1. A Dirty Energy Superpower?

Alberta's tar sands, the source of oil to be pumped through Kinder Morgan's expanded Trans Mountain pipeline, lie under vast tracts of boreal forest. This 'overburden' (the industry term for soil and vegetation) is the breeding ground for 80–240 million birds of more than 200 species. It is also home to endangered caribou, wolves, and numerous wildlife species that are being severely affected by such development

PHOTO: ST. ALBERT GAZETTE

Fracking, Coal, Tar Sands Oil, and Tankers

Coastal British Columbia, once identified for its vast, majestic landscapes of forested river valleys flowing with salmon, is rapidly being transformed into the gateway for consumption of the world's dirtiest fossil fuels. And Vancouver, with its image of green living and enlightened thinking, is poised to become the nexus for this fossil fuel agenda.

Under the previous Conservative government, the world formed an unfavourable impression of Canada with our distinction as the first country to withdraw from the Kyoto Accord[1] to the radical undoing of environmental laws and regulations. Our thirst to precipitously extract and sell oil, LNG (liquid natural gas), coal, and other non-renewable resources now threatens a broad range of species and habitats from the arctic to the coastal temperate rainforest. This includes habitats of iconic species such as polar bears, woodland caribou, salmon, and killer whales—species that are the fabric of Canada's cultural identity. However with the advent of the new Liberal government, there is renewed hope that Canada can be a leader in climate and environmental policies.

Despite widespread public opposition, objections of First Nations, doubts about economic benefits, and concern about significant environmental impacts, exploitation of the Alberta tar sands has become the world's largest mining initiative. The escalating development of the tar sands is driving plans for greater oil pipeline capacity via projects like the Keystone XL, Enbridge's Northern Gateway, and Kinder Morgan's Trans

1 Part of the UN Framework to address climate change. Canada's withdrawal is despite evidence of the need to surpass required GHG reductions.

Mountain expansion, all of which are occurring without a coherent, sustainable Canadian energy strategy.

PHOTO: ALAMY

The Ghost of Canada's Climate Change Commitments

Under the previous Conservative government, Canada abandoned its greenhouse gas reduction (GHG) commitments. A 2013 Environment Canada report confirmed that Canadian GHG emissions were on the rise. Although a long way from the 2020 reduction goal[2] (about 600 Mt CO_2 e[3] annually), Canada had previously lowered its emissions (by 2009) to below 700 Mt. Yet, rather than try harder to reach the 600 Mt target, the federal government abandoned GHG targets, and put emissions on track to surpass 800 Mt annually by 2020[4] (Fig. 1.1).

At COP 21 in Paris in 2015, Canada's new Liberal government supported the goal of reducing CO_2 emissions to hold global temperature warming to no more than 1.5° C. This goal will require bold climate policies.

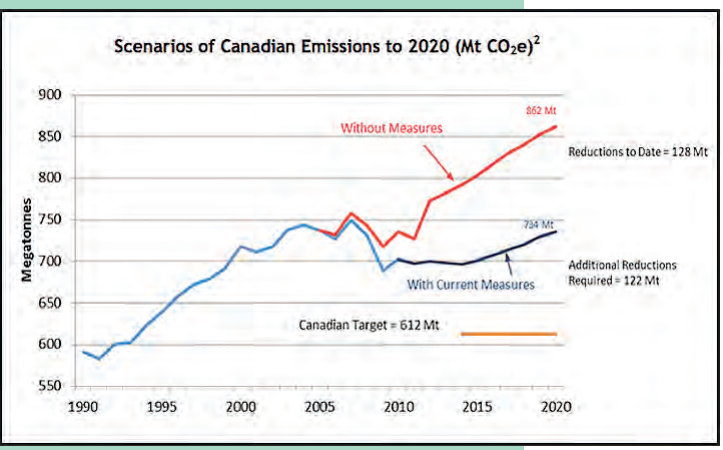

Figure 1.1 Canada's GHG emissions 1990–2020. The red line shows the path of GHG emissions if proposed measures are abandoned. The dark blue line shows the projected emissions if Canada implements its existing commitments. The orange line is Canada's target of 612 Mt annually.

