

Developing and Delivering Remediation Endpoints Following an Oil Release to the Red Deer River, Alberta

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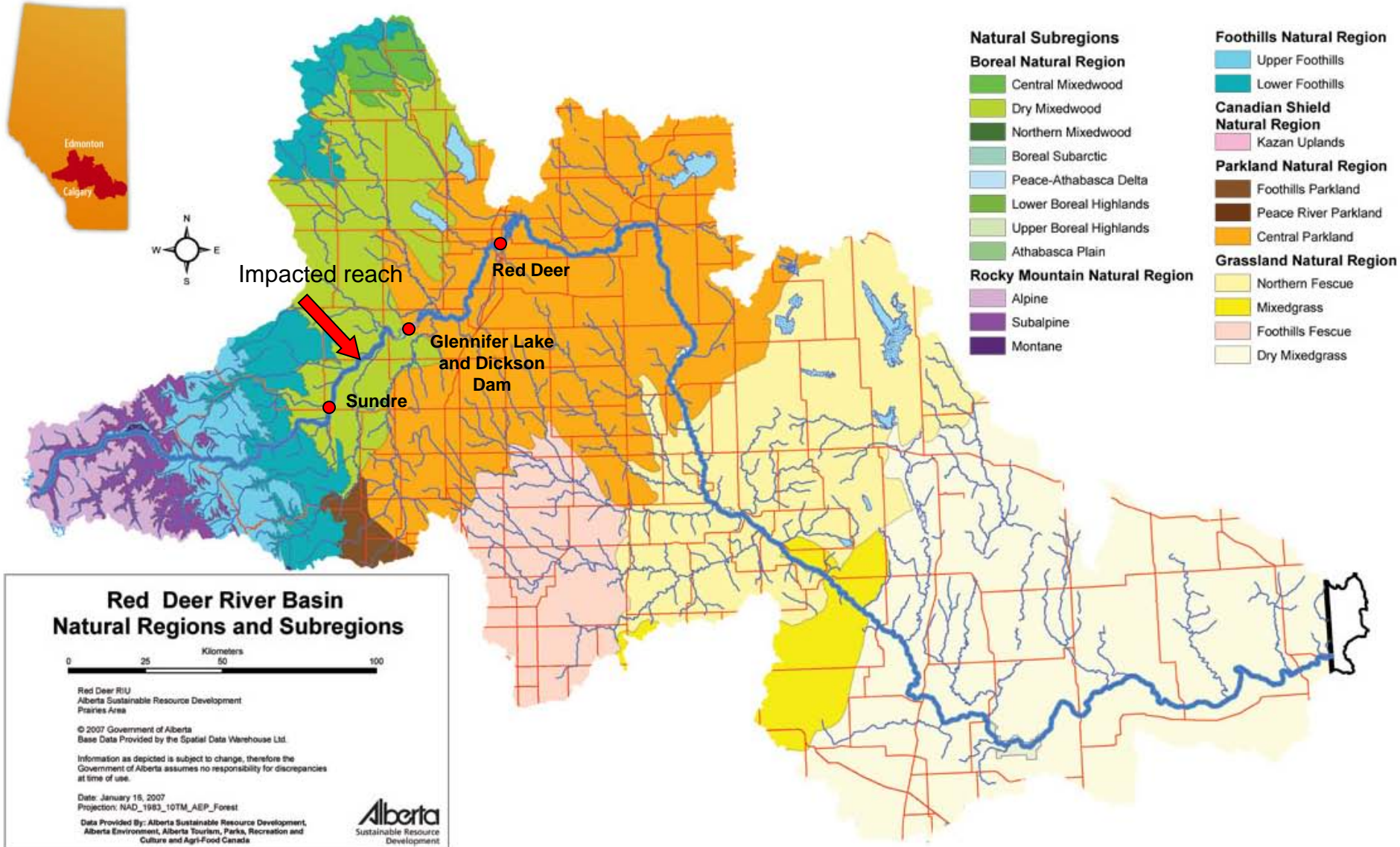
BC Spill Symposium
March 2013

Introduction

- Red Deer River Watershed forms part of the South Saskatchewan Basin
- Flows from Rocky Mountains to the Alberta Saskatchewan border
- Dickson Dam provides flow stabilization (flood mitigation), limited energy production and steady supply of source water for downstream communities
- Majority of agriculture, industry and population downstream of reservoir

