Hearing Order OH-001-2014
Trans Mountain Pipeline ULC (Trans Mountain)
Application for the Trans Mountain Expansion Project (Project)

Written evidence of the City of Vancouver

PART 1 – CITY OF VANCOUVER WRITTEN EVIDENCE

1. INTRODUCTION

I, Sadhu Johnston, of the City of Vancouver, am the Deputy City Manager with responsibility for Emergency Management and Sustainability. I am a member of Vancouver's Corporate Management team and both the Emergency Management Department and the Sustainability Department report to me. I am also the Executive Sponsor for Vancouver's intervention in Trans Mountain's application to the National Energy Board for the Trans Mountain Pipeline Expansion Project (the "TMEP").

I have held the position of Deputy City Manager since November 2009.

I have knowledge of the matters set out in the City of Vancouver's written evidence. Other City staff have also provided input on issues of concern to the City of Vancouver as stated in this evidence.

1.1 GENERAL BACKGROUND

The City of Vancouver ("Vancouver") is the most densely populated urban marine centre in Canada with 630,000 residents and 70,000 businesses. Vancouver contributes more than $40 billion per year to the Canadian economy, representing 3% of national GDP. Many residents and businesses, as well as significant park lands and beaches (including Stanley Park, a National Historic Site), benefit and depend on access to waterfront, the Burrard Inlet and the Fraser River. Vancouver is also a significant property owner within the City of Vancouver and its assets include stormwater infrastructure, waste disposal sites, transportation, municipal office buildings, public housing, green space, parks and many other lands and facilities. Vancouver's Financial Planning and Analysis Department advises that Vancouver's assets have a net book value of $6.4 billion and a replacement value, excluding land assets, of $20.5 billion.

The northern boundary of Vancouver is the Burrard Inlet, which is also Vancouver's main harbour and the location of Port Metro Vancouver, Canada's largest port. The southern

boundary of Vancouver is the Fraser River, one of the largest rivers entering the Pacific Ocean[1] . The Fraser River estuary is also one of the most ecologically important coastal marine habitats along the entire Pacific coast of North America.

Trans Mountain Pipeline ULC ("Trans Mountain") has applied for a Certificate of Public Convenience and Necessity to construct and operate an expanded pipeline, expanded oil storage facilities and an expanded marine terminal to export petroleum products extracted from the Alberta oil sands (the "Project"). The Project would increase pipeline transport capacity from about 47,700 m^3 per day to 141,500 m^3 per day (ie. 300,000 bbl/day to 890,000 bbl/day), with a corresponding increase in tanker traffic from five to as many as 34 vessels per month, assuming that Aframax-class tankers are calling at the marine terminal. The proposed pipeline would make over 700 water crossings in British Columbia, including over 80 within the Lower Fraser River Watershed. Once the oil is loaded onto tankers at the Westridge Marine Terminal in Burnaby, BC, the tanker route would pass through the Central, Inner and Outer Harbours of Burrard Inlet into the Georgia Strait.

The risk of oil spills from the pipeline, storage facilities, marine terminal and tanker traffic raises concerns for Vancouver about both short-term and long-term impacts on Vancouver's emergency response and other services, human health and environment as well as the economic impacts on Vancouver, its local businesses and tourism. Vancouver has had very recent experience with an oil spill that, despite its small size, has resulted in significant impacts on Vancouver in terms of both time and resources required to respond to the oil and ongoing recovery efforts. A larger oil spill in Burrard Inlet or along the Fraser River would have devastating consequences for Vancouver, its neighbouring communities and the environment.

[1] http://www.tourismvancouver.com/vancouver/about-vancouver/location

1.2 CITY OF VANCOUVER INVOLVEMENT IN TMEP APPLICATION

On December 18, 2013, Vancouver City Council passed a motion directing staff to apply for Intervenor status for the City of Vancouver in the National Energy Board hearings of the TMEP application and to advance the following points:

1. The expansion of the pipeline through the Metro Vancouver region and associated increases in tanker traffic pose an unacceptable risk to the City of Vancouver, residents and businesses including, but not limited to, risks to Vancouver and the region's vibrant economy, local environment and parks, infrastructure, financial and legal liability, public health, and our international brand as one of the world's most liveable cities.

2. The City of Vancouver does not agree with the NEB's position that harms caused by the eventual combustion of the fossil fuels carried by the pipeline not be considered as part of the review of impacts on the public interest. Further that the City of Vancouver views an increase in the extraction of fossil fuels intended for combustion, and the increase in greenhouse gases associated with this extraction and combustion, as posing a direct risk to the city as a result of sea-level rise and extreme weather impacts associated with anthropogenic climate change.

3. The City of Vancouver has grave concerns on the following points:

    - that no appropriate emergency response plan is in place from appropriate provincial and federal government agencies; in fact capacity has been reduced in recent years;

    - that the City of Vancouver, its residents and businesses are not indemnified against all financial loss associated with a spill from current or proposed shipments;

    - that full recovery funding is not guaranteed for all affected parties; and

    - that Kinder Morgan and other responsible agencies have not invested in appropriate mitigation efforts to avoid a spill of current shipments.

A copy of the Minutes of the Standing Committee of Council on City Finance and Services is attached at **Appendix 1.**

2. CITY OF VANCOUVER AND THE LOCAL ENVIRONMENT

2.1 GENERAL

Vancouver is one of the most densely populated cities in North America after New York City and San Francisco, with approximately 5,335 people per square kilometre. 25,000 Vancouver residents, occupying 16 million sq ft of residential space, live within 300 m of the Burrard Inlet and English Bay shorelines. As of May 2015, there are 38,801 business licenses that have been issued by Vancouver to businesses located within 1,000 metres of Burrard Inlet.

Vancouver also has significant economic activity and residential developments along the Fraser River. For example, a 130 acre site is currently being developed at the East Fraserlands (EFL) which lies in the southeast corner of Vancouver the Fraser River between Kerr Street and Boundary Road. Approximately 7.2 million square feet of the EFL will be residential development with an expected population of 12,500 people. There will be a K to 7 elementary school and a high school built on the lands and other amenities will include a community centre, 4 child care facilities, and nearly 25 acres of parks and open space situated primarily along the water front.

Another development, the Cambie Corridor Plan situated between 59th Avenue and the Fraser River, is expected to have 11,000 residents and new office, retail and cinema space which is estimated to employ approximately 1,400 people.

There are 2,563 business licenses issued by the City to businesses located within 1,000 metres of Fraser River as of May 2015.

Figure 1 below is a map of Vancouver showing its location in the Burrard Inlet, daytime population densities and vulnerable places. The daytime population for downtown Vancouver (situated on the peninsula between Burrard Inlet and English Bay) is estimated at 223,000, based on recent population counts. **Figure 2** below is a map of Vancouver showing pedestrian traffic counts in the downtown core and at the Burrard Bridge, Granville Bridge and Cambie Bridge crossings.

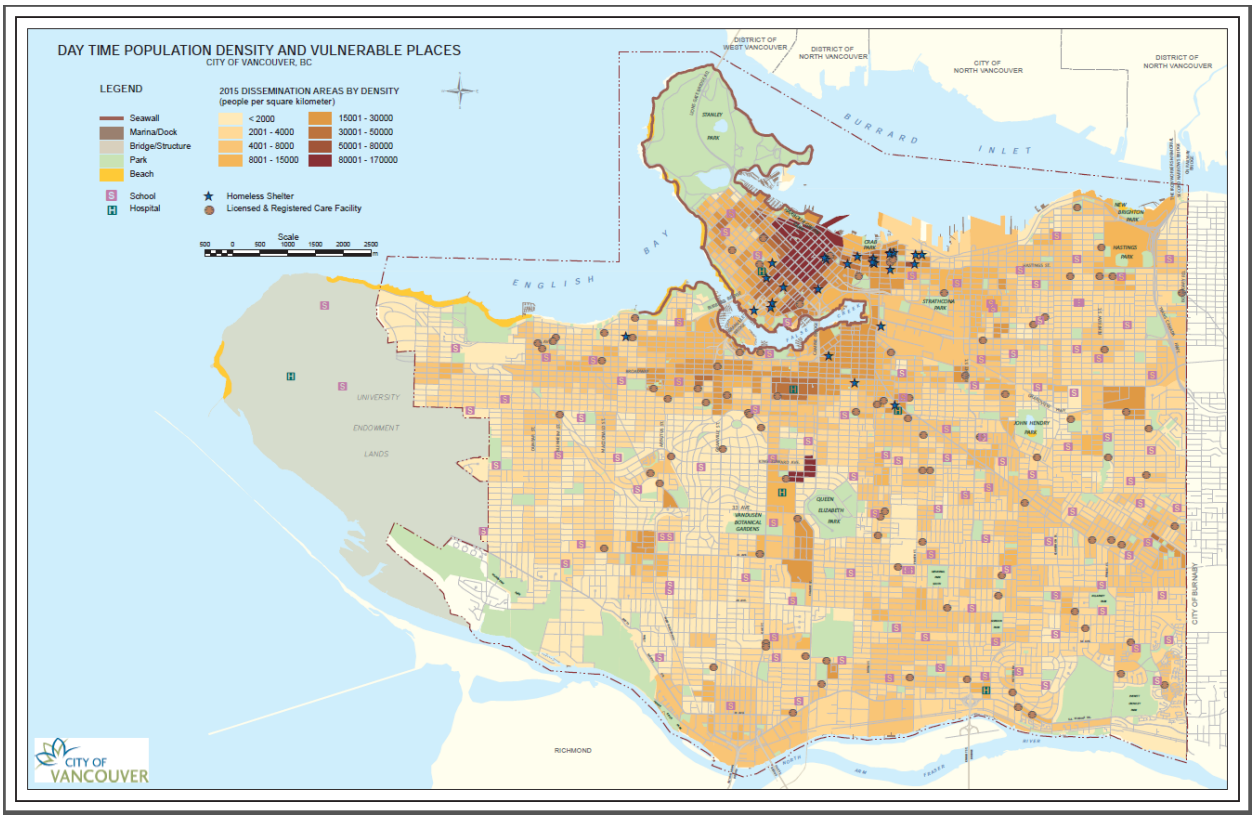

Figure 1: Vancouver Daytime Population Density and Vulnerable Places

Figure 2: Vancouver Traffic Counts - Pedestrians

Vancouver is known for its natural beauty, shoreline, quality of life, innovation and green growth and is consistently ranked as the world's most livable city by the Economist Intelligence Unit and Mercer[2]. There are 220 parks in Vancouver, which make up 11% of the City's land mass. The largest of these is Stanley Park, a designated historic site of Canada, with 400 hectares of natural West Coast rainforest. In 2014, the park was named the top park in the world by Trip Advisor's Annual Park Survey.[3]

Vancouver has 69.8 km of waterfront along Burrard Inlet, English Bay, False Creek and the Fraser River, with 18 km of beaches (ten ocean-side beaches in total) and a 22 km long seawall. There are 5.5 million visitors to Vancouver's seawall annually.

Figure 3 below is a map of Vancouver showing its parks and beaches and other sensitive sites, such as dedicated fire protection systems, marinas, outdoor pools, convention centres and False Creek. Additional maps showing land values, businesses located within 1,000 metres of Burrard Inlet and the Fraser River, traffic counts for cyclists and motor vehicles, night time population density, and land use are attached at **Figure 4** through **Figure 9**.

[2] Source: Vancouver Economic Commission

[3] http://www.tripadvisor.ca/TravelersChoice-Attractions-cParks-g1 retrieved May 22, 2015 and attached at **Appendix 2**

Figure 3: Sensitive Sites and City Owned Land

The Salish Sea, and especially Burrard Inlet and the Fraser River estuary, has been identified as one of the most ecologically important coastal marine habitats along the entire Pacific coast of North America. It is seasonally inhabited by over a million sea- and shorebirds, including more than 30% of the global population of snow geese. It is one of just 6 sites along the west coast of North America of international and hemispheric importance.[4]

The JWS Report describes the Fraser River as the largest single salmon-producing river on the Pacific Coast of North America (including Alaska), supporting runs of Sockeye salmon that can number in the tens of millions, along with major runs of Chinook, Chum, Pink and Coho salmon, as well as Steelhead Trout. These returning adult salmon support several species of marine mammals, including the endangered southern resident killer whale, commercial fisheries worth millions of dollars, and subsistence harvests for First Nations that depend on them for

[4] Short, Jeffrey W., *Fate and Effect of Oil Spills from the Trans Mountain Expansion Project in Burrard Inlet and the Fraser River Estuary*, May 11 2015, at page 15, para. 3.3 – attached at **Appendix 3** ("**JWS Report**").

maintaining their cultural heritage as well as for nutrition. Juvenile salmon outmigrating from the Fraser River depend on the estuary's high biological productivity and in turn provide forage for the seabirds and other fish species.[5]

Attached as **Appendix 4** is a Report on The Economic Importance of the Lower Fraser River July 2014 prepared by the Richmond Chamber of Commerce. The report identifies the following factors:

1. Soil in Fraser Valley supports some of the most fertile agricultural land in Canada and annually generates more than 62% of the province's gross farm receipts ($1.6 billion).

2. 9 of 10 Federal Small Craft Harbours (SCH) in the region are located along the Lower Fraser River. Steveston hosts the largest SCH in Canada, a key facility for the commercial fishing industry on the B.C. coast.

3. 300,000 people live in the floodplain of the Lower Fraser River and it is estimated that by 2040, an additional one million people will be living in the Lower Mainland region, putting additional pressure on the need for upgrades of all infrastructure.

4. The Vancouver Fraser Port Authority (doing business as Port Metro Vancouver) is the largest port by export tonnage in North America and is the country's principal ocean gateway to the Pacific. Port infrastructure on the Lower Fraser River estuary is an integral part of Port Metro Vancouver, accounting for a significant portion of current port tonnages and jobs.

The pipeline facilities proposed for the TMEP are currently designed with 700 water-crossings in British Columbia, including over 80 within the Lower Fraser River Watershed. The water-crossings within the Lower Fraser River Watershed put the environment, wildlife and fisheries as well as the residents and businesses at risk of an oil spill in this economically significant region. The proposed design standards for pipeline construction and the safety measures proposed are of significant concern for Vancouver. For this reason, Vancouver raised questions in the

[5] JWS Report, Appendix 3, page 16, para. 3.4

Information Request process about Trans Mountain's decision to design the pipeline at all river crossings other than the Fraser River to withstand a 200 year flood event rather than the higher flood design standard recommended by the Association of Professional Engineers and Geoscientists of BC in the 2012 guidance document "Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC". The guidance document identifies a design standard for high consequence failures where there is a "high loss potential" or "very high loss potential" of 1:1000 to 1:2500. A copy of the APEG BC guidance document is attached at **Appendix 5**.

2.2 SUSTAINABILITY AND GREENEST CITY INITIATIVE

Vancouver has been concerned about climate change and has been taking action to address sustainability issues since the 1990's. The work of Vancouver's Sustainability group, as well as other operational parts of the organization, is dedicated to climate change mitigation and adaptation, renewable energy, air quality protection and supporting other environmental sustainability initiatives within Vancouver's operations and throughout the community. Vancouver's leadership in sustainable development and the Vancouver Greenest City initiative provide significant value to the economy, 94% of which is non-resource based.

The local economy depends on Vancouver's reputation for sustainability to attract businesses, professionals and other workers as well as tourists and students. Vancouver was ranked as one of the top 10 largest clean technology clusters in the world by Global Cleantech Cluster Association. Vancouver also has one of the strongest green building clusters in the Pacific North West. Vancouver's green building sector comprises over 70 firms and about 1,600 employees. In 2012, the tourism industry generated $3.6 billion in revenue[6] and over 666,000 cruise ship passengers visited Vancouver, contributing $167 million to the economy.

Sean Pander, of the City of Vancouver, is the Assistant Director of the Sustainability Group. He has held the position of Assistant Director since November 1, 2010 and has worked in positions related to Vancouver's sustainability programs since July 4, 2005. Mr. Pander is a Professional

[6] http://www.tourismvancouver.com/includes/content/images/media/docs/expenditure_by_industry_sector.pdf retrieved May 22, 2015 at attached at **Appendix 6**

Engineer in good standing with the Association of Professional Engineers and Geoscientists of British Columbia.

As Mr. Pander states in his Affidavit sworn May 16, 2014, Vancouver has identified a number of areas in which Vancouver will be significantly impacted by climate change due to its geographical location, including the following[7]:

a. Vancouver is a coastal city with 69.8 kilometres of waterfront, much of it highly developed and containing high concentrations of valuable urban infrastructure and real estate. As sea levels rise, as internationally recognized climate change projections predict, Vancouver's waterfront is vulnerable to flooding;

b. Vancouver's oceanic climate will be susceptible to increased frequency and severity of extreme weather events that will have impacts on city infrastructure;

c. Changing precipitation patterns will result in higher rainfall amounts during winter but significantly drier summer periods, with increased incidences of heat-related mortality and morbidity, and droughts;

d. Changing precipitation patterns, especially during winter months where rainfall amounts will increase significantly, will result in higher frequencies of overland flooding and sewer backup; and

e. Decreasing winter snow pack will result in reduced drinking water availability during summer dry periods.

Climate change is one of the external risks that Vancouver faces and Vancouver has actively assessed, and continues to actively assess, the potential impacts of climate change on Vancouver's infrastructure, real estate and its citizens. As with all risks Vancouver faces, it is preparing appropriate mitigation plans.

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[7] Affidavit of Sean Pander sworn May 16, 2014 and attached as **Appendix 7** ("**Pander Affidavit**")

An assessment of the potential for present and future flooding in Vancouver in view of the projected sea level rise was prepared by Northwest Hydraulic Consultants in December 2014 in a report entitled "City of Vancouver Coastal Flood Risk Assessment Report". A copy of the report is attached at **Appendix 8.**

The report looks at the potential impacts of sea level rise due to climate change and defines the floodplain extents, flood depths and flood construction levels and assesses vulnerable areas and the consequences to people, property and infrastructure in Vancouver. The study is a first step in an overall strategy for flood response and its results will feed into Phase 2 of the project, which will explore options for mitigating and adapting to the flood risk across the City.

Robert Bartlett, Director of Enterprise Risk Management and the Chief Risk Officer for Vancouver, oversees the insurance requirements for Vancouver and advises that insurance companies are increasingly concerned about the risks associated with climate change. The risks and impacts of climate change have been researched and published by insurers in their reports. One such report sponsored by Swiss Re, a recognized leader in the reinsurance market, is entitled "Natural Catastrophes and Manmade Disasters in 2013". The reinsurance market is a wholesale market which provides capacity and protection to retail insurers, particularly to insulate from large catastrophic losses. A copy of an excerpt from the Swiss Re report is attached as Exhibit "A" to the Affidavit of Robert Bartlett sworn May 16, 2014. Mr. Bartlett's Affidavit is attached at **Appendix 9.**

Vancouver will incur costs in preparing for and responding to impacts of climate change. The more severe these impacts are, the greater the costs of adaptation and response will be. Preliminary projections by the Province of British Columbia suggest that the costs to prepare 250 km of shoreline and low lying areas in southwestern BC by traditional flood protection mechanisms and land acquisition would be in the order of $9.5 billion.

Increasing severity of climate change impacts will also reduce Vancouver's ability to respond adequately to or prepare for extreme events. The fifth assessment report of the Intergovernmental Panel on Climate Change (the "IPCC") released in 2014 notes that, in some parts of the world, insufficient responses to climate change impacts are already eroding the basis for sustainable development.

On July 5, 2011, Vancouver adopted the "Greenest City 2020 Action Plan". It has three over-arching areas of focus: (1) Climate Protection, (2) Waste Reduction, and (3) Ecosystem Health. Vancouver has completed nearly 100 projects and currently has more than 50 additional projects underway to achieve is Greenest City goals. One of these goals (Goal 2) is Climate Leadership to "eliminate dependence on fossil fuels" and targets reducing community-based greenhouse gas emissions by 33% from 2007 levels by 2020.[8]

Since 2011, Vancouver has been recognized over fifteen times through various national and international indices and awards relating to sustainable development. These include awards for climate action, green building design, renewable energy systems, energy efficiency, transportation and overall sustainability of the city.

3. CLIMATE CHANGE and THE FUTURE OF OIL SANDS DEVELOPMENT

3.1 INTERNATIONAL MARKET FOR OIL SANDS BITUMEN

Vancouver has taken regulatory action to reduce greenhouse gas (GHG) emissions through its Greenhouse Gas Emission Reduction Official Development Plan By-law[9] and through land use and transportation planning which promotes the reduction of GHG emissions by creating compact, mixed-use, walkable neighbourhoods, supported with public transit and with walking and cycling infrastructure.

Vancouver commissioned independent expert evidence to assess the regulatory frameworks currently in place or posed by jurisdictions other than Canada to limit or reduce GHG emissions, and the implications that such regulatory frameworks may have for Canada's petroleum exports generally and, more specifically, the long-term economic feasibility of the TMEP. The evidence of Professor Kathryn Harrison, along with her report entitled "*Review of Destination Country Policies with Potential Impact Demand for Canadian Oil Exports*", is provided in **Appendix 10** and Vancouver relies upon and adopts this evidence

[8] Pander Affidavit, Exhibit C
[9] Pander Affidavit, Exhibit B

Professor Harrison's report includes the following findings:

1. Recent comparisons of global climate and energy policies find that there has been exponential growth of policy development in both developed and developing countries.

2. With respect to transportation fuels, this is evident in a roughly 50% tightening of fuel economy limits in the decade from 2015 to 2025, with a very high degree of convergence between developed and rapidly developing country standards. Policies already announced have the potential to reduce fuel consumption in industrialized countries, while further strengthening of transportation policies in response to international climate agreements and national commitments could yield reductions even in rapidly growing markets in China and India.

3. If the international community maintains its commitment to limit climate change to 2C, it is projected that international demand for oil will peak as early as 2020 and decline thereafter. In this scenario, it is likely that demand for Canada's bitumen would experience a greater decline than light crudes due to heavy oil's greater cost and higher emissions, both at the point of production and downstream combustion.

Professor Harrison also notes that the 30-year economic case for the TMEP, while conservative in terms of the life of a pipeline, is equivalent to several lifetimes of environmental policy. She concludes that it is a virtual certainty that legal requirements and regulatory standards will become more stringent over time.

Attached as **Appendix 11** is a copy of the report "Know Your Oil" referenced in the Harrison Report. The authors of this report confirm that Cold Lake diluted bitumen is one of the highest GHG-emitting oils on a lifecycle basis and the most expensive to produce[10].

[10] Know Your Oil, page 44, Figure 16

Climate change regulation is an issue that was recently addressed in an article published in the journal Nature, confirming that approximately 74% of Canadian oil reserves will remain unused if regulations continue to be put in place to limit global warming to 2°C. The article, entitled "The geographical distribution of fossil fuels unused when limiting global warming to 2°C" is attached at **Appendix 12.**

Vancouver commissioned independent expert evidence to assess the impact of national and international climate policies on future development of and demand for oil sands bitumen. The evidence of Professor Mark Jaccard is provided in **Appendix 13**, together with his report entitled "*Impact of National and Global GHG Targets on the Trans Mountain Project*", and Vancouver relies upon and adopts this evidence.