SOURCE: ENVIRONMENT CANADA 2013

Although Canada currently contributes around 2% of global CO_2 emissions (US EPA 2008), it ranks third by CO_2 emissions per capita (UCS 2013). Globally, Australia has the highest per capita emissions of CO_2 (20.82 tons/capita) followed by United States (19.18) and Canada (17.27). Comparatively, Germany is at 10.06 and the UK 9.38 tons/capita, whereas the emerging economies of China (4.91) and India (1.31) are significantly lower but rapidly increasing. This disparity represents a key problem in climate change negotiations and a reason why Canada should not shirk its own responsibilities.

A Lasting Footprint

Due to the nature of extraction processes, the carbon footprint of tar sands development is up to 23% higher than average

2 Copenhagen Accord Target: an unbinding international agreement and successor to the binding GHG emission targets of the Kyoto Protocol that ended in 2012.

3 e is equivalent. Carbon dioxide equivalents account for other GHG and enable standardised reporting.

4 This figure does not include land use, land-use change and forestry. Environment Canada 2013.

Raw Tar Sands
The oil sands yield bitumen, a highly viscous form of petroleum that is produced by surface mining or by injecting steam to mobilize bitumen deep underground. After separation from the host sand and rock, bitumen is diluted with lighter petroleum products for transport (NAS 2015).

PHOTO: GREENPEACE

fuels (Brandt 2011) and requires between 2.5–4 barrels of water for each barrel of bitumen produced (NEB 2012). Production of tailings reached 1.8 billion litres per day in 2008 (Pembina 2008).

Visible from space, the footprint of this development has already created more than 170 sq km of toxic tailings ponds (Swift et al. 2011) and destroyed 65,000 hectares of boreal ecosystems by 2008 (Timoney and Lee 2009). The boreal landscape, including peatland, cannot be restored, and existing plans could release nearly 50 million metric tonnes of stored carbon while reducing potential carbon sequestration by 7-7,000 metric tons per year (Rooney et al. 2012).

Polluted Water, Land, and Air

Despite natural background levels of contaminants and continued failures with industry monitoring (Hall et al. 2012, Ayles et al. 2004) numerous scientific studies are demonstrating a range of environmental impacts from the tar sands (Kurek et al. 2013, Kirk et al. 2014, McLachlan 2014). Studies of

PHOTO: P. ESSICK

snowpack and watersheds in the Athabasca River (Kelly et al. 2010) suggest that the tar sands industry releases numerous pollutants (copper, lead, mercury, nickel, silver and zinc) that exceed Canada's guidelines for aquatic life.

Work by McLachlan (2014) showed elevated levels of metals (cadmium, arsenic, selenium and mercury) in wildlife that form the traditional foods consumed by First Nations including duck, fish, and moose. Other impacts include seepage from tailings ponds, impacts on migratory and resident birds (Schick and Ambrock 1974, Timoney and Lee 2009), risks to aquatic life (Kirk et al. 2014) and various impacts on air quality (Timoney and Lee 2009, Jautzy et al. 2014).

At a regional level, studies of lake sediments in the Athabasca tar sands indicate increased delivery of polycyclic aromatic hydrocarbons (PAHs) and dibenzothiophenes (DBTs), both known contaminants, up to 23 times higher than pre-development levels (Kurek et al. 2013), and with risks to ecosystem health also identified (Timoney and Lee 2009, Kirk et al. 2014, McLachlan 2014).

A Risk to Human Health

Tar sands development poses chronic and acute risks to human health from air pollution and consumption of contaminated fish and foods (Timoney and Lee 2009, McLachlan 2014). In Fort Chipewyan, a study by the Alberta health board concluded that cancer cases were higher than expected, in particular for biliary tract cancers, cancers of the blood, and cancers of the lymphatic system (Chen 2009). McLachlan found that the occurrence of cancer increased in accordance with employment in the oil sands and consumption of traditional foods including local fish. Although the human health findings from earlier studies have been challenged (RSC 2010), recent and mounting evidence is linking the presence of carcinogens to increased health effects (Timoney 2007, Kurek et al. 2013, Kirk et al. 2014, McLachlan 2014).

A Risk to Human Health and Wildlife

Tar sands development presents risks to human health, wildlife, clean water and air.

Human health risks come from air pollution and consumption of contaminated foods. Fish, bird and mammal impacts occur from exposure to contaminants, destruction of forests, rivers and lakes, and caribou recovery efforts that promote wolf kills.