Spill Chronology

- June 7, 2012 pipeline owned by Plains Midstream Canada ruptures and spills ~450,000L of light crude oil to Red Deer River near Sundre
- Emergency Response initiated over June 7 and 8th
- Broken pipeline is fitted with stop valve so no additional product will be released
- Containment boom deployed in Gleniffer Lake/Reservoir to limit movement of surface oil beyond the Dickson dam
- Remediation and Restoration continue to November



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Spill Chronology

- Water quality and wildlife monitoring/mitigation begin June 8, 2012
- Clean-up operations start and focus on containment and recovery of visible free product in the reservoir and on shoreline
- Drinking Water facilities at Carefree and Gleniffer resort are closed
- Downstream of the dam the Anthony Henday and Red Deer Water Treatment plants are monitored

Spill Characteristics

- Visible oil product transported down the river (~40km) and finally stopped by booms at reservoir
- Dissolved product moves into Gleniffer Lake and downstream of reservoir

Two systems and sets of effects:

- 1) upstream soiling/smothering of aquatic organisms, habitat and wildlife
- 2) downstream potential toxic effects from dissolved constituents

Five Pillars of Spill Management

- Prevention
- Planning & Mitigation*
- Response*
- **Recovery and Remediation***
- Restoration and Reclamation*

* Monitoring occurs at both short and long-term scales from Planning (baseline) to Reclamation (closure) stage to assess remediation success and impact/recovery of receptors of concern

Remediation

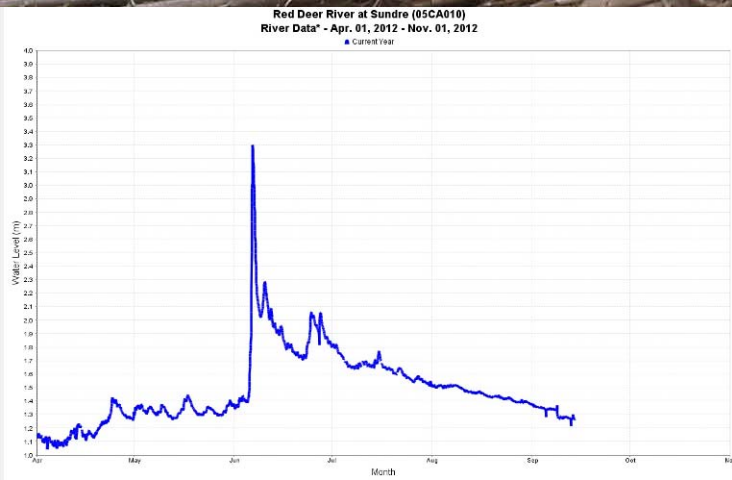
- ESRD requires Environmental Remediation Objectives/Endpoints to be determined concurrent with initial response efforts
- Typically ask for “Specialty Plans” to be developed:
 - *Wildlife Plan (short/long term)*
 - *Water quality, non-fish biota, fish monitoring Plan(s) (short/long term)*
 - ***Shoreline Treatment and Access Plan(s)***
 - *Waste Handling Plan*
 - *Restoration and Reclamation Plan*

Plans are reviewed and approved by the Lead Provincial Agency before implementation

Red Deer River at time of incident

Remediation efforts complicated due to:

- High water level
- Current velocity
- Inaccessible islands
- Slow back channels
- Inundated terrestrial vegetation
- Pooling of product
- Stranded oil and moving woody debris
- Increasing reservoir levels