Professor Jaccard's report includes the following findings with respect to the impact of international climate policy on future development of and demand for oil sands bitumen:

1. All of the leading independent energy-economy-models concur that the global demand for oil will fall from current levels by 2050. They also show that production of unconventional oil (such as oil sands) will not grow and may even decline to zero over the next few decades:

2. Internationally, the implementation of climate policies to meet the 2°C cap on global warming would have the effect of lowering global oil demand from almost 90 million barrels per day in 2013 to 63 million barrels per day in 2050. This falling demand would lead the average world oil price to fall to below $40 (2013 $US) per barrel by 2040.

3. As one of the highest cost sources, oil sands production will be uncompetitive.

4. The combination of low oil prices and high production costs for oil sands renders new investment in the oil sands uneconomic. As a consequence, new oil pipelines serving the oil sands, such as the TMEP, will not be "used and useful".

The recent report from HSBC Bank plc identifies the risk associated with stranded fossil fuel assets, defined as "those [assets] which have suffered from devaluations or conversion to liabilities prior to the end of their economic life. Fossil fuel companies, or some of their assets, may become non- viable or 'unburnable' because of a number of factors." The report, entitled "*Stranded assets: what next?*", (the "HSBC Report") describes three of the drivers for fossil fuel stranding and concludes that stranding risks will become increasingly acute going forward. A copy of the report is attached at **Appendix 14**.

The HSBC Report explains the three drivers for fossil fuel stranding as follows:

1. **Climate Change Regulation:** *The last twenty years has seen the emergence of policies aimed at mitigating climate change. Climate change policies pose regulatory risks to fossil fuel production, particularly those assets which are more carbon intensive … New climate change regulation will continue, in our view, to have a restraining effect on GHG emissions - capping emissions and increasing the cost of emitting through taxes and emissions trading schemes - thereby posing further downside risks to more carbon intensive projects.*

2. **Lower Energy Prices:** *The most significant stranding dynamic to have emerged recently comes from the fall in the oil price and other fossil fuels. Chart 3 shows the falls in fossil fuel energy prices since the beginning of 2014, with falls in oil and gas prices more pronounced. … Where the decision is taken not to produce from a proven reserve or to cease production which was underway, then the asset can be said to be economically stranded – non-viable given the current energy economy.*

3. **Energy Innovation:** *[The] third dynamic supporting the stranded assets paradigm will be innovation in energy systems, disruptive technologies and efficient processes. … We expect innovation in efficiency and technological advancements, including in renewables, battery storage and enhanced oil recovery, to alter the energy mix and pricing in the energy economy, potentially resulting in further stranding of high carbon and high cost fossil fuels.*

With respect to the future of oil prices, Trans Mountain's application includes the Written Evidence of Steven J. Kelly which was filed in December 2013, months before oil prices began to fall to the current level of US$65.03 per barrel for Brent Crude and US$58.98 per barrel for Western Texas Intermediate (WTI). One of the issues that Mr. Kelly was asked by Trans Mountain to address in his evidence was the question of whether the TMEP would generate higher netback prices for crude oil producers. Mr. Kelly conducted a Netback Pricing and Benefits Analysis and the results of that analysis are included in his written evidence.

Attached at **Appendix 15** is a copy an excerpt from the Written Reply Evidence of Steven Kelly dated January 31, 2013, filed with the National Energy Board in Trans Mountain's application pursuant to Part IV of the *NEB Act*. Mr. Kelly gives the following evidence regarding: (a) the use of netback pricing and benefits analysis; and (b) the connection between the upstream development of oil sands production and the downstream development of the Asian refining industry as a market outlet for Western Canadian crude:

> (a) We [IHS] are aware that any netback analysis conducted on the basis of current market conditions may yield distorted results, given the pipeline constraints currently affecting prices of Canadian crude oil. An analysis based on netbacks available from markets potentially served by Western Canadian crude oil over the long term may be useful. However, in our experience, it may also produce distorted results to the extent it compares term and spot deliveries in different export pipelines.[11]

> (b) [T]he development of the Asian refining industry as a market outlet for Western Canadian crude is expected to proceed in conjunction with upstream developments in the oil sands. The commercial arrangements under which crude oil is delivered to Asia (and the resulting netback price) may vary considerably, depending on the type of crude being processed, the need for incremental refining capacity to be constructed to process the crude, the basis upon which such capacity is justified, financed and constructed, and the organizational relationship between the crude seller and buyer.

[11] Reply Evidence of Steven Kelly, Hearing Order RH-001-2012, January 31, 2013, page 16

Trans Mountain's application also includes a report of the Conference Board of Canada (CBC) entitled "The Trans Mountain Expansion Project: Understanding the Economic Benefits for Canada and its Regions". This CBC report on the TMEP, authored by Glen Hodgson, uses Statistic Canada's interprovincial Input-Output (I/O) model as the basis for its calculations. The Alberta Treasury Board and Finance has cautioned that the structure and limitations of I/O models lend themselves to measuring the impacts of projects that are shorter term in nature and that for longer-term, time series analysis, general equilibrium models are more appropriate.[12]

3.2 REGULATORY ACTION REQUIRED IN CANADA TO MEET GHG EMISSION REDUCTION TARGETS

Professor Jaccard's report, referenced above, assesses the implications of Canada's commitment to reduce GHG emissions by 2050 for oil sands bitumen production and concludes that projected growth in oil sands production alone would, by 2050, account for over 90% of Canada's emissions commitment, allowing almost no other emissions from the rest of the economy. In order to achieve Canada's 2050 target, a rising carbon price or equivalent tightening of GHG emissions is required. These regulatory measures would increase new "in situ" oil sands production costs by almost 50%. New in situ oil sands projects would only be profitable if the oil price producers receive remains on average above $85-$90 per barrel over the next three decades of Canadian climate policy.

3.3 CONTRIBUTION OF TMEP TO GHG EMISSIONS

In an earlier report prepared for Vancouver, Professor Jaccard, concludes that the total upstream emissions attributable to the TMEP are 8.8 million metric tons of carbon dioxide equivalents (MMTC02-e) per year, which is equivalent to adding 2.2 million average emission cars to Canada's existing vehicle stock. The additional unaccounted emissions, whether from further processing and refining, overseas transport, or final consumption, that would occur outside of Canada are estimated at 71.1 MMTC02-e per year. A copy of Professor Jaccard's report entitled "*Impact on GHG Emissions and Climate Targets of the Trans Mountain Project "* is attached as part of the written evidence at Appendix 13.

[12] Alberta Treasury Board and Finance, *Alberta Economic Multipliers – 2009,* page 4 – **Appendix 16**

Professor Jaccard's conclusions regarding the contribution of the TMEP to GHG Emissions are consistent with the recent findings of the United States Department of State Bureau of Oceans and International Environmental and Scientific Affairs in its review of the environmental impacts of the Keystone XL Project (the "Keystone SEIS"). A copy of the Keystone SEIS Executive Summary together with Volume 4 is attached at **Appendix 17.**

The Keystone SEIS finds that lifecycle greenhouse gas emissions from development and use of oil sands crude is about 17% greater than emissions from average crude oil refined in the United States on a wells-to-wheels basis.[13]

The Keystone SEIS also finds that the incremental greenhouse gas emissions from the extraction, transport, refining and use of the 830,000 barrels per day of oils sands crude that could be transported by the project at full capacity would result in up to an additional 27.4 million metric tons of carbon dioxide equivalents (MMTC02-e) per year.[14] 27.4 MMTC0 2-e per year is equivalent to the annual greenhouse gas emissions from 5.7 million passenger vehicles or 7.8 coal fired power plants.[15] Over the 50-year lifetime of the pipeline, this could translate into releasing as much as 1.37 billion more tons of greenhouse gases into the atmosphere.[16]

4. SPILLS HAVE HAPPENED IN THE PAST AND WILL CONTINUE TO HAPPEN

The City Council resolution on December 18, 2013 directing staff to apply to intervene in the NEB hearing of the TMEP identified as a major concern the unacceptable risk associated with the expansion of the pipeline facilities and increased tanker traffic to Vancouver, residents and businesses including, but not limited to, risks to Vancouver and the region's vibrant economy, local environment and parks, infrastructure, financial and legal liability, public health, and our international brand as one of the world's most liveable cities.

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[13] Keystone SEIS, Executive Summary, p. ES-15
[14] Keystone SEIS, Executive Summary, p. ES-15
[15] Keystone SEIS, p. 4.14-46
[16] Keystone SEIS, p. 4.14-41

Throughout Trans Mountain's application for the TMEP, reference is made to the existing pipeline which, according to Trans Mountain, has "been operating safely for more than 60 years."

Vancouver commissioned an independent expert to conduct a review of the historical operations of the Trans Mountain Pipeline and provide an assessment of the oil spills and other incidents relating to the existing facilities. The evidence of Sean Kheraj is provided in **Appendix 18**, together with his report entitled "*Historical background Report: Trans Mountain Pipeline, 1947-2013*". Vancouver relies upon and adopts this evidence.

Professor Kheraj's assessment includes the following findings:

1. Oil spills on the Trans Mountain pipeline have occurred in a random and sporadic fashion, often the result of accidents, hardware failures, material failures or unforeseen causes.

2. The most environmentally disastrous oil spills were caused by faulty welds and other construction defects, human error, and forces of nature.

3. Between the years 1961 and 2013, Trans Mountain reported 81 liquid hydro-carbon spill incidents to the NEB, an average annual rate of 1.53 spills/year.

4. The total "uncontained spillage" reported by Trans Mountain in this timeframe is approximately 5,799,700 litres of liquid hydrocarbons. Nearly 57% of the total oil spill volume since 1961 occurred in just three years: 1966, 1977, and 1985. However, there have been three substantial oil spills on the Trans Mountain Pipeline in the recent past, all of which occurred in or around the lower mainland:

    a. In July 2005, 210,000 litres of crude oil, affecting 14,300 square metres of land, spilled into Kilgard Creek near Abbotsford, BC. The Transport Safety Board found that "delays in emergency response, as well as the time taken to identify the leak, increased the severity of the accident." A resident had complained about

acrid odours just outside the Sumas tank farm on July 8, 2005 but it was not until one week later, on July 15, that a Trans Mountain employee discovered the oil spill.

b. On July 24, 2007, approximately 234,000 litres of crude oil spilled from the Westridge Dock Transfer Line, with crude oil spraying twelve to fifteen metres into the air for a period of twenty-five minutes. The spill drained into Burrard Inlet via storm sewers.

c. On May 6, 2009, 277,000 litres of light sweet crude oil spilled from one of the tanks at the Burnaby Terminal as a result of the failure of the fitting on the suction pump.

The risks and the economic impacts to Vancouver of an oil spill are discussed in detail in the sections below, including evidence of Vancouver's recent experience with the oil spill from the *M/V Marathassa* in April 2015.

PART 2 – CITY OF VANCOUVER WRITTEN EVIDENCE

5. THE RISK OF AN OIL SPILL INTO BURRARD INLET or FRASER RIVER

I, Daniel Stevens, am the Director of Emergency Management in the Office of Emergency Management of the City of Vancouver. I have held the position of Director of Emergency Management since March of 2012. Prior to this, I held the position of Manager of Emergency Planning and Senior Emergency Planning Coordinator for the City of Vancouver.

I have knowledge of the matters set out in the City of Vancouver's written evidence. Other City staff have also provided input on issues of concern to the City of Vancouver as stated in this evidence.

5.1 OFFICE OF EMERGENCY MANAGEMENT – PLANNING AND RISK ASSESSMENT

The Office of Emergency Management ("OEM") is responsible for overseeing the emergency management program for Vancouver which includes emergency planning, training, exercising, response, and a number of mitigation activities. OEM facilitates hazard, vulnerability and risk assessments, provides support and expert advice on planning for individual City departments and implements programs to maintain a state of readiness to respond to all-hazards. As part of its planning responsibility, OEM continuously monitors the Vancouver area for new or changing risks, and gathers the information that is required to assess and plan for these risks.

In British Columbia, local authorities base emergency management activities (preparedness, mitigation, response and recovery) on the British Columbia Emergency Response Management System[17], an overview of which is attached at **Appendix 19**. The BCERMS response goals guide local authority objectives in developing plans and implementing response and recovery actions. In accordance with best practice in emergency management, Vancouver engages with

[17] British Columbia Emergency Response Management System, September 2000: http://www.embc.gov.bc.ca/em/bcerms/bcerms_overview-manual.pdf (accessed May 15, 2015)

stakeholders in the public, private and non-profit sector to develop emergency response plans and to promote community and organizational preparedness and resilience. Vancouver also works closely with critical infrastructure providers, such as Vancouver Coastal Health, Fortis BC, BC Hydro, and the Vancouver School Board to coordinate response planning, risk assessment and preparedness and mitigation activities. OEM tests and improves Vancouver's plans based on the outcomes of training and planning exercises and real-life emergencies that involve internal and external response partners.

The Emergency Social Services (ESS) Volunteer program provides essential basic needs for individuals impacted by emergencies that result in evacuation or loss of their homes. OEM trains ESS volunteers to manage reception centres and group lodging, and to coordinate with other local agencies such as the Salvation Army and BC Housing support to the public using the BCERMS model. During the recent chemical fire at Port Metro Vancouver, ESS volunteers were placed on standby to establish reception centres at local community centres in the event that the fire was not brought under control or an evacuation order was issued. OEM jointly manages the Vancouver Volunteer Corps (VVC) program with Vancouver Fire and Rescue Services ("VFRS"). VVC Members may be called on to support the City in responding to emergencies in a number of capacities, including but not limited to: providing information to the public during a response and recovery, providing support and information to City staff and responders overseeing public safety operations for large special events and supporting damage assessment post-emergency. For example, during the recent *M/V Marathassa* oil spill, VVC members were deployed along with local first responders to provide information to the public about the spill and to warn people to stay away from the oil on the shoreline.

Vancouver's Emergency Response and Recovery Plan defines the overall response of Vancouver to an emergency or disaster, including the structure of response, the roles and responsibilities of departments, and mechanisms for providing information to the public at risk. This plan meets the requirements of the *Emergency Program Act*[18] and the *Local Authority*

[18] *Emergency Program Act*, RSBC 1996 ch. 111 – **Appendix 20**

Emergency Management Regulation[19] and was developed after extensive review of emergency plans for other local governments in BC as well as plans from other metropolitan areas across Canada. Vancouver's Emergency Response and Recovery Plan is regularly reviewed and updated as Vancouver's risk profile changes and to align with best practice.

As part of Vancouver's Emergency Response and Recovery Plan a formal Hazard Risk and Vulnerability Assessment (the "HRVA") was completed in 2008 that identifies the top ranked hazards based on the best available information at that time. Subsequent to the completion of the HRVA, Kinder Morgan introduced its proposal to expand the Trans Mountain Pipeline to allow for a significant increase in the volume of diluted bitumen transported from the Alberta oil sands to the Westridge Marine Terminal in Burnaby and the export of the diluted bitumen by tanker through the Burrard Inlet.

Vancouver engaged a number of experts and local stakeholders to understand the consequences of a major spill of diluted bitumen from a tanker in the Burrard Inlet, as well as from a pipeline release in the Fraser River. The new information that Vancouver has obtained through its experts and other sources concerning the substantial human health and environmental risks associated with diluted bitumen and the consequences of a diluted bitumen spill has prompted Vancouver to include the risk of an oil spill in the list of top ranked hazards.

5.2 APPROACH TO RISK ASSESSMENT OF TMEP

5.2.1 How Risk is Defined

Trans Mountain's application excludes study segment 2 (Vancouver Harbour area) and study segment 3 (English Bay) from its risk assessment on the basis that these segments are "*Not considered as viable spill location due to relatively low frequency for an accidental oil cargo spill*."[20] Oil spill scenarios were not considered for these study segments and no risk assessment was undertaken regarding the impacts of an oil spill in Burrard Inlet on Vancouver. Trans

[19] *Local Authority Emergency Management Regulation*, B.C. Reg 380/95 – **Appendix 21**
[20] Study Segments 3 and 4 "*Not considered as viable spill location due to relatively low frequency for an accidental oil cargo spill*." Source: TERMPOL 3.25 General Risk Analysis and Intended Methods of Reducing Risks, Ch. 10.1 Table 31.

Mountain also excluded any assessment of the cumulative impacts of a series of smaller spill events.

Vancouver commissioned independent expert evidence to evaluate the risk assessment methodology used by Det Norske Veritas ("DNV") in their report to Trans Mountain. The evidence of David Etkin is provided in **Appendix 22** and Vancouver relies upon and adopts this evidence.

As Professor Etkin states in his evidence, risk can only be evaluated using both (1) hazard (probability and severity) and (2) consequence (exposure and vulnerability). He concludes that the Trans Mountain/DNV risk assessment incorrectly uses hazard probability in lieu of risk and this has resulted in an improper exclusion of a large range of low probability, high consequence (LPHC) events from the risk assessment.[21]

In his evidence, Professor Etkin also highlights the fact that the Trans Mountain/DNV risk analysis does not include consideration of the local population's view of what is an acceptable level of risk and, therefore, does not meet TERMPOL standards for risk assessment.

Professor Etkin's conclusion that an assessment of the risk of a diluted bitumen spill to Vancouver requires an assessment of both the likelihood of a spill occurring and the impact of a spill on Vancouver is consistent with the approach to risk assessment promoted by DNV in an online publication titled "Time to Rethink Risk", DNV states:

> *Good and traditional risk management includes ranking risks according to consequence and probability of occurrence, and giving most attention to management of those that score high on both. ...*
>
> *However, our traditional risk management methods have a weak spot. Following this approach strictly may result in little attention given to those few risks with a very high loss potential and very low probability of happening. The most dramatic consequences are typically a result of a combination of many factors, each with their own risk picture. This*

[21] Written Evidence of David Etkin, page 2

> *can be said about such shocking events as the earthquake and tsunami that violently struck Japan, the global financial meltdown and the Macondo well blowout disaster in the Gulf of Mexico. The occurrence and consequences of these events were not impossible to foresee, they were just highly improbable – and managing the risks effectively up front would come at a cost.*
>
> *[. . .]*
>
> *it is time for us to focus of [sic] our attention, technical skill and research and development on the low probability, high consequence, events.*[22]

Further, DNV in its online publication "Oil Spill Risk Management" states:

> *Understanding the risk of a major oil leak or a blowout gives half the oil spill risk picture. The probability of impacting personnel and the environment and the potential consequences of this must also be included in the overall risk picture . . . The risk is calculated by combining the potential impact with the probability of the spill and the probability of oil pollution of the sensitive environmental resources.*[23]

Professor Etkin's conclusion is also consistent with the approach followed by Vancouver's OEM and with provincial, federal and international risk assessment standards. Two such examples are the Federal Policy for Emergency Management[24] and the All Hazards Risk Methodology Guidelines (the "AHRM Guidelines")[25] developed by Public Safety Canada. The standards for risk assessment set out in these two documents require an assessment of both likelihood and consequence, with specific reference to impacts on people, property and the environment.[26] The assessment of consequence may be supported by quantitative data extracted from past risk events

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[22] Det Norske Veritas, "Time to Rethink Risk" (May 25, 2011), online at http://www.dnv.com/industry/oil_gas/publications/updates/offshore_update/2011/01_2011/Timetorethinkrisk.asp (accessed May 12, 2015) – **Appendix 23**

[23] Det Norske Veritas, "Oil Spill Risk Management" (April 25, 2012), online at http://www.dnv.com/industry/oil_gas/publications/updates/oil_and_gas_update/2012/01_2012/oilspillriskmanagement.asp (accessed May 12, 2015) – **Appendix 24**

[24] Public Safety Canada, Federal Policy for Emergency Management, December 2009 – **Appendix 25**

[25] Public Safety Canada, All Hazards Risk Assessment Methodology Guidelines, 2012-1013 –**Appendix 26**

[26] Federal Policy for Emergency Management, Appendix 25, para. 5.3; All Hazards Risk Assessment Methodology Guidelines, Appendix 26, page 21.

or extrapolated from experiments or qualitative information derived from experts' judgment.[27] The AHRM Guidelines set out the following steps from the assessment of impacts:

> *Impact Analysis generally comprises the following steps:*
>
> *1. Identification of all individual impacts from all hazards and threats associated with the risk event.*
>
> *2. Quantification of the impacts from all hazards and threats associated with the risk event, based on the six impact categories and their respective rating schemes as described in detail below.*
>
> *3. Consolidation of all impacts into high-level impact dimensions.*
>
> *4. Aggregation of the high-level impacts into an overall impact for the risk event, together with an expression of the level of confidence in the estimates.*[28]

Another example of best practice in risk assessment, which includes an assessment of consequences based on the definition of risk that includes both probability (likelihood) and hazard (impact)**,** is the recent risk assessment from the Integrated Partnership for Regional Emergency Management ("IPREM").[29] This assessment ranked a series of hazard scenarios in terms of risk. Hazard categories include Natural, Human Accidental, Technological, Terrorism CBRNE and Human Intentional. The results of this assessment included the identification of regional hazards with the greatest potential impacts to the Metro Vancouver area. One of the greatest potential impacts identified was the grounding of a vessel near the mouth of the Burrard Inlet, at first narrows, resulting in a major fuel spill event.[30]

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[27] All Hazards Risk Assessment Methodology Guidelines, Appendix 26, page 21
[28] All Hazards Risk Assessment Methodology Guidelines, Appendix 26, page 22
[29] IPREM, *Regional Hazards Impacting Metro Vancouver – An Analysis*, December 19, 2013, paragraph 3.1.4 – **Appendix 27**
[30] *Regional Hazards Impacting Metro Vancouver – An Analysis*, **Appendix 27**, pdf pages 126 and 138,

Low probability high consequence events pose some of the greatest planning and response challenges for local communities, but are among the most important to understand and plan for. For example, a large earthquake does not have a high likelihood ranking but it does have among the highest potential impact ranking for Vancouver. In 2012-13, the City of Vancouver worked with NRCan to assess the risk of a magnitude 7.3 Earthquake in the Georgia Strait using HAZUS, a modelling tool that calculates the impact of hazards on communities. The result of this work was the development of an Earthquake Preparedness Strategy that was reported to and approved by Council. Although there are a range of more probable and also higher magnitude earthquakes that could occur in other locations in the lower mainland, this scenario was identified for the purposes of Vancouver's emergency planning because it is the scenario which is likely to have the most severe impact.

This approach to emergency planning is consistent with best practice and is necessary so that Vancouver can prioritize its response plans and activities, inform the public about the risk, and consider appropriate mitigation and preparedness actions. This approach also enables Vancouver to be better prepared for earthquakes of lesser magnitude that are more likely to occur but are also anticipated to have major consequences for the City. Earthquakes of lesser magnitude can have significant impacts, either because of the location in which they occur and values they impact or because they result in cascading impacts.

