



August 28, 2017

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Sent via email to: P66MarineTerminalPermitRevision@baagmd.gov

Re: Comments of San Francisco Baykeeper, STAND.earth, and Friends of the Earth on the Phillips 66 Marine Permit Revision Project - Draft Environmental Impact Report

Dear Mr. Young,

San Francisco Baykeeper, Stand.earth, Friends of the Earth, Communities for a Better Environment, Center for Biological Diversity, and Sierra Club (collectively, "Environmental Groups") appreciate the opportunity to submit comments on the scope and content of the Bay Area Air Quality Management District's ("BAAQMD's") Environmental Impact Report ("EIR") for the Phillips 66 Marine Terminal Permit Revision Project ("Project"). We applaud the BAAQMD's decision to prepare an EIR on the full scope of environmental impacts associated with the Phillips 66 Marine Terminal operational expansion. BAAQMD's policies, regulations, and planning documents must reflect California's commitment to combat climate change, protect water, air, and other natural resources, and uphold principles of fairness and environmental justice. Because of this commitment, Environmental Groups believe that the Project should be denied.

At a time when California is expected to lead the nation and the world in efforts to combat climate change, and given the state's goal of reducing greenhouse gas emissions by 80 percent of 1990 levels by 2050, allowing Phillips 66 to increase its refinery's ability to process dangerous tar sands-derived crude oil is ill-advised at best. Environmental Groups are gravely concerned about multiple pollution, health, safety, and climate impacts that this refinery expansion could cause. This letter focuses on potential water quality impacts, and touches on many of the other impacts that can be expected to occur as a result of Project approval.

The dirtier crude oil feedstocks derived from tar sands that will likely be carried to the expanded marine terminal have dangerous consequences for nearby communities as well as for ecosystems in the Bay Area, all along potential shipping routes, and for the Earth's climate. The

impacts of a spill in marine waters remains unknown, and responders do not have adequate real-time information about what cargoes ships are carrying. Furthermore, information about the precise chemical composition and proportion of those cargoes is difficult to obtain, when it should be readily available to the responders and communities that will have to deal with the aftereffects of a spill. Worse still, there are no proven containment methods for mitigating a spill of these dirtier crudes.

Phillips 66 is just one of multiple oil companies operating Bay Area refineries that are preparing facility modifications to enable more tar sands crude to be imported by ship. Taken together, these refinery modifications will significantly increase ship traffic in the Bay, making spills and accidents more likely. More ships will also result in greater amounts of air pollution, water degradation, impacts to area species, and increased health risks. Environmental Groups strongly urge BAAQMD to fully disclose and evaluate all of the direct and indirect impacts of this dangerous project.

I. Statements of Interest

San Francisco Baykeeper (“Baykeeper”) has worked for more than 25 years to stop pollution in San Francisco Bay and has more than five thousand members and supporters who use and enjoy the environmental, recreational, and aesthetic qualities of San Francisco Bay and its surrounding tributaries and ecosystems. San Francisco Bay is a treasure of the Bay Area, and the heart of our landscape, communities, and economy. Oil spills pose one of the primary threats to a healthy Bay, and environmental impacts from increased marine terminal activity directly threaten Baykeeper’s core mission of a Bay that is free from pollution, safe for recreation, surrounded by healthy beaches, and ready for a future of sea level rise and scarce resources. San Francisco Baykeeper is one of 200 Waterkeeper organizations working for clean water around the world. Baykeeper is a founding member of the international Waterkeeper Alliance and was the first Waterkeeper on the West Coast. Baykeeper also works with 12 Waterkeepers across California and the California Coastkeeper Alliance.

Stand.earth (formerly ForestEthics) was founded nearly twenty years ago by a group of dedicated people who were working day in and day out to solve a big problem: What do you do when the health and foundation of communities and their environment are being undermined? Stand.earth’s campaigns challenge destructive corporate and governmental practices, demand accountability, and create solutions that protect the forests and the stable climate required to keep our planet – and us – thriving. An unstable climate isn’t good for anyone. We’re already seeing the ugly effects of record-breaking temperatures, increased storm damage, displaced populations, and declining ecosystems as the result of climate change. The time is now to take swift action to stave off even greater disruption. Solutions to climate change are realistic, popular, and have enormous benefits. But first, we must overcome resistance from corporate and governmental forces that are motivated to continue to use outdated polluting supplies of fossil energy.

Friends of the Earth strives for a more healthy and just world and has been a loud and fearless voice for the environment for 47 years. Friends of the Earth is one of 75 national member groups of Friends of the Earth International, a global network representing more than two million activists in 75 different countries. The climate crisis is the definitive challenge of our time, and our reliance on fossil fuels is driving it. Oil pollutes our air and water and threatens our health. But

energy use doesn't have to make us, or the planet, sick. That's why Friends of the Earth promotes conservation and clean energy — including wind, solar and geothermal power — and why Friends of the Earth fights to end our unhealthy dependence on dirty sources including coal, oil, nuclear and biofuels. Friends of the Earth's climate and energy project seek to prevent the extraction and use of dirty tar sands oil, a high carbon fuel strip-mined from beneath Canada's Boreal forest. Fuel from tar sands represents an increasingly significant portion of the fuel used in cars in the United States.

Sierra Club is a national nonprofit organization with 67 chapters and over 635,000 members dedicated to exploring, enjoying, and protecting the wild places of the earth; to practicing and promoting the responsible use of the earth's ecosystems and resources; to educating and enlisting humanity to protect and restore the quality of the natural and human environment; and to using all lawful means to carry out these objectives. The Sierra Club has over 147,000 members in the state of California, including approximately 38,151 members in the San Francisco Bay Chapter and 2,157 members in the chapter's West Contra Costa Group which includes Rodeo. The Sierra Club's concerns encompass the causes and impacts of climate change. The Sierra Club is particularly concerned about our nation's dependence on dirty fossil fuels, such as crude oil, the emissions from which are exacerbating climate change, and its impacts on communities throughout the nation, and in particular on California communities and low income disadvantaged communities disproportionately burdened by toxic industrial pollution from the extraction, movement, refining, and consumption of crude oil. The Sierra Club seeks out opportunities to stem our nation's dependence on harmful fossil fuels, including advocating against projects that will exacerbate the harms associated with the proliferation of fossil fuels, in particular risky infrastructure projects for transporting hazardous crude.

