

## 1. EXECUTIVE SUMMARY

On July 24, 2007, third party contact with the Trans Mountain Pipeline operated by Kinder Morgan Canada resulted in the release of crude oil onto Inlet Drive in Burnaby BC. Oil travelled through the storm drain system into Burrard Inlet. Three general areas were affected: 1) the residential area; 2) the foreshore of Burrard Inlet; and 3) Kask Creek. This fact sheet summarizes the activities and environmental conditions associated with the spill for the foreshore area, which was the main marine area affected. Information is provided about:

- The oil release, immediate spill responses and subsequent remediation activities
- Short-term effects of the spill
- Establishment of endpoints for recovery
- Long term monitoring as follow-up for the spill, and attainment of recovery endpoints
- A summary of response activities and effects on Kask Creek
- Recommendations for spill preparedness
- A list of reports documenting the environmental impacts, endpoints for recovery and long-term monitoring.

The emergency response and follow up remediation at the Westridge release site were effective in removing the released oil from the environment and limiting the short term and long term effects of the spill. By 2011, most of the recovery endpoints established for the spill had been met (water quality in 2007; intertidal sediment quality, PAH levels in crab and intertidal community structure in 2011). PAH levels in mussels collected at Westridge have not yet met the endpoint; however, results are confounded due to the influence of PAHs from unrelated, third party sources such as urban runoff and vessel traffic; monitoring of this component continues. Intertidal communities in two areas near the terminal were disturbed in 2007 by removal of oiled vegetation; although community structure (dominated by the seaweed *Fucus*, with associated benthic invertebrates) has recovered, monitoring will continue to assess variability in the affected areas.

The Burrard Inlet area is heterogeneous, with heavily developed industrial, commercial and residential shorelines and watersheds; road, rail, and marine traffic; and more natural areas with highly valued marine habitat and recreational uses. Inlet sediments contain contaminants from historic and current activities, as well as from the 2007 oil release. Given the many potential inputs of contaminants to Burrard Inlet, distinguishing one hydrocarbon source from numerous others is challenging.

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## 2. THE OIL RELEASE AND CLEANUP

- The spill:
  - Occurred on July 24, 2007, when a third party backhoe operator accidentally ruptured the pipeline carrying crude oil to the Westridge Terminal
  - Approximately 224,000 litres of Albion heavy synthetic crude oil was released (72,000 litres recovered as free product from land and water, 131,000 litres recovered by removal of contaminated soil and sediment, 15,000 litres volatilized from land surfaces, 364 litres recovered from Kask Creek remediation, and 5,636 unrecovered)
  - Approximately 100,000 litres of the oil entered the storm drain system and reached Burrard Inlet through shoreline storm outfalls, a submerged storm outfall, and Kask Creek. The main entrance point was a storm drain outfall 100 m west of the Kinder Morgan dock.
  - An estimated 5,636 litres was not recovered and was considered to be released to the marine environment.
- Oversight of the spill response:
  - The response was led by Kinder Morgan Canada and Polaris Applied Sciences Inc. (spill response specialists), with Western Canada Marine Response Corporation (WCMRC, formerly known as Burrard Clean) organizing the booming and removal of oil, Stantec conducting the environmental monitoring, and Focus Wildlife rehabilitating affected wildlife
  - National Energy Board (NEB) was responsible for overseeing the actions of Kinder Morgan and coordinating the responses of federal and provincial agencies
  - Regional Environmental Emergency Team (REET) was established to provide consolidated and coordinated environmental advice, information and assistance. The REET was co-chaired by Environment Canada and the Ministry of Environment and attended by representatives from the NEB, Canadian Wildlife Service, Vancouver Port Authority and Fisheries and Oceans Canada. The City of Burnaby and the Squamish and Tsleil Waututh Nations were also involved.
- The spill response:
  - Incident occurred at 12:32, WCMRC was requested to respond to spill at 13:24, began booming by 14:15 (within 45 min of oil appearing at shoreline stormwater outfall)
  - SCAT (Shoreline Cleanup Assessment Technique) to identify oiled shorelines (categorized as low, medium, high), establish cleanup methods and set clean up priorities
  - Recovery and rehabilitation of affected wildlife (daily surveys for six weeks following the spill)
  - Aerial surveys (helicopter) of Burrard Inlet to First Narrows July 27 to Aug 2, and again on Aug 7 to identify distribution of oil slicks, patches and affected shorelines—responders used this information to assign cleanup crews to specific areas