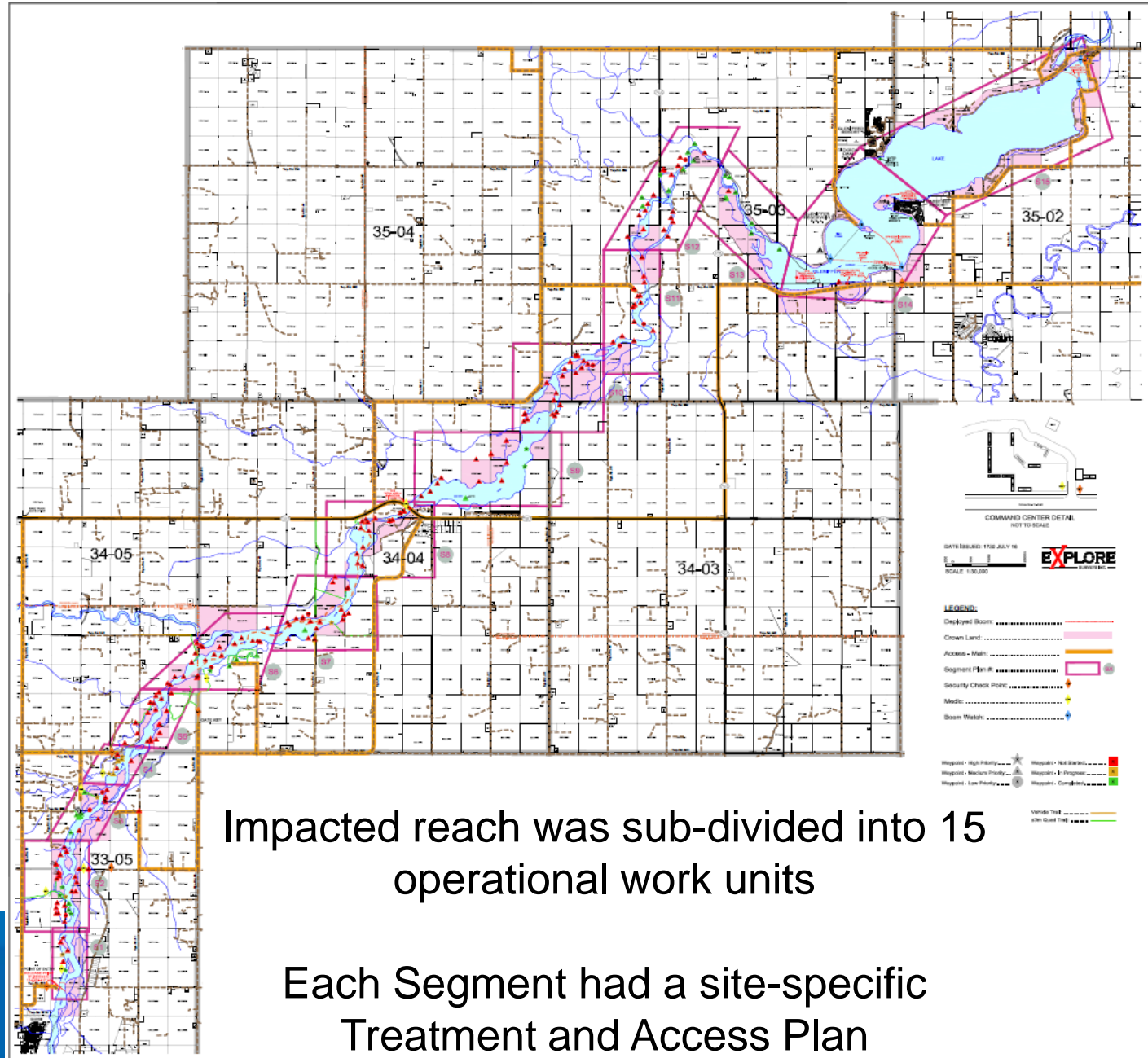


Treatment and Access Plans

- Require accurate delineation and maps of oiling
- Inventory of affected shoreline / habitat type
- Standard categories to describe oiling
- Categories to prioritize treatment
- Treatment Endpoints*
- List of approved treatment technique to be used based on shoreline type
- Designate access trails, crossings, equipment and transport vehicles
- Document clean-up progress

Oil Spill Delineation

- RP delineate location and extent of oil
- Document progress of treatment and priority treatment locations
- Agencies audit/inspect mapped locations for accuracy and achievement of treatment objectives



Develop Standard Semi-Quantitative Oiling Categories

- Allow common understanding when developing treatment work plans
- Provide better understanding of resources required to treat an affected area
- Helps to prioritize work areas based on associated risk

River Shoreline Prioritization

Prioritizing of the shoreline sites for treatment has been ranked high, medium and low. The criteria for assigning priorities are as follows:

High – free product or covered

Medium – coated vegetation or ground surface

Low – staining on vegetation or ground surface

A more detailed breakdown of oil distribution description, based on a 10 m lineal area or a 5 m x 5 m area, is as follows:

C	Continuous	91 - 100%
B	Broken	51 - 90%
P	Patchy	11 - 50%
S	Sporadic	1 - 10%
T	Trace	<1%