The Center for Biological Diversity is a national, nonprofit conservation organization with more than 1.3 million members and online activists dedicated to the protection of endangered species and wild places, public health, and fighting climate change. The Center works to secure a sustainable and healthy future for people and for all species, great and small, hovering on the brink of extinction. It does so through science, law, and creative media, with a focus on protecting the lands, waters, and the climate.

Communities for a Better Environment ("CBE") is a California nonprofit environmental health and justice organization with offices in Oakland, Richmond, Huntington Park, and Wilmington. CBE has thousands of members throughout the state of California. More than 2,700 of CBE's members live, work, or engage with environmental justice issues in urban communities in Northern and Southern California. This includes hundreds of people living, working, and breathing in Contra Costa County ("County") and the area surrounding the Phillips 66 Company, formerly Conoco Phillips, Refinery ("Refinery"). CBE's organizational goals include protecting and enhancing the environment and public health by reducing air and water pollution and minimizing hazards in California's urban areas, including the area surrounding the Refinery.

II. Scoping Comments Overview

While BAAQMD describes the project as little more than an "increase in the amount of crude and gas oil brought by ship to the Marine Terminal at the Phillips 66 Company (Phillips 66) San Francisco Refinery in Rodeo, California," in reality the Project represents much more than that.

Canadian tar sands production has led to significant oil transport infrastructure projects including – according to the company’s website¹ – the proposed \$7.4 billion Kinder Morgan Trans Mountain Expansion Project that would increase tar sands pipeline capacity from 300,000 to 890,000 barrels of oil per day. This increase promises to result in a drastic surge in the amount of tar sands crude that reaches the west coast.

Tar sands oil deposits produce bitumen, “a dense and highly viscous petroleum found in clay and sand deposits known as bituminous sands, oil sands, or tar sands.”² In spite of increasing bitumen production, “the scientific study of impacts has largely lagged behind the rapid pace of oil sands development, and where it has progressed, it has focused primarily on effects on regional landscapes, freshwater systems, climate change, and human communities. To date, the effects of the industry on marine environments have received relatively little scientific attention.”³ There is no publicly available information available on the behavior, fate, and toxicity of dilbit in the marine environment. These uncertainties are of great concern to Environmental Groups, and any evaluation of the environmental impact of an increase in the shipping of bitumen to the Phillips 66 refinery must take this uncertainty into account by evaluating worst case scenarios and requiring robust mitigation measures based on precautionary principles.

Bitumen is chemically distinct from conventional oil and must be diluted to transport and refine. The diluted product is often referred to as “dilbit.” Bitumen is generally considered to be a recalcitrant and immobile crude oil that requires unconventional extraction methods as well as the addition of diluents for transport through unheated transmission pipelines. “The key differences are in the exceptionally high density, viscosity, and adhesion properties of the bitumen component of the diluted bitumen that dictate environmental behavior as the crude oil is subjected to weathering (a term that refers to physical and chemical changes of spilled oil).”⁴ There are many different formulas for the dilution of bitumen, most of which are considered trade secrets. “Diluted bitumen refers to many chemically distinct substances that vary in toxicity and chemical behavior from conventional oil (Crosby *et al.* 2013; Environment Canada 2013).”⁵ Indeed, “sampling information for some blended bitumen products reveals high variability in chemical composition and physical properties,” and precise information on chemical composition is considered a trade secret, effectively denying public access to vital safety information.⁶

There is very little publicly available information about the reaction of dilbit to the marine environment and the organisms and ecosystems found there, and widespread uncertainty remains even as to the most basic questions like whether dilbit products will float or sink, what chemicals are contained in dilbit at what concentrations, what response dilbit will have to weathering, and how it will interact with marine species and sediment.

¹ Available at <https://www.kindermorgan.com/pages/business/canada/tmep.aspx>.

² Green *et al.*, 2017, attached.

³ *Id.*

⁴ National Academies of Sciences 2016, attached.

⁵ Green *et al.*, 2017, attached.

⁶ *Id.*

In cases where traditional removal or containment techniques are not immediately successful, the possibility of submerged and sunken oil increases. This situation is highly problematic for spill response because (1) there are few effective techniques for detection, containment, and recovery of oil that is submerged in the water column, and (2) available techniques for responding to oil that has sunk to the bottom have variable effectiveness depending on the spill conditions.⁷

Tar sands refining could increase drastically in California if existing pipeline and rail plans move forward. In fact, the tar sands industry's expansion plans rely on California's refinery capacity, partially because Gulf Coast heavy crude refining capacity is more limited. Current Canadian production of tar sands crude sits around 100,000 barrels per day, but that could increase to as much as 800,000 barrels per day in coming decades.⁸

The Kinder Morgan pipeline company has been explicit about their intention to increase pipeline capacity from tar sands deposits in Alberta to tidewater in British Columbia for export to Californian (among other) markets. The Kinder Morgan Canada Initial Public Offering Prospectus, which offered investors stock in the company being formed to hold the Transmountain Pipeline Expansion Project (and several other assets), detailed expected markets for the tar sands crude that would fill the pipeline's additional capacity:

At an estimated total capital cost of approximately \$7.4 billion (including capitalized financing costs), upon completion, the Trans Mountain Expansion Project will provide western Canadian crude oil producers with an additional 590,000 barrels per day of shipping capacity and tidewater access to the western United States (most notably Washington, California and Hawaii) and global markets (most notably Asia).⁹

The prospective specifically addresses refineries in California:

[R]efineries in Washington State and California, which comprise an important point of sale on the U.S. West Coast, have, in the past, been supplied primarily by crude oil from the Alaska North Slope. As such, there has historically been some competitive pressure on supply originating from the [West Canadian Sedimentary Basin ("WCSB")] for sale in the Washington State and California refinery markets ... due to recent changes in U.S. legislation, oil from the Alaska North Slope may now be sold to markets outside of the United States. To the extent this additional access to alternative markets for Alaskan producers increases overall demand from Washington State and California refineries, the [Trans Mountain Pipeline, TMPL] system, through its Puget Sound pipeline connection to four

⁷ National Academies of Sciences 2016, attached.

⁸ *Report: West Coast Tar Sands Invasion*, Natural Resources Defense Council et al., p. 4 (April 2015) (based off of a report by the Borealis Centre for Environmental and Trade Research, commissioned by NextGen and NRDC), attached.