Vancouver's emergency planning also incorporates a number of reasonable assumptions. For example, it is assumed that, depending on the time and day of the earthquake, many staff and their families will be impacted and may not be able to get to work to assist with emergency response. It is also assumed that damage to transportation and communication infrastructure will present challenges to emergency responders that need to be planned. To address these potential challenges, Vancouver has put in place a series of redundant networks to support communications, but also plans for the worst case scenario that all communications will be down. The city has been divided into six zones with a Disaster Staging Area in each zone. Staff members have been pre-identified to report to critical locations, including the EOC and the six Disaster Staging Areas. Each Disaster Staging Area has a shipping container which includes communications equipment, damage assessment equipment, food, water, cots and other response

equipment. This will enable responders and volunteers to start working immediately regardless of where they are physically situated in the city.

5.2.2 Human Error

There is a plethora of evidence to suggest that human factors are a major cause of significant accidents, including those involving oil spills, fires and explosions. According to DNV, "the human factor is the main cause in approximately 80 percent of accidents."[31] A 2006 report by Nuka Research & Planning Group, LLC for the Prince William Sound Regional Citizens Advisory Council also identified "human factors"—either individual errors or organizational failures—as the cause for up to 80% of oil spills and marine accidents[32]. The US Coast Guard in its report "Human Error and Marine Safety" identified human error as contributing to 84 – 88% of tanker accidents, 79% of towing vessel groundings, 89 – 96% of collisions, 75% of allisions, and 75% of fires and explosions.[33] Human error can also cause response mistakes and failures that can exponentially increase the negative effects of such accidents.

Specific accidents in which human factors were identified as major contributors include:

a. the 2007 Cosco Busan oil spill in San Francisco, which the National Transportation Safety Board concluded was caused by human errors of the pilot and master of the vessel[34];

b. the July 24, 2007 rupture of the Trans Mountain pipeline and resulting release of crude oil in Burnaby BC and Burrard Inlet;[35]

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[31] Det Norske Veritas, "Human Factors and Safety Culture" (undated), online at http://www.dnv.com/industry/oil_gas/services_and_solutions/risk_management_advisory/safety_risk_management/human_factors (accessed May 12, 2015) attached at **Appendix 28**

[32] Nuka Research and Planning Group, LLC, *An Assessment of the Role of Human Factors in Oil Spills from Vessels*, (August 2006) attached at **Appendix 29**

[33] US Coast Guard Research & Development Centre, "Human Error and Marine Safety" (undated) attached at **Appendix 30**

[34] National Transportation Safety Board, *Allision of Hong Kong-Registered Containership M/V Cosco Busan with the Delta Tower of the San Francisco–Oakland Bay Bridge*, November 7, 2007, at p. 135-136.

c. March 22, 2014 collision between the bulk carrier *Summer Wind* and the *Miss Susan* Tow in the Houston Ship Channel, Texas, during which the pilot of the *Summer Wind* was using a portable pilot unit laptop, and both vessels had working radars and automatic identification system, yet never contacted each other by radio until 3 minutes before the accident, causing a double hull cargo tank rupture;[36] and

d. The Enbridge hazardous liquid pipeline rupture and release in Marshall, Michigan, July 25, 2010, which remained undetected for 17 hours due to inadequate training of personnel[37].

5.2.3 Need for a Comprehensive Risk Assessment

Vancouver has reviewed best practices for industrial risk assessment, including the Major Industrial Accidents Council of Canada risk assessment guidelines[38], and is concerned that the application does not present a comprehensive risk assessment for the entire project. The application presents incremental risk on a piecemeal basis, an approach which tends to underestimate risk. By way of contrast, and as an example of best practices, the approach promoted by the UK Health and Safety Executive is to assess risk posed to the public by a single industrial activity in a given location as a whole.[39]

5.3 EMERGENCY PLANNING CONSIDERATIONS SPECIFIC TO VANCOUVER

Vancouver has several unique characteristics that make it particularly vulnerable to a hazard event such as an oil spill from a tanker or from a segment of the pipeline near the Fraser River.

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[35] Transportation Safety Board of Canada, Pipeline Investigation Report P07H0040, "Trans Mountain Pipeline L.P., 610 –Millimetre-Diameter Crude Oil Pipeline Kilometer Post 3.10, Westridge Dock Transfer Line, Burnaby, British Columbia, 24 July 2007", at p. 12, online http://www.tsb.gc.ca/eng/rapports-reports/pipeline/2007/p07h0040/p07h0040.pdf (accessed May 25, 2015) attached at **Appendix 31**

[36] National Transportation Safety Board, Investigator-in-Charge's Accident Summary ,"Collision between Bulk Carrier Summer Wind and the Miss Susan Tow Kirby 27706" March 24, 2015, attached at **Appendix 32**

[37] National Transportation Safety Board, "Enbridge Incorporated Hazardous Liquid Pipeline Rupture and Release, Marshall, Michigan, July 25, 2010" (July 10, 2012), at p. xii – attached at **Appendix 33**

[38] Major Industrial Accidents Council of Canada, "Hazardous Substances Risk Assessment: a Mini-Guide for Municipalities and Industry" (1994) attached at **Appendix 34**

[39] UK Health & Safety Executive, "Reducing Risks, Protecting People: HSE's decision-making process" (2001), online at http://www.hse.gov.uk/risk/theory/r2p2.pdf (accessed May 22, 2015), at para. 136 – attached at **Appendix 35**

These include: (i) the density of population in the downtown core and in close proximity to Burrard Inlet and English Bay; (ii) the high number of vulnerable populations; (iii) the complexity of the transportation infrastructure; (iv) the extensive shoreline; (v) the wildlife supported by the ocean and the Fraser River; and (vi) the marine-dependant economic and recreational activities.

Vancouver is densely populated, with projections for major growth in the future. Every day hundreds of thousands of people travel to Vancouver to work, increasing the daytime population of Vancouver, especially in the downtown core. Vancouver is also a popular tourism destination, which adds to the number of people that would be exposed in the event of an oil spill. In the summer months, over 800 000 cruise ship passengers come through Vancouver, with as many as 5 cruise ships docking in a single day[40].

There are a high number of vulnerable populations in Vancouver that require special planning considerations. Vulnerable populations include but are not limited to the elderly, children, people who don't speak English, people who are homeless, medically dependent, or disabled. Many people living in the downtown East Side are particularly vulnerable to emergencies, as we experienced during the recent chemical fire at Port Metro Vancouver. Details of that incident are discussed below. A recent study on vulnerable populations in Vancouver identifies additional areas within Vancouver that are at risk[41]. While this study is specific to earthquake vulnerabilities, it is also relevant to planning for other types of emergencies.

Transportation infrastructure in the region is complex, and includes many bridges as well as important public transportation routes such as the sea bus, which may be impacted by a hazard event in the harbour, and West Coast Express, which may be impacted by a hazard event at the Port.

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[40] http://www.portmetrovancouver.com/docs/default-source/about-facts-stats/cruise-stats-2014-season.pdf?sfvrsn=2

[41] Jana C. Fox, *Vulnerable Populations: A spatial assessment of social vulnerability to earthquakes in Vancouver, British Columbia*, May 2008 – attached at **Appendix 36**

The population density of some areas, combined with the number of bridges, means that shelter-in-place is often the only option for public safety in an emergency. Shelter-in-place is an alternative to evacuation and requires that the public remain in doors and take care of themselves. During a shelter-in-place emergency, shelter needs to be provided for people who are homeless and those who do not have immediate access to shelter or do not reside in the city. The high population density of Vancouver's downtown area, including the West End, and the geography of the peninsula presents additional challenges to emergency response as major access points are by bridge.

Key pieces of Critical Infrastructure in the city are also vulnerable, especially those housing vulnerable people such as hospitals and care homes. These sites require additional consideration when conducting risk assessments and developing response plans as their residents may be disproportionately impacted by emergency events and the stress of evacuation or shelter-in-place.

All of these factors were recently engaged by the container fire at Port Metro Vancouver.

5.3.1 Container Fire at Port Metro Vancouver

At 1:38 p.m. on March 4, 2015, a 911 call was received reporting a fire at the Centerm container terminal located at Port Metro Vancouver facilities in the Vancouver Harbour. The South Shore Terminal was evacuated and the Canterm Terminal was shut down for 51 hours while emergency responders worked to control the fire until it eventually burned out.

Soon after the 911 call was received, the fire was determined to be a chemical fire and air quality concerns required a decision to be made to order evacuation or shelter in place for the nearby residential area. The affected area, a map of which is reproduced below, is densely populated, with 5 schools and a number of vulnerable populations. Notification to residents in the Downtown East Side is particularly challenging and there are many people on the streets at any given time.

The quick notification of emergency responders and identification of the product in the container, combined with the fact that the VFRS and VPD had access to appropriate protective gear, enabled the safe deployment of responders within 30 minutes to begin door-knocking in the impacted area, notify residents of the risks, and limit the health impacts to the population.

The decision to implement a Shelter-in-Place order instead of an evacuation was made because of the immediacy of the human health impacts and the difficulty in evacuating the area without exposing people to the plume. During a hazmat event, buses do not operate within impacted zones, which makes it even more difficult to get people out of an area without advance notice. Whereas in a rural or less densely populated area, evacuation may have been the identified option, it was not the best option in this case given the densely populated urban environment, the risk of exposure for people evacuating, the lack of transportation options, and the potential for transportation bottlenecks. Community Centres in the impacted zone served as shelter-in-place locations for people in the area. Vancouver also coordinated with BC Housing to keep shelters open for extended hours to keep people safe.

One of the challenges identified in the response to the Port fire was the lack of air monitoring equipment available to deploy across the community to assess the impacts to human health as the

wind direction changed. While different air quality monitoring equipment exists with various agencies in the lower mainland, there is no one agency for equipment to monitor all types of air-borne hazardous chemicals. Plume modelling from Environment Canada also took a long time to be communicated to the EOC. Given the lack of information, the EOC made decisions based on an abundance of caution for public health and safety.

5.4 ON-WATER OIL SPILLS

On-water oil spills are the only type of emergency that Vancouver does not have the primary responsibility to plan for and respond to. These spills fall under the responsibility of the federal government and the Responsible Party. Vancouver does, however, have responsibility to respond to protect the local population.

Vancouver expects to engage in oil spill response for any spill that impacts or threatens to impact the city in three broad functional areas: Emergency Management, Incident Command, and Operations.

5.4.1 Emergency Management Core Functions

For any oil spill that impacts or threatens to impact the City of Vancouver, Vancouver would activate the Emergency Operations Centre (EOC) to oversee the emergency management functions that Vancouver would be responsible for assuming during any local emergency. Some of the activities at the EOC may overlap with or parallel the Incident Command Post (ICP), and coordination between the two groups is essential. As previously discussed, Vancouver responds based on BCERMS response goals, and there may be a disconnect between the objectives of the Incident Command Post and Vancouver's EOC. Given Vancouver's local resources, it is likely that public health and safety response may begin before the ICP is even established.

5.4.2 City Presence and Participation in Incident Command

Unified Command typically consists of local, provincial and federal agencies, First nations, as well as the Responsible Party. Unified Command is responsible for directing the overall response to the incident and has primary responsibility for the containment and cleanup of the oil spill. Unified Command activities occur at the ICP.

Vancouver has a role within the Unified Command, providing representation to the Unified Command and support staff at the ICP. Vancouver representation in Unified Command ensures that the objectives and priorities of Vancouver, including the protection of public health and safety, are incorporated into planning and response. Vancouver provides representation to the Unified Command and support staff at the ICP to fill other roles in the spill response organization through the Incident Command System.

Vancouver has a duty of care to its citizens, and a responsibility to protect the public on land and within its jurisdictional boundaries. The primary response of Vancouver will be land-based, although Vancouver may serve in an enabling or supporting role to operations on the water. Through Unified Command, Vancouver will provide input regarding the priorities of on-water response operations that will impact the response requirements and actions on land.

While some Vancouver staff, departments, and resources may be reassigned to support the Unified Command or EOC, there are other Vancouver operations and functions that will be expected to continue as normal during an oil spill, and others that will be required to expand or adapt to the changing spill response situation. These operations will be managed primarily through existing lines of authority within city departments, and may require a reallocation of resources or implementation of continuity plans.

Vancouver's emergency response functions in each of these areas were recently engaged in the *M/V Marathassa* Oil Spill on April 8, 2015.

5.5 MARATHASSA OIL SPILL – April 8, 2015

On April 8, 2015, at approximately 5:00 pm local time, a recreational boater reported visible oil leaking from the starboard stern of the *M/V Marathassa*, a Panamax-sized bulk grain carrier at anchor in Vancouver's English Bay. The first vessel on-scene from Port Metro Vancouver arrived approximately one hour after the boater's initial spill reports. Two hours later, the Canadian Coast Guard (CCG) directed Western Canada Marine Response Corporation (WCMRC) to respond to the spill. WCMRC crews were on-scene within about 90 minutes of the CCG call (approximately 9:30 pm – 4 hours and 30 minutes after the original report).

According to initial reports, WCMRC identified the *M/V Marathassa* was the most likely source of the oil spill at around 4:00 am on April 9, eleven hours after the spill was first reported, although the Responsible Party did not formally acknowledge this until the evening of April 9. WCMRC informally notified Vancouver of the oil spill at 5:06 am, twelve hours after the spill was initially reported. WCMRC finished deploying containment boom around the leaking vessel just before 6:00 am on April 9. On-water skimming operations were conducted, and, according to WCMRC, approximately 1000 L of oil was skimmed from the water during the first two days of the response and, as at April 16, another 400 L is estimated to have been recovered from oiled boom and sorbent materials.[42]

There were several occasions during the response where the cleaning of vessel hulls anchored in English Bay was halted due to weather and safety concerns. Operations were halted for vessel cleaning for part of the day on April 13 and most of the day on April 14. The conditions on these days reflected fairly average conditions in the area, with rain on April 13, and winds gusting up to 50 km/hr on April 14.

The total volume of oil spilled remains unknown to Vancouver. The responsible party has not provided an estimate of how much oil was released from the *M/V Marathassa* and Vancouver has been advised that information about the total volume of oil released cannot be provided as there is an ongoing investigation.

In the initial days following the oil spill, some reports were provided by the CCG which included observations from an overflight of the area that occurred 18 hours after the spill was reported. At that time it was estimated that there was still 2700 L of oil remaining on the surface of the water and the estimated area of on-water oiling was 6.1 square kilometres. Attached at **Appendix 38** is a copy of the Marathassa Overflight Oil Map dated April 9, 2015 at 10:23 PDT. However, WCMRC skimming operations had already been underway for some time when the overflight occurred. Unless those skimming operations were entirely ineffective and no oil was recovered

[42] Email from Scott Wright to Elise DeCola dated April 21, 2015, attached at **Appendix 37**

in the first 18 hours of the spill, it is reasonable to conclude that the total volume of oil spilled must be greater than 2700 L observed during the overflight.

By hour 18, the source of the leak had still not been established and oil continued to leak from the vessel for several hours after the overflight information was obtained. On April 13, it was also discovered that there was a patch of oil (later determined to cover an area of approximately 40 m^2) suspended in an indent in the vessel hull. The on-water estimate does not account for the volume of oil that was trapped underneath the vessel during the April 9 overflight, oil that would have already adhered to the containment boom around the vessel, or the oil adhered at the water line to the hull of casualty vessel itself.

Even if it were assumed that the total volume of oil on the surface of the water (ie. not including oiled boom, the oiled vessel, and oiled shoreline) was 2700 L, which cannot be the case for the reasons mentioned above, WCMRC has only confirmed recovery of 1000 L from on water skimming. Clearly the 80% recovery estimates widely reported in the media are inaccurate.

Once notified, Vancouver quickly responded by initiating a teleconference with the Corporate Management Team, activating Vancouver's EOC, and dispatching City staff to the Port Metro Vancouver offices to meet with the Canadian Coast Guard and the Ministry of Environment. Following that initial meeting, the BC Ministry of Environment representative requested that the three parties form a Unified Command. This was agreed and it was determined by the CCG that the PMV Operations Centre would serve as the ICP.

Vancouver had a role in the Unified Command, along with the CCG, Responsible Party (RP) representatives, WCMRC, the Province of BC, West and North Vancouver municipalities, and the Tsleil-Waututh and Squamish First Nations. Vancouver also assigned support staff to the ICP to participate in the incident management process. I took on the role of Unified Commander (UC) for the City of Vancouver. As UC, I communicated Vancouver's objectives to other parties, and supported the coordination and deployment of city resources to support UC activities.

Vancouver's primary focus during the Marathassa oil spill into English Bay was to protect the health and well-being of its residents. Vancouver departments that were involved in managing the consequences of the English Bay oil spill to the city, its resources, and its residents included:

i. City Manager's Office;

ii. Communications;

iii. Digital Services;

iv. Emergency Management;

v. Vancouver Fire and Rescue Services;

vi. Vancouver Police Department;

vii. Engineering;

viii. Legal Services;

ix. Vancouver Board of Parks and Recreation;

x. Real Estate and Facilities;

xi. Risk Management; and

xii. Financial Services and Supply Chain.

In addition, EOC trained staff were pulled from virtually every City department to take on roles across all sections. These roles are not necessarily directly related to their normal role or department, but does represent contribution from across departments.

There were a number of gaps in policy, plans, and resources that were observed during the Marathassa incident which are described below.

Delays in Incident Notification Process

Vancouver was notified 12 hours after the initial spill was reported and this notification was received informally, rather than through a formal notification process.

Delays in Responsible Party Acceptance of Responsibility

The Marathassa oil spill into English Bay was first reported by a recreational boater who noted the slick as appearing to originate from the *M/V Marathassa*, however, the vessel initially denied responsibility for the spill.

Gaps in Incident Management Team and Incident Command System Implementation

The English Bay oil spill was only the third time that the CCG had implemented the Incident Command System (ICS) as a method for organizing and managing the spill response, and there were some challenges in its implementation. While the Vancouver staff assigned to the ICP expected that ICS would be employed from the beginning, there was a very uneven level of proficiency among federal agencies and other partners in the ICP. This manifested in many ways, including delays in producing Incident Action Plans (IAP), lack of consistency in incident documentation, outdated or incorrect information posted in ICP situation displays, incomplete staffing of all ICS functions, and an often chaotic meeting environment. Vancouver made a number of recommendations to the CCG and RP during the response to try to enhance the ICS implementation.

The challenges with implementing the ICS for the English Bay oil spill stand in contrast to the the detailed level of multi-government standards and planning in place for Washington State and

Oregon as provided in the Region 10 Regional Response Team/Northwest Area Committee's 2015 Northwest Area Contingency Plan, or (NWACP). [43]

The Prince William Sound Citizens Advisory Committee, an independent non—profit corporation created in response to the Exxon Valdez oil spill pursuant to the Oil Pollution Act of 1990 and (independently) funded by industry, provides an example of multi-level engagement in monitoring, planning, research, and preparedness relating to oil transportation in Prince William Sound.[44] [45]

Gaps in Spill Science and Environmental Protection

The RP hired a single consulting firm to simultaneously serve as the RP's designate in the Unified Command and to conduct shoreline assessment. Vancouver and other local stakeholders expressed concern about this relationship during the response, but it was permitted by the CCG. As a result, there were a number of issues where Vancouver believes that a conflict of interest may have adversely impacted the rigor of environmental assessments conducted during the response. Specific examples include:

1. Shoreline Cleanup and Assessment Technique (SCAT) teams did not fully survey all areas of impacted or potentially impacted shoreline in the Burrard Inlet and English Bay.

2. Shoreline assessment maps produced by the RP's contractor were incomplete and inaccurate.

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[43] Region 10 Regional Response Team/Northwest Area Committee's 2015 Northwest Area Contingency Plan, or (NWACP), available online at http://www.rrt10nwac.com/nwacp/. (accessed May 22, 2015) - **Appendix 39**
[44] Prince William Sound Regional Citizens' Advisory Council website, online at http://www.pwsrcac.org/about/ and http://www.pwsrcac.org/programs/ (accessed May 22, 2015) – **Appendix 40**
[45] Prince William Sound Regional Citizens' Advisory Council, "Effectiveness of Citizen Involvement", June 2006, online at http://www.pwsrcac.org/wp-content/uploads/filebase/resources/citizen_oversight_and_history_of_the_council/effectiveness_of_citizen_involvement.pdf (accessed May 22, 2015) – **Appendix 41**.

3. Insufficient environmental sampling and monitoring was conducted, and the RP's representative to Unified Command discouraged scientific sampling.

On a number of occasions on April 9 and 10, Vancouver requested protective booming of sensitive sites, including Stanley Park, English Bay, and False Creek, as a precaution. The response from the CCG was that they would "wait and see" where the oil was going. This response is in direct contrast to the precautionary approach applied in other jurisdictions. The Cosco Busan oil spill in San Francisco Bay is an example of an oil spill in which the volume of oil spilled was unknown. The National Transportation Safety Board's report notes that, in the absence of a firm estimate of the amount of oil spilled, the response organizations were required by California regulations to respond to the "reasonable worst-case" scenario, which would have been based on the capacity of the vessel's largest fuel tank.[46]

Ultimately oiling occurred along stretches of the shoreline of Stanley Park and in the Vancouver Harbour, including several beach and park locations. A map of the shoreline oiling that was prepared by a representative of the ship owner as of April 23, 2015 is attached as **Appendix 42**. While Vancouver disagrees with some of the data in this map for reasons which include an inadequate assessment of West Point Grey, the map illustrates a "best case" scenario for the extent of shoreline oiling.

The response to the Marathassa Oil Spill served as an important illustration of the challenges in coordinating between various government agencies to respond efficiently and effectively to prevent and mitigate environmental consequences.

Environment Canada has in place an Environmental Emergencies Program in order to focus efforts on emergency pollution incidents related to releases or spills of hazardous substances, such as oils and chemicals. The program was founded following a 1973 oil spill in Nova Scotia, which highlighted the need for the federal government to have the tools and expertise in place to

[46] National Transportation Safety Board, "Allision of Hong Kong-Registered Containership M/V Cosco Busan with the Delta Tower of the San Francisco–Oakland Bay Bridge," November 7, 2007, at p. 15

identify environmental protection priorities in order to minimize environmental consequences from significant pollution incidents.

Prior to 2012, Environment Canada would chair a Regional Environmental Emergency Team (REET) in response to an oil spill. The purpose of the REET was to bring together regional environmental experts to advise in the case of a spill response. However this program has been replaced with the concept of a "Science Table" and Environment Canada representatives are based in Montreal. Although there was an EC representative communicating with the UC via phone from Montreal, there was no Science Table established to provide comprehensive advice on environmental monitoring or impact assessment. This limited the information that was available to the UC to make decisions, and had serious implications for the environmental impact assessment and monitoring process, including significant delays initiating sampling. At this time there is still no approved environmental monitoring plan from the RP.