- Ongoing shoreline cleanup between July 25 and September 5, with oil removed from 15,000 m of shoreline, mainly in a 2,500 m area between the Shell dock and Barnet Marine Park
- Emergency clean up techniques:
  - Booming—to contain oil around the release points and also exclusion booming to protect sensitive shorelines
  - Skimmers and absorbent pads to remove oil
  - Manual removal of tar balls, oily debris and oiled *Fucus*
  - Sign-off that shoreline clean up met the recovery endpoints was done by a SCAT team composed of First Nations, Port Metro Vancouver and federal, provincial and municipal officials. The endpoint for high use areas, public access shorelines, and sensitive cultural and archaeological resource areas was met in summer 2007. The endpoint for industrial shorelines (except Westridge Terminal) was met in spring 2008. The endpoint for industrial shoreline at Westridge Terminal was met following completion of additional remediation in May 2008.
  - Flushing of storm and sanitary sewers with hot or cold water; cleaning of catch basins and manholes with steam pressure washing; collection and disposal of oil; video documentation to check sewer condition—complete in August 2007
  - Removal of oil from the combined sanitary and stormwater system leading to Annacis Island Treatment Plant (removed from all affected sewer lines, pump stations and the treatment plant)—completed by September 12, 2007.
- Favourable environmental factors at the time of the spill:
  - Sunny weather (slowed the movement of oil in storm drains, facilitated evaporation of oil)
  - Spill occurred on slack tide (incoming tide helped keep the oil near shore while booms were placed, helped limit the movement of oil in the Inlet)
  - Outside the primary migration and over-wintering period for birds, and after the breeding bird season
  - Prior to the main period of salmon migration to creeks and rivers for spawning
- Remediation programs after the emergency cleanup:
  - Clean-up of two rocky shoreline areas at Westridge using a shoreline cleaner (August 2007)
  - Agitation (tilling) of intertidal sediment at Westridge (May 2008)
  - Agitation of sediment at the outlet of a submarine outfall of the Metro Vancouver storm sewer system, offshore from the Westridge terminal (February 2009).
- Natural weathering processes at work:
  - Evaporation, emulsification, dissolution, photo-oxidation, chemical oxidation, biological weathering (mainly microbial oxidation)
  - Evaporation removes volatile hydrocarbons quickly; biological processes work more slowly on persistent compounds like PAHs.

- Tracking the oil spill over time and space:
  - Monitored PAH concentrations (persistent toxic compounds)
  - Burrard Inlet sediments contain a mix of PAHs from many sources (road runoff, vessel traffic, atmospheric deposition), making it challenging to attribute PAHs specifically to the spill; sediment at the Westridge Terminal area contained PAHs that could be related to historic and current shipping activities of the same Albian heavy synthetic crude oil
  - Used a fingerprinting technique, with parent and alkylated PAH, to compare PAH profiles in the released oil to PAHs in sediment and biota (most useful in the early stages of a spill, as weathering changes the profile of the oil in sediment and biota)
  - More complex organisms (crabs, fish, birds) have a greater ability to metabolize PAHs than do simpler organisms (mussels, clams), limiting the usefulness of fingerprinting techniques to assess exposure to oil in complex organisms; both mussels and crabs were monitored over time.

### 3. SHORT-TERM ENVIRONMENTAL EFFECTS

The spill affected 15,000 m of the 50,000 m of shoreline assessed during SCAT surveys, east of Second Narrows. The main area impacted was 2,500 m around and between the storm drain outfalls, from the Shell dock (1,000 m west of the Kinder Morgan Canada dock) to the western end of Barnet beach in Barnet Marine Park. Maplewood Mudflats, Cates Park and Belcarra were affected to a lesser degree.