⁹ Kinder Morgan Canada Limited, Preliminary Prospectus, Initial Public Offering, p. 23 (April 24, 2017), attached.

refineries in Washington State, will be in a position to facilitate supply to such markets for WCSB producers. As evidence of these competitive advantages, capacity on the TMPL has been over-subscribed since 2010 and approximately 80% of the capacity of the TMPL upon completion of the Trans Mountain Expansion Project is subject to long-term firm commitments.¹⁰

There are six California refineries in the San Francisco Bay and Los Angeles areas that expect to be targets for increased shipments of tar sands crude oil, all of which have a past history with tar sands. The Phillips 66 Refinery in Rodeo is one of them. Phillips 66 is currently in the process of attempting a series of projects to allow a switch to refining what its management calls “advantaged crude.” The company emphasizes “[the] opportunity that we have ... is to get ... Canadian crudes down into California ... We’re looking at rail to barge to ship, down to the West Coast refineries”¹¹ In May 2013, Phillips 66 Executive Vice President Tim Taylor stated in response to a question on bringing heavy Canadian crude oil into California: “Today, we are doing some barge movements down the coast into California on heavy Canadian. You can look in the Northwest to do that. So that’s an option that we’re going to continue to use and we’re looking at expanding that opportunity with some of the logistics things we’re putting in place.”¹²

Each tanker trip carries an added risk of a spill, and Environmental Groups are deeply concerned with the possibility that a tanker carrying tar sands crude to the Phillips 66 Marine Terminal will cause an oil spill. Marine cleanup of a tar sands spill has never been tried, and Environmental Groups are deeply concerned with the potential ecological consequences of such a spill and responders’ ability, or lack thereof, to effectively clean up a spill of tar sands dilbit.

The submergence of persistent residues of dilbit in aquatic environments, as was seen in the Kalamazoo River spill in Marshall, Michigan, and the potential for long-term deposition in sediments and banks and remobilization in the water column present environmental concerns and cleanup challenges not presented by commonly transported crude oils.

California’s legislators are paying attention to this threatened influx of tar sands oil. “California’s bays, rivers, and coastline are some of the most stunning and important natural resources in the world, and we need to be vigilant in safeguarding them from destructive oil spills,” said State Senator Scott Wiener in support of legislation to mandate adequate spill prevention plans in case of a tar sands oil spill. “A tar sands oil spill in San Francisco Bay would be devastating, but right now, we don’t even require oil companies to state how they will clean up this sinking oil if it

¹⁰ *Id.* at 73.

¹¹ September 12, 2013 Transcript, pdf p. 7, *available at* http://www.phillips66.com/EN/investor/presentations_ccalls/Documents/Barclays_091213_Final.pdf (last accessed Jan. 17, 2014).

¹² May 31, 2013 Transcript, pdf p. 13, *available at* http://www.phillips66.com/EN/investor/presentations_ccalls/Documents/PSX-Transcript-2013-05-01.pdf (last accessed Jan. 17, 2014).

spills.”¹³ That tar sands legislation did not pass into state law, so there is little in the way of specific tar sands emergency preparedness currently on the books in California.

III. Environmental Impacts

a. Water Quality Impacts

The water quality impacts from expansion of the Phillips 66’s marine terminal must be thoroughly examined, from impacts associated with the extraction of tar sands feed stocks in Canada to the dilution of those feedstocks with diluents and shipment by pipeline to Vancouver or other ports, through the loading process onto tankers and the shipping routes they take down the west coast to San Francisco Bay, then to the unloading of those feedstocks and transport into the refinery, the separation and reuse of diluents, the eventual shipment of refined or reused products to end markets or extraction sites, and finally through to impacts from the use of end products. This lifecycle analysis must take into account global effects such as climate change and ocean acidification, as well as local water quality impacts that could have serious consequences for the communities at extraction sites, ports, along the shipping routes, and near the actual Project site in Rodeo. This analysis must also disclose the extent to which unknowns exist, such as the lack of concrete information concerning effective marine spill cleanup methodologies for tar sands dilbit and the environmental impacts of such spills, and evaluate the risks taken as a result of those unknowns. Such risk evaluation must take into account the massive harm done by dilbit in other places, such as Kalamazoo.

Each tanker trip carries an added risk of a spill, as a reported 50% of large spills occur in open water.¹⁴ The majority of spills, however, are less than 200,000 gallons, and most of these spills happen while in port.¹⁵ Two types of tanker will likely be used to transport tar sands crude to California refineries, coastal tankers, which can carry as much as 340,000 barrels of oil (14.3 million gallons), and coastal tank barges, which typically carry 50,000 to 185,000 barrels of oil, though newer models can carry as much as a coastal tanker. For reference, the tar sands spill in the Kalamazoo that cost over a billion dollars and still isn’t cleaned up was 843,000 gallons of tar sands crude.¹⁶ Even the smallest tar sands barge would carry at least twice that amount.

California’s 45-billion-dollar coastal economy has a lot to lose to a spill.¹⁷ California commercial fisheries for instance, produced from 186-361 million pounds of fish from 2013-2015, at a value of 129-266 million dollars.¹⁸ After the Costco Busan disaster spilled 53,000 gallons of oil into San Francisco Bay, the Governor closed the fishery, a significant portion of which was either contaminated or killed, closed more than 50 public beaches, some as far south as Pacifica, and thousands of birds died. All told that spill resulted in more than 73 million dollars in estimated

¹³ *Senator Wiener Introduces Bill to Protect California Waterways from Dangerous Spills of Tar Sands Oils*, California State Senate Office of Senator Scott Weiner (March 3, 2017).

¹⁴ The International Tanker Owners Pollution Federation (2016 spill statistics), p. 8.

¹⁵ *Id.*

¹⁶ National Academies of Sciences 2016, p. 15, attached.

¹⁷ *California Ocean and Coastal Economies*, National Ocean Economics Program (March 2015), attached.

¹⁸ Based on California Department of Fish and Wildlife and National Marine Fisheries Service data.

damages and cleanup costs.¹⁹ Imagine that times 267, the amount of oil carried by a fully laden coastal tanker, and instead of over a month to clean up, it could take as long as five years. An EIR evaluating the environmental impacts of expanding operations at the Phillips 66 Marine Terminal must take into account the increased risk of an unprecedented spill of tar sands crude oil into San Francisco Bay or at any other point along the route oil transport tankers and barges will take from Canada.

