast Guard's leadership role will resolve challenges surrounding the spiller's influence over decision-making in Unified Command.
- No mechanism such as a Regional Citizens Advisory Council to formally involve a range of communities, stakeholders and members of the public in spill planning and preparedness.
- No provisions for federally-run unannounced drills that test all agencies involved in a spill response, or to test specific planning assumptions.
- Reliance on public rather than industry funding to fully implement planning, response and recovery.

One of the most critical gaps is the lack of assessment of response limitations due to environmental conditions. This is addressed in the following section.

5. Limits to effectiveness of containment booms

In this section, we address whether spill response equipment would be effective for the environmental conditions in the Project marine area.

5.1 Overview

Environmental conditions can interfere with the effectiveness of spill response equipment or, as demonstrated by the recent *SeaRose* spill in Newfoundland,[73] they may prevent responders from even attempting a response. Another example of high-profile equipment failure occurred recently on the BC coast, during the sinking of *Nathan E Stewart*. On October 13, 2016, the *Nathan E Stewart* ran aground in Seaforth Channel near Bella Bella in Heiltsuk Nation Territory.

[73] McKenzie-Sutter, Holly, 2018. Largest Newfoundland oil spill ever shows risks of offshore drilling, regulatory board says.

The resulting response operation was hampered by wind, waves and currents in the area of the sinking. Containment booms rated for use in up to 1.5 knots of current were deployed in waters where currents were "often higher."[74] The result was ineffective booms and "very little containment."[75] The end result was the release of 110,000 liters of diesel, lubricants, heavy oil and other pollutants into the area.[76]

In this section, we examine the operating limits of the most basic mechanical response unit, the containment boom. To do so, we compared published boom failure limits to wave and wind speeds, and surface currents, along the Project tanker route. We find that routine coastal conditions regularly exceed the operating limits of the equipment in WCMRC's inventory.

5.2 Background: the impact of weather conditions on containment boom

Oil spill recovery is primarily achieved through mechanical means. Containing or collecting spilled oil requires specialized equipment, and the most fundamental mechanical unit for this effort is the containment boom. The purposes of containment boom include: to enclose oil to prevent spread, to protect areas of specific concern, to divert oil to areas it can be treated or recovered, and to concentrate oil at a relatively even thickness for skimmers or other response techniques.[77] All other forms of mechanical recovery depend on containment booms, and the limits of containment booms are therefore the most fundamental limits to mechanical spill response.

Boom impairment and failure caused by weather conditions takes a number of forms:

- **Wind speed** affects sea state, increases wave energy and moves oil on water, potentially leading to boom containment failures. Wind can also limit the operational aspects of spill response. High speed winds make it more difficult for vessels to stay within their booming area and for crew members to deploy and operate boom,[78] and may tear booms off anchor points.[79]

- **Waves** impact spill response through wave height, steepness, and energy, potentially leading to boom containment failures. Steeper waves create more challenges for operational response than longer swells. Operational limits take several forms. Waves

[74] Heiltsuk Tribal Council, 2017 *INVESTIGATION REPORT: The 48 hours after the grounding of the Nathan E. Stewart and its oil spill*
[75] Ibid.
[76] Ibid.
[77] Fingas, Merv, 2013, *The Basics of Oil Spill Clean Up*
[78] Nuka Research and Planning, 2015, Technical Analysis of Oil Spill Response Capabilities and Limitations for Trans Mountain Expansion Project
[79] Nuka Research and Planning, 2007, Oil Spill Response Challenges in Arctic Waters

make it more difficult for crews to operate safely on deck, limiting boom deployment, operation and retrieval. Vessels will have more difficulty staying in their booming area. Waves also limit visual monitoring of spilled oil.[80]

- **Currents** impact booms' ability to contain spilled oil by increasing the relative velocity of water passing by the boom. Strong currents can therefore cause boom containment failure. Currents are created by a number of forces acting on water, including tides, wind, temperature and salinity, among other factors. The strength and direction of currents are impacted by depth contours, shoreline configurations and interactions with other currents.

We did not examine other key weather-driven limitations such as staff mobilization time, ability to conduct aerial surveillance, and operating limits for skimmers. We also did not consider other weather limits that exist, such as rip currents, tidal fronts, and visibility. All of these would significantly worsen the picture of weather driven limitations. As a result our analysis is likely to underestimate the frequency of operating limits being breached. Also, it should be noted that weather impairment and failure conditions not being met does not guarantee that spill response will be successful. It means only that booms could be deployed without necessarily suffering impairment or failure due to the conditions we studied.

5.3 Methodology

We used NOAA[81] and Fisheries and Oceans Canada[82] data sets for wind speed and wave height taken from weather buoys along the Project-related tanker route between the Westridge Terminal and Neah Bay, at the entrance to the Strait of Juan de Fuca. The buoys analyzed are New Dungeness,[83] Neah Bay,[84] and La Perouse Bank.[85] We did not conduct a full analysis of the Halibut Bank buoy since it rarely reaches boom operating limits. We focused on conditions classified as open water to focus on the spill response capabilities along the tanker route, not in a protected harbour. We compared the weather buoy data to the impairment conditions established in three studies: Fingas 2004,[86] Tedeschi 1999[87] and Nuka Research 2015.[88] A simple Python script was used to make this comparison. Data from all buoys has been analyzed for 2015, 2016 and 2017.