Draw on City Resources

The spill response created a significant draw on Vancouver's resources, including operational staff (particularly within Parks, because of the need for additional attention on beaches and parks). Vancouver actively engaged in activities to protect the public and, in turn, improve the outcome of the response. These activities helped to mitigate the adverse impacts of the spill (keeping oily waste out of regular waste streams, keeping the public from handling oily waste without proper training and equipment, providing local knowledge about the shoreline, reporting oil sightings on the water and shoreline directly from the field). This included:

i. A volunteer registration process for the general public managed by Vancouver through which 4,000 individuals volunteered to assist with the spill response.

ii. Deployment of trained emergency management volunteers from the Vancouver Volunteer Corps to provide information to the public as well as to communicate issues to the Unified Command via the CoV EOC.

iii. Developing signs and assigning representatives (employees and volunteers) to communicate beach closure information to the public.

iv. Providing Sanitation resources to manage coordination of disposal of oily waste during the initial days of the response, because convergent volunteers were placing oily waste in Vancouver's trash receptacles.

v. Providing Parks staff to participate on SCAT, and deploying additional rangers to manage crowds on beaches.

vi. Providing Engineering staff to set up fencing in support of wildlife response, and additional bylaw staff to keep dogs and people away from oiled wildlife at the request of the Wildlife Unit.

vii. The VPD Marine unit provided a vessel for Shoreline Assessment in areas where access by land was not possible.

Additional details of Vancouver's response are provided in Part 3 of the Written Evidence below under the heading Economic Effects of an Oil Spill.

5.6 THE TMEP AND EMERGENCY RESPONSE

Vancouver's experience with the Marathassa oil spill confirmed a number of the concerns that Vancouver has raised in recent years about the risks presented by an oil spill of diluted bitumen and oil spill response capacity in the region. Attached as **Appendix 43** is a copy of the Council Motion to endorse a resolution to the Union of British Columbia Municipalities (UBCM) 2014 Annual Convention entitled "Requiring Consequence and Response Capacity Assessment for Sunken or Submerged Diluted Bitumen in Local Communities" of September 16, 2014. Attached as **Appendix 44** is a copy of the Council Motion dated March 24, 2014 to endorse a resolution to the UBCM to call on the provincial and federal governments to expand the scope of oil and hazardous and noxious substances (HNS) risk assessment and response planning to include all impacts and consequences on local communities and governments, and introduce additional funding for the resources and locally-specific capacity building required to ensure that

municipalities are in the best possible position to plan for and protect communities and the environment in the event of fires, explosions, spills and related incidents as a result of increasing transportation of oil and HNS.

Vancouver has a duty of care for its citizens and has a responsibility to understand and protect the public from risks and hazards. Public health and safety is the primary concern for the Office of Emergency Management with respect to the risk of an oil spill, and there are four general categories of risk that have been identified:

1. Scientific Data regarding the fate and effects of diluted bitumen;

2. Oil Spill Response Capacity, including: (a) the speed of response both in the event of a tanker spill in the Burrard Inlet or a pipeline spill into the Fraser River; (b) the capacity of lead agencies to respond and establish a suitably-resourced command and control structure quickly; and (c) the need for evidence based and best practice approaches to response and recovery.

3. Risk to Responders

4. Emergency Response Plans and Protocols

5.6.1 Fate and Effects of Diluted Bitumen

A number of reports in the US, as well as the experience of the Kalamazoo River spill[47], identify two unique risks associated with a spill of diluted bitumen. The first is the potential for diluted bitumen to submerge when spilled and the second is the risk posed to air quality and human health by the toxic plume created by evaporating diluents. These two factors present additional risks to first responders and the public and have implications for the speed and effectiveness of any oil spill response and recovery measures.

[47] United States Environmental Protection Agency, Dredging Begins On Kalamazoo River, August 2013, attached at **Appendix 45.**

5.6.1.1 *JWS Report - Environmental Impacts*

Jeffrey W. Short, Ph.D., prepared a report for Tsleil-Waututh Nation, Vancouver and the Living Oceans Society, entitled "*Fate and Effect of Oil Spills from the Trans Mountain Expansion Project in Burrard Inlet and the Fraser River Estuary*", dated May 11, 2015 (the "JWS Report"). The JWS Report provides a peer-review of the Trans Mountain ecological risk assessment ("ERA") and an independent assessment of the fate and effects of oil spills from the proposed project in Burrard Inlet and the Fraser River estuary. The JWS Report is attached as Appendix 3 and Vancouver relies upon and adopts this evidence.

In the assessment of the fate and effects of oil spills of diluted bitumen in Burrard Inlet and the Fraser River estuary, the JWS Report makes a number of findings about the fate and behaviour of diluted bitumen as compared to normal crude oils:

1. The bitumen component of diluted bitumen consists essentially of highly biodegraded petroleum that is naturally prone to submerging in fresh and brackish water.

2. Submergence would be hastened if inorganic suspended particulate material (SPM) entrained in the water column adheres to the bitumen, increasing the density of the bitumen. Surface waters of Burrard Inlet and the Fraser River estuary are often brackish or nearly fresh where the fresh water of the Fraser River mixes with the ocean water (referred to as the Fraser River plume). Frequent winds, warm temperatures and high Fraser River discharge during spring and summer create favourable conditions for submergence of diluted bitumen. Under near worst-case ambient conditions of warm summer temperatures and moderate winds, spilled diluted bitumen may begin to submerge in the surface layer of the Fraser River plume and Burrard Inlet about 24 hours following initial release.

3. Diluted bitumen is a mixture of high-volatility, low-density hydrocarbon diluent, such as benzene, with low-volatility, high-density bitumen and once spilled, rapidly loses the high-volatility components, in marked contrast with normal crude or heavy refined oils.

4. Concentrations of polycyclic aromatic hydrocarbons (PAH), the most toxic components of petroleum, in diluted bitumen are comparable with typical concentrations in crude oils

5. The large tidal excursion range is conducive to spilled diluted bitumen stranding on shorelines, particularly on the long, flat shorelines in Burrard Inlet and at Sturgeon Bank and the South Arm marshes. An oil spill anywhere in the Burrard Inlet would almost certainly result in considerable shoreline oiling, which in itself forms an important habitat for organisms. Once incorporated beneath the surface of the shoreline, diluted bitumen can persist for considerable periods of time in the absence of physical disturbance.

6. If diluted bitumen submerges in the waters of Burrard Inlet or elsewhere in the Fraser River estuary, species inhabiting the water column or on adjacent shorelines may ingest oil directly. Once ingested, these species become an indirect route for oil exposure to predatory species.

The JWS Report concludes that a credible worst-case scenario oil spill of 16,000 cubic metres near the Fraser River estuary could rank within top ten bird mortality events from an oil spill. Comparison with other spills suggests that a major spill near the Fraser River could kill more than 100,000 sea and shorebirds. Marine mammals are also vulnerable as they inhabit the sea surface. A major oil spill could result in substantial mortalities of harbour seals and porpoises and could jeopardize the viability of the endangered southern resident killer whale population, which would permanently alter the marine food web of the Salish Sea. Even spills considerably smaller than the credible worst-case scenario of 16,000 m^3 can have substantial adverse effects on sea- and shorebirds as well as marine mammals and other organisms inhabiting the sea surface, shorelines and the water column if the oil submerges. Small to medium sized oil spills on the order of 100 to 1,000 m^3 can cause substantial mortalities to seabirds, and estimated effects for small to medium spills in Canada and in Alaska have the potential to contaminate tens of kilometers of shorelines on time scales of decades.

5.6.1.2 ***Human Health Effects***

Trans Mountain's application includes several human health risk assessments for operational emissions from the Burnaby Farm Tank, the Westridge Terminal and for Marine Transportation as well as for certain spill scenarios at Westridge Terminal and at Arachne Reef, in the vicinity of the Haro Strait. With respect to the Trans Mountain human health risk assessment, Jennifer Mayberry, Manager of Environmental Planning for the City of Vancouver, advises that:

1. the human health risk assessments included in Trans Mountain's application do not conform with standard BC Ministry of Environment requirements as set out in the "*Technical Guidance on Contaminated Sites: Supplemental Guidance for Risk Assessments*".[48]

2. Trans Mountain's application does not refer to Health Canada guidance documents on human health deterministic risk assessment,[49] as recommended by the British Columbia Ministry of Environment.

3. Trans Mountain's human health risk assessments states that there is no available toxicity assessment for the inhalation of lead, even though this information is readily available in the BC Ministry of Environment, "*Technical Guidance on Contaminated Sites: Supplemental Guidance for Risk Assessments*" (October 2012).[50]

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[48] British Columbia, Ministry of Environment, "Technical Guidance on Contaminated Sites: Supplemental Guidance for Risk Assessments" (October 2012), online: http://www2.gov.bc.ca/gov/DownloadAsset?assetId=3EADE1EF798944ADA75A6A0009A57054&filename=tg07-v3.pdf (accessed on May 19, 2015) – attached at **Appendix 46**

[49] Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0, Health Canada, 2012; Federal Contaminated Site Risk Assessment in Canada, Part II: Health Canada Toxicological Reference Values (TRVs) and Chemical-Specific Factors, Version 2.0, Health Canada, 2010 – attached at **Appendix 47**

[50] British Columbia, Ministry of Environment, "Technical Guidance on Contaminated Sites: Supplemental Guidance for Risk Assessments" (October 2012), at Appendix 48; See also, California, Office of Environmental Health Hazard Assessment, "Toxicity Criteria Database", online: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp (accessed May 19, 2015) – attached at **Appendix 49**

Fraser Health and Vancouver Coastal Health prepared a guidance document entitled "*Guidance to Metro Vancouver and Fraser Valley Municipalities to Assist in Reviewing the Trans Mountain Pipeline Project from a Public Health Perspective*", dated August 2014,[51] for interested municipalities to assist them in reviewing the human health risk assessments submitted by Trans Mountain to the National Energy Board.

Fraser Health reviewed the human health risk assessments filed by Trans Mountain and concluded that Trans Mountain may be underestimating the potential health effects. Fraser Health identified a number of limitations in these assessments, including:

1. The assumptions in the air dispersion models may be incorrect. The assumption and parameters that are entered into the air dispersion model should accord with established provincial, national and international guidelines and should be truly representative of the conditions in the field in order to properly characterize the risk;

2. The omission of identified key air pollutants, such as diesel particulate matter, 1,3-butadiene and carbon tetrachloride in air dispersion models;

3. The exclusion from spill scenarios of products other than Cold Lake Winter Blend diluted bitumen that would also be carried by the expanded pipeline system (refined products such as gasoline and jet fuel, which contain a greater proportion of lighter and more volatile/flammable hydrocarbon fractions);

4. The exclusion from spill scenarios of exposure pathways other than air inhalation. Other plausible pathways of potential exposure, including inhalation of dust, food ingestion and direct dermal contact, should be included in Trans Mountain's health risk assessments. The human health risk assessments should also identify how Trans

[51] Vancouver Coastal Health and Fraser Health Authority, "Guidance to Metro Vancouver and Fraser Valley Municipalities to Assist in Reviewing the Trans Mountain Pipeline Expansion Project from a Public Health Perspective" (August 2014) ("VCH & FHA, Public Health Perspective") – attached at **Appendix 50**.

Mountain intends to assess potential post-spill health risks and other plausible exposures to the public and to individuals involved in spill clean-up; and

5. The absence of an assessment on the human health risks from the construction phase activities of the project.

Fraser Health recommended that the assessment of potential effects of different spill scenarios be performed with consideration of the likelihood or probability of large spills. Consideration should also be made of national and international best practices in the field of proposed spill prevention measures.[52]

Fraser Health and Vancouver Coastal Health also recommended that health authorities be included in spill/incident notification protocols. Public health decisions in a response may include evacuation orders, shelter-in-place advisories, air quality advisories, drinking water advisories, beach and recreational water use advisories and general public health messaging regarding an incident.[53]

Fraser Health and Vancouver Coastal Health noted that it was not clear from Trans Mountain's proposal what it was planning to fund in the event of a spill that resulted in human health consequences. They recommended that Trans Mountain be required to clarify its financial commitment to post-spill recovery and compensation costs and demonstrate its ability to cover those costs. They further recommended that any health care costs arising from an oil spill be covered on the basis of the polluter pays principle.[54]

Vancouver Coastal Health completed a literature review on the health impacts of oil spills. It found that the literature on oil spills:

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[52] VCH & FHA, Public Health Perspective, pp. 4 – 5.
[53] VCH & FHA, Public Health Perspective, p. 14.
[54] VCH & FHA, Public Health Perspective, p. 17.

1. contained evidence of short term and reversible physical health effects for people living close to spills;

2. contained evidence of potential long term physical health effects for people involved in spill clean-up; and

3. under-recognized the mental health impacts from spills on affected populations.[55]

In a letter from Fraser Health and Vancouver Coastal Health dated May 25, 2015, attached at Appendix 51, the health authorities confirmed that their overall assessment of the TMEP set out in their August 2014 guidance document has not changed and that recent events – the chemical fire at Port Metro Vancouver and the Marathassa oil spill in English Bay – reinforce the issues previously identified.

5.6.1.3 ***Levelton Report***

Metro Vancouver commissioned Levelton Consultants Ltd. to provide an air dispersion modelling report simulating oil spills in Burrard Inlet and English Bay. The report, entitled "Air Quality Impacts from Simulated Oil Spills in Burrard Inlet & English Bay", dated May 11, 2015, is provided in **Appendix 52** and Vancouver relies upon and adopts this evidence.

Levelton modelled four spill locations – English Bay, First Narrows Bridge, Second Narrows Bridge and Westridge Terminal. Westridge Terminal was modelled for an instantaneous spill of 8,000 cubic metres. The other three locations were modelled for an instantaneous oil spill of 16,000 cubic metres. For each of the spill locations, the spills were modelled at 12 different time periods, for a total of 48 scenarios, in order to capture a range of possible tidal and meteorological conditions during an oil spill. Each simulation was modelled for consecutive hours one through six following an oil spill.

[55] VCH & FHA, Public Health Perspective, Appendix C

The Levelton Report compared the results from the air quality modelling assessment to acute inhalation exposure limits and the Protective Action Criteria (PAC) from the United States Department of Energy Emergency Management Issues Special Interest Group. The PAC is described in the report as a hierarchy-based system, with three tiers of exposure limits for each chemical – PAC-1 "mild, transient health effects", such as dizziness and nausea; PAC-2 "irreversible or other serious health effects that could impair the ability to take protective action", such as neurological damage; and PAC-3 "life-threatening health effects".

While noting that the study area was not large enough to capture the full extent of potential impacts arising from an oil spill, if the study were comprehensive, Levelton opines that the results would likely indicate a greater population would be affected and would likely indicate higher concentrations of air contamination.

Levelton predicts exceedances for the majority of pseudo-components of acute inhalation, PAC-1 or PAC-2 exposure thresholds. Over water, there were predicted exceedances for i-butane, n-pentane and n-hexane of PAC-3 exposure thresholds. Over land and water, there were predicted benzene PAC-2 exceedances in areas where people may be present, including Stanley Park, Lions Gate Bridge, Second Narrows Bridge (this analysis was only conducted for benzene). The acute inhalation exposure benzene limit was exceeded in large areas of the study, affecting a range of 133,100 to 1,077,700 people for the different scenarios considered.

The PAC-1 threshold for benzene was exceeded in areas that would affect a range of 2,600 to 31,400 people within the different spill locations and scenarios considered; the acute inhalation exposure limit was exceeded for benzene in an area covering 75 km^2 to 580 km^2. The PAC-1 threshold for benzene was exceeded in an area covering 7 km^2 to 42 $km.^2$

Levelton finds that the greatest human risk from benzene and i-butane is likely to occur during the first hour following an oil spill based on the simulations conducted. The maximum predicted one-hour concentrations for benzene decreased below the PAC-1 threshold six hours after an oil spill but remained above the acute inhalation exposure limit for all spill locations and scenarios considered. The maximum predicted one hour i-butane concentrations decreased below PAC-

1/PAC-2 levels two hours after an oil spill and were below the acute inhalation exposure limit by the fifth hour.

In the letter dated May 25, 2015, at Appendix 51, Vancouver Coastal Health and Fraser Health comment on the findings in the Levelton report and the risk to human health from the high concentrations of chemicals in the first hour or two following a spill, stating that "it is not certain whether such air monitoring equipment, even if available, could be deployed quickly enough".

5.6.2 Oil Spill Response Plans and Preparedness

A number of recent reports, including reports from the Auditor General of Canada[56] and the Tanker Safety Expert Panel[57], have revealed substantial gaps in planning and preparedness for oil spill response in Canada. Transport Canada commissioned a risk assessment to inform the report of the Tanker Safety Expert Panel, which was completed by WSP Canada Inc. The WSP risk assessment considers both likelihood and consequence in the assessment. WSP ranked the entire Georgia Strait, including the Vancouver region as "very high" on the Environmental Risk Index for crude oil spills within a range of volumes from 10 m^3 to 10,000 m^3.[58]

This assessment did not, however, take into consideration the potential future increase in tanker traffic as a result of the proposed TMEP. Future projects, including the TMEP, were separately considered in Appendix 4 to the assessment. Appendix 4 to the WSP Risk Assessment states that "doubling the volume of oil passing through the Pacific sub-sector 5 would likely increase the spill risks to "very high" for all zones (nearshore, intermediate and deep-sea) for 10 000 m3 spill volume and greater."

[56] Report of the Commissioner of the Environment and Sustainable Development to the House of Commons – Chapter 1: Oil Spills from Ships, 2010 – **Appendix 53**
[57] Tanker Safety Expert Panel, *A Review of Canada's Ship-Source Spill Preparedness and Response*, September 2014 – **Appendix 54**.
[58] WSP Canada (2014) Risk Assessment for Marine Spills in Canadian Water: Phase 1, Oil Spills South of the 60th Parallel. Report from WSP Canada Inc. to Transport Canada. 172 p. and appendices – **Appendix 55**

Currently up to 5 tankers a month transit through Burrard Inlet carrying largely diluted bitumen from the Westridge Marine Terminal. Despite the potential for major impacts to the City of Vancouver in the event of a spill, the Office of Emergency Management has never been invited by Trans Mountain to participate in the Unified Command structure in an exercise simulating a spill or incident from a Trans Mountain tanker in the Burrard Inlet or at the Westridge Terminal. OEM has also never been invited by WCMRC or the CCG to participate beyond the role of observer in table-top or functional exercises that simulate spills in the Burrard Inlet or Lower Fraser River.

Joint training and exercising is a critical element of a comprehensive emergency management program, and the only way to identify and address gaps in response plans and protocols before an incident occurs. Although WCMRC and Trans Mountain are required to conduct exercises to meet certifications, none of these exercises have ever included Vancouver staff in a Unified Command role, or elsewhere in the Incident Command structure. Vancouver has only ever been invited to participate as an observer and none of the exercises observed involved a scenario that impacted Vancouver's shoreline. For the exercises that Vancouver has observed, Vancouver has not been involved in the debrief or after action reporting process, and has not been provided with exercise outcomes or after action reports.

Some of the exercises that Vancouver OEM staff have observed, involving both WCMRC and the CCG, have raised concerns that there is insufficient capacity to respond to the current risk presented by the Trans Mountain Pipeline and the existing number of tankers transporting diluted bitumen. For example, on September 10, 2014, WCMRC carried out a spill exercise which was intended to demonstrate the capacity to respond to a 10,000 L spill, as was required for Transport Canada certification. However, the exercise, which simulated a release of diesel into the Burrard Inlet, was conducted so that the spill occurred within an area that had already been boomed. The only volume of oil that needed to be responded to was the 1,000 L that escaped from the boom. It was unclear how this exercise demonstrated WCMRC's capacity to respond to a 10,000 L spill nor did it demonstrate the capacity to respond to and manage the unique risks posed by a spill involving diluted bitumen.

Vancouver has been unable to obtain an oil spill response plan from the CCG or WCMRC that clearly explains how spills in the Burrard Inlet will be managed, or how the risks to the public of a spill in this densely populated area will be addressed.

These concerns have been reinforced by the recent Marathassa oil spill in English Bay in which there was a delay in the response to the spill, a delay in notification of Vancouver, insufficient capacity to deploy protective boom when requested to Stanley Park and other sensitive sites identified by Vancouver, incomplete information about the volume of oil spilled and recovered, and a number of challenges with the reporting of information at the Incident Command Post.

Thomas Gunton, PhD, and Sean Broadbent, PhD, have jointly authored a report entitled "An Assessment of Spill Risk for the Trans Mountain Expansion Project" (May 2015) (the "Gunton Report"), commissioned by Tsleil-Waututh Nation, Tsawout First Nation and Upper Nicola Band. The Gunton Report evaluates Trans Mountain's oil spill risk assessments contained in its application to for the TMEP, provides estimates of oil spill frequency risk for pipeline, terminal and tanker spills, and estimates potential damage costs of TMEP oil spills.

The authors' evaluation of Trans Mountain's methodology for estimating spill rates concludes that Trans Mountain's spill risk analysis meets none of the seven best practice criteria. In total, the authors' identify 27 major weaknesses in the Trans Mountain risk analysis and conclude that Trans Mountain's application does not provide the necessary information to enable an accurate assessment of the likelihood of adverse environmental effects resulting from oil spills for decision makers and as required by CEAA 2012.

With respect to the risk of pipeline spills, the authors of the Gunton Report estimate risk based on recent historical spill frequency data from the National Energy Board, Enbridge liquids pipeline system, and the Pipeline and Hazardous Materials Safety Administration. The authors conclude that, based on these data sources as well as TMEP's own analysis, spill likelihood is high, with the number of spills for the new Line 2 ranging from 1 to 3 spills every 2 years.

The authors of the Gunton Report assessed the potential spill likelihood specific to the Vancouver harbour area of the tanker route. To estimate spill risk in the Vancouver harbour area

in the TMEP application, the authors combined the likelihood of a spill occurring in the Inner Harbour (defined as the region of the tanker route from English Bay to Westridge Terminal) and spill likelihood at the marine terminal. The risk of a spill occurring in the port (i.e. spills that occur in harbours or at piers) was also estimated using the OSRA model. The comparison shows that spill probabilities over 30- and 50-year periods are relatively similar for both methodologies. The TMEP application estimates an 83.0% likelihood of a spill in the harbour over a 50-year period whereas the OSRA model estimates a spill probability of 87.4%.[59]

Despite the high risks of a pipeline, terminal and tanker spill, and the potentially catastrophic consequences for Vancouver, Trans Mountain has not included an assessment of the impacts of an oil spill into either the Burrard Inlet or the Fraser River in its Application. Further, very little information has been provided by Trans Mountain about the fate and behaviour of diluted bitumen and the local capacity to respond to a spill.

As a result, Vancouver has undertaken its own impact assessment which has been informed by the expert evidence that we commissioned along with our own experience with the recent Port fire and the Marathassa oil spill.