PHOTO: WHITEFISH FROM LAKE ATHABASCA K. RADMANOVICH

In 2008, Kinder Morgan Bulk Terminals pleaded guilty to a violation of the Ocean Dumping Act in a case where a terminal employee bribed a ship's captain to illegally dump potash at sea (USDJ 2008).

The Trans Mountain Pipeline Expansion (TMX)

Operational since 1953, the Trans Mountain pipeline was originally built to serve Canadian domestic needs. Under ownership of Kinder Morgan since 2005, the company has secured increased pipeline capacity through a series of incremental requests designed to avoid environmental assessment and public scrutiny. These have occurred despite written objections to the National Energy Board by concerned conservation groups (Raincoast 2011).

Kinder Morgan is now proposing a new pipeline that will triple capacity from the current 300,000 barrels per day (bpd) to 890,000 bpd. This pipeline would facilitate the export of tar sands oil (as diluted bitumen or dilbit) through the Salish Sea to offshore markets in Asia and the United States. Kinder Morgan is undertaking little more than a desktop review to identify risks from tankers to the marine environment and the species affected.

Kinder Morgan. A Different Kind of Energy Company?

Beginning as Kinder Morgan Energy Partners in 1997 when former Enron executive Richard Kinder and his colleague William Morgan acquired Enron's liquid pipeline assets, Kinder Morgan is now the largest energy transport company in the US (Kinder Morgan 2014). The numbers behind Kinder Morgan's environmental, safety and labour record tell their own story.

In 2007, the company paid 5.2 million $US to resolve liabilities with three oil spills and violations of the Federal Clean Water Act, Oil Pollution Act, Endangered Species Act and California's Water Quality Control and Oil Spill Prevention and Response Acts (EPA 2007a, Sightline Institute 2012).

In the same year, Kinder Morgan subsidiary Transmix Co. paid the US Environmental Protection Agency (EPA) more than 600,000 $US for federal air and waste regulatory violations that included mixing hazardous waste with gasoline (EPA 2007b). In addition, an FBI investigation in 2007 led to Kinder Morgan reaching a 25 million $US civil settlement with the Tennessee Valley Authority for allegedly stealing their own customers coal and selling it themselves (TOIG 2007).

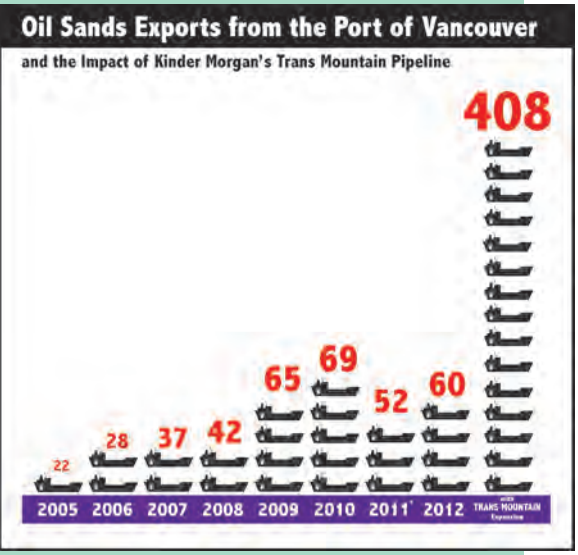

Figure 1.2. Since 2005, the Salish Sea has been host to rising oil tanker traffic. Kinder Morgan's request for expanded pipelines would dramatically increase the number of oil tankers departing Vancouver. Kinder Morgan has already increased tanker traffic three-fold since taking over Trans Mountain in 2005. Their TMX proposal would see an 18-fold increase in tanker traffic above 2005 levels.

IMAGE SOURCE CRED 2013

Kinder Morgan has increased tanker traffic departing Vancouver for the Salish Sea three-fold since taking over Trans Mountain in 2005. The expanded TMX pipeline proposal would see an 18-fold increase in tanker traffic above 2005 levels.

What Does the New Pipeline Mean for Tanker Traffic through Vancouver and the Salish Sea?