- A full biophysical assessment was undertaken to identify “Areas of Potential Environmental Concern” and to determine if “Potential Contaminants of Concern” occurred in these areas:
  - Laboratory analysis of hydrocarbons (PAH, alkylated PAH, BTEX, LEPH, HEPH, phytane, pristane) was done in samples of water, sediment, mussel and crab tissue, and released oil.
  - Parent PAH levels were compared to established guidelines for protection of aquatic life.
  - PAH fingerprinting (parent and alkylated PAH) was used to distinguish between PAHs from the released oil and other sources in Burrard Inlet.
- Effects on marine water:
  - Nine stormwater outfalls were monitored until they met the recovery endpoint (met water quality guidelines or Metro Vancouver reference concentrations for stormwater following two high rain events); many outfalls met the endpoint within a month or two of the spill, but three outfalls did not meet the endpoint until November 2007.
  - Surface water samples were collected from 30 sites throughout eastern Burrard Inlet one and two week’s post-release and analyzed for EPH and PAH; EPH concentrations were below detection limits and some PAHs were detected (but less than marine water quality guidelines).
- Effects on marine sediment:

- Sediment samples were collected from sandy beaches and mudflats in eight areas of Burrard Inlet (78 samples in early August and 31 samples in early September 2007).
- EPH levels were near or below detection at most sites. Some samples collected in August from the Westridge area had TEPH levels up to 12,500 mg/kg; by September, levels had dropped sharply, likely as a result of remediation efforts and natural weathering.
- Total parent PAH levels ranged from 0.001 to 30.3 mg/kg, highest in samples collected in August from Westridge (east of Shell dock) and much lower at all other sampling sites.
- In August, 20 of the 78 sediment samples had PAH levels higher than the marine sediment quality guidelines for protection of aquatic life (10 samples from Westridge).
- PAH levels generally decreased between August and September.
- PAH composition at Westridge sites showed a strong correspondence with the released oil (higher correlation in August than September). PAH composition at other locations showed no strong correlation with released oil.
- Effects on intertidal habitat:
  - Heavy oiling and remediation activities in the main impact area resulted in loss of habitat (primarily *Fucus*) and mortality of intertidal fauna (sea stars, barnacles, mussels, limpets).
- Effects on shellfish:
  - Mussels (*Mytilus* sp.) were collected from 19 sites in the eastern inlet and analyzed for PAHs.
  - Mussels from Westridge and Barnet Marine Park showed elevated PAH levels and profiles similar to that of the released oil.
  - PAH profiles in mussels collected from all other sites were suggestive of pyrogenic (combustion-derived) sources.
- Effects on crabs:
  - PAH levels were measured in red rock crabs (*Cancer productus*) and Dungeness crabs (*Metacarcinus magister*) collected from five sites (Westridge, Barnet Marine Park, Berry Point, Indian Arm and Port Moody Arm).
  - Only red rock crabs from Westridge had PAH levels and profiles similar to that of the released oil.
- Effects on fish:
  - Some resident and juvenile salmon may have been affected; however, the Westridge area is not known to provide high value habitat for juvenile salmon. Migrating adults are typically not present in the Inlet until early August or later, so minimal effects were expected.
  - Most of the sediment samples had PAH levels below sediment quality guidelines, so effects on benthic fish were expected to be limited and localized to the Westridge area.
  - Golder Associates Ltd. sampled starry flounder at Westridge and Barnet Marine Park in October 2007; there were no detectable PAHs in bile.

- Effects on marine birds:
  - Focus Wildlife captured 15 Canada geese, 2 gulls and 1 Pelagic Cormorant because of oiling; all but 2 Canada geese were cleaned and released (one was transferred to a different facility and the other was euthanized due to an injured eye).
  - Effects on marine birds were minimal, largely because overwintering birds had not yet returned from northern breeding ranges.
- Effects on marine mammals:
  - No marine mammal deaths were noted to be directly related to the release (one dead harbour seal pup from the north shore at IR#3 had a slight amount of oil on its stomach; however, the post mortem was unable to determine the cause of death).