Uncertainty over how to clean up spills of oils derived from tar sands extends to the specific technology used for cleanup efforts. “The environmental impacts associated with oil spill clean-up efforts (e.g. mechanical or chemical) may increase the magnitude of ecological damage and delay recovery.”²⁰ Recent surveys have not found any studies on the response of “trophic groups within eelgrass and kelp forest ecosystems to bitumen in the environment, or the impacts of different spill-response methods.”²¹

A recent spill at the Phillips 66 Marine Terminal serves as a warning of what could result from increased marine terminal operations. According to press reports, “BAAQMD issued two ‘public nuisance’ violations to Phillips 66 for its Sept. 20, 2016 spill, which leaked oil into the bay and sent an estimated 120 people to the hospital from fumes.”²² That spill, which occurred while the Yamuna Spirit was offloading at the Phillips 66 Marine Terminal in Rodeo, was responsible for more than 1,400 odor complaints and a shelter-in-place order for the 120,000 residents of Vallejo, in addition to the hospital visits already mentioned.²³ In light of these concerns, BAAQMD must consider an independent study on tar sands cleanup, the adequacy of existing cleanup procedures and the need for additional cleanup and restitution funds, and increased monitoring for water and air quality impacts to communities surrounding the Project, whether those communities are located in the same county or not.

As pointed out by California State Senator Bill Dodd, it is vital that BAAQMD thoroughly investigate the causes of this spill and how such a spill can be prevented in the future.²⁴ Such an investigation must be completed before any additional ships are authorized by BAAQMD to use the same marine terminal where the spill was reported. Without a thorough report on past spills that

¹⁹ See, e.g., *Incident Specific Preparedness Review M/V Cosco Busan Oil Spill in San Francisco Bay Report on Initial Response Phase*, Baykeeper, OSPR, NOAA, et al. (Jan. 11, 2008).

²⁰ Green et al., 2017, attached.

²¹ *Id.*

²² Katy St. Clair, “Supervisor Brown says ‘no way’ to proposed Phillips 66 expansion,” Times-Herald (Aug. 5, 2017), available at <http://www.timesheraldonline.com/article/NH/20170805/NEWS/170809877>; see also Ted Goldberg, “Refinery, Tanker Firm Cited for Fumes That Sickened Scores in Vallejo,” KQED News (June 16, 2017), available at <https://www.kqed.org/news/2017/06/16/refinery-tanker-firm-cited-for-fumes-that-sickened-scores-in-vallejo/>; Ted Goldberg, “Phillips 66 Seeks Huge Increase in Tanker Traffic to Rodeo Refinery,” KQED News (July 27, 2017) (“, available at <https://www.kqed.org/news/2017/07/27/phillips-66-seeks-big-increase-in-tanker-traffic-to-rodeo-refinery/>).

²³ Ted Goldberg, “Refinery, Tanker Firm Cited for Fumes That Sickened Scores in Vallejo,” *id.*

²⁴ See Senator Bill Dodd, Letter Re: Vallejo Odor and Bay Area Air Quality Management District Response (March 8, 2017), available at <https://www.documentcloud.org/documents/3514729-Sen-Dodd-BAAQMD-Letter-3-8-17.html>.

includes a description of what happened and how such accidents can be prevented in the future, the proposed EIR will not be able to adequately evaluate the Project's potential environmental impacts.

Additional National Pollutant Discharge Elimination System ("NPDES") effluent criteria may be needed, a possibility which must be evaluated in the proposed EIR. Foreseeable spill rates from an increase in marine terminal activity might qualify as a discharge to waters of the United States because it is reasonably predictable that a certain number of spills will occur. With this and other water quality impacts in mind, the regional water board should at least be another responsible agency, if not the lead agency evaluating a permit to increase marine terminal operations. Furthermore, different feedstock may result in a change in the effluent discharged by the refinery under their existing NPDES permit, another reason why the regional water board should at least be a responsible party. The proposed EIR must evaluate an updated NPDES permit that reflects the changing feedstock that will result from the Project.

No reasonable mitigation or planning can be done with regard to the risk posed by the transport of dilbit to the Phillips 66 refinery in Rodeo without specific information as to the chemical composition of the crude oil being transported. Details on the types of oil expected to arrive on the tankers utilizing the Marine Terminal's expanded capacity must be part of the EIR and must be made publicly available. It is irresponsible to base risk assessment and best practices for the handling of dilbit on assessments and practices for conventional oil without at least knowing exactly what the chemical composition of the dilbit is, including separate information on bitumen and diluent constituents, and how it differs from conventional oil. As indicated above, the available scientific evidence suggests that the type of risks associated with marine spills of dilbit, tars sands, and other sinking oils are wholly different from risks from spills of floating conventional crude oil. Additional research into best management practices, spill prevention practices, and cleanup and response planning is needed before we can allow a major increase in the amount of tar sands coming into California's waters.

Environmental Groups ask that the EIR contain and make publicly available an independent scientific study on the risks to – and best achievable protection of – state waters from spills of nonfloating or potentially nonfloating oils. This study should evaluate the hazards and potential hazards associated with a spill or leak of nonfloating oils. The study should encompass potential spill impacts to natural resources, the public, occupational health and safety, and environmental health and safety. This analysis should include calculations of the economic and ecological impacts of a worst-case spill event in the San Francisco Bay ecosystem, along the California coast, and along the entire projected shipping route for the expanded marine terminal.

Based on this study, the EIR should also include a full review of the spill response capabilities and criteria for oil spill contingency plans and oil spill response organizations (OSROs) responsible for remediating spills. Environmental Groups respectfully request that BAAQMD include an analysis indicating whether there are OSROs currently operating in California capable of responding adequately to a spill of non-floating oil. Further, the adequacy of an OSROs spill response capability should be compared to the baseline of no action rather than to a best available control technology standard.

Additional ships delivering oil to the Project would be passing through a channel that the Army Corps of Engineers has slated for reduced dredging. The Project thus contemplates increasing ship traffic through a channel that could be insufficiently dredged. The EIR must evaluate the safety risks posed by reduced Pinole Shoal Navigation Channel Maintenance Dredging.²⁵ Should BAAQMD require Phillips 66 to dredge the channel, it must fully evaluate and disclose impacts from such dredging in its environmental analysis.