Information provided by Kinder Morgan shows that long-term increases in tanker traffic would be significant compared with historic rates (Figure 1.2, Table 1.1). Although the company anticipates 408 laden tanker departures per year by 2017, this figure could still be an underestimate. Analysis by economist Robyn Allan (2012) indicates that potential increases in pump capacity could bring the pipeline capacity to more than 1 million barrels per day, potentially requiring up to 475 tankers (950 transits) a year.

Expansion of the Westridge Marine Terminal

In addition to refineries in Washington State, the Trans Mountain pipeline delivers crude oil to the Chevron refinery in Burnaby and Kinder Morgan's Westridge Marine terminal for export. With the pipeline upgrade, the Westridge Terminal will increase local storage at Burnaby by 3,900,000 barrels (Kinder Morgan 2013a), and expand its tanker capacity with two additional berths.

In 2011, Kinder Morgan presented plans to increase the size of tankers from the current Aframax (with a capacity of 650,000 bls) to Suezmax tankers with a capacity of 1,000,000 bls (Anderson 2011). Not only does this increase potential spill volume, it also requires dredging of the second narrows bridge. However, Kinder Morgan's project web site (Kinder Morgan 2013b) indicates that these larger tankers are not under consideration.

Tanker traffic	2005	2006	2007	2008	2009	2010	2016	2016B	2017
Annual number of crude oil tankers	22	27	38	40	65	71	288	475	408

Table 1.1: Historic and projected crude oil tanker traffic into the Port of Metro Vancouver (Anderson 2011). 2016B[a] figure is based on additional pumping capacity (Allan 2012). Crude petroleum represented 4.5% of total outbound cargo in 2010, dropping to 2.4% in 2011 (due to increased delivery to US refineries), (PMV 2011).[b]

a) As of January 2013, TMX project website indicates up to 34 tanker visits per month by 2017
b) Calculated from data in PMV, Statistics Overview 2011

Traffic Report

US and Canadian oil spill experts recognize that while spill probabilities appear reduced by increased regulatory requirements and enforcement, predicted vessel traffic in the Salish Sea will increase the probability of an oil spill (OSTF 2011). Mitigation measures are no guarantee against the heightened risk of accidents associated with more vessel traffic (Van Dorp and Merrick 2013).

Salish Sea waters are predicted to see an increase in container ship traffic by 300% over the next 15 years. The number of bulk cargo vessels over this time will grow by 25% and cruise ship traffic is expected to increase by at least 20% (Hall 2008). The proposed Roberts Bank Terminal II terminal provides an additional 2.4 million container units.[5]

In Washington State, coal exports are the principal driver for the Gateway Pacific Terminal. This project will have a maximum capacity of 54 million tonnes of coal per year requiring 487 vessels (Booth and Steinberg 2013). It received 124,000 public comments on the scope of the environmental assessment (SVH 2013). A changing US energy supply is also driving US coal exports through Canada.

Expanding exports from Burrard Inlet
Port Metro Vancouver moved 2.5 million container units in 2011, about the same volume as is planned for the Roberts Bank Expansion. In 2013, the City of Vancouver approved Neptune Terminal's (on Vancouver's North Shore) application to expand. This will double coal exports from 8 to 18 million metric tonnes annually.

Port Activity
Port Metro Vancouver is Canada's largest port, handling 122 million tonnes of cargo in 2011. A significant proportion of inbound container goods (47%) are household goods and construction materials with most outbound container cargo consisting of lumber, wood pulp, and speciality crops.

In 2009, more than 80% of crude petroleum exports out of Vancouver went to the US, with just over 10% sent to China (PMV 2011). By 2011, crude petroleum exports to China increased to 28%. Visits of foreign tankers (one inbound, one laden outbound) to Port Metro Vancouver have varied from 206 to 270 between 2009 and 2011 (PMV 2011).

Vancouver, the New Newcastle?

Plans to increase coal exports in the Salish Sea were approved by Port Metro Vancouver in August 2014 (Ball 2014). Fraser Surrey Docks has been approved to ship four million tones of US coal requiring 640 barges a year. The existing Westshore facility is already Canada's largest coal exporter. This exceeds the US coal exports exported in 2011 by 30% (27.3 million tonnes) (Westshore.com Feb 2013). Neptune Terminals, on Vancouver's North Shore, have

5 Containers measured on twenty-foot equivalent unit (TEU)

also submitted plans to increase export by six million metric tonnes and one vessel each week (PMV 2013).