## 4. RECOVERY ENDPOINTS

Recovery endpoints were established through consultation with the NEB, federal, provincial and municipal governments, Tsleil-Waututh First Nation and Squamish First Nation. The endpoints recognize the pre-spill conditions (historic and current sources of PAHs in the Inlet) in addition to the Kinder Morgan release. The principal contaminants of concern in the foreshore and intertidal environment were parent and alkylated PAHs, given that these compounds persist and are known to be toxic to many organisms.

Recovery endpoints for the foreshore environment are presented in Table 4-1 along with the criteria used for selecting the endpoints.

**Table 4-1: Recovery Endpoints for the Foreshore Environment**

Component	Endpoint	Rationale and criteria for selection
Water	PAH concentrations less than BC MOE water quality guidelines for protection of marine life	Short-term effects might be detected in surface waters (related to oil slicks)
Submerged Metro Vancouver Outfall	A minimum of three months of no oil being released from the outfall	With no applicable guidelines for sewer or outfall water quality, the endpoint was established through discussions with stakeholders
Intertidal Sediment	Meets sediment quality guidelines and Burrard Inlet Objectives, or if higher than guidelines, the PAH profile (parent and alkylated) does not match that of the released oil, or levels are similar to background levels.	Contaminants typically settle in areas of fine sediment and can persist over time. The sediment endpoint considers chronic oil contamination at Westridge, historic sources of PAHs in the Inlet, BC sediment guidelines, and Burrard Inlet sediment objectives (which were updated by BC MOE in 2010). A review of historical PAH levels in Burrard Inlet was done to determine background levels.
Mussels	PAH levels in mussels from Westridge and Barnet Marine Park are similar to background levels in Burrard Inlet, or with	Mussels are filter feeders, so are likely to accumulate PAHs (clams were also considered, but species distribution was inconsistent among monitoring sites).

Component	Endpoint	Rationale and criteria for selection
	a PAH profile dissimilar to the released oil; below the provincial tissue guideline for benzo(a)pyrene <sup>1</sup>	Shellfish provide food for other animals. There is no human consumption of shellfish as there is a ban on harvesting due to elevated coliform levels
Crabs	Benzo(a)pyrene levels in hepatopancreas of crabs from the Westridge and Barnet Marine Park areas less than the provincial guideline for muscle tissue, or have a PAH profile dissimilar to the released oil.	Crabs are detritus feeders, and use both intertidal and subtidal habitat. The endpoint is conservative, recognizing that PAH levels would be two to four times higher in hepatopancreas than muscle tissue. Crabs provide food for other animals and for humans.
<i>Fucus</i>	Similar coverage and community composition of <i>Fucus</i> and other marine organisms in affected and reference areas.	Oiled <i>Fucus</i> was removed from heavily oiled rocky intertidal areas near the release site, resulting in loss of habitat and associated biota. Similar coverage and community composition at affected and reference areas indicates successful recolonization and recovery.

**NOTE:**

<sup>1</sup> Tissue guideline is benzo(a)pyrene levels below 4 ug/kg at low consumption level of 50 g/week; 2 ug/kg at moderate consumption level of 100 g/week; 1 ug/kg at high consumption level of 200 g/week

## 5. LONG-TERM MONITORING

Following the July 2007 spill, a long-term monitoring program was developed to monitor recovery of impacted areas, assess changes in levels of contaminants from the spilled oil in the marine environment, and evaluate potential effects on marine organisms. The components identified in Section 4 were chosen for long-term monitoring based on their ecological relevance and results of monitoring conducted after the release in 2007. The long-term monitoring program began in 2008 and will continue annually until all recovery endpoints are reached and stakeholders have signed off on the program. The monitoring results were evaluated each year to identify whether further remediation would be needed. To date, five of the six components have met the recovery endpoints (Table 5-1).