Finally, the EIR must evaluate ship maintenance impacts. Increased shipping means increased maintenance in regional shipyards and at regional anchorages, and these impacts must be analyzed.

b. Wildlife Impacts

Increased shipping as a result of tar sands production and transport causes stress to the marine environment and can thus impact wildlife. Wake generation, sediment re-suspension, noise pollution, animal-ship collisions (or ship strikes), and the introduction of non-indigenous species must all be studied as a part of the EIR process. “Wake generation by large commercial vessels has been associated with decreased species richness and abundance (Ronnberg 1975) given that wave forces can dislodge species, increase sediment re-suspension (Gabel et al. 2008), and impair foraging (Gabel et al. 2011).”²⁶ Wake generation must be evaluated as an environmental impact of the Project.

Acoustic impacts can also be extremely disruptive. “Increased tanker traffic threatens marine fish, invertebrate, and mammal populations by disrupting acoustic signaling used for a variety of processes, including foraging and habitat selection (e.g. Vasconcelos et al. 2007; Rolland et al. 2012), and by physical collision with ships – a large source of mortality for marine animals near the surface along shipping routes (Weir and Pierce 2013).”²⁷ Acoustic impacts must be evaluated as an environmental impact of the project.

Invasive species are also a dangerous side effect of commercial shipping. “Tankers also serve as a vector for the introduction of non-indigenous species (NIS) via inadvertent transfer of propagules from one port to another (Drake and Lodge 2004), with the probability of introduction depending on the magnitude and origin of shipping traffic along tanker routes (Table 1 and Figure 3; Lawrence and Cordell 2010).” Invasive species impacts must be evaluated as an environmental impact of the project.

c. Public Trust Impacts

The proposed Marine Terminal occupies 16.7 acres of leased, filled and unfilled. This land is California-owned sovereign land in San Pablo Bay, and as a result the California State Lands

²⁵ Memorandum for Commander, South Pacific Division (CWSPD-PD), FY 17 O&M Dredging of San Francisco (SF) Bay Navigation Channels, U.S. Army Corps of Engineers (Jan. 12, 2017) (Army Corps memo discussing deferred dredging), attached.

²⁶ Green *et al.* 2017, attached.

²⁷ *Id.*

Commission is a responsible party. Public trust impacts to this land and to other public trust resources must be evaluated in the EIR.

d. Tribal Resources Impacts

The Kinder Morgan Trans-Mountain Pipeline (“TMPL”) has been opposed by a number of Canadian First Nations and tribes based in the United States. In short, the project appears to have significant and unmitigated impacts on traditional hunting and fishing resources. In the case of the tribes based in the United States, these hunting and fishing grounds are subject to protections enshrined in treaties between the tribes and the United States government. To the extent that the Phillips 66 marine terminal expansion is intended to facilitate shipments from the TMPL Expansion this Project is implicated in the impacts of that project, including impacts to these tribes and first nations. Environmental Groups request that BAAQMD initiate consultations with the following tribes and First Nations and account for the impacts identified during those consultations in the scope of the EIR.

Canadian First Nations with active challenges to the Canadian National Energy Board’s recommendation to approve the TMPL:

- Tsleil-Waututh Nation
- Squamish Nation
- Coldwater Indian Band
- Musqueam Indian Band
- Aitchelitz First Nation
- Squalia First Nation
- Upper Nicola Band
- Stk’emlupsemc Te Secwepemc Nation
- Shxwhá:y Village
- Skowkale First Nation
- Soowahlie First Nation
- Tzeacheten First Nation
- Yakweakwioose First Nation
- Skwah First Nation
- Kwaw-Kwaw-Apilt First Nation
- Ts’Elxweyeqw Tribe

U.S. tribes that have intervened in the TMPL permitting process:

- Lummi Nation
- Swinomish Indian Tribal Community
- Tulalip Tribes
- Suquamish Tribe

In addition, any potential impacts to fisheries found in the EIR – whether as a result of spills or some other environmental impact – could impact tribal resources tied to fisheries.

e. Shipping Traffic Impacts

Additional impacts must be analyzed starting at the port that ships take on their crude oil cargos and ending at the ports they discharge it to. The EIR should include shipping impacts to public or non-Project commercial vessels and businesses, including impacts to recreational boaters and ferries, that might experience increased delay, anchorage waits or related crowding, and navigational complexity. Such shipping traffic impact evaluations should extend to spills, air quality, marine life impacts from ship collisions, and other environmental impact evaluated by the EIR that could impact shipping traffic.

f. Air Quality Impacts

Air quality impacts evaluated by the EIR must include an adequate study area in order to appropriately estimate the Project's potential to result in substantial increases in criteria pollutant emissions. The air quality baseline examined by the EIR must be specifically based on current conditions, and cannot rely only on permitted levels. As part of this analysis, the EIR must take into account the fact that refinery emissions are likely to backslide as a result of different feedstocks that feature tar sands.²⁸ Air quality impacts must include all of the Project's components and connected actions. The Project's climate change implications must be accurately estimated. Any offsets or emission reduction credits contemplated must be legally adequate and thoroughly studied, including any environmental justice impacts from the use of such offsets or credits. Finally, the EIR must take into account emissions from construction activities.

Tar sands crudes alone are comprised of higher molecular weight chemicals than the current slate of feedstocks processed at the Refinery. These chemicals include large amounts of benzene, toluene, ethyl-benzene, xylenes (together commonly referred to as BTEX compounds), and other heavy metals such as lead. These chemicals are found in both state and federal toxic emissions inventories, and are, therefore, of particular concern to both federal and state regulatory agencies.²⁹ The U.S. Geological Survey reports that natural bitumen, the source of all Canadian tar sands-derived oils, contains 102 times more copper, 21 times more vanadium, 11 times more sulfur, six

²⁸ Refining tar sands could result in an increase in Toxic Air Contaminants and Hazardous Air Pollutants. Tar sands crudes are distinct from even the heaviest of crudes processed in the past at the Refinery, for two principal reasons: (1) the unique chemical composition of the bitumen itself; and (2) the presence of large quantities of volatile diluents containing high levels of VOCs, TACs and HAPs. When released, these air pollutants cause significant public health and air quality impacts that must be adequately addressed in the EIR.