Recent risk assessments of vessel traffic specifically indicate the potential impact of three key proposals, the Pacific Gateway Terminal, Kinder Morgan's Trans Mountain expansion (TMX), and the Delta Port expansion. Draft results indicate that relative to a 2010 base year, these projects increase the potential frequency of vessel traffic collision and grounding by 21% and 17% respectively. Potential loss of oil cargo due to collision is increased by 97% and potential loss of oil cargo because of grounding by 73% (Van Dorp & Merrick 2013).

The Westshore facility at Robert's Bank is Canada's largest coal exporter shipping 30 million tonnes of coal in 2013.

PHOTO: WESTHORE.COM

Sink, Float, or Submerge?

The fate and behaviour of diluted bitumen (dilbit) in the marine environment is poorly understood. Concerns about this were first raised by the Canadian Federal Government in 2011. The Coast Guard highlighted the lack of scientific agreement on how spilled dilbit would behave in the ocean, and the fact that when fine sediments are suspended in saltwater and mixed with diluted bitumen, the mixture either sinks or is dispersed as floating tar balls (GOC 2013).

In late 2015, The US National Academy of Sciences (NAS) released the most comprehensive and rigorous review to date on the potential environmental consequences of diluted bitumen spills. The National Academy found that dilbit differs substantially from other crude oils. Importantly, it behaves like other crude oils when first spilled, but begins reverting back towards the properties of the initial bitumen once evaporation and other weathering processes begin.

The National Academy also concluded that dilbit is inclined to submerge quite soon after a spill on water, and can sink to the bottom even if the oil is less dense than water (NAS 2015).

Diluted bitumen spilled in the Kalamazoo River floats submerged below the surface.

PHOTO: WDIV -TV

Trans Mountain's application to the National Energy Board (NEB) asserts that dilbit (and crudes like it) are quite comparable with respect to fate and weathering, and spill countermeasures (TMEP 2013). Describing the results of its laboratory analysis, Trans Mountain claimed that dilbit proved "no different than what might be expected of other conventional heavy crudes when exposed to similar conditions" (TMEP 2013). These assertions and claims are

Figure 1.3: Accidents happen
On July 22 1991, the Chinese freighter Tuo Hai collided with a Japanese fishing vessel, Tenyo Maru, 40 km (25 mi) northwest of Cape Flattery off the northern coast of Washington close to the US–Canadian border. It sank, releasing 8,500 barrels of fuel oil and 2,300 barrels of diesel (NOAA 2012).

MAP SOURCE: NOAA

In the Navy
The two tugs assisting the fishing trawler American Dynasty did not prevent it from colliding with the naval frigate HMCS Winnipeg at Esquimalt harbour on April 23, 2013 (TSB 2013).

PHOTO: TRANSPORTATION SAFETY BOARD

largely refuted by the findings of the far more authoritative National Academy report.

While the true likelihood of a spill is unknown, the Brander Smith (1990) federal review of tanker safety in Canadian waters predicted, based on 1990 traffic levels, at least one major spill (above 10,000 bls) every year and a catastrophic spill once every 15 years. Similarly, a 1999 report for the Canadian Coast Guard predicted that Canada should expect a major oil spill from a tanker once every seven years (SL Ross 1999).

Based on current traffic levels, the Federal Government's 2013 National Marine Spill Risk Assessment identified two key areas of concern. One, the Pacific region has the highest probability for small spills and two, the southern tip of Vancouver Island has the highest probability for a large spill (GENIVAR 2013).

Accidents Happen

Although there has been a decline in the frequency of tanker oil spills over the last two decades, spills still occur. Once tankers are present, many believe it is a statistical question of when, not if, an accident happens. This point was underscored by the BC Environment Minister, Barry Penner (2008), who informed the Pacific States/British Columbia Oil Spill Task Force that, "given the high marine traffic and topography of our coastline, it simply is not possible to completely prevent spills from happening." Although this does not solely refer to oil tankers, the point is borne out in recorded incidents.

Accidents in the Salish Sea

From the puncturing of the Nestucca oil barge off Grays Harbour to the Westwood Annette oil spill in Howe Sound, accidents involving major marine vessels occur in and affect the Salish Sea in BC and Washington State. There have also been several near misses.