**Table 5-1: Components of the Foreshore Long-term Monitoring Plan and Timeline for Monitoring**

Component	Monitoring Frequency	2008	2009	2010	2011	Post-2011
Marine Water (surface water)	Endpoint met in 2007					
Metro Vancouver Outfall	Weekly	X	X	X	Endpoint met in 2010	
Intertidal Sediment	Once a year, July or August	X	X	X	X	Endpoint met in 2011
Blue Mussels ( <i>Mytilus edulis</i> )	Once a year, July or August	X	X	X	X	X Another year of monitoring, as results are confounded by additional PAH sources in Westridge area
Dungeness ( <i>Metacarcinus magister</i> ) and Red Rock Crabs ( <i>Cancer productus</i> ) and Subtidal Sediment	Once a year, July or August	X	X	X	X	Endpoint met in 2011

Component	Monitoring Frequency	2008	2009	2010	2011	Post-2011
<i>Fucus</i> Community	Once a year, July or August	X	X	X	X	X Endpoint met in 2011 but additional monitoring will be done to assess annual variability

**NOTE:**

Fish were not included in the long term monitoring program as intertidal, rather than subtidal or pelagic habitat was affected; most fish species are transitory, so would have had limited exposure to released oil. Marine birds and mammals were not included because cleanup and remediation activities undertaken immediately after the spill successfully recovered most of the exposed oil along shoreline habitats. After the initial response, there were no reports of oiled birds or marine mammals.

- Marine water:
  - The recovery endpoint was met in 2007 and monitoring was terminated.
- Metro Vancouver outfall:
  - The number of oil droplets surfacing from the submerged outfall was monitored weekly in 2007, 2008 and 2009.
  - In February 2009, a large debris pile at the base of the outfall was flushed, releasing ~ 12.5 litres of oil. The rate of oil droplets surfacing declined and stabilized, indicating that most of the oil had been released.
  - No oil was observed on nine of the last thirteen monitoring dates in 2010 and monitoring was terminated.
- Intertidal sediment (Table 5-2):
  - The endpoint for intertidal sediments was met in 2011 and monitoring was terminated.
  - Intertidal sediments were collected from 30 to 36 locations (62 to 106 samples) in 8 general areas of Burrard Inlet each year. All samples were analyzed for parent PAH and a subset of samples was analyzed for alkylated PAH.
  - In 2007, samples collected at Westridge had high total parent PAH levels (above the sediment guideline) and the PAH profiles were similar to that of the spilled oil. Peak PAH levels decreased from August to September due to remediation of the site. Samples collected from locations away from Westridge had much lower levels of total parent PAH, and a PAH profile dissimilar to the released oil.
  - In 2008, total parent PAH levels at Westridge dropped substantially, and have continued to decline steadily; all samples meet the sediment quality guideline for total parent PAH.
  - PAH levels at sites away from Westridge have fluctuated from year to year, generally meeting the sediment guideline. The exception is sediment at Maplewood Flats, a tidal marsh across the Inlet from Westridge, where sediment levels have been consistently higher than the guideline. The PAH profile in samples collected away from Westridge do not resemble the spilled oil and reflect background conditions (largely related to local hydrocarbon sources, currents, and deposition patterns specific to those areas).
  - Although the sediment guideline for total parent PAH has been met, there are occasional exceedances of guidelines for specific PAH compounds at Westridge and other areas. Samples collected east of the Shell dock continue to show some resemblance to the released oil.