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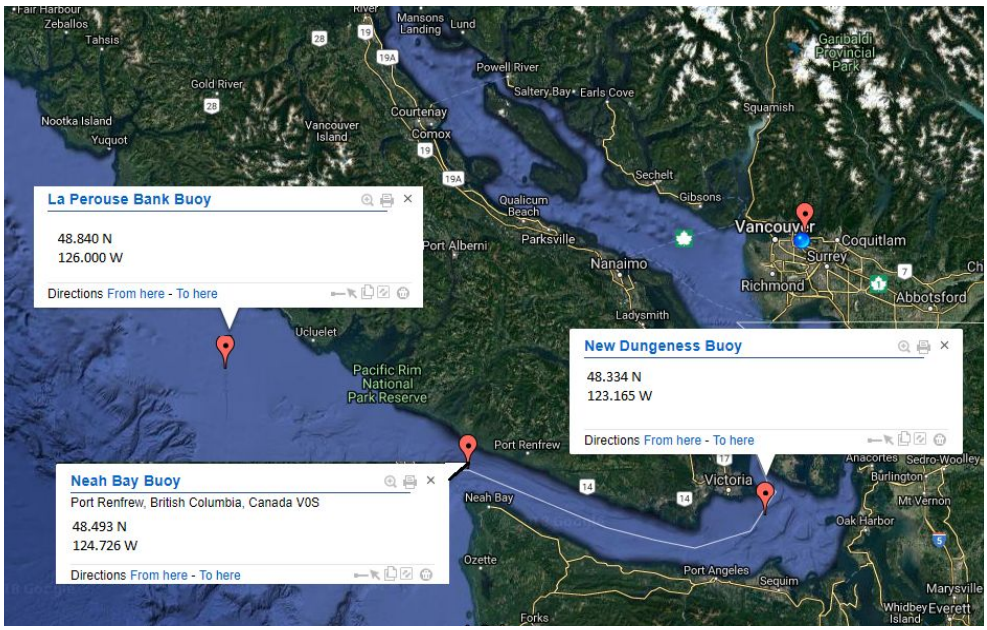
[80] Nuka 2015
[81] NOAA National Buoy Data Center
[82] Fisheries and Oceans Canada Wave Data
[83] New Dungeness Buoy
[84] Neah Bay Buoy
[85] La Perouse Bank Historic Data
[86] Fingas, Merv, 2004, Weather Windows for Oil Spill Countermeasures
[87] Tedeschi, Edward, 1999, Booms
[88] Nuka 2015

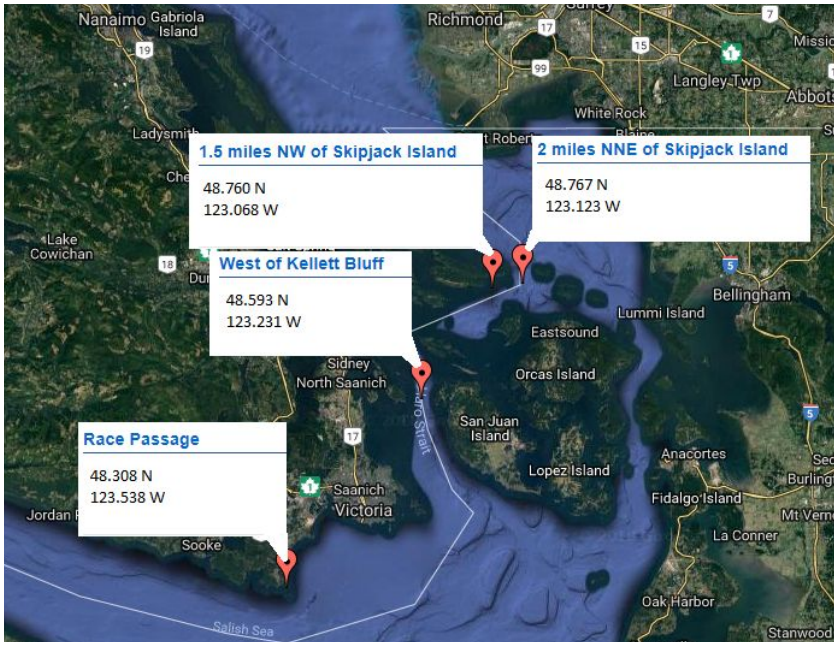
For currents, we used DFO current tables for 2017[89] at Race Passage, and NOAA current tables for 2015 for two locations near Skipjack Island,[90] and a point west of Kellett Bluff.[91] Current predictions[92] were compared to failure conditions derived from Schulze 2001[93] and Swift (in Fingas 2004)[94]; and manufacturer or response organization reported limits for Kepner boom, [95] Ro-Boom 2000,[96] and Current Buster 4.[97] A simple Python script was used to make this comparison.