Between 1999 and 2009, more than 1,200 vessel incidents[6] were reported on the BC coast, 12 involving tankers (LOS 2010). From 1995-2008, 14 oil spills from tankers in Washington State released 310 barrels of oil. During the same period, 132 near-miss casualty incidents also occurred for vessels carrying a total of 64 million barrels of oil (ERS 2009).[7]

6 Refers to a vessel in distress, i.e. loss of engine power, which can lead to a casualty. Reid, S. 2008.
7 Within US waters of Washington State.

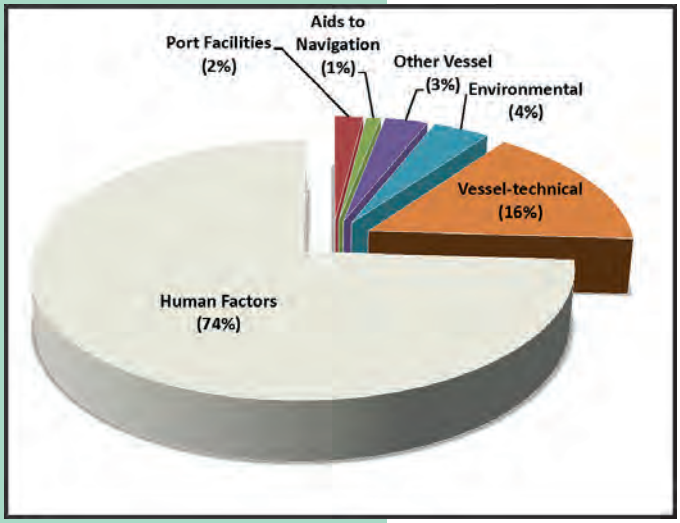

Figure 1.4:
What causes oil spills?
Groundings, collisions, and equipment failures are often cited as the cause of accidents at sea, but these are actually consequences, not root causes. Ultimately, human failures cause up to 80% of the accidents at sea, with miscommunication and cost saving among them (Trucco 2008).

What's the Risk in Canadian Waters?

Causes of Spills: Human Error

Small and medium sized oil spills account for 95% of the reported oil tanker spill incidents globally. Almost 70% of these spills occurred during loading and discharging operations, primarily within ports and oil terminals. Large spills (above 5500 bls) account for the remaining 5% of accidents.

In large oil spills, 58% occurred while vessels were away from port when they hit objects, grounded, or collided with another vessel.[8] Within ports and harbours, collision and groundings account for 95% of the accidents that cause spills (OSTF 2011).

How Safe is the Tanker Route?

High risk places for shipping accidents occur where traffic converges, such as the western entrance of the Juan de Fuca Strait. Risk of groundings and collisions also increase when vessels travel closer to shore (OSTF 2002). In recognition of this, an emergency response tug is stationed at Neah Bay to help prevent incidents. Between 1999 and 2010, the tug was deployed 46 times to assist vessels that were completely disabled or suffering reduced manoeuvrability. In 11 incidents, the tug took vessels in tow to prevent them from drifting onto rocks, ripping holes in the hulls and potentially releasing oil (WSDE 2012). These 11 vessels had a combined spill potential of 120,000 barrels of oil. As tankers travel to and from the Strait of Juan de Fuca, they must navigate sharp turns on entering or exiting Haro Strait and Boundary Pass. In addition to high shipping traffic, there is a high density of pleasure and fishing boats and the shoreline has numerous anchorages. The risk of collision also increases with large vessel speed (OFTF 2011).

Once vessels reach the port of Vancouver, they must pass the first and second narrows of Burrard Inlet (top photo page 16).

8 with other vessels or objects

Burrard Inlet and the railway bridge at Second Narrows after the tanker *Erica* hit it in 1978.

BRIDGE PHOTOS: C. PRUTTON

Currently, second narrows has movement and speed restrictions that require laden oil tankers to pass only in daylight hours within windows for safe tide and wind, and with the use of tugs (VFPA 2010). These measures were largely implemented after a tanker (*Japan Erica*) hit the bridge in 1978, but did not prevent 17 incidents from occurring within the second narrows restricted area (VFPA 2008), including collisions, fire and near contact with the bridge. In addition, a bulk freighter went aground at Stanley Park in 2006.

Ships Safe at Anchor?