**Table 5-2: Mean Total Parent PAH (mg/kg dry weight) Concentrations in Intertidal Sediments by General Sampling Location in Burrard Inlet, 2007 – 2011**

Date	Westridge	Main Dock Area	Barnet Marine Park	Maplewood Flats	Cates Park	Port Moody	North Shore	South Shore
Aug-07	<b>8.76</b> (10)	n/a (0)	0.16 (12)	1.54 (2)	0.29 (7)	0.53 (11)	0.03 (6)	0.38 (8)
Sep-07	0.90 (9)	n/a (0)	0.16 (8)	<b>2.02</b> (3)	0.35 (5)	n/a (0)	n/a (0)	0.38 (6)
Sep-08	0.53 (15)	0.13 (6)	0.20 (12)	<b>2.48</b> (2)	0.38 (6)	0.23 (6)	0.01 (6)	0.08 (6)
Aug-09	0.34 (15)	0.20 (3)	0.11 (10)	<b>2.25</b> (2)	0.82 (6)	0.61 (5)	0.02 (4)	0.35 (6)
Aug-10	0.23 (15)	0.66 (4)	0.10 (12)	<b>2.15</b> (2)	0.65 (6)	0.38 (6)	0.02 (4)	0.21 (6)
Aug-11	0.21 (15)	0.33 (4)	0.07 (12)	<b>3.15</b> (2)	0.29 (6)	0.14 (6)	0.07 (4)	0.20 (6)

**NOTE:**

Deep samples and outfall samples were excluded from analysis. Number of samples from each site is shown in brackets.

**Bolded** font indicates exceedance of Burrard Inlet sediment quality objective for total parent PAH (1.68 mg/kg)

▪ **Mussels:**

- The endpoint for mussels has not yet been met at Westridge, and monitoring will continue.
- Mussels were collected from 12 locations in 2007 and 4 or 5 locations from 2008 to 2011. Composite samples of 25 mussels were analyzed for parent and alkylated PAH.
- In 2007, mussels collected from the Westridge site had high total parent PAH levels (733 – 840 µg/kg) compared to the other sites (29 – 116 µg/kg), PAH fingerprint similar to the spilled oil, and benzo(a)pyrene levels 10 to 20 times higher than the consumption guidelines. Samples from most of the other sites also benzo(a)pyrene levels higher than the guidelines.
- Total parent PAH levels in mussels from Westridge decreased steadily between 2007 and 2011 and by 2009, PAH profiles of mussels from Westridge showed little similarity to the released oil, and were suggestive of combined pyrogenic and petrogenic sources. At the other sites, total parent PAH levels have fluctuated around low levels.
- In 2011, benzo(a)pyrene concentrations in mussels from Westridge continued to exceed the guideline for human consumption; however, PAH profiles showed almost no similarity to the released oil, suggesting sources of hydrocarbons other than the spilled oil. Because PAH levels at Westridge continue to be elevated relative to other locations and benzo(a) pyrene concentrations continue to exceed the human consumption guideline, mussel sampling will continue in 2012.

▪ **Crabs:**

- In 2011, crab tissue met the endpoint and no further monitoring will occur
- Crabs (Dungeness, red rock) and subtidal sediment were collected from five areas in 2007 and three areas in 2008 – 2011. Samples were analyzed for parent and alkylated PAH.

- Subtidal sediment in the Westridge area had a PAH profile similar to that of the released oil in 2007. Since then, total parent PAH concentrations have fluctuated and exceeded the draft sediment guideline (1.68 µg/g) at Barnet Marine Park and Westridge, but not at Berry Point. Analysis of alkylated PAHs showed no significant correlations with the oil released in 2007, and suggest alternate sources of hydrocarbons being deposited.
  - Crab tissue analyzed in 2007 indicated 2 of the 50 crabs had levels of benzo(a)pyrene higher than the provincial guideline for moderate consumption: one red rock crab from Berry Point and one Dungeness crab from Barnet Marine Park; however the PAH profile did not resemble that of the spilled oil. Red rock crabs collected from Westridge had PAH compounds that may have been linked to the released oil.
  - Since 2007, total parent PAH levels in crab tissue have been low at Berry Point, and have decreased notably over time at Westridge and Barnet Marine Park. Levels are now consistent with historic data for various parts of Burrard Inlet. The PAH profiles have not resembled that of the spilled oil. Benzo(a)pyrene levels have generally been below the detection limit.
  - Given the ability of crabs to quickly metabolize PAHs, the length of time that has passed since the 2007 release, and the low similarity of PAH profiles in crab tissue and subtidal sediments to the released oil, it is unlikely that crabs collected in 2011 are assimilating oil from the 2007 release.
- The *Fucus* Community:
    - Meets the endpoint for *Fucus* (similar coverage and community composition of *Fucus* and other marine organisms in affected and reference areas) in 2011
    - Although the endpoint has been met, surveys will continue in 2012 to ensure the *Fucus* community can continue to sustain its current coverage, diversity, and habitat function.
    - In 2007, two areas at Westridge and Barnet Marine Park were remediated by removal of oiled *Fucus* and associated biota. Since 2008, recolonization has occurred. In 2009, 2010 and 2011, mean *Fucus* coverage at impacted sites has increased, and abundance and diversity of green and red algae, and invertebrates (barnacles, mussels, grazing molluscs, shoreline crabs) were greater at impacted than reference sites.