5.6.2.1 *Genwest Oil Spill Model*

The City of Vancouver, City of Burnaby and the Tsleil-Waututh Nation commissioned an expert to conduct oil spill trajectory modelling of four major oil spill scenarios in the Burrard Inlet.

The modelling, done by Genwest Systems Inc, found that a spill in Burrard Inlet would quickly impact nearly all communities surrounding the Inlet. In all modeling scenarios, between 50 per cent and 90 per cent of the oil would reach the shorelines within days, and in many scenarios within hours, causing significant impacts to human health, the environment and the economy. Beaching of oil can cause it to adhere to sediment and increase the speed at which it will submerge or sink when it refloats. A copy of the report of Genwest Systems Inc. is attached at **Appendix 56** and Vancouver adopts and relies upon this report.

[59] Gunton Report, page 92

The Genwest report identifies two serious shortcomings in the oil spill model used by Trans Mountain in the TMEP application. First, the beaching algorithm in the Trans Mountain Model does not allow refloating of oil that is beached and, instead, removes all beached oil from further spreading once it comes into contact with the shoreline. As the author of the Genwest report states, this treatment of beach oil is strongly contradicted by experience with thousands of real spills. Oiled shorelines act as a secondary source of oil as some of the previously stranded oil is rewashed into the ocean over a number of tidal cycles. The failure to include refloating in the modelling of oil spill trajectories could lead to significant underestimates of both the extent and duration of concern associated with a spill, particularly with respect to spills in Burrard Inlet and the Fraser Delta.[60]

The second shortcoming pertains to Trans Mountain's modeling scenario for a spill at the Westridge Marine Terminal. Genwest identifies as a "very serious" shortcoming, Trans Mountain's unrealistic assumption that the containment boom at the Westridge Marine Terminal will be 100% effective.

Genwest created a two-dimensional model to analyze the spill trajectories of four oil spill scenarios in the Burrard Inlet. A spill of 16,000 cubic metres (m^3) was modeled at each of three locations: i) First Narrows Bridge; ii) Second Narrows under the Canadian National Railway Bridge; and iii) Outer Harbour at Anchorage #8. A fourth spill of 8,000 cubic metres (m^3) was modeled at the Westridge Marine Terminal. Scenario modeling was conducted using GNOME (General NOAA Operational Modeling Environment) and incorporated physical transport processes (e.g. tidal currents), a constant wind, and historical observed wind and tide data.

Based on results from the four spill scenarios, Genwest concludes that:

[60] Genwest Report, page 1

1. The confined setting of the Burrard Inlet can result in oil spreading quickly with potential to affect the entire inlet from the Port Moody and Indian Arms, to the Outer Harbour and beyond.[61]

2. Winds and tides are major drivers of oil movement in the inlet with strong winds tending to strand oil on the leeward shore while weak winds allow tidal currents to distribute oil over a larger area.[62]

3. the models "provide a realistic representation of the behavior of oil spills in Burrard Inlet [and] can therefore be used to realistically evaluate the possible extent of oil spread resulting from a spill at the Terminal, Second Narrows, First Narrows, and the Outer Harbour locations."[63]

A stochastic modeling approach was also used combining ten (10) random start times to capture the expected range of possible results and Genwest tested and confirmed that the stochastic model provides a realistic representation of expected zones that would be threatened by an oil spill in each release scenario.[64] Genwest provided instructions to Vancouver, City of Burnaby and Tsleil-Waututh Nation setting out the appropriate modeling approaches and methods to do the modeling work.[65]

Using Genwest's model and following the instructions provided, Vancouver staff in the Geographical Information System (GIS) department advise that they created an oil spill analysis map which shows the percentage of oil in each of the three zones of the Burrard Inlet (i.e. Outer Harbour, Inner Harbour, other areas which includes Central Harbour, Port Moody Arm and Indian Arm) 24 hours after a spill at the First Narrows (Figure 10 below[66]). To create this map, the 16,000 m^3 spill was represented by 8,000 splots (2000 m^3 per splot). Wind and tide data was drawn from twelve randomly selected dates in the period from January through December 2005

[61] Genwest Report, page 3, Figure 11 and Figure 19
[62] Genwest Report, page 7
[63] Genwest Report, page 8
[64] Genwest Report, page 7
[65] Genwest Report, Appendix N
[66] Additional maps were created for a spill at 24, 48 and 72 hours at First and Second Narrows and at Anchorage 8. This package of maps is included with Figure 10, reproduced as an attachment to the Written Evidence.

to create SPLOT location maps which represented where oil would end up under different environmental conditions during the year. These 12 SPLOT files, representing a random date from each month of the year 2005, were combined and the total number of splots that landed in each of the three zones were calculated to arrive at a percentage distribution.

Figure 10 shows that, within a period of 24 hours, virtually all stretches the City of Vancouver waterfront could be affected by a spill at the First Narrows at any time of year.

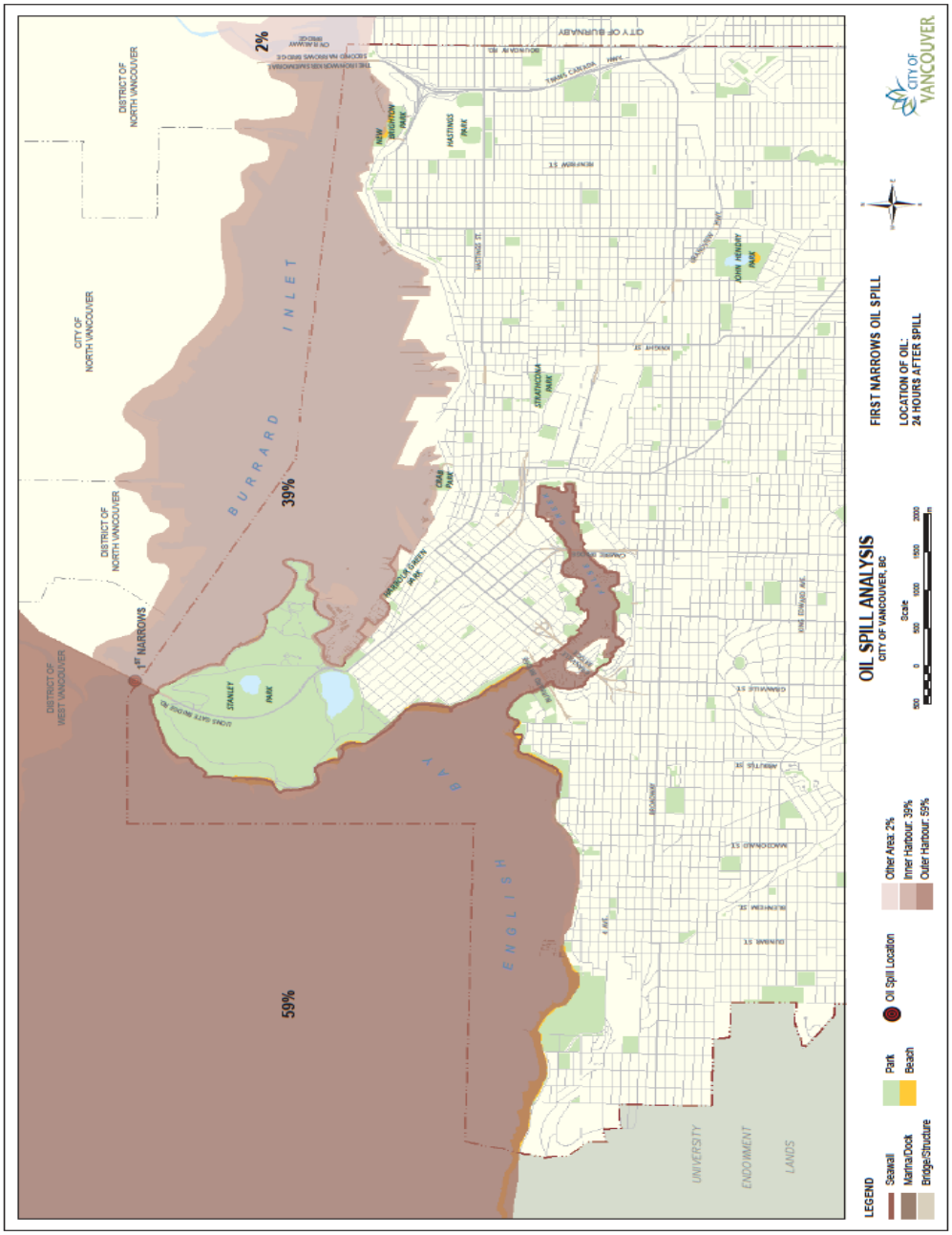


Figure 10: Location of Oil 24 Hours After Spill at First Narrows

In addition to the mapping referenced above, Vancouver GIS staff also followed the instructions of Genwest to prepare a series of maps showing outputs from the Genwest spill model for three locations: First Narrows, Second Narrows and Anchorage 8 in English Bay. Each set of maps shows the predicted location of the oil at 6, 12, 24, 48, 72 and 96 hours as follows:

1. The maps at **Appendix 57** and **Appendix 58** show the spread of an oil spill at First Narrows over the first four days using wind and tidal data from April 25, 2005 and October 15, 2005 respectively;

2. The maps at **Appendix 59** and **Appendix 60** show the spread of an oil spill at Second Narrows over the first four days using wind and tidal data from April 25, 2005 and October 15, 2005 respectively;

3. The maps at **Appendix 61** through **Appendix 63** show the spread of an oil spill at Anchorage 8 in English Bay over the first four days using tidal data from August 18, 2007 with varying wind conditions: an easterly wind of one knot, south-southwesterly wind of three knots and no wind; and

4. The maps at **Appendix 64** through **Appendix 66** show the spread of an oil spill at Anchorage 8 in English Bay over the first four days using tidal data from August 24, 2007 with varying wind conditions: a south-southwesterly wind of three knots; an easterly wind of one knot and no wind.

Following Genwest's instructions for the Genwest model, Vancouver's GIS staff advise that they were able to calculate the estimated length of oiled shoreline for each of the spill locations at 24, 48 and 72 hours on a randomly selected date in each month. The results of these calculations are summarized in the table at **Appendix 67**. For example, in the event of an oil spill at First Narrows in March (using 2005 wind and tidal conditions), 10.9 kilometres of shoreline would be oiled within the first 24 hours. This is illustrated in **Figure 11** below:

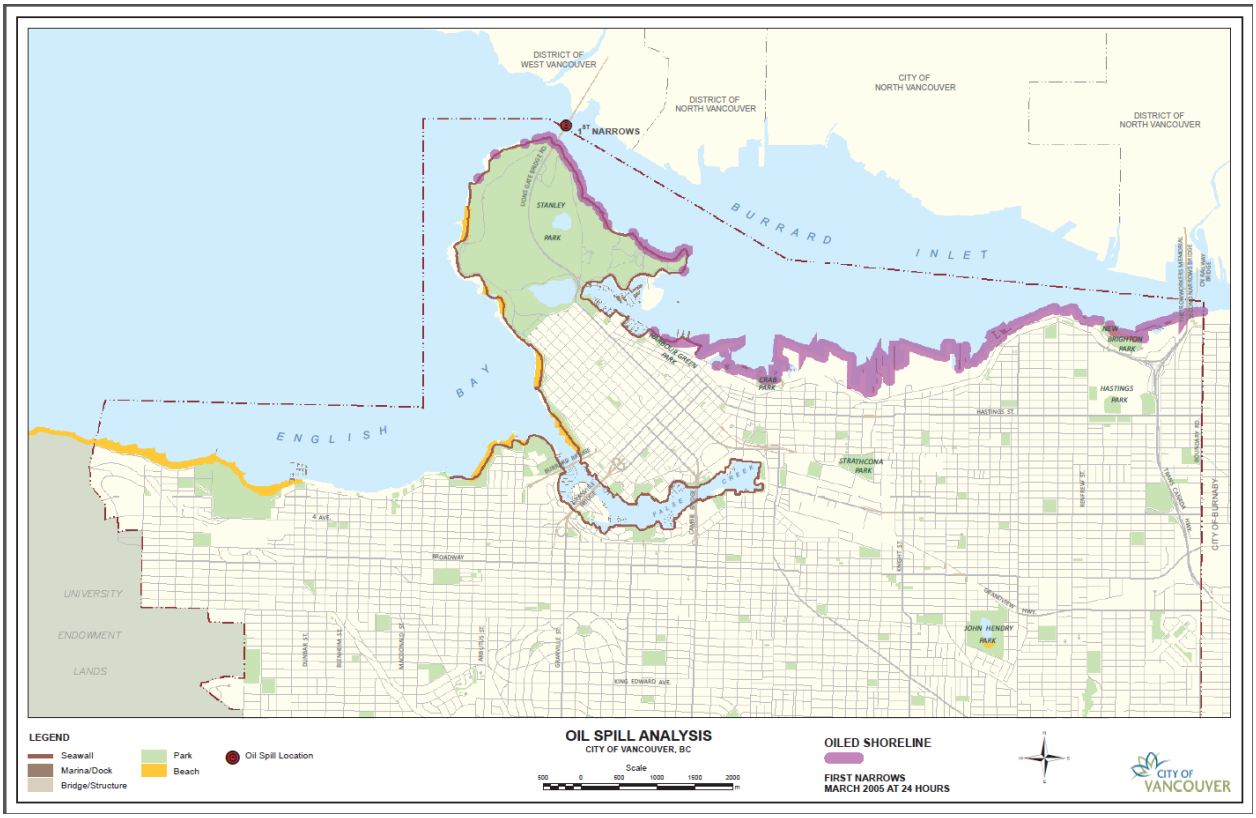


Figure 11: Oiled Shoreline

Genwest conducted an additional analysis using the stochastic modelling approach. This additional analysis focused exclusively on the areal coverage of floating oil (that is all oil that was not beached on a shoreline). The purpose of the analysis was to provide a statistical view of the oil that would be drifting around Burrard Inlet which would be the target of traditional oil spill recovery operations. During oil spill operations, the modelling results would be calibrated and further refined through the addition of observations from overflights. The results of Genwest's analysis show that a significant percentage of the oil spill tends to spread covering many tens of square kilometres. This was found to be particularly true for a spill at First Narrows where, in four days, an area of nearly 90 square kilometres might expect to have some

floating oil present.[67] After only 48 hours, an area of over 70 square kilometres might expect to have some floating oil present.[68]

5.6.2.2 ***Gaps in Response and Capacity***

The City of Vancouver, Tsleil-Waututh Nation and Tsawout First Nation commissioned an expert to assess the oil spill response capabilities and limitations in areas of Southern British Columbia that are vulnerable to potential oil spills from the TMEP. A copy of the report of Nuka Research and Planning Group, LLC entitled "Technical Analysis of Oil Spill Response Capabilities and Limitations for Kinder Morgan Trans Mountain Expansion Project" is attached at **Appendix 68** (the "Nuka Report") and Vancouver adopts and relies upon this report as part of its written evidence.

The Nuka Report examines key factors that could impact the mitigation of potential oil spills along the TMEP pipeline and marine vessel routes in British Columbia using a three-part analysis: (1) a marine oil spill response gap analysis; (2) a marine oil spill response capacity analysis; and (3) a river oil spill response logistics analysis. All three analyses highlight certain conditions under which environmental conditions, response system capacity, or logistical constraints may hinder or preclude effective response to oil spills from the proposed Trans Mountain Pipeline Expansion.[69]

Marine Oil Spill Response Gap Analysis

The authors of the Nuka Report note that, at the National Energy Board's request, Trans Mountain submitted a partial response gap analysis as part of the project application (Trans Mountain, 2014a), but it did not apply a standard methodology and did not account for several important factors, such as visibility limits, interaction among factors, and seasonal variability. The response gap analysis in the Nuka report considers many of the same inputs as Trans

[67] Genwest Report, page 63 and Appendix M, page 131
[68] Genwest Report, Appendix M, page 131
[69] Nuka Research and Planning Group, LLC, *Technical Analysis of Oil Spill Response Capabilities and Limitations for Kinder Morgan Trans Mountain Expansion Project*, at page i

Mountain's partial study, but applies more rigorous and detailed analysis using a standard methodology derived from multiple peer-reviewed studies. The results provide a quantitative estimate of the percentage of time during which on water oil spill response operations would not be feasible in each of five locations at different times of the year: (1) Central Harbour, (2) Outer Harbour, (3) Georgia Strait, (4) Juan de Fuca Strait, and (5) Neah Bay.

For the Central Harbour (the area east of Second Narrows) and Outer Harbour (the area west of First Narrows to the Georgia Strait), the authors conclude that on water oil spill response operations would be impeded or completely shut down due to weather or environmental conditions for 34% of the time during the summer months and for 57% of the time during the winter months.

Marine Oil Spill Response Capacity Analysis

The authors of the Nuka Report modelled a series of hypothetical oil spills at the five locations along the Trans Mountain tanker route to estimate the total potential oil recovery during the first 72 hours of the spill. The analysis compares response effectiveness by location and season, and considers the difference to overall recovery based on differences in force composition, delays in response mobilization, and incorporation of night operations. The potential impact of oil submergence and stranding to overall oil recovery estimates are described in the report but were not factored into the capacity estimates.

A credible worst case spill of 8,000 m^3 was modeled for the Central Harbour site; at all other sites, a 16,000 m^3 spill is modeled. The authors identify an 8,000 m^3 spill at the Central Harbour site as a credible worst case scenario because it represents the 90th percentile spill volume for a tanker that is struck at berth, according to risk analyses provided in the TMEP application. The other spills (16,000 m^3) also represent 90th percentile spill volumes (expected spill size for highest 10% of potential scenarios) for tanker accidents along the route.

The authors reach the following conclusions regarding marine oil spill response capacity:

1. On-water oil spill recovery capacity is reduced during winter months by as much as 50% compared to summer.

2. If spill response were delayed for any reason – lags in detection, poor weather, equipment malfunction, air quality impacts – the total volume of oil recovered would decrease significantly. A 48-hour delay in the modeled response to a 16,000 m^3 Outer Harbour spill would result in over 11,000 m^3 of oil left in the environment.

3. The modeled response capacity estimates do not consider the potential for shoreline stranding. This may overestimate total recovery at all sites, and most significantly in Burrard Inlet where models show up to 90% of an oil spill stranding on the beaches.

4. The spill response forces currently available in Southern B.C. have the capacity to recover only 10-20% of a worst case oil spill under favourable conditions.

5. Current response forces are clustered in the Burrard Inlet or Port Metro Vancouver area, which reduces response capacity for other sites along the Trans Mountain tanker route.

6. Night operations require double the personnel and create significant safety risks that may not be justified by the modest improvement to oil recovery from 24-hour operations.

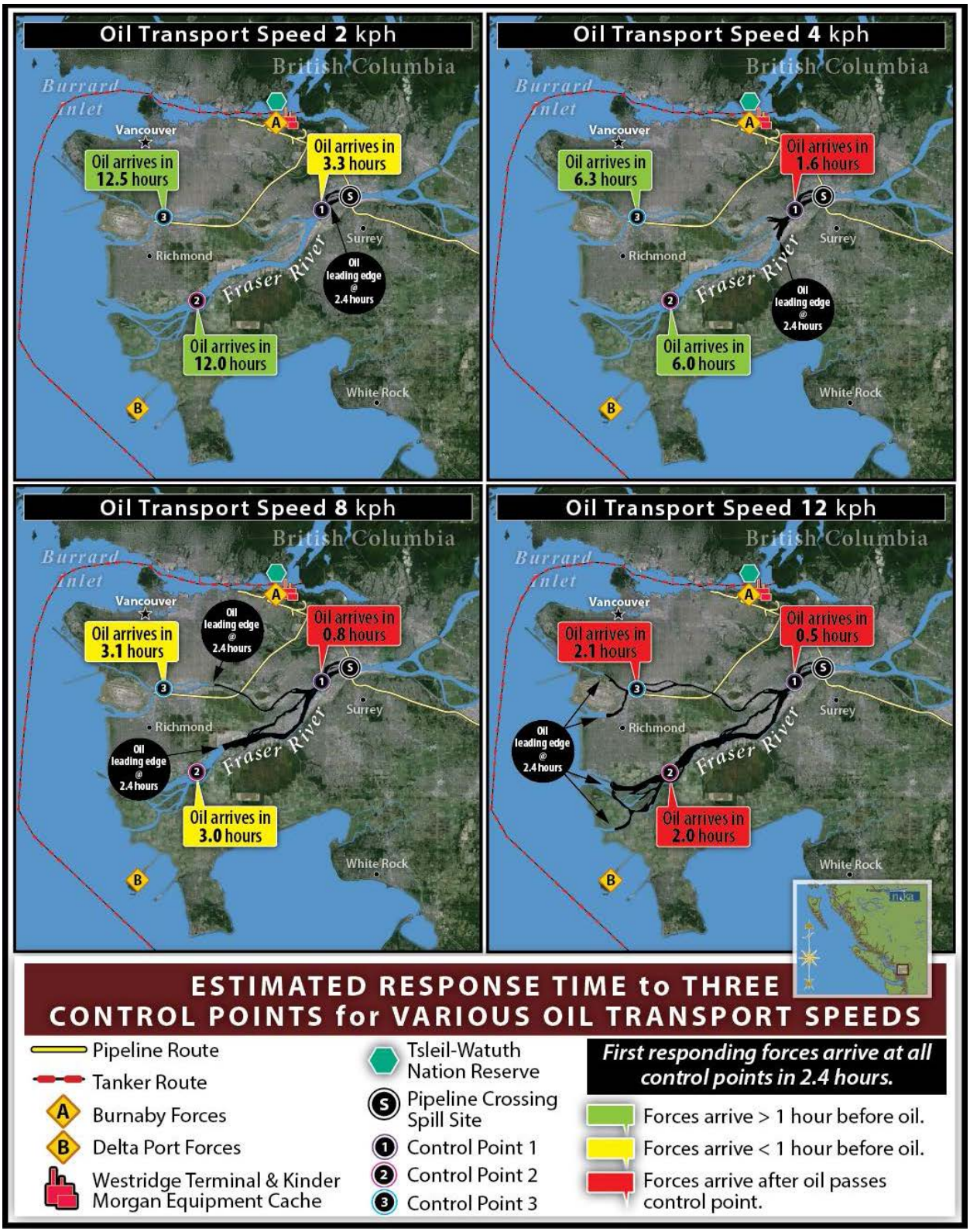
7. Changes to diluted bitumen density and viscosity within the first few days of the release may render oil spill response systems ineffective.