Map 1: Weather buoy locations



Map 2: Current station locations

[89] Race Passage (#1200) 2017 Current Table
[90] Skipjack Island, 2 miles NNE of, Skipjack Island, 1.5 miles northwest of
[91] Kellett Bluff, west of
[92] Data on observed surface currents is lacking in the Project marine area. Current prediction tables issued by government agencies, used by mariners for navigation purposes, were used for completeness.
[93] Schulze, Robert, 2001,OIL SPILL RESPONSE PERFORMANCE REVIEW OF BOOMS
[94] Fingas, Merv, 2004, Weather Windows for Oil Spill Countermeasures
[95] ECRC-SIMEC, 2013, Kepner Boom
[96] Desmi, accessed Nov 2018, webpage for Ro-Boom
[97] NOFI, accessed Nov 2018, webpage for Current Buster 4



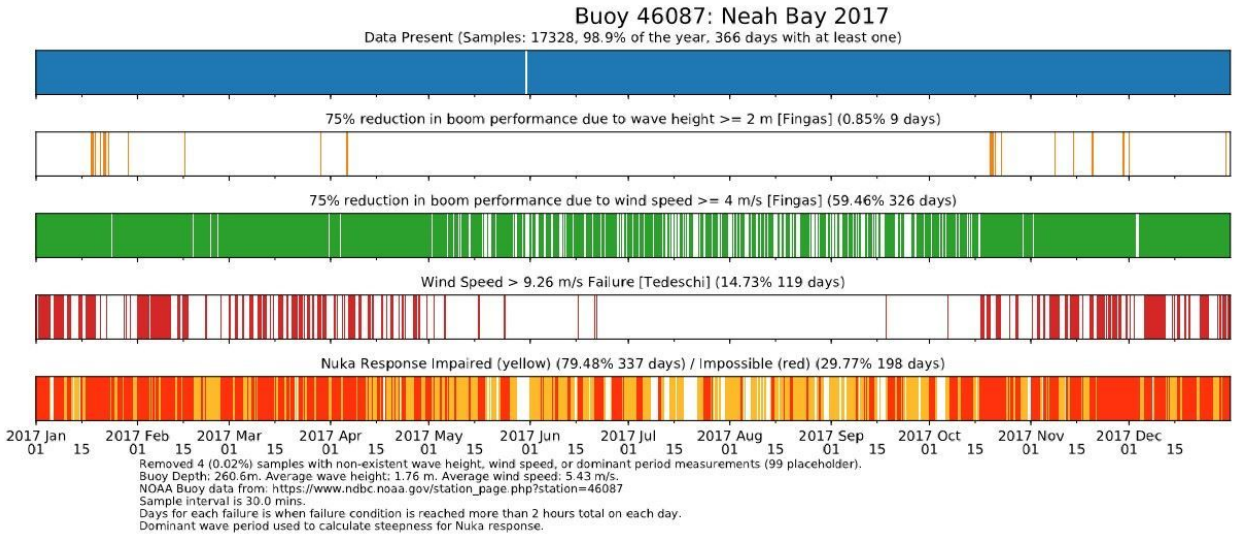
More detailed information on the methodology, data sets, and failure conditions we used is available in Appendix A.

5.4 Results of analysis

5.4.1 Boom impairment and failure rates for wind and waves

Wind and wave data from each weather buoy was compared to the failure conditions established in Fingas 2004, Tedeschi 1999 and Nuka Research 2015. The results of that comparison are presented in a chart for each buoy for each of 2015, 2016, and 2017. A sample chart is shown here, and all charts are available in Appendix A.

Figure 1: Sample wind and wave chart, Neah Bay buoy, 2017



The first horizontal bar represents weather data availability. Weather data sets were not perfectly complete. A vertical **blue** line represents an available data point over a temporal interval (either 30 or 60 minute periods) derived from time stamps in the source data.

The second horizontal bar represents conditions when wave height would cause boom impairment, taken from Fingas 2004. The presence of an **orange** vertical line indicates that data is available, and that a deployed **boom would suffer 75% performance impairment due to wave height**.

The third horizontal bar represents wind speed impairment, taken from Fingas 2004. The presence of a **green** vertical line indicates that data is available, and that a deployed **boom would suffer 75% performance impairment due to wind**.

The fourth horizontal bar represents wind speed failure, taken from Tedeschi 1999. The presence of a **red** vertical line indicates that data is available, and that **oil would move faster than a deployed boom's ability to contain it**.

The fifth horizontal bar represents response impairment and impossibility, taken from Nuka 2015. The presence of an **orange** vertical line indicates that data is available and that **oil spill response would be impaired**. The presence of a **red** vertical line indicates that data is available, and that **oil spill response would be impossible**.

The percentage numbers above each bar represent the percentage of time that containment boom would fail or be impaired, out of the total of intervals for which we have data.