## 6. DOCUMENTS

### Environmental Impact Statement

Stantec Consulting Limited (Stantec). 2010. Environmental Impact Statement. Divisions B and D: Sewers, Foreshore, and Marine Environment. Westridge Hydrocarbon Accidental Release. Prepared for Kinder Morgan Canada.

Jacques Whitford AXYS (JWA). 2009a. Environmental Impact Statement Division C: Kask Creek. Prepared for Kinder Morgan Canada.

### Endpoints and Remediation

Jacques Whitford AXYS Stantec Limited (JWASL). 2009. Foreshore Endpoints and Remediation. B and D: Sewers and Foreshore Environment. Westridge Hydrocarbon Accidental Release. Prepared for Kinder Morgan Canada. Report submitted to Kinder Morgan Canada, Burnaby BC by Jacques Whitford AXYS Stantec Limited, June 2009

Stantec. 2010. Endpoints and Remediation. Division C: Kask Creek, Westridge Hydrocarbon Accidental Release. Prepared for Kinder Morgan Canada. June 2010.

### Long Term Monitoring Plan

Stantec Consulting Limited (Stantec). 2011. Long-term Monitoring Plan. Foreshore Environment. Westridge Hydrocarbon Accidental Release (Final Report). Prepared for Kinder Morgan Canada.

### Long Term Monitoring Reports

Stantec Consulting Limited (Stantec). 2010. Long-term Monitoring Program – 2008 Report. Foreshore Environment. Westridge Hydrocarbon Accidental Release. Prepared for Kinder Morgan Canada.

Stantec Consulting Limited (Stantec). 2010. Long-term Monitoring Program – 2009 Report. Foreshore Environment. Westridge Hydrocarbon Accidental Release. Prepared for Kinder Morgan Canada.

Stantec Consulting Limited (Stantec). 2011. Long-term Monitoring Program – 2010 Report. Foreshore Environment. Westridge Hydrocarbon Accidental Release. Prepared for Kinder Morgan Canada.

Stantec Consulting Limited (Stantec). 2012. Long-term Monitoring Program – 2011 Report. Foreshore Environment. Westridge Hydrocarbon Accidental Release. Prepared for Kinder Morgan Canada.

## 1. KASK CREEK

On July 24, 2007, third party contact with the Trans Mountain Pipeline operated by Kinder Morgan Canada resulted in the release of crude oil onto Inlet Drive in Burnaby BC. Oil travelled through the storm drain system into Burrard Inlet. Three general areas were affected: 1) the residential area; 2) the foreshore of Burrard Inlet; and 3) Kask Creek. This fact sheet summarizes the activities and environmental conditions associated with the spill for Kask Creek, which was the main freshwater habitat area affected.

Kask Creek is a short (103 m long), non-fish bearing watercourse fed mainly by stormwater, which flows down steep terrain into Burrard Inlet. Oil traveled through storm drains into Kask Creek then into Burrard Inlet. Approximately 364 litres of oil was recovered from Kask Creek during the spill response and remediation. The steep terrain provided many challenges in accessing the site by machine, and for safety of response staff.