Lower Fraser River Oil Spill Response Logistics Analysis

The authors of the Nuka Report conducted a river response logistics analysis for the Lower Fraser River from the Port Mann Bridge to the Fraser Delta to analyze the minimum response time required to mobilize and deploy resources to three control points. The authors compared road travel time estimates for response resources from equipment caches in Burnaby, Delta Port, and Hope to the three control points with the potential rate of downstream transport of an oil spill

from the Port Mann Bridge pipeline crossing for various nominal speeds. The river response logistics analysis is described at page 86 of the Nuka Report as follows, and a summary of the results is illustrated in the figure below:

> To estimate the amount time required to mobilize response resources from the four regional equipment caches to control pints along the Lower Fraser River ahead of the leading edge of a spill from the pipeline at the river crossing, the downriver oil transport velocities were compared against response equipment deployment time estimates. Three categories were used to describe the deployment timing:
>
> - **Green** indicates that the estimated arrival time of response forces is more than one hour ahead of the oil, based on the fastest route of transport from one or more equipment caches. This represents the most favorable opportunity to deploy containment or control resources ahead of the spill.
>
> - **Yellow** indicates that the estimated arrival time of response forces is ahead of the oil, but by less than one hour, based on the fastest route of transport. This means that it is possible to deploy containment or control resources ahead of the spill, with virtually no margin for error.
>
> - **Red** indicates that the estimated arrival time of response equipment is concurrent with or after the oil reaches the control point. This would not allow for sufficient time to deploy containment or control equipment before the oil migrates past the control points.



SUMMARY OF RESULTS FROM FRASER RIVER SPILL RESPONSE LOGISTICS ANALYSIS (Nuka Report, at page xi)

The Lower Fraser River response logistics analysis shows that a minimum of two and a half hours is required to mobilize equipment to control points along the river, assuming no traffic or other delays. In order to set up control point tactics before the oil reaches the site, the spill must be detected, spill managers must direct the response resources to be mobilized and transported to the control point, and trained responders must arrive along with the equipment in time to deploy the tactics. Successful implementation will rely on smooth operations for the entire chain of events.[70]

The authors note that there will be times when an oil spill from the Port Mann Bridge may travel the length of the Lower Fraser River and reach the delta before any countermeasures can be applied. When oil is transported downriver at rates of 4 kph or higher, the window of opportunity to deploy resources ahead of the leading edge of the spill is 6 hours or less. At a transport rate of 8 kph or higher, the window of opportunity is reduced to 3 hours.[71]

Based on the results of the Fraser River Logistics Analysis, the authors conclude that:

1. If an oil spill occurs at the Port Mann Bridge and moves downriver at 8 kph or faster, there may not be time to mobilize and deploy equipment in time to control the spill before it reaches the Lower Fraser Delta. At transport speeds of 12 kph or higher, this becomes impossible.

2. Response equipment inventories along the Lower Fraser River are limited.

3. Existing river response equipment is meant for floating oil, and would not be effective in the event that a diluted bitumen spill submerged or sank in the Lower Fraser River.

[70] Nuka Report
[71] Nuka Report

4. It is unclear whether Trans Mountain has access to the specialized oil spill response equipment, tactics, and trained personnel necessary to control oil spills in fast water conditions (greater than 0.8 kts/1.5 kph).

5. The Trans Mountain application lacks critical detail about how responders will manage practical and logistical considerations – such as site access, travel routes, boat launch access, and tactical planning – that are critical to successful river response.

5.6.3 Risk to Responders

There is another risk presented by the evaporation of diluents from a bitumen spill in addition to the human health effects discussed above. There is a risk of life-threatening injuries from fire or explosions due to exceedances of the lower exposure limit ("LEL") vapour levels. The LEL is the lowest concentration of a vapour for a given material that will support combustion. The Arachne Reef Scenario modelled by Trans Mountain in response to Cowichan Tribes IR No. 1.08l provides an example of the LEL vapour level exceedances associated with a 16,000 m^3 spill. In that scenario vapour levels consistently exceeded 10 % of the LEL and reached as high as 54.4 % at and around the spill site until after hour 8.

The Canadian Coast Guard's Oils Spill Response Field Guide[72] (the "CCG Field Guide") identifies the LEL as the key measurement for evaluating the risk of fire or explosion. The risk is site and substance specific and must be evaluated before response personnel enter a spill area or damaged vessel. The CCG Field Guide states that a burning vessel or spilled material should only be approached by trained and experienced personnel with proper safety, respiratory and measurement equipment.[73] Further, in potentially flammable atmospheres, responders (and anyone else in the affected area) should not use open lights, internal combustion engines, steel tools and certain radio-transmission devices. Where LEL exceedances are between 10% and

[72] Canadian Coast Guard, Oil Spill Response Field Guide, 1995 ("CCG Field Guide") attached as **Appendix 69**
[73] CCG Field Guide, at page 20

25%, the CCG Field guide requires responders to proceed with care. Where LEL exceedances are greater than 25%, responders are required to leave the area quickly and carefully.[74]

In the event of an oil spill resulting in a fire or explosion on board a tanker, I am advised by John McKearney, Fire Chief for Vancouver, that Vancouver's Marine Fire Response Service does not currently have the training or equipment to fight shipboard fires on tankers. I am advised by Legal Services that Vancouver is in the process of finalizing an agreement with Vancouver Fraser Port Authority (Port Metro Vancouver) based on an executed term sheet dated May 20, 2014 which states that the scope of services provided by Vancouver's Marine Fire Response Service for vessels over 75' is firefighting support only, such as external hull cooling and supply delivery, and that "crew may board ship but will generally not enter hull". Firefighting support is on a response-available basis.

5.6.4 Emergency Response Plans and Protocols

Despite Vancouver's requests for emergency planning documents, WCMRC and Trans Mountain have failed to provide any plans for oil spill response along Vancouver's shorelines, or to respond to submerged or sunken oil. No control point plans were provided by Trans Mountain, information that is required in order to evaluate the capacity of Trans Mountain to respond to a pipeline rupture impacting the Fraser River or other water bodies. To compound this issue, the current Canadian Coast Guard Marine Spills Contingency Plan - National Chapter[75] does not incorporate the Incident Command System, and provides no specific area plans or information for the Pacific Region.

This stands in contrast to the level of detail provided by Kinder Morgan to the US Pipeline and Hazardous Materials Safety Administration by its Emergency Response Field Guide for Puget Sound.[76] It also stands in contrast to the level of detail made available to the public by Western

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[74] CCG Field Guide, page 21
[75] Canadian Coast Guard, "Marine Spills Contingency Plan – National Chapter" (April 2011), attached as **Appendix 70**
[76] Kinder Morgan, "Emergency Response Field Guide – Puget Sound" (revised July 2013) – Cover Page and Table of Contents attached as **Appendix 71**; full document available online at

Canada Spill Services (WCSS) with respect to Control Point Plans for critical control points along waterways in Alberta that are at risk from pipeline ruptures. An example of a WCSS critical control point plan is included at **Appendix 72**. WCSS is an Alberta-based response agency.

Wildlife Response

The City has retained the Oiled Wildlife Society to give a presentation to staff on the status of oiled wildlife response in British Columbia, and has consulted with OWS on best practices for oiled wildlife response in order to understand potential options to mitigate the impact of local oil spills on wildlife and subsequently on environmental and human health.

The City understands that there is no legislative requirement for oiled wildlife response, and that there is limited capacity to mount a response to oiled wildlife in the region, given the lack of permanently staged resources and region specific planning, limited funding for the agencies with authority in this area, and a heavy reliance of non-profit volunteer organizations to maintain a state of readiness and respond in the event of a spill. The City of Vancouver is concerned that Trans Mountain, despite the current risk posed by its operations to the harbour and to local wildlife, has not developed specific plans for coordinated oiled wildlife response, or raised this issue in its application for the TMEP. The Burrard Inlet and the Fraser River Estuary are home to a vast array of species of birds and mammals. The lack of pre-planning or consideration for a wildlife response is a key concern for public health and safety given that:

1. Untrained members of the public will often attempt to rescue injured wildlife, further harming the animal/ bird or scaring them to new locations that then become contaminated

2. People who capture wildlife are exposing themselves to hazardous materials

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http://www.phmsa.dot.gov/staticfiles/PHMSA/ERR/Kinder_Morgan_Trans_Mountain-Puget_Sound.pdf (accessed May 22, 2015).

3. Untreated oiled wildlife becomes a permanent source of contaminants in the ecosystem, getting into the food chain and impacting water sources

4. The timeframe in which oiled wildlife response is successful for rehab is limited and requires major resources to be in place very quickly

5. It is an important component of measuring the ecological impact and quantifying damages

6. Even after chance of successful rehab is possible, capturing live and dead contaminated wildlife is important to limit spread of oil through the environment and the food chain

Attached at **Appendix 73** is a copy of the World Leading Wildlife Response Standards prepared by the Oiled Wildlife Trust for BC Ministry of Environment outlining the major challenges for oiled wildlife response and identifying a number of best practices for improvement.

Convergent Volunteer Management

One issue of particular concern to Vancouver, which has not been addressed above, is planning for volunteer management.

Vancouver has worked closely with the City of San Francisco to understand their response to the Cosco Busan Spill and the approach that was used to manage volunteers at that time. The Cosco Busan Spill prompted a major shift in the way volunteers are managed and planned for in the US during spills. The Pacific States – British Columbia Oil Spill Task Force has released guidelines[77] for managing volunteers in oil spill response, and the United States National

[77] Pacific States – British Columbia Oil Spill Task Force, Planning Guidelines for Convergent Volunteer Management, June 2008 – **Appendix 74**

Response Team, the member agencies of which include the US Environmental Protection Agency and the US Coast Guard, has also put forward guidelines[78] for volunteer management.

The Cosco Busan oil spill, and the experience of the City and County of San Francisco (CCSF) in responding to the oil spill, highlights the challenges faced by local governments in responding to an even relatively small oil spill. In the Cosco Busan oil spill, CCSF had difficulties receiving accurate and timely information about the oil spill. Such lack of communication particularly impacts a local government as residents typically look first to local government to convey information and answer questions in an emergency incident. This close relationship with its residents is reflected in the manner in which CCSF was faced with the difficult task of managing volunteers in the Cosco Busan incident. Furthermore, the Cosco Busan incident demonstrated that the interests of federal and state authorities charged with coordinating the response did not necessarily align with and protect the interests of CCSF. Finally, CCSF's experience in dealing with the Cosco Busan oil spill demonstrates the critical role that local government plays in a response and the impact an oil spill can have on a local government's resources.

The evidence of Rob Dudgeon, the Deputy Director of the Department of Emergency Management for CCSF is provided in **Appendix 76** and Vancouver relies upon and adopts this evidence.

Like San Francisco, there is no question that Vancouver residents will involve themselves in any response to an oil spill. The potential for volunteer activity in Vancouver, and the legitimacy of Vancouver's concerns about the need for volunteer management during oil spills, was demonstrated during the recent Marathassa Spill. Immediately after residents learned of the oil spill, people started showing up at the beaches to assist with the clean-up effort. Within days, 4,000 people had offered to volunteer their time.

Given the potential risks to public health and the knowledge that people would self-deploy to respond, the Vancouver representatives at Unified Command requested that a volunteer

[78] U.S. National Response Team, Use of Volunteers Guidelines for Oil Spills, September 27, 2012 – **Appendix 75**

management plan and a plan to protect public health and safety be developed immediately. No direction was given by the Coast Guard to develop these plans or address these concerns. Unified Command did request that people stay off the beaches, but members of the public nonetheless took it upon themselves to remove and dispose of the oil. This well-meaning action put many people at risk of exposure to the oil, and also led to further spread of contaminants.

Vancouver expects that in a larger spill the number of volunteers from within Vancouver would be much greater as well as attracting volunteers from outside the region. Failure to plan for ways to utilize convergent volunteers puts the public at risk, can impact response efforts, and ignores current best practice and recommendations for disaster response. Volunteers need to be trained, fed, and assigned to tasks that are both meaningful and appropriate for their skill level.

Significant resources are required to plan for and manage convergent volunteers and must form part of any oil spill response plan.

Lack of Compliance with NEB Audit Protocol

Vancouver has identified a number of areas where Trans Mountain's plans and current operations do not meet the criteria laid out in the NEB Audit Protocol. This includes requirements for a data management system for hazards, incidents and near misses, requirements for Emergency Response Plans, and notification of emergencies. A copy of the NEB's Audit Protocol, July 17 2013, is attached at **Appendix 77**.

Marine Firefighting and Salvage

There is no information provided in Trans Mountain's application related to response plans or compensation process for damages from tankers caused by fire or explosion. The Federal Government has signaled its intent to ratify the International Maritime Organizations (IMO) International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (2010 HNS Convention). The HNS

Convention includes non-persistent damage from oil tankers, such as damage from fire or explosion. Attached as **Appendix 78** is a copy of the HNS Convention.[79]

Attached as **Appendix 79** is a copy of Transport Canada's Termpol Review Process 2001

5.7 TABLE TOP EXERCISE

The results from this expert work, informed the development of a tabletop exercise that enabled senior managers and first responders to assess the potential impacts of an oil spill in Burrard Inlet and the Fraser River to the community, the environment and to Vancouver as an organization.

Vancouver commissioned an expert to develop a worst-case oil spill scenario based on information provided by experts, and to facilitate a workshop series to assess the impact of a hypothetical oil spill in the Burrard Inlet on the community, the environment, and the City of Vancouver as an organization. The Workshop Report prepared by Elise de Cola of Nuka Research and Planning is provided in **Appendix 80** and Vancouver relies upon and adopts this evidence.

At the time of the Marathassa oil spill, Vancouver had already begun planning for a Tabletop Exercise that would allow senior staff to consider the implications of a major marine oil spill by participating in a simulated response to a hypothetical tanker spill. When the Marathassa oil spill occurred, Vancouver directed Ms. De Cola to revise the structure of the workshop to incorporate a debrief of the real-life spill response with a facilitated discussion that considered how Vancouver might need to scale up the recent experience in the face of a 16 000 m^3 diluted bitumen tanker spill. Previous sections discuss some of the impacts and outcomes of the Marathassa oil spill, many of which are also reflected in the Workshop Report. The Workshop Report summarizes the outcomes from the portion of the focus group sessions and workshop

[79] An Overview of the International Convention on the Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (The HMS Convention), 2010: http://www.imo.org/OurWork/Legal/HNS/Documents/HNS%20Overview.pdf (accessed May 22, 2015).

dedicated to the consideration of a hypothetical 16 000 m^3 spill of diluted bitumen, including the following concerns:

Public health and safety

- Understanding and evaluating the extent, movement, and duration of a toxic plume or vapour cloud from a major diluted bitumen tanker spill that occurs near City of Vancouver population centers.

- Understanding potential routes of exposure to first responders, City employees operating in the field, and local populations.

- Capability to implement air quality monitoring swiftly and in the highest risk areas immediately following a release.

- Delays in notification and the impact of delays on public health and safety.

- Access to the information about type of product released and plume location (toxicity and explosive risks) to support decision-making and emergency operations related to evacuation or shelter-in-place orders.

- Challenges associated with evacuation and shelter-in-place of thousands of residents and businesses.

- Properly equipping first responders to protect them from potential adverse health effects.

- Detecting and remediating any cross-contamination that creates risk of secondary exposure to spilled oil in public buildings or transportation infrastructure.

Emergency Management

- Drain on local emergency services to support emergency calls, traffic control, safety perimeters, and crowd control.

- Level 3 activation of Vancouver EOC would be unprecedented and require substantial resource tracking, management, and coordination for a prolonged period of time.

- Need to make quick emergency management decisions with incomplete information.

- Need for data to support closing and opening areas to public use.

- Human resource impacts to city personnel working on the oil spill (long hours, need for rest, burnout, critical incident stress).

- Continuity of operations impacts and potential need to suspend certain city services while resources are allocated to the spill response.

Public Interface

- Need for clear and consistent information flow between the Incident Command Post and EOC, including regular status updates from the ICP regarding spill cleanup operations, response priorities, and other activities.

- Process for coordinating volunteer registration and overseeing volunteer response activities.

Consequence Management

- Planning for and addressing re-oiling events after active spill cleanup has ended.

- Ensuring that the City's priorities for protecting the environment and the public are incorporated into shoreline cleanup plans.

- Potential for lingering impacts to environment, wildlife, ecology, human use, economy, and quality of life.

- Coping with adverse impacts to sea and shorebirds and marine mammals that will propagate to other marine species and cause ecosystem-level effects.

- Managing community impacts and meeting the social service needs of impacted residents.

- Timeframe and documentation requirements for damage claims and potential for City damages to exceed liability limits.

The tabletop exercise assisted Vancouver with identifying areas where it can continue to focus its preparedness efforts in the event of future spills. As the Workshop Report states, the exercise also exposed the fundamental reality that the consequences of a worst case tanker spill in the Burrard Inlet could not be fully mitigated, and that there would be significant adverse impacts to the local environment, culture, public health, and economy.

5.8 CONCLUSION

The consequences of a diluted bitumen spill on Vancouver and the local population could be catastrophic given the speed at which the oil is likely to hit the shorelines, if spilled from a vessel or the terminal in the confined harbour, and, in the event of a pipeline rupture at or near the Fraser River, the speed at which oil will move downstream to the Fraser River Delta and beyond. The unique properties of diluted bitumen exacerbate the risks posed by an oil spill in Burrard Inlet and the Fraser River, including:

1. the chemical composition of the diluents and the toxicity of the plume created by quickly evaporating diluents identified by the Levelton Report in the hours immediately following a spill;

2. the explosion hazard and health risk that the evaporating diluents present to first responders, who may be delayed in their response for safety reasons, and to the local population; and

3. the lack of plans and equipment in place to protect the shorelines and recover submerged diluted bitumen.

The impact of an oil spill make this event one of very high consequence that should be fully assessed, planned for, and mitigated wherever possible.

PART 3 – CITY OF VANCOUVER WRITTEN EVIDENCE

6. ECONOMIC EFFECTS OF AN OIL SPILL

6.1 RISK MANAGEMENT

I, Robert Bartlett, am the Director of Enterprise Risk Management and Chief Risk Officer for Vancouver. I hold a Bachelor of Arts degree in Environmental Management and a Master's degree in Emergency Management.

In my position as Director of Enterprise Risk Management and the Chief Risk Officer, I oversee the insurance claims and enterprise risks associated with all Vancouver business and assets, which includes the categorization of both internal and external risks. In its 'business as usual' state the Risk Management group is responsible for (1) coordinating Vancouver's insurance portfolio and compensation regimes; (2) managing first and third party claims; (3) identifying and advising on risk to Vancouver; and (4) coordinating Vancouver's business continuity portfolio.

In the event of an emergency, including an oil spill, the Chief Risk Officer and Risk Management staff are actively involved in Vancouver's Emergency Operations Centre (the "EOC"). If the emergency involves other jurisdictions or authorities and a Unified Command ("UC") is formed, Vancouver will also have representatives on site at UC and this may include Risk Management. In an emergency, Risk Management is generally responsible for the following response and recovery activities:

i. conduct rapid situation assessment and brief EOC and UC desks of immediate risks;

ii. liaise with EOC desks and assist with making risk based decision;

iii. liaise with business units that have functional business continuity plans to utilize their continuity tools in the immediate response to the emergency (ie. Manual PO forms, Manual financial tracking, BCP staff list for EOC deployment, etc.);

iv. participate in key operational and strategic meetings;

v. identify the scope of expenses that the City may claim from the responsible party, senior government, and auxiliary insurers;

vi. review and coordinate procedures for handling claims with the Legal department;

vii. determine the need for Claims Specialists and hire personnel;

viii. communicate claims requirements to the EOC desks so they can capture the information required for filing claims; and

ix. keep the Finance Section Chief briefed on activities.

In the aftermath of an emergency, the Risk Management group works closely with the Legal and Financial, Risk and Business Planning groups to prepare cost recovery claims. If required, Risk Management will:

i. assist EOC desks with documenting their claims related forms and procedures;

ii. act as EOC Director or Deputy Director;

iii. assist with submitting and tracking of claims verification forms; and

iv. participate in lessons learned reviews and advise on next actions.

In the case of the recent Marathassa oil spill on April 8, 2015, Risk Management deployed three of its staff to assist with the emergency response: the Chief Risk Officer, the Risk Manager and one other staff member. As Chief Risk Officer, I was one of the directors in the EOC and provided assistance with risk based decisions. I also participated in policy group, EOC, and UC conference calls to coordinate Vancouver's response.

The Risk Manager was responsible for conducting a rapid situation assessment and briefing the EOC and UC desks of the immediate risks. She was also responsible for identifying expenses that the City would claim from the Responsible Party, the Ship-Source Pollution Fund (SOPF), and the provincial government (EMBC). The Risk Manager coordinated the requirements for the long term recovery plan with the EOC's Planning Chief and coordinated cross-approval compensation forms (204s), EOC/UC/Field staff scheduling, and procurement requests.

The participation of the Risk Management group in the recovery from the Marathassa oil spill is ongoing and it is not yet known when the recovery phase will be completed. Preliminary steps have been taken to secure Vancouver's claim for compensation for costs incurred as a result of the oil spill, however, the extent of those costs is not yet known. What is clear is that the response to the volume of oil spilled in this incident placed significant demands on Vancouver's staff and resources. Response and recovery costs incurred by Vancouver alone may be in the range of $1 million or more. Based on this experience, it is reasonable to expect that a larger oil spill would result in exponentially higher costs to Vancouver.

6.2 COSTS TO VANCOUVER

Prior to the Marathassa spill, Vancouver commissioned independent expert evidence to provide an opinion on the costs that local governments are likely to incur in responding to and recovering from an oil spill based on a review of and interviews with other local governments that have experienced oil spills. The evidence of Jeremy Stone is provided in **Appendix 81** and Vancouver relies upon and adopts this evidence.

6.2.1 Summary of Stone Evidence

As Mr. Stone states in his written evidence, a common principle in disaster management is the notion that all disasters are "local" (Dynes, 2002; Perry, 2003). Until external resources arrive, local jurisdictions confront disasters on their own, and long after recovery teams leave local communities live with the lasting effects of disasters. Consequently, the greatest exposure from oil spills is borne by the local jurisdiction. Despite the availability of compensation mechanisms, the most vulnerable populations to oil spills will generally be locally impacted communities, and the costs or impacts that are not compensated by national and international regimes will devolve to local governments, local businesses, and local individuals. Therefore, a thorough accounting

of costs that local governments face is important to understand the exposure of impacted cities to potential oil spills, and the levels of compensation required for long-term recovery.[80]

6.2.2 Cost Categories (Local Governments)

The following cost categories were identified by Mr. Stone as costs incurred by local governments in responding to and recovering from oil spills. These cost categories do not include the direct costs incurred by the ship owner, contractors or other parties responsible for the on water response and clean up of a marine-based oil spill.

i. **Staging**[81] **-** Cost of staging response activities (resources and activities dedicated to the coordination of response activities).

   Example: $1,633,951 - Cosco Busan oil spill.

ii. **Space Requirements** – Space required for both implementing response operations and housing incoming response workers.

   No local government data available.

iii. **Evacuation** - toxic fumes may pass onshore which require monitoring and possible evacuation, especially if the spill happens near a populated area.