²⁹ See, e.g., U.S. EPA, Clean Air Act 1990 List of Hazardous Air Pollutants, *available at* <http://www.epa.gov/ttn/atw/orig189.html>; see also, California Air Resources Board Toxic Air Contaminant Identification List, *available at* <http://www.arb.ca.gov/toxics/cattable.htm#Note 1>.

times more nitrogen, 11 times more nickel, and 5 times more lead than conventional heavy crude oil.³⁰

The distinction in crude oil feedstock matters. The chemical composition of raw materials that are processed by a refinery directly affect the amount and composition of the refinery's emissions. The amount and composition of sulfur in the crude slate, for example, ultimately determines the amount of sulfur dioxide that will be emitted from every fired source in the refinery and the amount of odiferous hydrogen sulfide and mercaptans that will be emitted from tanks, pumps, valves, and fittings. The composition of the crude slate establishes the CEQA baseline against which impacts must be measured. Other significant impacts, such as increased energy consumption, air emissions, toxic pollutant releases, flaring and catastrophic incident risks, are also entirely dependent on the quality of crude oil processed at the facility. Furthermore, the diluents typically used in dilbit have a low molecular weight and high vapor pressure, so they can cause fugitive, gaseous releases by increasing vapor pressure in various refinery operation and transport components, including tankers and pipelines. Finally, a heavier crude oil feedstock has also been identified as a contributing factor to potentially catastrophic incidents at refineries, and a root cause of the August 6, 2012 fire at the Chevron Richmond Refinery.³¹

An increase from 59 ships per year to 135 ships per year carries with it obvious air quality impacts from ship exhaust as well. These impacts must be evaluated for every mile the ships travel, and for every community along their route. Ships will not arrive at the Project terminal from out of a vacuum, and each additional ship beyond those currently in fact using the terminal – not just those currently permitted – must be evaluated.

Phillips 66 does not have a good record of avoiding air quality violations at its Rodeo refinery. Just last year, BAAQMD settled for nearly \$800,000 with Phillips 66 for 87 air quality violations between 2010 and 2014.³² Such past violations must be evaluated when considering the likelihood of future violations that may relate to a change in feed stock or increased refinery activity as a result of the marine terminal expansion.

g. Environmental Justice and Economic Impacts

To the extent the Project utilizes offsets or credits, these have an undue impact on disadvantaged and already polluted communities, and the environmental justice impacts of such use must be evaluated. Violations, such as the 87 violations referenced above, also have an undue

³⁰ R.F. Meyer, E.D. Attanasi, and P.A. Freeman, *Heavy Oil and Natural Bitumen Resources in Geological Basins of the World*, U.S. Geological Survey Open-File Report 2007-1084, 2007, p. 14, Table 1, available at <http://pubs.usgs.gov/of/2007/1084/OF2007-1084v1.pdf>.

³¹ See Chemical Safety Board Interim Report on Chevron Fire (April 19, 2013). In addition, high acid levels in dilbit and its semi-refined products would accelerate corrosion of refinery components, contributing to equipment failure, more accidental releases, and risk of harm to both worker's and the public's health and safety.

³² "Air District settles case with Phillips 66," BAAQMD Press Release (August 3, 2016), available at http://www.baaqmd.gov/~media/files/communications-and-outreach/publications/news-releases/2016/settle_160803_phillips-pdf.pdf?la=en.

impact on disadvantaged and already polluted communities, impacts that cannot be addressed through monetary penalties. The EIR should include a full Health Risk Assessment for communities that will be affected by this project.

Rodeo ranks in the top 8% of the state's highest concentration of hazardous waste facilities, has a high concentration of contamination from Toxic Release Inventory chemicals, ranking in the top 3% for that factor.³³ Moreover, Rodeo also suffers from a high rate of low birth weights and asthma, ranking in the top 1% and 16%, respectively.³⁴

Fisheries would also be a major casualty of any large spill of dilbit or other petroleum product, and struggling fishing communities would be hardest hit by such impacts. Dungeness crab landings, for instance, were 3.1 million pounds in 2015, down almost 83% from the year before, with Oregon landings down a similar percentage.³⁵ Additional stress on these fisheries as a result of a spill or from other impacts from increased tanker traffic could have catastrophic consequences that need to be examined in the EIR. Overall, California produced 366 million pounds of fish worth 252.6 million dollars in 2014 and 195 million pounds of fish worth 143.1 million dollars in 2015, and threats to this industry that result from the Project must be evaluated in the EIR.

h. Climate Impacts

Tar sands is one the most greenhouse gas intensive fuel source in the world. "Per unit of energy delivered, transport fuel derived from oil sands deposits generates more greenhouse gases throughout its lifecycle than other petroleum products."³⁶ Because tar sands oil has a greater impact on climate, any change in marine terminal operations that has the practical effect of changing the feedstock used at the Phillips 66 refinery to include a greater mix of dilbit must take into account lifecycle climate impacts, including ocean acidification, ocean warming, and sea-level rise. Tar sands development will exacerbate the effects of ongoing climate change, so the Project EIR must take impacts from climate change into account.

With the use of tar sands comes the additional possibility that a change in feedstocks could result in an increase in the production of petcoke or other petroleum derivatives. This possibility should be included in the impacts analysis, along with lifecycle evaluations of all derivatives.

The EIR must also explain whether this project's increased greenhouse gas emissions are consistent with California's greenhouse gas reduction goals: a reduction of 40 percent below 1990 levels by 2030 and 80 percent below 1990 levels by 2050.³⁷

³³ OEHHA, Cal Enviro Screen 1.1 (amended), Statewide Zip Code Results, Rodeo, *available at* <http://oehha.maps.arcgis.com/apps/OnePane/basicviewer/index.html?appid=1d202d7d9dc84120ba5aac97f8b39c56>.

³⁴ *Id.*

³⁵ See 2015 NOAA Fisheries of the United States, attached.

³⁶ Green *et al.* 2017, attached.

³⁷ See California Executive Orders B-30-15 and S-3-05.

The Environmental Impact Statement for the Keystone XL pipeline provides an important precedent. Like this project, the environmental impact of that pipeline included the facilitation of new sources of crude oil, which included tar sands. The methodology employed by the U.S. State Department in that case accounted for increased emissions from the entire lifecycle of these new sources of crude oil, including both tar sands and Bakken, which was compared to lifecycle emissions of a baseline conventional crude. The marginal change in lifecycle emissions was multiplied by the pipeline's throughput to arrive at the change in greenhouse gas emissions that could be directly attributed to the pipeline. These calculations are contained in Appendix U of the Keystone XL document. Keystone XL is an analogous oil import infrastructure project, and BAAQMD should also utilize this methodology in completing the Project EIR.