The emergency spill response involved:

- Cleanup of Kask Creek began on July 28, 2007, with suctioning oil using vacuum trucks from the top and bottom of the creek, manual removal of oil from substrates, then controlled flushing five times with water to move any mobile oil downstream. Follow-up occurred on August 3 with removal of oiled vegetation and debris from the channel and flushing with hot water.

Further remediation included:

- Flushing of storm drains leading to Kask Creek (late August 2007)
- Replacement of an oiled culvert at a road crossing near the foreshore by City of Burnaby and removal of 1 m<sup>3</sup> of soil and sediment from upstream of the rail line culvert (September 2007)
- Identification and delineation of contaminated areas in October 2007 and June 2008 and remediation in August 2009. Remediation involved excavation of contaminated soils and sediment from a 65 m long section of creek and adjacent area with shovels and vacuum suction, backfilling of excavated areas with rip rap and cobbles, replacing removed alders at a 2:1 ratio, and hydroseeding and mulching to stabilize exposed soils.

Endpoints for remediation were developed to protect wildlife using the area and limit the release of PAHs into downstream habitat in Burrard Inlet. The endpoints, and time they were met, are as follows:

- Effluent (water) quality that met BC water quality guidelines for protection of aquatic life or Metro Vancouver reference values for stormwater (met in late July 2007)
- No visible oil on vegetation (met in early August 2007)
- Sediment and soil that met BC Contaminated Sites Regulation (CSR) standards for Freshwater Sediment (typical, non-sensitive sediment) and for urban park land use (met in August 2009)

Short and long term effects on the environment were limited, given that Kask Creek has ephemeral flows (mostly from stormwater) and is non-fish bearing. However, the forested area and watercourse provides cover, forage and water for wildlife (invertebrates, amphibians and birds). Potential effects included:

- Short term effects on aquatic invertebrates (food source for wildlife) from oiling and site remediation, as organisms would recolonize the substrates within a year; the watercourse did not provide high quality aquatic habitat before or after the spill, given the substrate (mix of clay hardpan, sand, boulders) and ongoing introduction of contaminants (metals, hydrocarbons, sediment) in stormwater
- Limited and short term effects on amphibians (newts, salamanders, frogs), given that surveys conducted on Kask Creek and three nearby control watercourses after the spill did not indicate the presence of amphibians or of breeding habitat. Any individual adults exposed to the oil would have been affected, but this would not lead to population level effects.
- Limited and short term effects on birds, with bathing in Kask Creek the most likely pathway for an effect (potential fouling of feathers by oil). No oiled birds were observed during clean-up and no residual oil was present in water following the preliminary clean-up (by July 29), with PAH levels in water meeting the Metro Vancouver reference values for stormwater by that date. The small amount of oiled vegetation (branches) removed from the stream bank in early August 2007 resulted in a minimal and short term reduction in cover for birds.
- Chronic effects related to PAH exposure could have occurred prior to the 2009 site remediation. Since the main exposure pathway is considered to be uptake from water, rather than from sediment, to biota, chronic effects would be limited. PAH levels in water met guidelines and standards soon after the spill (except for non-spill sources in stormwater). Also, higher animals (amphibians and birds) do not tend to bioaccumulate PAHs due to their ability to metabolize PAHs, so would not be expected to display chronic effects.

No long term monitoring was required for Kask Creek because remediation resulted in the removal of all hydrocarbons and, therefore, the potential for any long term effects.

## **2. DOCUMENTS**

### **Environmental Impact Statement**

Jacques Whitford AXYS (JWA). 2009. Environmental Impact Statement Division C: Kask Creek. Prepared for Kinder Morgan Canada.

### **Endpoints and Remediation**

Stantec. 2010. Endpoints and Remediation. Division C: Kask Creek, Westridge Hydrocarbon Accidental Release. Prepared for Kinder Morgan Canada. June 2010.