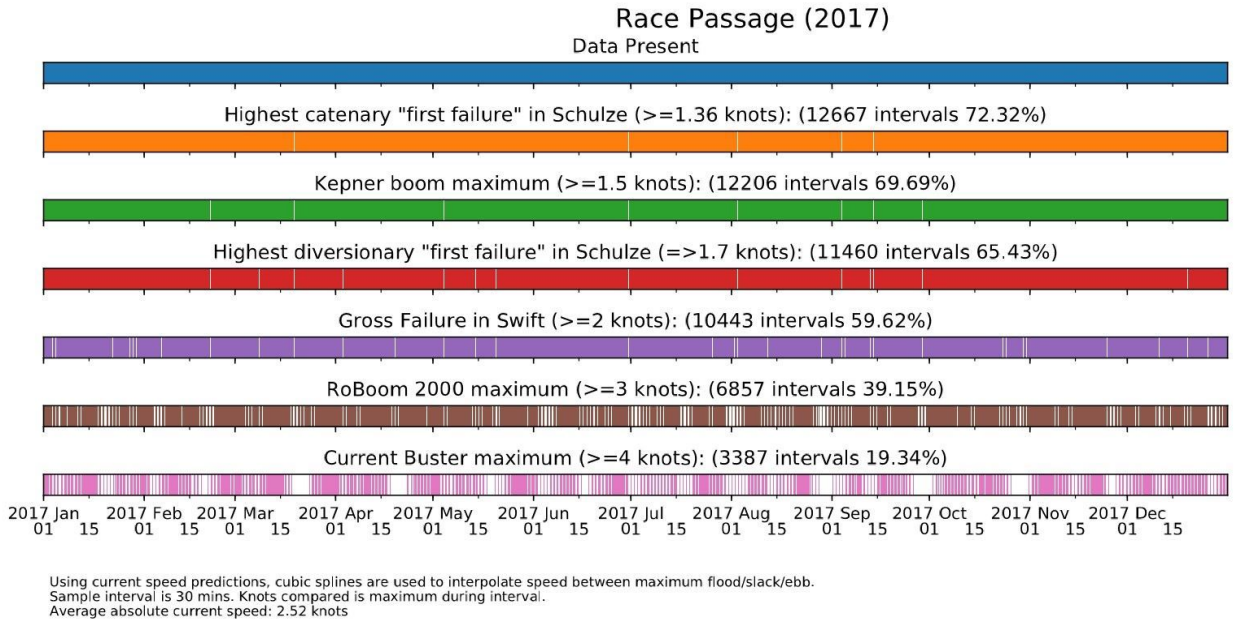
The results from the three buoys for 2017 are summarized in the following table. A full discussion of the results from each location is available in Appendix A.

Wind speed and wave height, days of exceedance of containment boom impairment/failure conditions, 2017			
Condition	**New Dungeness Buoy**	**Neah Bay Buoy**	**La Perouse Bank Buoy**
Fingas 75% Decrease in Performance - Wave Height	0 days	9 days	37 days
Fingas 75% Decrease in Performance - Wind Speed	232 days	326 days	294 days
Tedeschi wind speed failure	100 days	119 days	139 days
Nuka response impaired	76 days	337 days	290 days
Nuka response impossible	58 days	198 days	204
Data completeness	48.59% of intervals, 275 days	98.9% of intervals, 366 days	73.16% of intervals, 304 days
Sources: NOAA, DFO, Fingas 2004, Tedeschi 1999 and Nuka Research 2015			

5.4.2 Boom failures for currents

Current predictions at four locations along the Project shipping route were compared to failure conditions derived from Schulze 2001 and Swift (in Fingas 2004); and manufacturer or response organization reported limits for Kepner boom, Ro-Boom 2000, and Current Buster 4. The results of these comparisons are presented in a chart for each location. A sample chart is shown here, and charts for all locations are available in Appendix A.

Chart 2: Sample current chart, Race Passage 2017



The first bar represents data presence. A vertical blue line represents an available data point over a temporal interval (30 minutes). As these are predictions, data presence is complete.

The second bar represents periods where current speed would meet or exceed the highest “first failure” for catenary[98] boom deployment, as detailed in Schulze 2001. The presence of an **orange** vertical line indicates that in catenary deployment the **boom would begin to lose oil**.

The third bar represents periods where the current speed would meet or exceed the maximum operating current for Kepner boom, as defined in Eastern Canada Response Corporation files. The presence of a **green** vertical line indicates that Kepner **boom would no longer be an effective mechanical barrier to oil**.

The fourth bar represents periods where current speed would meet or exceed the highest “first failure” for diversionary[99] boom deployment, as detailed in Schulze 2001. The presence of a **red** vertical line indicates that in diversionary deployment the **boom would begin to lose oil**.

The fifth bar represents periods where current speed would meet or exceed “gross failure”, as derived from Swift and detailed in Fingas 2004. The presence of a **purple** vertical line indicates that **massive, continual loss of oil would escape past a deployed boom**.

The sixth bar represents periods where current speed would meet or exceed Ro-Boom 2000’s maximum operating current, taken from the manufacturer. The presence of a **brown** vertical line indicates that the **boom’s stability in the water would be compromised**.

[98] A U-shaped deployment of boom
[99] A J-shaped deployment of boom

The seventh bar represents periods where current speed would meet or exceed the ability of Current Buster 4 to retain oil, taken from the manufacturer. The presence of a **pink** vertical indicates that Current Buster 4 would begin **losing significant amounts of oil**.

The percentage numbers above each bar represent the percentage of time that current predictions would result in a boom impairment or failure were it deployed at that time.

The results from all four locations are summarized in the following table. A full discussion of the results from each location are available in Appendix A.

Current speed and boom failure: Percentage of time current speed exceeds containment boom limits, four locations on Project tanker route				
Failure Type	Skipjack Island, 2 miles NNE of	Skipjack Island, 1.5 NW of	Kellet Bluff, west of	Race Passage
Highest catenary "first failure" in Schulze	64%	6%	40%	72%
Kepner boom maximum operating current	60%	4%	34%	70%
Highest diversionary "first failure" in Schulze	56%	2%	26%	65%
Gross failure in Swift	48%	0%	16%	60%
RoBoom 2000 current stability maximum	25%	0%	1%	39%
Current Buster 4 maximum current	9%	0%	0%	19%

5.5 Alternative response measures

Apparently in recognition of the limited effectiveness of existing mechanical response techniques, the federal government has stated that it is moving towards the use of Alternative Response Measures such as spill-treating agents (dispersants) and in-situ burning. In 2016, regulations were established that approved the offshore use of the dispersant Corexit on a case-by-case basis, and under the OPP the government is now consulting on legislative changes and an operational framework to guide the use of alternative response measures.