Based on the Keystone XL analysis completed by the State Department, 78,818 barrels per day of Bakken crude yields a net increase of almost 175,000 metric tons of carbon dioxide equivalent per year, a significant impact that would require approximately 44 wind turbines³⁸ to offset. The net change in lifecycle emissions from this Project – compared to conventional crude – is between 800,000 metric tons of carbon dioxide equivalent per year (if the project moved entirely to Bakken crude) and 1,533,000 metric tons of carbon dioxide equivalent (if the project moves entirely tar sands).

Furthermore, since the completion of the Environmental Impact Statement for Keystone XL, there has been substantial new research indicating that the problem of methane escapement from extraction of fracked shale oil is significantly worse than had been previously understood. This research must be used to update the calculations above. For example, “relative to respective increases in oil and gas production, emission estimates correspond to leakages of $10.1\% \pm 7.3\%$ and $9.1\% \pm 6.2\%$ in terms of energy content, calling immediate climate benefit into question and indicating that current inventories likely underestimate fugitive emissions from Bakken and Eagle Ford.”³⁹ Methane is a significant contributor to climate change and has 87 times greater global warming potential compared to carbon dioxide.⁴⁰ Thus, even small leakage rates can result in significant climate impacts.

Ocean acidification is a real threat to the health of California's marine ecosystem and the connection between ocean acidification and high-carbon activities, such as tar sands extraction, refinement, and fuel consumption, is well established.

Elevated CO₂ concentrations in the atmosphere lead to higher dissolved CO₂ concentrations in seawater, which in turn lower its pH. Acidification can alter growth, survival, and reproduction of species (Doney et al. 2009; Kroeker et al. 2013). At particular risk are organisms with calcareous shells or skeletons that cannot form properly in acidified seawater. These species tend to be at the base

³⁸ According to the U.S. Environmental Protection Agency's Greenhouse Gas Equivalency Calculator, available at <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>.

³⁹ Schneising et al., *Remote sensing of fugitive methane emissions from oil and gas production in North American tight geologic formations*, attached.

⁴⁰ See G. Myhre et al., *Anthropogenic and Natural Radiative Forcing*, IPCC Table 8.7 at 714 (Cambridge Univ. Press 2013), attached.

of marine food webs, amplifying the impacts throughout marine ecosystems (Harley et al. 2006; Kroeker et al. 2013).⁴¹

Ocean acidification impacts must be evaluated in the Project EIR.

Marine ecosystems are also threatened by warming water temperatures. “Warming sea-surface Temperatures have been associated with decreased productivity, diversity, and resilience of nearshore marine ecosystems over the past few decades (Hoegh-Guldberg and Bruno 2010; Wernberg et al. 2011a) and with increased risk of species extinction (Wernberg et al. 2011b).”⁴² As such, warming water temperature impacts must be evaluated in the Project EIR.

Sea level rise is a clear and present danger, not just in California but throughout the world. “Sea-level rise will shift habitat for nearshore marine communities in regionally specific ways, depending on local geomorphology, and is expected to have substantial economic consequences for coastal human populations (e.g. Hinkel et al. 2014).”⁴³ Extensive research in California has modeled and predicted some of the effects of sea level rise, and this research must be taken into account by the Project EIR when determining the environmental impact of expanding the Phillips 66 Marine Terminal to accommodate increased dilbit supply from Canada.

Because of the high greenhouse gas cost of tar sands, this Project may well increase California’s overall greenhouse gas emissions and/or undermine California’s rigorous climate change reduction goals. The Project must be evaluated for consistency with Assembly Bill 197, which instructs regulators to reduce emissions directly from industrial sources such as the Phillips 66 Refinery that disproportionately impact disadvantaged communities. In addition, the Project must be evaluated for consistency with state and local plans and local planning codes, which could include in particular climate change.

i. Cross-Border Impacts

Tar sands extraction is intensely environmentally destructive, and the Project EIR must take into account environmental impacts that occur outside of California as a result of actions within California.

j. Cumulative Impacts

The completion of the Kinder-Morgan Pipeline in Canada will mean an eight-fold increase in the amount of tar sands crude oil that reaches the Canadian coast. The predicted increase in tar sands production could result in more than 2,000 additional barges and tankers carrying tar sands crude to and from these refineries on the West Coast. Each such barge trip carries an incrementally increasing chance of a spill, so the Project’s cumulative impact with other marine terminal

⁴¹ Green *et al.* 2017, attached.

⁴² *Id.*

⁴³ *Id.*

operations that will also be expanded as a result of the increased supply of dilbit from Canada must be evaluated.

Review must also consider a reasonable range of project alternatives including cleaner, alternative fuel sources and include an evaluation consistent with state and bay area plans to reduce climate change pollution and transition to a clean energy economy.

k. Terrorism Impacts

More ships bring increased risk, especially if those ships are carrying a volatile fuel like tar sands. Anti-terrorism and security measures, as well as the potential impacts from a terrorist or other non-accidental action, must be evaluated in the proposed EIR.

IV. Project Baseline, Piecemealing, and Lifecycle Analysis

The Project's baseline should include the 2012-13 increase in marine terminal capacity approved by BAAQMD – which was allowed without full CEQA compliance – and not just current conditions. Other baseline conditions must be taken into account, such as the type of feedstock currently utilized at the Refinery and the change expected as a result of the Project. A project baseline should not necessarily rely on permit limitations, but rather should examine conditions as they actually exist on the ground. Actual emissions must be used to establish baseline air quality, for instance.

Environmental Groups are also very concerned about the potential for the Project to be piecemealed. There are multiple additional projects that should have been included in Phillips 66's decision to convert to refining tar sands crude, not just the marine terminal expansion currently before the Board. The expanded marine terminal operations requested by Phillips 66 under the current Project cannot be fully utilized without additional operational capacity in the refinery itself and in other areas connected to the Marine Terminal but not contemplated by the Project. The Phillips 66 Propane Recovery Project should have been included as a connected action because it proposed refinery improvements to recover propane and butane, common diluents used to ship tar sands.⁴⁴ The project will decrease sulfur compounds from RFG streams at the Phillips 66 Rodeo refinery in Contra Costa County. Even the current Project does not fully encapsulate the shipping expansion contemplated by Phillips 66.⁴⁵ Any cumulative impact analysis is de facto inadequate without all taking into account all related projects, including the potential for other Bay Area refineries to increase marine terminal operations themselves and bring in more tar sands oil.