Just as ships anchoring in the Gulf Islands represent a spill risk, the same is true of the increasing number of oil tankers in Vancouver Harbour. Some anchorages in English Bay are already known to be susceptible to dragging in certain winds. Although these anchorages are subject to seasonal restrictions, the risk of unseasonably high winds is always present (VFPA 2010) and will be increasing with climate change.

Figure 1.5: Inbound and outbound oil tanker routes to Kinder Morgan's Westridge Terminal.

Chronic Oiling

Although our principal concern is large spills, increases in traffic also raise the issue of recurrent oil spills from tanker and other shipping activities. Even if relatively small, these chronic spills have long-term ecological impacts and can contribute more oil to the marine environment than catastrophic spills (Serra-Sogas et al. 2008). The routine nature of these spills at ports and terminals is an important factor in the chronically oiled condition and degraded habitats found near these vicinities.

Are We Fooling Ourselves?

In 1995, a report to the federal government on oil spill risk by Brander Smith found Canada, "wholly unprepared" for a catastrophic spill. Twenty years later, Canada's Commissioner of the Environment and Sustainable Development determined that Canada's plan for oil spill preparedness and response did not establish national preparedness capacity (OAGC 2010). Drastic budget cuts in 2012 to the agencies responsible for dealing with oil spills (Fisheries and Oceans and Environment Canada), further undermined the capacity to respond. Another blow to response capacity was the transfer of BC's oil spill response centre to eastern Canada.

Notably, all of Canada's oil spill response capacity is based on the critical, but false, assumption that oil will float when spilled and that wind and wave conditions will be low.

Close calls should make us wary
In November 2009, the bulk freighter *Hebei Lion*, carrying two million gallons of fuel, dragged anchor in high winds overnight and was blown onto a reef between Pender and Mayne Islands in the southern Gulf Islands (WSDE 2009). Fortunately, the tide was high and the vessel was towed off, but this incident reinforces the fact that heightened regulations and navigational technology cannot override natural forces or human error.

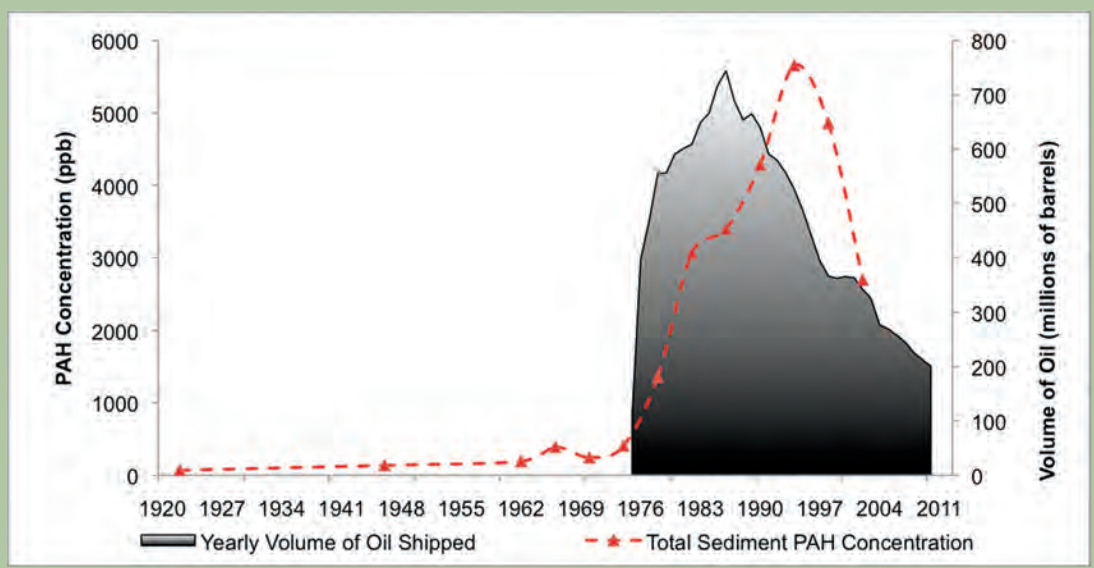

Figure 1.6: Studies from the Port of Valdez show a clear correlation between levels of Poly Aromatic Hydrocarbons in sediment and volume of oil shipped (Savoie et al. 2006).