However, there are serious concerns with the use of these techniques. In-situ burning has all of the problems of combusting fossil fuels: carbon emissions, the release of harmful air pollutants,

and toxic residues. Carbon emissions have climate-destabilizing impacts. Thick clouds of black smoke and toxic residue are a risk to local ecosystems and to human health. While the effects of large clouds of toxic smoke are generally understood, residues in water from in-situ burning are under-studied in terms of containment and recovery,[100] and chronic toxicity.[101] Further research is needed to understand the trade-offs involved in using this technique, and those studies must be completed before in-situ burning is considered in oil spill plans.

Chemical dispersants were used at scale in the wake of the *Deepwater Horizon* disaster, with a number of scientific studies done to assess the impact of their use. In these studies, dispersants were shown to cause adverse health effects on spill responders;[102] to inhibit the effect of oil-eating microbes, diminishing the natural response to oil spills;[103] to increase the toxicity of oil to deep-sea coral;[104] and to be highly toxic to plankton,[105] with one study pegging increased oil toxicity at 52 times normal levels.[106] There is also evidence that dispersants are rendered less effective by sunlight.[107] It should be noted that contaminants have been identified as one of the three primary threats to the recovery of BC's endangered Southern Resident Killer Whale population.[108] Inhaling a combination of the evaporated components of spilled oil and airborne chemical dispersants could pose a serious threat to killer whales, which must surface to breathe.[109] This evidence indicates that a high burden of proof must be met around the biological, economic and human health trade offs before the use of chemical dispersants can be allowed.

The limits to mechanical recovery discussed above are often cited as the rationale for the expanded use of alternative response measures. However, the safety of these techniques has not yet been adequately demonstrated. Until they are, alternative response measures should

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[100] Shigenaka, G., Overton, E., Meyer, Buffy, Gao, Heng, Miles, Scott., 2015 PHYSICAL AND CHEMICAL CHARACTERISTICS OF IN-SITU BURN RESIDUE AND OTHER ENVIRONMENTAL OIL SAMPLES COLLECTED DURING THE DEEPWATER HORIZON SPILL RESPONSE

[101] NOAA Office of Response and Restoration, Residues from In Situ Burning of Oil on Water

[102] McGowan, Craig,Kwok, Richard, Engel, Lawrence, Stenzel, Mark, Stewart, Patricia, Sandler, Dale, 2017, Respiratory, Dermal, and Eye Irritation Symptoms Associated with Corexit™ EC9527A/EC9500A following the Deepwater Horizon Oil Spill: Findings from the GuLF STUDY

[103] Kleindienst S, Seidel M, Ziervogel K, Grim S, Loftis K, Harrison S, Malkin SY, Perkins MJ, Field J, Sogin ML, Dittmar T, Passow U, Medeiros PM, Joye SB, 2015 Chemical dispersants can suppress the activity of natural oil-degrading microorganisms

[104] Ruzi-Ramos, Fisher, Baums, 2017 Stress response of the black coral Leiopathes glaberrima when exposed to sub-lethal amounts of crude oil and dispersant

[105] Almaeda, Hyatt, Buskey, 2014 Toxicity of dispersant Corexit 9500A and crude oil to marine microzooplankton

[106] Rico-Martinez, Snell, Shearer, 2013 Synergistic toxicity of Macondo crude oil and dispersant Corexit 9500A® to the Brachionus plicatilis species complex (Rotifera)

[107] National Sciences Foundation, 2018 Sunlight reduces effectiveness of dispersants used to clean up oil spills

[108] Fisheries and Oceans Canada, 2018. Recovery Strategy for the Northern and Southern Resident Killer Whales (Orcinus orca) in Canada

[109] Logland, K, Genovali, C, 2018. New oil-spill response much like the old ones

not be used, and therefore cannot be considered an effective response to the product being shipped by Project-related tankers.

5.6 Conclusion

Wind and wave conditions will present significant constraints for containment booms along much of the project tanker route. From the New Dungeness buoy seaward, boom operating limits in wind and wave are reached frequently. Fingas' 75% boom impairment limit for wind is reached in over 50% of tanker route data sets. Tedeschi's wind failure limit is reached in 10-20% of observations. Nuka's response impossibility limits are reached 6-9% of the time at the New Dungeness buoy, 30% to 40% of the time at Neah Bay, and 43-49% at La Perouse Bank. At Neah Bay and La Perouse, these operating limits are breached for days or weeks at a time, indicating mechanical containment and recovery will not be an effective option in these areas. This entire section of the tanker route is within current and proposed Southern Resident Killer Whale critical habitat.

Currents in the Boundary Pass/Haro Strait area will form an operational constraint ranging from negligible (Skipjack Island, 1.5 miles northwest of) to significant (Skipjack Island, 2 miles north-northeast of). At Race Passage, near Victoria, currents will be an extreme operational constraint. For example, current speed would meet or exceed the maximum operating current for Kepner boom in 69.69% of the current predictions. Current speed would result in a massive, continual loss of oil past a deployed boom (Swift's 'gross failure') in 59.62% of the current predictions. Boom failures due to current may not be catastrophic; depending on the type of boom and operational strategies, losses may be small in each instance. But numerous small oil losses can add up, increasing the risk to nearby shorelines and the potential for ecosystem impacts. As demonstrated in the *Nathan E Stewart* response, some losses from boom failure aren't small, leading to large releases of product.