⁴⁴ See Phillips 66 Propane Recovery Project, Contra Costa County, *available at* <http://www.co.contra-costa.ca.us/4729/Phillips-66-Propane-Recovery-Project>. Components of the Rodeo Propane Fuel Recovery Project potentially lock the Rodeo Refinery into a change in oil feedstock processing, which is very likely to be tar sands dilbit.

⁴⁵ For instance, BAAQMD issued a Permit Evaluation and Statement of Basis for Minor Revision of Major Facility Review Permit, Permit Application 22906, for Phillips 66 in 2013 that allowed expanded Marine Terminal operations. Now, just four years later, another permit has been requested. It is clear that Phillips 66 is attempting to evade environmental review by breaking up its project into smaller pieces.

Phillips 66's other conversions or expansions must be part of the analysis for the Project, including any linkage between the Project and the proposed Phillips 66 crude by rail terminal in Santa Maria, in San Luis Obispo County, which has been denied but is being litigated and may still be built. Even if the denial of the San Luis Obispo Crude by Rail project stands up in court, Phillips 66 may still be seeking ways to get tar sands crude to their facilities in Santa Maria. Shipping into Rodeo raises the additional possibility that Phillips 66 may use its existing pipeline to transfer oil from Rodeo to its refinery in Santa Maria as a foreseeable result of Project approval. Phillips 66 must disclose all linkages to its refinery in Santa Maria, and if Phillips 66 intends to process or partially process oil in Santa Maria that has been shipped in to the marine terminal in Rodeo, any impacts, including air quality impacts, from such refining must be disclosed and taken into account as a part of the current environmental evaluation.

As a threshold issue, BAAQMD must acknowledge that the Phillips 66's San Francisco Refinery consists of two facilities linked by a 200-mile Phillips-owned pipeline. The Santa Maria facility is located in Arroyo Grande, in San Luis Obispo County. Currently, semi-refined products from the Santa Maria Refinery are sent by pipeline to the Rodeo Refinery for upgrading into finished petroleum products. The refining processes at Phillips 66's Santa Maria and Rodeo facilities are integrated to a capacity that neither can achieve alone. Further, Phillips 66 reports these two facilities as a single processing entity, the San Francisco Refinery, to industry and government monitors.⁴⁶

Because of the many connected action associated with the Project – as described above the Project is piecemealed and potentially contemplates an inadequate baseline – BAAQMD must find that it is part of one larger project, and as a result would be more appropriate to analyze under a Program EIR. This has several advantages: providing a more exhaustive consideration of effects and alternatives than would be practical in an EIR; ensuring adequate consideration of cumulative impacts that might be slighted in a case-by-case analysis; allowing for an earlier and more practical consideration of mitigation measures; and saving considerable agency resources.⁴⁷

Finally, BAAQMD must undertake a lifecycle analysis of tar sands crude to evaluate environmental impacts such as climate, air quality, and wildlife impacts, to name just a few. This lifecycle analysis would have to include the foreseeable, inevitable result of refining crude oil, end use combustion.

V. Conclusion

The many impacts that can be expected from a project of this magnitude, as explained throughout this document, necessitate a great deal of caution in the approvals process. The Environmental Groups urge BAAQMD to pursue the studies and recommendations in this document as well as those contained in the suggestions of the numerous other commenters at public scoping meetings and in written comments to the Board. In addition, the Environmental Groups urge

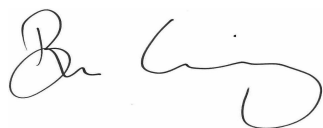
⁴⁶ See Oil & Gas Journal, 2012; EIA Ref. Cap. 2013; See also orders R2-2011-0027 and R3- 2007-0002 (comparing the references shows "Rodeo" capacities reported to EIA).

include the Santa Maria facility.

⁴⁷ CEQA Guidelines § 15168.

BAAQMD to hold a public hearing on the issuance of the Permit. Phillips 66's permit application has already drawn tens of thousands of comments to the Board from members of the public concerned about the Project's potential environmental impacts. It is inappropriate for a decision of this magnitude – a decision that impacts the health and safety of so many members of the public both in the communities surrounding the Phillips 66 Refinery, up and down the coast of California, Oregon, Washington, and Canada where tankers and barges will be carrying dangerous crudes, and worldwide where the impacts of climate change will be felt more strongly as a result of the exploitation of dirty tar sands resources – be made behind closed doors without a public hearing. The public must be allowed to review the draft environmental documents generated as a result of this scoping process and confront the actual decision makers with their comments and concerns.

Sincerely,



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Attachments

California Ocean and Coastal Economies, National Ocean Economics Program (March 2015).

Fisheries of the United States 2015, National Oceanic and Atmospheric Administration (September 2016)

G. Myhre et al., *Anthropogenic and Natural Radiative Forcing*, in CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS. CONTRIBUTION OF WORKING GROUP I TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, IPCC Table 8.7 at 714 (Cambridge Univ. Press 2013), available at https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf.

Green et al., *Oil sands and the marine environment: current knowledge and future challenges*, The Ecological Society of America, *Front Ecol. Environ.* 2017; 15(2): 74–83.

Memorandum for Commander, South Pacific Division (CWSPD-PD), FY 17 O&M Dredging of San Francisco (SF) Bay Navigation Channels, U.S. Army Corps of Engineers (Jan. 12, 2017).

Preliminary Prospectus for Kinder Morgan Canada Limited. Filed with the Canadian Securities Regulatory Authorities. April 24, 2017.

Report: West Coast Tar Sands Invasion, Natural Resources Defense Council et al. (April 2015).

Schneising et al., *Remote sensing of fugitive methane emissions from oil and gas production in North American tight geologic formations*, AGU Publications (2014), available at <http://acmg.seas.harvard.edu/publications/aqast/articles/schneising2014.pdf>.

Spills of Diluted Bitumen from Pipelines: A Comparative Study of Environmental Fate, Effects, and Response, National Academies of Sciences (2016, National Academies Press).