   No local government data available.

iv. **Fire, police and emergency services**[82] – for a relatively small Cosco Busan spill (188 m^3), the cost of emergency services alone was $203,419. The costs to the City of New Orleans of the Deepwater Horizon spill, where the spill never reached the city's shores, was $305,000.

v. **Public Health Costs**[83] – in the context of costs to local governments, this refers to costs of public health precautionary measures, such as beach closures, public notification, air and water monitory and worker safety.

   Example: $610,696 – Kalamazoo spill.

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[80] Written Evidence of Jeremy Stone, page 3, para. 1.3
[81] Written Evidence of Jeremy Stone, pages 11 and 12
[82] Written Evidence of Jeremy Stone, page 14, para. 2.4
[83] Written Evidence of Jeremy Stone, page s 14 – 25, para. 2.5

vi. **Waste collection, transportation and disposal**[84] – waste management activities with both short and long term costs.

No local government data was available, however recent spill recovery modeling for a spill of up to 60,000 m^3 calculated disposal costs of approximately $107,000,000.

vii. **Communication costs**[85] - This can include various IT costs including a communications center and staff for researching and relating information to the public.

Example: $297,982 – Cosco Busan oil spill

viii. **Volunteer Management**[86] - Typical cost categories for volunteers include: reception and registration, training (both safety and work training), personal protective equipment (PPE - overalls, boots, gloves, masks etc), equipment and materials (spades, buckets, sorbents), accommodation, transport, and food/water and medical costs.

Example: $408,377 – Cosco Busan oil spill. However, in addition to direct costs of managing volunteers, there are additional hidden costs which are difficult to calculate.

ix. **Permitting and Regulatory Oversight** - Following the Exxon *Valdez* disaster some researchers found that issues like temporary structure permit requests, building code enforcement, land use permits, land leases, water demand, and other types of requirements put enormous pressure on local governments (Rodin et al., 1992).

No local government data available.

x. **Lost Use of Parks and Other Municipal Spaces** - Marine and waterfront properties owned or used by municipalities may be damaged by direct oil contamination or while being used as staging or temporary disposal sites during the response. Although marine property losses have been recorded for various spills (*Cadiz, Hebei-Spirit,*

[84] Written Evidence of Jeremy Stone, pages 15 – 17, para. 2.6
[85] Written Evidence of Jeremy Stone, pages 17 and 18, para. 2.7
[86] Written Evidence of Jeremy Stone, pages 18 and 19, para. 2.8

etc.) there is little indication of what portion of these properties were owned by local governments (Grigalunas et al, 1986; Cheong, 2012).

xi. **Municipal Brand Recovery**[87] - The image of a city can be tarnished by an oil spill when concerns are raised over the cleanliness of the city, the safety of seafood or local goods, and the quality of the water or other tourist amenities. In almost every case it is necessary for municipalities to launch brand recovery campaigns to reinvigorate their economies in the wake of such disasters.

Example: $37,000,000 – Prestige oil spill.

xii. **Opportunity Costs** – Opportunity costs to a municipal government associated with spill response and recovery efforts include: staff time, routine operations and maintenance, and future development activities.

xiii. **Costs of damage assessment**[88] - Natural resource assessments, economic analyses, and other damage assessments are usually necessary to prepare for response activities and claims recovery, as well as to perform ongoing monitoring and post disaster planning.

Example: $550,000,000 – Exxon Valdez oil spill.

xiv. **Recovery Planning** - Recovery planning usually involves a multi-stakeholder process that engages community members in designing their own recovery, and allocating resources to their needs. Recovery programming is the resulting series of activities that are used to implement the plan.

No local government data available.

xv. **Technical Assistance Programs**[89] - In many cases, oil spill victims have neither the expertise nor the capacity to engage in application processes, which usually requires technical assistance support from the public and non-profit sectors.

Example: $190,000 – Deepwater Horizon

xvi. **Interim Financial Relief** - Governments or other entities may provide short-term assistance in the form of grants, loans, or suspension of tax payments.

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[87] Written Evidence of Jeremy Stone, page 29, para. 4.6
[88] Written Evidence of Jeremy Stone, page 20, para. 3.1
[89] Written Evidence of Jeremy Stone, page 21, para. 3.3

No local government data available.

xvii. **Mitigation and Preparedness Activities**[90] **-** The quality of the contingency planning and the management of response operations have been defined as a potentially crucial variable in determining the costs of the oil spill.

For example, in the wake of the 1988 *Nestucca* fuel barge spill in Washington and the catastrophic 1989 Exxon *Valdez* tanker spill in Alaska, the Washington legislature created two dedicated accounts to fund the Department of Ecology's oil spill prevention, preparedness, and response activities. Today its core services include vessel and facilities inspections, plan review and approvals, contingency plan drills, natural resource damages assessment on spills to water, environmental restoration, and response to oil and hazardous materials spills delivered 24/7 from field offices.

According to the 2013-15 operating budget for the program, nearly $27.0 Million is assigned to the program. Out of this budget 17% ($4.68 million) is allocated for prevention (Washington Department of Ecology, 2014).

xviii. **Lost Tax Revenues**[91] - When economies, incomes, and real estate lose value, tax bases suffer. This is especially problematic after an oil spill because at the very time there is a greater need for public services to assist with the disaster, the volume of resources available to meet these needs decreases.

Example: $164,000,000 – Deep Water Horizon

xix. **Legal Costs**[92] - Recovery from oil spills can cost millions of dollars in litigation and other legal services. However, due to the strict confidentiality that is held around legal expenses it is challenging to determine the total cost associated with litigation.

Example: $59,000,000 – Prestige oil spill

6.2.3 Conclusions

Mr. Stone concludes that a catastrophic spill could present significant costs for local governments. The upper bound of the quantified spill costs that he identified add up to close to

[90] Written Evidence of Jeremy Stone, page 23, para. 3.5
[91] Written Evidence of Jeremy Stone, page 26, para. 4.1
[92] Written Evidence of Jeremy Stone, page 26, para. 4.2

$1 billion in costs and, as he points out, the aggregate number would likely be much higher if monetary figures could be provided for the numerous cost categories that were identified in the course of this research, yet for which there was no available quantitative data. In addition, the characteristics of the location of the oil spill also play an important part in oil spill impacts, and spills that occur in-shore or adjacent to high population areas can be much more expensive to clean up.[93]

A worst-case scenario oil spill in the Vancouver region could put immense fiscal pressure on the City of Vancouver and other local governments, especially in cases where non-compensable damages are high. The limitations of the existing compensation regime for marine-based oil spills are addressed in section 7.4 below.

6.2.4 Marathassa Oil Spill

Vancouver's recent experience with the Marathassa Oil Spill has confirmed that many of the cost categories identified in the Stone Report are costs that Vancouver would actually incur in the event of a large oil spill. During an initial debrief of the Marathassa Oil Spill, a number of additional risk factors and response activities were identified in relation to an oil spill involving diluted bitumen. For example, requirements for evacuation, shelter in place, air quality testing, personal protection equipment, were not engaged by the Marathassa Oil Spill. However, based on the expert advice that Vancouver has received regarding the chemical properties of diluted bitumen, the evaporation rate of the diluents, the toxicity of the plume created by evaporating diluents, and the resulting explosion hazard and health risks, these additional response measures and health costs should be anticipated in the event of a large spill of diluted bitumen.

While the scale of the response activities and costs of the Marathassa Oil Spill are not comparable to a large oil spill and the full range of response activities were not engaged, a description of the nature of the activities that Vancouver was engaged in provides a reference point.

[93] Written Evidence of Jeremy Stone, page 8, para. 1.5

6.2.4.1 *Staging*

Daniel Stevens, Director Manager of Emergency Management for Vancouver, advises that Vancouver was first notified of the oil spill at 5:06 a.m. on the morning of April 9, 2015. Notification was informal and occurred more than twelve hours after the initial oil spill was reported to the Canadian Coast Guard. Vancouver's EOC activation was initiated at 6:30 a.m on April 9, 2015 and the EOC remained activated until April 17, 2015. Vancouver's Financial Planning and Analysis department advises that well over 100 staff members were in attendance at the EOC in the initial days of the response.

Vancouver was also part of Unified Command ("UC") from the outset. Mr. Stevens advises that, in this role, Vancouver:

i. worked to push forward objectives related to public health and safety, public information and communication, and the coordination of tasks including waste management, security, volunteer management, call centre management, and environmental assessment;

ii. provided local knowledge and field reports to UC regarding response priorities, sensitive sites and public safety concerns;

iii. provided the first GIS support available to UC, and had representatives in the Environmental Unit, Communications, Logistics Section and Planning Section of UC; and

iv. advocated for the contracting of independent experts for shoreline assessment, corrected inaccurate information, pushed for the release of public information and maps, and provided templates for status boards and tracking.

Mr. Stevens advises that Vancouver staff were present for the entire activation of the Incident Command Post ("ICP") for the UC, which was set up at Port Metro Vancouver and DFO offices at 401 Burrard Street from April 9 through to April 24. Up to 20 Vancouver staff members attended the ICP on a given day.

6.2.4.2 *Fire, police and emergency services*

Vancouver Fire and Rescue Services ("VFRS") was active in a number of roles. The Fire Chief served as the Vancouver representative in Unified Command for several days and VFRS staff were also actively involved at the ICP and Vancouver's EOC in various capacities. VFRS and Vancouver Police Department ("VPD") staff were deployed to beaches to provide information to the public, working along with volunteers, Park Rangers and Engineering staff.

VFRS and VPD marine boats were deployed to conduct on water assessments and to observe the oil spill cleaning operations. VPD Marine also provided boats for Shoreline Assessment as well as wildlife responders.

Staff from Vancouver's Engineering department supported wildlife rescue efforts by providing personnel and fencing to protect impacted birds in the ponds at Vanier and Jericho Parks. Park Board staff were instrumental in providing information to the EOC and UC about the location of impacted wildlife and oiled shoreline. Park Board staff also worked with FOCUS wildlife to identify locations for wildlife staging areas.

Park Board staff and staff from Vancouver's Environmental Planning department accompanied teams conducting the Shoreline Cleanup and Assessment Technique ("SCAT"). These staff members provided local knowledge about the Vancouver shoreline and shoreline values and also conducted and documented their own assessments for Vancouver.

6.2.4.3 *Public Health Costs*

Vancouver notified Vancouver Coastal Health ("VCH") of the oil spill almost immediately following Vancouver's receipt of the courtesy call from WCMRC. VCH was included in all policy calls with Vancouver. Vancouver also worked with VCH to test water and sediment to determine if beaches were safe for swimming.

Mr. Stevens advises that, in the first two days following the oil spill, UC did not have security plans in place or plans for shoreline clean up and closures. As a result, Vancouver deployed staff and volunteers to shoreline and beach areas to warn the public about the oil spill and to ask them

not to touch any oil on the shoreline or any impacted wildlife. Vancouver also had notification signs prepared and posted them at various beach locations.

6.2.4.4 *Waste collection, transportation and disposal*

Staff from Vancouver's Engineering department were involved at Vancouver's EOC and coordinated with the Ministry of Environment Waste Management team to develop a plan for managing hazardous waste on the shoreline. Staff from Vancouver's sanitation department were deployed to assist with the removal of oil spill-related hazardous waste.

6.2.4.5 *Public Communication*

Mr. Stevens advises that Vancouver established a call-in number for the public for the region and this was used to receive and provide information about the spill, impacted wildlife, claims, and volunteer interests. As mentioned above, Vancouver, together with Vancouver Board of Parks and Recreation, prepared and posted signage at its beaches and developed a plan and deployed staff and volunteers to provide information to the public at beaches and along the shoreline.

Vancouver also provided information to the public via media and social media throughout the oil spill response period.

6.2.4.6 *Volunteer Management*

A number of 'convergent volunteers' showed up at different oiled sites to clean up oil, including at English Bay on April 9, 2015. The City deployed trained volunteers to provide information to the public about the spill and to warn people about the dangers of touching the oil. The City also took calls from volunteers at the call-in number referred to above. Over 4000 members of the public offered to volunteer with clean up. In addition, there were offers from other groups, such as the Vancouver Aquarium to send volunteers to support response.

6.2.4.7 *Lost Use of Parks and Other Municipal Spaces*

The initial WCMRC response was staged from the Burrard Civic Marina. Shoreline clean up happened at Stanley Park, New Brighton Park, Crab Park, and around English Bay. Some resources were staged at these areas during clean up.

The initial wildlife response was staged at Stanley Park and later re-located to HMCS Discovery (Deadman's Island).

The Director of Vancouver Board of Parks and Recreation advises that some public spaces were closed to the public for a period of time or use was limited. This included beaches and parks (English Bay Beach, Second Beach, Third Beach, Crab Park and New Brighton Park) that were signed to warn the public against people or pets going into the water and parts of Stanley Park that were closed for cleanup of the oil spill.

6.2.4.8 *Brand Recovery*

Vancouver has not yet determined what resources and expenditures may be required to repair any damage to Vancouver's greenest city brand and its international reputation as one of the most liveable cities in the world. The value of Vancouver's brand, and the potential impact of a small, medium and large oil spill on Vancouver's brand value is discussed under section 7.2.5 below.

6.2.4.9 *Opportunity Costs*

Mr. Stevens advises that a number of emergency management projects were put on hold as a result of the resources that were required for response to the oil spill. Work is being re-prioritized at this time to account for the anticipated time commitment of the after action and recovery process. Most emergency management work is work that has to be done, it is not optional. For example, public safety planning for events and protests had to continue throughout the spill. This means that there has been a major impact on staff who have worked long hours and weekends to continue regular business.

6.2.4.10 *Costs of damage assessment*

This is an ongoing process, some of which is being undertaken within Vancouver's Risk Management and Finance departments. Other aspects of the Vancouver's damage assessment are tied to the Oil Spill Recovery Plan Proposal and the long term environmental monitoring program discussed below.

6.2.4.11 *Recovery Planning*

Mr. Stevens advises that Vancouver staff drafted the Oil Spill Recovery Project Plan which ultimately formed the basis for the Project Management Office proposal. This proposal has been adopted by the Canada Coast Guard and is under review. In the process of preparing the Oil Spill Recovery Project Plan proposal, Vancouver reached out to subject-matter experts and other communities that had been through spills to get input on recovery needs. Two Vancouver staff members worked on this plan over a period of days, and collaborated with other municipalities and First Nations to bring forward an acceptable proposal. Vancouver Senior Managers also reviewed and provided comments on this plan.

In addition to the Oil Spill Recovery Plan proposal, Vancouver staff from the Environmental Planning department and the Parks Board also contributed to the development of the Scope of Work for the long term environmental monitoring program.

6.2.4.12 *Mitigation and Preparedness Activities*

Vancouver is currently in the process of undertaking after action and debrief processes. This will include debriefs with staff who were involved at the ICP and Vancouver's EOC, as well as staff in the field. Vancouver expects that it will also include debriefs with other agencies and municipalities involved in the spill.

6.2.4.13 *Legal Costs*

Legal costs will continue to be incurred until such time as Vancouver's claim for compensation is resolved.

6.2.5 Vancouver Brand

Prior to the Marathassa spill, Vancouver commissioned independent expert evidence to provide an assessment of the brand value of the City of Vancouver brand and to determine what impact, if any, an oil spill in the Metro Vancouver area (defined as the City of Vancouver, surrounding municipalities and bordering water bodies of the Pacific Ocean and Fraser River) would have on this Brand Value from an economic standpoint. The evidence of Edgar Baum, Brand Finance

(Canada) Inc. ("Brand Finance") is provided in **Appendix 82** and Vancouver relies upon and adopts this evidence.

6.2.5.1 *Summary of Brand Valuation Impacts*

As Mr. Baum explains in his written evidence, Vancouver's brand was valued using a brand strength assessment (the "Brand Strength Index (BSI)"). Brand Finance determined a relative brand strength score for Vancouver of 65 out of 100 as compared to five other cities: San Francisco, Singapore, Sydney, Shanghai and Hong Kong. Brand Finance used the BSI to calculate the Brand Value of Vancouver and calculated total Brand Value (including Primary, Secondary and Tertiary sectors) at USD $31.475 billion.

As part of the brand valuation assessment, independent market research was conducted by Luth Research, a San Diego based market research firm. The responses from a significant majority of respondents to the market research study demonstrated that the Vancouver brand is associated with the environment, 'green' living and environmental leadership that was discernably ahead of that of the five other city brands studied.

As part of the independent of the market research study, survey respondents were asked to provide feedback regarding the changes in their perceptions of and behaviours toward each of the six cities studied in the event of a small, medium and large oil spill. The results of this study were used to assess the impacts of an oil spill on Vancouver's brand value. Mr. Baum's concludes that an oil spill would result in the impairment of the Vancouver brand and a reduction in Brand Value ranging between USD $1 billion for a small spill and USD $3 billion for large spill.

6.3 COSTS TO OCEAN-BASED ECONOMY

Vancouver commissioned independent expert evidence to provide an assessment of the potential economic cost of an oil spill in the Burrard Inlet on key ocean-dependent economic activities within the City of Vancouver in order to inform the NEB's assessment of the potential costs and benefits of the proposed TMEP. The evidence of Rashid Sumaila, PhD, is provided in **Appendix 83** and Vancouver relies upon and adopts this evidence.

6.3.1 Potential Economic Impact of a Tanker Spill on Ocean-Dependent Activities

With ten sand beaches skirting the shoreline from Kitsilano to the West End, Vancouver has been named one of the world's Top 10 Beach Cities by National Geographic.[94] Vancouver beaches attract over three million users per year[95], waterfront parks attract another five million[96] and the 22 km seawall attracts another 2.7 million[97] users per year.

Professor Sumalia estimates that ocean-dependent activities in Vancouver directly employ four percent of Vancouver's population and, when indirect and induced values are also considered, the Burrard Inlet provides employment for approximately eight percent of Vancouver's population.[98]

The study assessed the performance of five ocean-dependent economic activities: commercial fishing, port activities, inner harbor transportation, tourism and recreation. Each of these are closely linked to the condition of the marine environment. These ocean-dependant activities are estimated by Professor Sumalia to currently contribute a total of $6,430 - $6,700 million CAD in output value, 32,520 – 36,680 person years of employment and $3,061 - $3,261 million CAD in gross domestic product (GDP) to the Vancouver economy each year.[99]

Three potential spill scenarios were analysed: no spill, a hydrocarbon spill in May (16,000 m³ at First or Second Narrows) and a hydrocarbon spill in October (16,000 m³ at First or Second Narrows). Professor Sumalia concludes that, in the event of a May spill, Vancouver's ocean-dependent activities could suffer total losses in the range of $380 - $1,230 million CAD in output value, 3,238 – 12,881 persons years of employment and $201 - $687 million CAD in GDP. Under this scenario, 46% of output value, 138% of employment and 40% of the contribution to

[94] Sumaila, R, et al, *Potential economic impact of a tanker spill on ocean-dependent activities in Vancouver, British Columbia*, ("Sumaila Report) at page 16, footnote 7
[95] Sumaila Report, at page 16, footnote 8
[96] Sumaila Report, at page 16, footnote 9
[97] Sumaila Report, at page 16, footnote 10
[98] Sumaila Report, at page 5
[99] Sumaila Report, at page 41

GDP from the proposed TMEP, as estimated by Trans Mountain in its Application, would be lost to the spill by the few economic activities that Professor Sumalia assessed.[100]

In the event of an October spill, Vancouver's ocean-dependent economy could suffer total losses in the range of $215 - $1,020 million CAD in output value, 1,972 – 11,216 person years of employment and $115 - $757 million CAD in GDP. Under this scenario, 38 % of output value, 120 % of employment and 34 % of GDP from the proposed TMEP, as estimated by Trans Mountain in its Application, would be lost to the spill.[101]

The losses from a hydrocarbon spill are substantial given the study's narrow focus on the market values of only five key ocean-dependent economic activities in Vancouver. The value of socio-economic impacts to local businesses and residents whose employment is not linked to the Burrard Inlet was not assessed in this study, including impacts on human health, real property values, community cohesion, local non-tourism businesses, general well-being of residents in the City of Vancouver, the 'Greenest City' brand and environmental damages. Professor Sumalia's study also does not include the costs of a spill response, clean-up and litigation activities or the costs incurred by local governments which are discussed above.

6.4 LIMITATIONS OF EXISTING COMPENSATOIN REGIME FOR MARINE-BASED OIL SPILLS

Vancouver's Risk Management Department has undertaken a review of Canada's regime of liability and compensation for ship source oil pollution and the following section summarizes the results of that review.

In Canada, the tanker owner is responsible for pollution damages from oil spills under the "polluter-pay principle"[102]. However, the payment of compensation is dependent to a large

[100] Sumaila Report, at page 51
[101] Sumaila Report, at page 51
[102] http://www.tc.gc.ca/eng/marinesafety/menu-4100.htm

extent on the legal regime applicable in Canada, which consists of two sets of international conventions and a national fund as follows, comprising a four-tiered compensation system[103]:

- Tier 1 – Civil Liability Convention (1992 CLC)
- Tier 2 – 1992 IOPC Fund Convention
- Tier 3 – 2003 Supplementary Fund
- Tier 4 – Ship-sources Oil Pollution Fund (SOPF)

6.4.1 Tier One: Civil Liability Convention – 1992 CLC

The 1992 Civil Liability Convention for persistent oil carried in bulk as cargo was established through the International Convention on Civil Liability for Oil Pollution Damage and provides compensation for spills of persistent oil carried in tankers. Compensation is paid by the vessel's insurer.

Under the 1992 CLC, claims for compensation for oil pollution damage caused by persistent oil (e.g., crude oil) may be made against the registered owner of the tanker, referred to as the Responsible Party, who is required to maintain compulsory insurance if the ship carries more than 2,000 tonnes of oil in bulk as cargo. The Responsible Party's liability, however, is restricted to a maximum amount of liability for any one incident calculated on the basis of the gross tonnage of the ship. In addition, there is an overall limit on the Responsible Party's liability under the 1992 CLC of approximately CDN $152 million[104].

In general, claims may be brought in relation to property damage, consequential loss and pure economic loss. The costs of reasonable measures to restore the environment are also recoverable, as are the costs of preventive measures[105]. However, the Responsible Party will not be liable for pollution damage in certain circumstances, including:

- damage resulting from grave natural disaster;
- damage wholly caused by sabotage by a third party;

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[103] http://www.ssopfund.ca/en/international-conventions/overview
[104] The value is based on Special Drawing Rights (SDR) as defined by the International Monetary Fund. Value of SDR on April 1, 2014 was approximately $1.7. Refer to http://www.ssopfund.ca/en/international-conventions/overview
[105] Extract from UNCTAD/DTL/TLB/2011/4

- damage caused by an act or omission done with intent to cause damage by a third party;
- damage caused as a result of the negligence of public authorities in maintaining lights or other navigational aids.