Summary: Operating limits for containment booms along the Project tanker route

- Wind and wave conditions will present significant constraints for effective containment booms along much of the Project tanker route.
- For portions of the route near Neah Bay and La Perouse Bank buoys, operating limits for booms are breached for days or weeks at a time, indicating mechanical containment and recovery will not be effective at these times.
- Currents in the Boundary Pass/Haro Strait area will form an operational constraint for effective containment booms ranging from negligible to significant, while at Race Passage currents will be an extreme operational constraint.

Given the boom impairment and failure rates presented above, and given that containment boom is the most fundamental unit of mechanical oil recovery, we conclude that spill response equipment available to WCMRC does not allow for an effective response for the environmental conditions that occur regularly at points along the Project tanker route.

6. Diluted bitumen

Section 4 of this report shows that, even with proposed upgrades to spill response capacity, in the event of an oil spill by a Project-related tanker, oil recovery rates are likely to remain unacceptably low. Section 5 shows that environmental conditions are likely to regularly occur that will mean the equipment available to responders cannot be used successfully. The analysis in Sections 4 and 5 is agnostic with respect to the type of oil spilled. However, the TMX project will be shipping diluted bitumen, which raises additional questions, complexities and potential risks.

As production and shipment of diluted bitumen (dilbit) has increased in North America in recent years, there has been significant debate about its fate and behaviour when spilled. This debate has focused on the extent to which dilbit's fate and behaviour differs from that of conventional crude. In particular, the debate focuses on whether spilled dilbit is likely to sink - or to float - in marine and freshwater, and therefore how effective conventional spill response tactics and technologies may or may not be.

One of the OPP initiatives seeks to expand the federal government's understanding of the fate, behaviour and biological effects of spilled diluted bitumen in aquatic environments, both through funding new research and reviewing existing science. Prior to releasing final results of this project, a multi-departmental federal Science Response Process was held to summarize and validate results to date. This resulted in a 2018 status report drawing together a) information on the fate, behaviour and response options resulting from seven real-world heavy oil spills and b) 36 meso-scale laboratory experiments carried out by Fisheries and Oceans Canada, Natural Resources Canada, Environment and Climate Change Canada and the US Geological Survey.[110] Questions the status report seeks to answer include:

- What do we know about diluted bitumen behaviour when spilled under which defined conditions? What environmental conditions or other factors influence their [dilbit's] behaviour when spilled?
- What do we know about the effectiveness of response options to treat diluted bitumen spills?
- Are conventional crude oil spill response countermeasures effective for diluted bitumen spills?

This is the research that is being used to inform the Canadian government's approach to regulating the shipment of diluted bitumen, and planning for a spill of diluted bitumen. Crucial to the federal government's justification of approving TMX are its claims that bitumen is likely to

[110] Fisheries and Oceans Canada, 2018, STATUS REPORT ON THE KNOWLEDGE OF THE FATE AND BEHAVIOUR OF DILUTED BITUMEN IN THE AQUATIC ECOSYSTEMS

float when spilled in the ocean,[111] and that conventional spill response tactics will be effective at recovering spilled diluted bitumen. However, our review of the status report suggests that the research it summarizes relies almost exclusively on laboratory experiments that cannot adequately reflect real world conditions in the Salish Sea. It also glosses over findings that suggest that spill countermeasures may not work in the same way for dilbit as for conventional crude.

6.1 Lab experiments vs. real world conditions in the Salish Sea

Of the seven real-world aquatic heavy oil incidents reviewed, six were spills into freshwater. The exception is the Westridge Terminal spill of Albian Heavy synthetic crude (not diluted bitumen) in 2007, which was the result of a land-based spill with limited marine impacts. It is therefore the laboratory experiments, using wave tanks, flume tanks and rotary agitation, that form the foundation for the government's approach.

Of the 36 experiments summarized in the 2018 status report, 21 were carried out in freshwater. The remainder were listed as saltwater (12), marine water (1), sea water (1) and brackish water (1). Of the 15 non-freshwater studies, only five lasted longer than 24 hours. All but seven used water temperatures above 20° C. This is considerably higher than sea surface temperatures in the Salish Sea, which average approximately 7°C – 15°C depending on the season.[112] No experiments combined water temperatures and sedimentation appropriate to local conditions with a temporal scope that reflects the reality that many spills last days and/or weeks, not hours.

These lab based experiments can offer only a limited understanding of how diluted bitumen would behave in real world conditions in the Salish Sea. The report acknowledges that "a comprehensive analysis of this information, in comparison to the fates and behaviours observed during real world events is warranted to validate lab results."

One of the features that makes the Georgia Strait such a unique environment is its relationship to the Fraser River. The Fraser River discharges 20 million tonnes of sediment a year into the ocean. Sediment discharge peaks over the course of the spring freshet at 32 million m^3, at which time freshwater is also pouring into the Georgia Strait at the rate of 10,000 m^3/second.[113] The 2018 status report is clear that unweathered (fresh) bitumen is liable to combine with sediment to form oil-particulate-aggregates, that sink below the surface in salt water. Diluted bitumen spilled along the tanker route during the spring freshet of the Fraser river could easily encounter very high sediment loads and therefore be liable to sink as OPAs while still fresh.

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[111] Penner, Derrick, for the Vancouver Sun, 2018, "Bitumen floats longer than expected, Natural Resources Canada research shows"
[112] World Sea Temperatures, 2018.
[113] Richmond Chamber of Commerce, 2014, THE ECONOMIC IMPORTANCE OF THE LOWER FRASER RIVER; Fisheries and Oceans Canada, accessed Nov 2018, Monitoring Southern BC Coastal Waters

This complicates the key message that the federal government has been promoting, which is that spilled dilbit will float for up to three to four weeks when it spills in the ocean.[114]

6.2 Adequacy of conventional crude spill countermeasures

One of the key conclusions of the status report is: “Conventional spill response countermeasures are similarly effective for diluted bitumen because its fate and behaviours remain within the existing range for conventional petroleum products.”

However, the results of several of the experiments which most closely approximate conditions in the Salish Sea cast doubt on this claim. For example:

- Saltwater flume tank 2-week study, water temperature > 15˚C and < 8˚C, no sedimentation (p. 8)
    - significant increase in density and viscosity in first 24 hours
    - rapid loss of light ends limits window of opportunity for certain countermeasures, increased potential to sink and interact with sediments

- Saltwater rotary mixer 16 hour experiment, water temperature 0 and 15°C, sedimentation 10,000 mg/L (p. 14)
    - Mixed with fine- and medium-sized sediments, the fresh to moderately weathered oils formed OPAs which sank in saltwater. Heavily weathered oil did not interact as much, instead forming discrete tarballs.

- Saltwater rotary agitator 12 hour experiment, water temperature 20 °C, sedimentation 2000 ppm (p. 12)
    - With water and sediment, an order of magnitude greater tar balls precipitate from the flocculation compared to conventional crude
    - Despite oil floating, tar balls would be dropped to the seabed

These results suggest that dilbit behaves differently than conventional crude, that dilbit may sink in saltwater in certain conditions, and that spill countermeasures may not work in the same way for dilbit as for conventional crude.

The status report also directly acknowledges that the properties and behaviour of diluted bitumen differ to those of conventional crude, and that response tactics may also need to be different. For example:

- The rate at which the toxic compounds reach a specific environmental component (e.g., shoreline) may be different [to conventional crude] (p.19)

[114] Penner, 2018

- There is an acknowledgement that the viscosity and density changes more rapidly for diluted bitumen compared to conventional oil products due to evaporation losses and [the] high, heavy-end content of the weathered oil. These changes in property mean that diluted bitumen may require a faster adaptation of routine response options for equipment (e.g., skimmers) designed for high viscosity heavy oils. (p.17)
- The window-of-opportunity for using certain response options may be shortened. (p. 17)

The report also identifies numerous knowledge gaps and priority research areas that need to be addressed. In our view, both the findings of the report and the remaining questions that it identifies do not support an unequivocal claim that "no new response countermeasures are specifically required to address diluted bitumen because its fate and behaviour is within the range observed for other conventional oils."

6.3 A different approach: United States science and Washington State standards

In 2016, the US National Academy of Sciences (NAS) conducted a two year comprehensive review of all existing studies on the environmental fate of dilbit, including Government of Canada science that informed the 2018 status report. The NAS concluded that:

- when compared with commonly transported crudes, diluted bitumen behaves in fundamentally different ways when spilled; and
- there is no technique or equipment available to effectively clean up heavy oils (whether conventional or dilbit) that have submerged, mixed into the water column or settled on the bottom of fresh- or salt-water bodies.

The NAS report concluded that "when all risks are considered systematically, there must be a greater level of concern associated with spills of diluted bitumen compared to spills of commonly transported crude oils." The NAS study goes on to recommend to the US government that the results of this research "warrants modifications to the regulations governing diluted bitumen spill response plans, preparedness, and cleanup." [115]

Although not specific to diluted bitumen, Washington State's planning standards for Group 5 (heavy) oils gives an indication of what such revised requirements could entail. The standards require equipment including:

- Sonar, sampling equipment or other methods to locate the oil on the bottom or suspended in the water column;
- Containment boom, sorbent boom, silt curtains, or other methods for containing the oil that may remain floating on the surface or to reduce spreading on the bottom;

[115]National Academies of Sciences, Engineering and Medicine, 2016, Spills of Diluted Bitumen from Pipelines: A Comparative Study of Environmental Fate, Effects, and Response (consensus study report)

- Dredges, pumps, or other equipment necessary to recover oil from the bottom and shoreline.[116]

The one aspect that most researchers and policy-makers from both sides of the border seem to agree on is how much we still don't know about spilled diluted bitumen: what will happen to it when spilled in different environments, how it will impact the marine environment and human health, how effective our response methods will be in different conditions, and much more. Unfortunately, large-scale real-world conventional crude oil marine spills have given researchers an understanding of these factors for conventional oil, as well as opportunities to assess the long-term impacts. However, the absence of an equivalent understanding for diluted bitumen in marine waters begs the question of whether this product should be allowed to be shipped while we still know so little.