6.4.2 Tier Two: IOPC 1992 Fund

The IOPC 1992 Fund was established in 1996 under the 1992 Fund Convention and provides compensation for spills of persistent oil from tankers, paid by receivers of oil in countries that have signed the conventions. The IOPC 1992 Fund pays compensation when:

- The damage exceeds the limit of the Responsible Party's liability under the 1992 CLC, or
- The Responsible Party is exempt from liability under the 1992 CLC, or
- The Responsible Party is financially incapable of meeting its obligations in full under the 1992 CLC and the insurance is insufficient to pay the compensation claims.

The maximum compensation from the IOPC 1992 Fund (inclusive of any Tier 1 compensation paid) is approximately $345 million.

The types of claims that may be compensated under the IOPC 1992 Fund include:

- Clean-up and preventive measures – Compensation is payable for the cost of reasonable clean-up measures and other measures taken to prevent or minimize pollution damage as well as for reasonable costs associated with the capture, cleaning and rehabilitation of wildlife, in particular birds, mammals and reptiles

- Property damage - Compensation is payable for reasonable costs of cleaning, repairing or replacing property that has been contaminated by oil

- Consequential loss - Compensation is payable for loss of earnings suffered by the owners of property contaminated by oil as a result of a spill

- Pure economic loss - Under certain circumstances compensation is also payable for:
  - loss of earnings caused by oil pollution suffered by persons whose property has not been polluted
  - the costs of reasonable measures, such as marketing campaigns, which are intended to prevent or reduce economic losses by countering the negative effects which can result from a major pollution incident.

- Environmental damage - Compensation is payable for the costs of reasonable reinstatement measures aimed at accelerating natural recovery of environmental damage.

- Use of advisers - Compensation is paid for reasonable costs of work carried out by advisers in connection with the presentation of claims falling within the scope of the Conventions.

6.4.3 Tier Three: Supplementary IOPC Fund

The 2003 Supplementary Fund Protocol established the Supplementary IOPC Fund to provide compensation for oil pollution damage in circumstances where the protection afforded by the 1992 CLC and the IOPC 1992 Fund Convention is inadequate. The Supplementary IOPC Fund provides additional compensation beyond the amount available under the 1992 CLC and IOPC 1992 Fund to a maximum of $932 million.

The aggregate amount available under the 1992 CLC (Tier 1), the IOPC 1992Fund (Tier 2) and the Supplementary IOPC Fund (Tier 3) is $1.278 billion. However, according to the IOPC Claims Manual[106], *"A claimant is entitled to compensation only if he or she has suffered a quantifiable economic loss"*. It is unclear whether, under the IOPC system, any compensation would be available for lost recreational opportunities for residents (use of beaches, parks and landscape) and non-use or passive use losses (cultural, non-use and heritage values) that occur in the time interval between the oil spill and the period when restoration is completed. These losses could be significant for Vancouver and its residents in the event of an oil spill.

6.4.4 Tier Four: Ship-sources Oil Pollution Fund (SOPF)

Canada created its own oil pollution fund in the 1970's. The SOPF is an independent fund under the *Marine Liability Act*, which is responsible for the investigation and payment of claims for oil spills from all classes of ships in Canada. Funds can be accessed only to compensate losses against oil spills incidents and claims can be made to cover:

- Oil pollution damage and cleanup costs (including reasonable preventive measures, actually incurred);
- Anticipatory and remedial expenses;

[106] http://www.iopcfunds.org/uploads/tx_iopcpublications/claims_manual_e.pdf

- Economic loss claims (but limited to those connected with loss of income from fisheries, aquaculture, and subsistence hunting in Canada);
- Pollution damage and cleanup costs caused by mystery spills (where the ship owner's identity is not established).

According to the SOPF Claims Manual[107], any person in Canada, including corporations and the Crown, who has sustained loss or damage, or incurred costs and expenses in respect of an oil spill may file a claim directly with the Administrator of the SOPF.

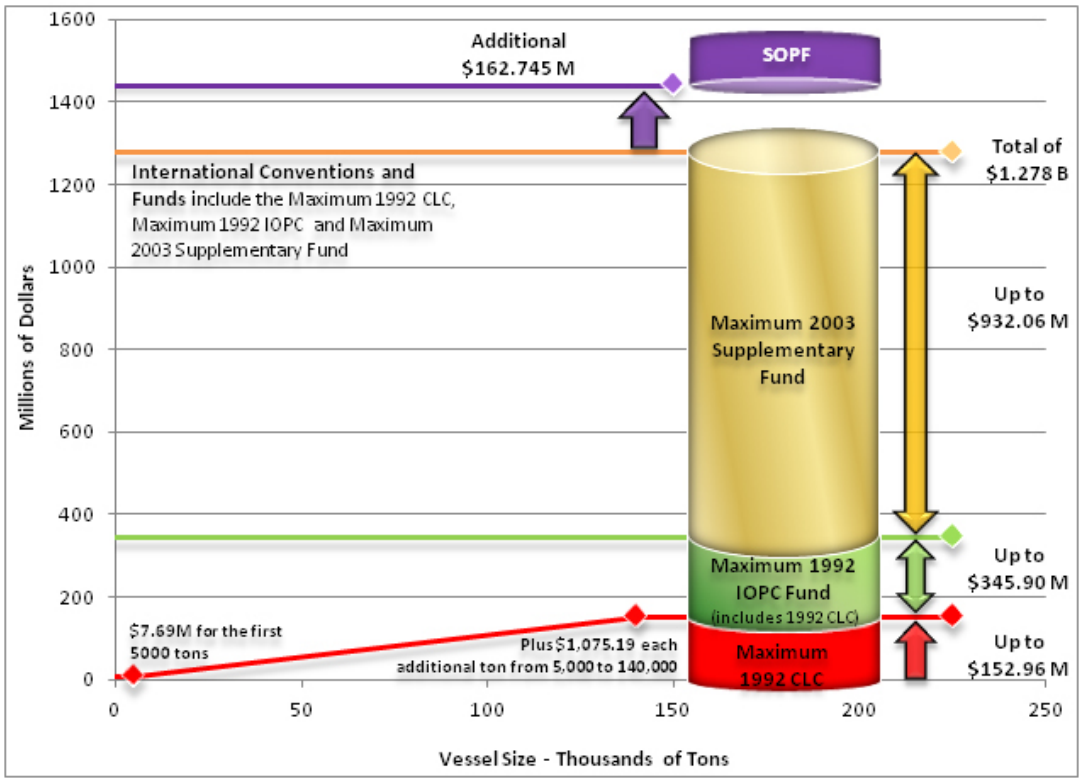
The SOPF reserve is currently about $400 million, however, its maximum liability for claims from any one spill is limited to approximately $162 million.

7.4.5 Summary of Limits of Liability and Compensation per incident for Oil Tanker Spills in Canada

A total of $1.44 billion is available to cover the damages from an oil tanker spill in Canadian domestic waters, including the territorial sea and the exclusive economic zone.

The conventions and funds are summarized in the graphic below:

[107] Ship-Source Oil Pollution Fund – Claims Manual 2014 Edition



Source: SOPF website (accessed on February 24, 2014)

The timing of each of the four components of the International and national compensation regime outlined above coincides with the historical timeline of significant ship-source oil spills, suggesting a reactive response by governments and legislators to marine disasters:

- The 1992 CLC and the IOPC 1992 Fund[108] began with the oil spill from the *Torrey Canyon*, which ran aground near the Scilly Isles in 1967, fouling UK and French coastlines.
- In 2003, Following the *Erika* and *Prestige* incidents, the third tier, the Supplementary IOPC Fund[109], was adopted to provide additional compensation.
- SOPF[110] began with the oil spill that occurred in 1970 when the tanker *Arrow* grounded in Nova Scotia. This incident was the catalyst for a made-in-Canada solution, and major amendments were made to the *Canada Shipping Act* at the same time.

[108] http://www.iopcfunds.org/about-us/history/
[109] http://www.iopcfunds.org/about-us/
[110] http://sopf.gc.ca/en/the-fund/information-and-background

6.4.6 Case Studies

The following is a review of three of the largest tanker oil spills in recent history, two of which were covered by the same compensation regime (Tiers 1, 2 and 3) that applies to Canada - the *Hebei Spirit* (Republic of Korea, 2007) and *Prestige* (Spain, France & Portugal, 2002) oil spills – and one - *Exxon Valdez* (USA, 1989) – which, although not part of the same compensation regime – is relevant to an understanding of the problems and limitations of the current regime.

6.4.6.1 *Hebei Spirit*[111]

Incident - on 7 December 2007, a crane barge was being towed by two tugs when the tow line broke, the barge drifted and collided with the anchored *Hebei Spirit*, which was carrying 209,000 tonnes of four different crude oils. The collision punctured three of the five tanks aboard the tanker and resulted in the leaking of some 10,900 tonnes of oil.

Impact - The spill occurred near Mallipo Beach (in Taean County), considered one of South Korea's most beautiful and popular beaches. The spill affected three of the four provinces along the western coast of South Korea, ultimately fouling more than 375 kilometers (233 miles) of shoreline.

Applicability of the Conventions - The Republic of Korea is a Party to the 1992 CLC and the IOPC 1992 Fund but, at the time of the spill, had not ratified the Supplementary Fund Protocol.

Compensation & Claims - According to the IOPC 2010 Annual Report, the Hebei Spirit was a major challenge to the Fund as 127,483 claims (mainly from fishing and shellfish sector) were received in connection with the incident by 31 December 2010. Compensation was only paid on 32,420 of these claims, representing 25% of the total number of claims submitted. Of the 32,420 claims that were at least partially compensated, only 35% of the total value of these 32,420 claims was paid. The total cost of the spill was estimated to be approximately $400 million.

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[111] IOPC Publications, Incidents involving the IOC Funds 2013 – Hebei Spirit, Note by the Secretariat (October 7, 2014) attached at **Appendix 84.**

6.4.6.2 *Prestige*[112]

Incident - on November 13, 2002, the tanker Prestige, carrying 76 972 tonnes of heavy fuel oil, began listing and leaking oil some 30 kilometres off Cabo Finisterre (Galicia, Spain). On November 19, whilst under tow away from the coast, the vessel broke in two and sank some 260 kilometres west of Vigo (Spain), the bow section to a depth of 3 500 metres and the stern section to a depth of 3 830 metres. The break-up and sinking released an estimated 63 272 tonnes of oil. Over the following weeks oil continued to leak from the wreck at a declining rate. It was subsequently estimated by the Spanish Government that approximately 13 700 tonnes of oil remained in the wreck. The spill lasted for more than 4 months, affecting Portugal, Spain and France.

Impact - Due to the highly persistent nature of the Prestige's cargo, released oil drifted for extended periods with winds and currents, travelling great distances. The west coast of Galicia was heavily contaminated and oil eventually moved into the Bay of Biscay, affecting the north coast of Spain and France. Traces of oil were detected in the United Kingdom (the Channel Islands, the Isle of Wight and Kent).

Applicability of the Conventions[113] - At the time of the incident, France, Portugal and Spain were Parties to the 1992 CLC. The Prestige was insured for oil pollution liability with London Club.

Compensation & Claims – Claims handling offices were set up in Spain and France. The office in Spain received 845 claims, including 15 claims from the Spanish Government totaling €984.8 million related to costs incurred in respect of:

- at sea and on shore clean-up operations,
- removal of the oil from the wreck,
- compensation payments made in relation to the spill on the basis of Spanish legislation
- tax relief for businesses affected by the spill,

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[112] IOPC Publications, Incidents involving the IOC Funds 2013 – Prestige, Note by the Secretariat (September 8, 2014) attached at **Appendix 85.**

[113] http://www.iopcfunds.org/incidents/incident-map/#126-2002-210-November

- administration costs,
- costs relating to publicity campaigns,
- costs incurred by local authorities and paid by the State,
- costs incurred by 67 towns that had been paid by the State,
- costs incurred by the regions of Galicia, Asturias, Cantabria and Basque Country and
- costs incurred in respect of the treatment of the oily residues.

The IOPC assessed the claims by the Spanish Government at €300.2 million. Other losses, such as loss of natural heritage (the Atlantic Islands National Park) and loss of recreational uses by tourists and residents, arising from the Prestige oil spill were estimated at 14 times[114] greater than the allowable IOPC compensation limits.

6.4.6.3 Exxon Valdez

Incident - on March 24, 1989, The *Exxon Valdez* was carrying 53 million gallons of oil. Three hours after leaving the port, the tanker ran aground Bligh Reef spilling approximately 11 million gallons of oil into Prince William Sound.

Impact - The spill impacted over 1,100 miles of non-continuous coastline in Alaska, making the *Exxon Valdez* the largest oil spill to date in U.S. waters until the Deepwater Horizon supplanted it in 2010. 25 years after the spill, there are still pockets of residual oil along the shorelines of Prince William Sound.

Applicability of the Conventions – The American congress passed the Oil Pollution Act (OPA90) in 1990. Up to that time, the scope of damages compensable under federal law to those impacted by a spill was fairly narrow; the American oil pollution liability and compensation legislation embraced a broad patchwork of federal statutes and laws of various coastal states. Exxon's exposure to liability for the grounding of the Exxon Valdez stems from the Clean Water Act (CWA), the Trans-Alaska pipeline Authorization Act (TAPAA), general maritime law, and Alaska state law.

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[114] Garza-Gil MD, Prada A, Varela M, Xosé M (2009), *Indirect assessment of economic damages from the Prestige oil spill: consequences for liability and risk prevention*: Loureiroa, M, Ribasa, A ,Lópezb, E Ojea, E, *Estimated costs and admissible claims linked to the Prestige oil spill*, at page 106 – **Appendix 86**

The more generous compensation regime imposed by OPA90, as compared to the current compensation regime that operates in Canada and elsewhere, has been described as follows:

> "[OPA90] *has some similarities with the international regime, such as strict liability and limited liability with compulsory financial guarantee. However, it has some substantial differences as well: the scope of compensable damage is much wider, liability is not channeled, and higher liability limits apply with more possibilities for the potential responsible parties to lose their right to limit their liability. OPA does not preempt state laws, which means that states can still impose additional liability or financial responsibility*"[115].

Compensation & Claims – The total compensation costs payable by Exxon were in the order of US$5 billion, although Exxon is believed to have spent at least the same sum on the clean-up operation, raising the cost of the spill even higher, The exact amount of monetary damages remains unknown.

6.4.7 Uncompensated Claims under the CLC/IOPC Regime

6.4.7.1 *Introduction*

Based on a review of the IOPC incident summaries for the Prestige and Hebei Spirit incidents, there is a clear divergence between the total estimated damages caused by the oil spill, the value of the compensation claims actually submitted by third parties, and the compensation eventually paid under the CLC-IOPC Regime[116]. In most cases where a total damage assessment is available, this is an estimated figure only, suggesting a fairly large degree of uncertainty as to the exact value of the damages sustained in some loss categories.

The IOPC Fund undertook a review of its decisions taken in the period 1979 to 1993 and summarized its findings in a document entitled "Criteria for the Admissibility of Claims for Compensation" dated January 12, 1994, a copy of which is attached at **Appendix 87**. A review

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[115] Extract from LIU JING, MICHAEL FAURE, AND WANG HUI http://law.uoregon.edu/wp-content/uploads/2014/05/Jing.pdf (page 146)

[116] For a detailed discussion of the process of damage assessment and compensation in the case of Hebei Spirit and Prestige, see Notes by the IPOC Secretariat for these incidents attached at Appendix 84 and Appendix 85.

specific to environmental damage claims was also undertaken and summarized in the IOPC Fund document dated January 4, 1994[117] which is attached at **Appendix 88**.

The following table sets out various categories of losses and the IOPC Fund's treatment of those losses as compensable or not, based on information provided in Appendices 87 and 88.

Simplified table of examples of cost of oil spill vs. compensation

	Example	**CLC – IOPC Compensation**
Environmental damage[118]	Non economical marine environmental losses such as rehabilitation, replacement or acquisition of equivalent natural resources	Unclear
Cleaning and restoration	Cost of reasonable clean-up measures	Yes
Waste Management	Cost of landfill space, dead animals and fishes, absorbent boom, oiled sand, other solid and liquid waste, debris	Yes[119]
Preventative Measures	Measures taken to prevent or minimize Pollution damage, including costs associated with the capture, cleaning and rehabilitation of wildlife, in particular birds, mammals and reptiles.	Yes
Property Damage	Property that has been contaminated by oil	Yes
Fisheries and related sectors	Loss of income	Yes
Use of advisers	Costs of work carried out by advisers in connection with the presentation of claims falling within the scope of the Conventions	Yes
Tourism	loss of earnings to hotel or a restaurant located in the immediate vicinity of the affected area and close to a contaminated public beach; Marketing campaigns to prevent/ reduce economic losses	Yes
Tourism	loss of earnings to hotel or a restaurant that is	No *(however each claim should be*

[117] IOPC Fund, *Criteria for the Admissibility of Claims for Compensation – Environmental Damage Claims*, 4 January 1994

[118] IOPC Fund Resolution No 3 – Pollution Damage, Annex to Appendix 88

[119] Appendix 87, at page 3. "Clean-up operations frequently result in considerable quantities of oil and oily debris being collected. Reasonable costs for disposing of the collected material are admissible".

	not located close to a contaminated public beach; Marketing campaigns to prevent/ reduce economic losses	*considered on its merits)*
Tourism (Non-regulated)	AirBnB, temporary/ vacation rentals	No
Other businesses	Businesses providing services or goods to tourism-related businesses and not directly to tourists (e.g. laundry services, taxi companies, merchants who purchase the fish from the boats, etc.)	No
Recreation	Use of beaches, seawall and landscape, sports (such as fishing) and natural resources by the public during the recovery period	No
Non-use/ passive use	Cultural, existence and heritage value (e.g. Stanley Park)	No
Public Health costs	Short and Long term health costs (physical and psychological)	No[120]
Evacuation of urban area and temporary shelter	Evacuation of urban area, temporary shelters, food and water	Unclear
Technical Assistance Programs	Claims & legal assistance, employment assistance, etc.	Unclear
Other Assistance Programs	Human and social services designed to assist impacted populations, such as job training, child care assistance, senior services, domestic violence response, etc.	No
Legal Costs	Legal/ litigation costs incurred by government	Unclear[121]
Volunteer Management	Engagement, PPE (Personal protective equipment), transportation, food and water, medical cost, liability insurance, planning, training, management of volunteers during oil spills	Unclear *(some claims presented by voluntary groups involved in the protection of wildlife were accepted on BRAER and TANIO cases)*
Research and damage assessment	Research studies and assessments	Only if the study was carried out as a part of the spill response as, a direct consequence of a particular oil

[120] Appendix 87, at page 4.

[121] Appendix 87, page 22. A claim was presented by a local authority in the TARPENBEK case for legal fees incurred in applying for a high court injunction (which was not granted) against certain preventive measures being taken. The IOPC Fund did not accept this claim, on the grounds that it was not covered by the definition of "pollution damage".

		spill
Communication Efforts	Developing and Launching website, signage, IT support (cell phone, computers, printers), internet	Unclear
Tax revenue	Property taxes, sales taxes	No *(refer to TANIO and HAVEN case)*
Cost of police, fire, first responders and emergency staff	Overtime, insurance, PPE, special equipment required, fuel for equipment, such as boats and vehicles, etc.	Unclear
Routine Operations and Maintenance	Continuity of city routine work that needs to be subcontracted at higher price	No
Brand recovery (City of Vancouver)	Marketing campaigns and tourism promotion to prevent/ reduce pure economic pure economic loss	Unclear *(rejected in HAVEN, BRAER cases)*
Brand value (long-term)	Value of the brand	No
Future developments	Future developments being disrupted due to the perception about the heightened risk of oil spills	No

Overall, the review of past oil spills demonstrates the challenges inherent in the international oil pollution compensation regime. Funding limits are inadequate and many categories of losses remain uncompensated. Petroleum exporting ports, such as the Port of Vancouver, need solid legal protection and regulations in place prior to a major oil spill event. The BC Government's technical analysis[122] noted that: "*The legacy of a spill and cleanup can last for decades. Indeed, the impacts from the Exxon Valdez spill have still not been completely addressed.*"

In practice, the IOPC Fund has been very restrictive in assessing claims, especially for damage to the marine environment. To date, no claims for restatement of the environment have been admitted in the Fund's experience[123].

[122] Requirements for British Columbia to Consider Support for Heavy Oil Pipelines - http://www.env.gov.bc.ca/main/docs/2012/TechnicalAnalysis-HeavyOilPipeline_120723.pdf
[123] Garza-Gil MD, Prada A, Varela M, Xosé M (2009) – Appendix 86

6.4.8 Conclusion

The devastating effects of major tanker oil spills on the marine and coastal environment as well as the significant economic losses and other costs to local governments, residents and businesses impacted by the oil spill have focused Vancouver's attention on the risk of oil pollution from the TMEP's proposed increased tanker traffic, marine terminal, tank farm and pipeline facilities.

Based on the examination of practical examples, Vancouver has identified a number of gaps in the existing national and international compensation regimes and several factors which limit the regime's effectiveness in compensating for the full socio-economic costs of an oil spill.

In the event of a large oil spill in Burrard Inlet, the existing compensation regime will be inadequate to fully compensate Vancouver, its businesses and residents, for the associated socio-economic impacts. Vancouver will be only one of many claimants who will also be submitting significant compensation claims.

Taking the costs to Vancouver identified in Mr. Stone's report together with the impairment to Vancouver's brand value assessed by Brand Finance and the costs to Vancouver's ocean-based economy assessed by Dr. Sumalia, the economic impact of a large oil spill in the Burrard Inlet on Vancouver and its ocean-based economy could exceed $2 billion. Cost of Securing Recovery for Un-Compensated Losses

Vancouver commissioned independent expert evidence to provide an assessment of the possible risk transfer mechanism that could be purchased by Trans Mountain to provide compensation for those economic impacts of a marine-based oil spill that would not otherwise be covered under the existing compensation regime discussed above, due either to the nature of those impacts or the dollar amount of those impacts. The evidence of Karen MacWilliam is provided in **Appendix 89** and Vancouver relies upon and adopts this evidence.

Four different alternative risk financing options were evaluated: (a) contingent capital arrangement; (b) catastrophe bond; (c) finite risk plan; and (d) captive insurer.

Ms. MacWilliam's concludes that the most suitable risk financing option is a catastrophe bond/insurance securitization arrangement with a cost estimated to be in the range of 3.5% to

14% of the total coverage required, for an initial bond issue with a maturity of 1 to 5 years. For example, a $500,000,000 bond could have an initial cost ranging from $17,500,000 to $70,000,000 (including broker's commission). One time administrative costs could be as much as $450,000 with ongoing administrative costs up to $400,000 annually if there are claims from a triggering event.[124]

The likelihood of successfully issuing and subscribing a catastrophe bond decreases as the amount of the bond increases. The likelihood of subscribing a catastrophe bond for an amount that is sufficient to compensation for $1 billion in losses from a triggering event is less than 20%.[125]

[124] MacWilliam, K, *Alternate Risk Financing Mechanisms – Trans Mountain Pipeline Application*, ("MacWilliam Report") at page 33
[125] Mac William Report, at page 33