7. Conclusions and recommendations

This report provides information on developments in the marine oil spill response regime since the May 2016 NEB report that are applicable to Project-related marine shipping. The report assesses whether these developments constitute a world-class marine spill response regime that provides adequate capacity to effectively respond to a spill of diluted bitumen.

7.1 Conclusions

Our review of commitments made under the Oceans Protection Plan, together with response capacity enhancements funded by Trans Mountain, identifies many significant remaining deficiencies. These deficiencies lead us to conclude that the spill response regime applicable to the Project marine area does not meet world-class standards.

In our assessment, the enhancements that would allow WCMRC to deliver a 20,000 tonne response capacity are insufficient to respond to a true worst-case spill. Projected oil recovery rates (recovered oil as a percentage of spilled oil) including the WCMRC enhancements are only 16% to 43%, assuming no delays, errors or other factors that might hamper a real-world response. On-water remaining spill volumes would remain unacceptably high, at 36% to 63%.[117] We conclude that Trans Mountain's estimate of a "credible worst-case" spill (16,000 tonnes, or 17% of a laden Project tanker's total cargo) is far too small, and instead Canada should follow the State of Washington's approach and prepare for a spill of a vessel's entire cargo, plus fuel, under adverse weather conditions.

We compared containment boom failure limits derived from oil spill response literature against wind and wave observations and surface current predictions along the Project tanker route. We

[116]Washington State Legislature, accessed Nov 2018, Planning standards for Group 5 Oils
[117] DeCola, 2016

found that routine coastal conditions frequently exceed the operating limits of the equipment currently in WCMRC's inventory. For example:

- In 2017 at Neah Bay, at the mouth of the Strait of Juan de Fuca, there were 337 days where wind speed and wave height combined would cause response to be impaired for at least two hours of the day. Response would be impossible on 198 days.
- Currents at full ebb and flood tide at Race Passage (near Victoria) routinely breach the maximum operating limits of WCMRC's booms. Kepner boom is breached 70% of the time. Even the most robust booms fail frequently: Current Buster 4 fails 19% of the time, and Ro-Boom 2000 39%.

We conclude that proposed WMCRC enhancements (vessels, personnel, equipment) do not provide sufficient capacity to respond to a true worst-case spill, and that containment boom, as the most fundamental equipment unit of mechanical oil recovery, fails to allow for an effective response due to environmental conditions that occur regularly at points along the Project tanker route. This is the case for conventional oil; however the TMX project will be shipping diluted bitumen, which raises additional questions and potential risks.

We reviewed the federal government's 2018 status report on the fate and behaviour of diluted bitumen which summarizes the science the government is relying upon in their deliberations on the TMX project.

The federal government's justification for approving TMX depends significantly on its claims that bitumen is likely to float for up to three to four weeks when spilled in the ocean,[118] and that existing spill response techniques are sufficient to effectively clean up a dilbit spill. However, the research summarized in the 2018 status report relies almost exclusively on laboratory experiments that cannot adequately reflect real world conditions in the Salish Sea. The status report itself glosses over findings that suggest that dilbit may sink in the ocean under certain conditions, and that spill countermeasures may not work in the same way for dilbit as for conventional crude.

Changes proposed under the OPP, together with Trans Mountain funded enhancements to WCMRC's capacity, represent welcome progress from the current state of marine spill response planning, preparedness and response on the West Coast. However, they do not constitute a world-class system, they are not sufficient to respond to a worst-case spill, and they rely on equipment that fails in environmental conditions that frequently occur along the Project tanker route. The federal government's own science identifies too many remaining questions about the fate and behaviour of diluted bitumen to conclude that existing spill countermeasures can be relied upon to successfully recover spilled dilbit.

[118] Penner, 2018

As a result, we conclude that changes to the marine spill prevention, preparedness and response regime since the 2016 NEB report do not ensure that 'the project will be safe', as the Prime Minister has claimed, or that these developments can be relied upon by the Board to determine that the adverse impacts of the Project are justified in the circumstances.

7.2 Recommendations

Georgia Strait Alliance makes the following recommendations based on the findings in this report.

Preparedness

1. All levels of contingency plans held by federal government agencies and WCMRC should be made available in the public domain.
2. Risk assessments conducted by government and industry should be required to consider low probability/high consequence events.

Response

3. The federal government should conduct a response capacity assessment for the Project marine area to establish the amount and type of resources that should be maintained by both government and industry. These should be prescribed in regulations, along with the quantity and qualifications of government and industry personnel.
4. The planning standard for a credible worst-case spill volume should be the entire cargo of the vessel, plus bunker fuels, under adverse weather conditions.
5. The federal government should conduct a response gap assessment for the Project marine area to identify how often equipment will be limited by environmental conditions and to establish mitigation measures.
6. WCMRC should be required to acquire more boom suitable for wind, wave and current conditions found along the Project tanker route
7. A research and development program, funded by the fossil fuel transport industry, should be undertaken to develop more effective oil spill response techniques, technology and equipment.
8. A clean-up standard should be established that mandates a minimum threshold of 80% for the removal of spilled product from the environment.
9. The Response Organization regulations should include planning and equipment standards specific to diluted bitumen.

System

10. The Canadian Coast Guard's role as the Lead Agency and final authority in Unified Command should be made explicit in the Canadian Shipping Act.

11. The federal government should establish a Regional Citizens Advisory Council for the Project marine area.
12. The federal government should conduct unannounced drills that test all agencies involved in a spill response, as well as specific planning assumptions.