Surface Oiling Descriptors - Thickness

PO	Pooled Oil (fresh oil or mousse > 1 cm thick)
CV	Cover (oil or mousse from >0.1 cm to <1 cm on any surface)
CT	Coat (visible oil <0.1 cm, which can be scraped off with fingernail)
ST	Stain (visible oil, which cannot be scraped off with fingernail)
FL	Film (transparent or iridescent sheen, or oily film)

Shoreline Classification

- Inventory of affected habitats
- Common description of shoreline type
- Vegetation/terrain that will be encountered
- Helps to identify operational needs and hazards

	River Shoreline Type	Description
1	Sand or Mixed Sand/Gravel/Pebble/Cobble	Sand or mixed sand/gravel/pebble/cobble sediments, with fine sediments filling interstitial spaces; includes ditches, side channels, oxbows, etc.
2	Natural Cobble/Boulder	Sediments that have a mean diameter of >6.4 cm (i.e., little or no sand); includes point bars and mid-channel bars.
3	Manmade Cobble/Boulder, Riprap, or Concrete	For cobble, mean diameter of >6.4cm (i.e., little or no sand); includes boat ramps (if present), bridge abutments, and any other impermeable man-made surfaces.
4	Steep Mixed Sediments Bank	Steeply sloped bank along main channel (high water velocity); little or no walkable shoreline.
5	Vegetated Cut Bank with Fine Mixed Sediments	Vegetation and soil that form a low cut bank at the high-water level. May include oiled brush or tree branches overhanging the shore zone and exposed oiled roots.
6	Vegetated Flat with Fine Mixed Sediments	Vegetated (e.g., grasses, sedges, shrubs, etc.) shallow ditches or braided channels within the floodplain that may have sand/mud sediments exposed between the plants. May be wetted, have sediments saturated with water, or be dry depending on river stage.
7	Shallow Delta Marsh	Vegetated areas at the inlet to Gleniffer Lake that are typically covered with water, but periodically exposed depending on water level fluctuations; declining water levels expose submergent aquatic vegetation or decomposing terrestrial vegetation, mudflats or silt beds; emergent vegetation includes grasses, cattails, sedges, rushes, and reeds.
8	Willow Stands	Willow stands within the floodplain. May be wetted or have sediments saturated with water depending on river stage.
9	Wetland Fringe	Cat-tails, sedges, or grasses at the river edge that form the shore zone and may have sand/mud sediments exposed between the plants.
10	Woody Debris	Woody debris typically with >10cm stem diameter, but includes smaller branches, particulate wood, pine needles, peat (by-product of the unapproved application of peat as sorbent during the emergency phase of the response), etc. May be distributed along shoreline, or in the form of log dams or beaver dams.

Treatment Endpoints

Developed to address the balance between environmental, economic and social impacts

Net Environmental Benefit is guiding principle in determining endpoints and recognizes that some oil will remain and naturally attenuate

Critical to a timely and focused remediation effort

- Environmental – wildlife (aquatic, semi-aquatic, terrestrial, avian); habitat (forage, rearing, refuge, spawning and mating), human (contact, ingestion, inhalation)
- Economic – tourism, stock watering, source water quality, clean-up efficiency, closure, property value
- Social – recreation, quality of life, access, noise and traffic

Develop Quantitative Endpoint Criteria by Shoreline Type

- Easily measureable
- Reduce risk/impact to receptors of concern (Environmental, Economic, Social)
- Achievable
- Net Environmental Benefit

	River Shoreline Type	Treatment Endpoint Criteria
1	Sand or Mixed Sand/Gravel/Pebble/Cobble	Stain (<0.01cm thick) and <20% distribution; stain is non-sticky, odourless, with no associated sheen
2& 3	Natural Cobble/Boulder & Manmade Cobble/Boulder, Riprap, or Concrete	Stain (<0.01cm thick) and <20% distribution; stain is non-sticky, odourless, with no associated sheen
4	Steep Mixed Sediments Bank	Non-sticky Coat (<0.1cm thick) and <20% distribution
5	Vegetated Cut Bank with Fine Mixed Sediments	Non-sticky Coat (<0.1 cm thick) and < 10% distribution on cut bank and over hanging vegetation. Non-sticky Coat (<0.1 cm thick) on larger tree roots. Sediments no visible surface oil
6	Vegetated Flat with Fine Mixed Sediments	Vegetation: non-sticky Coat (<0.1 cm thick). Sediments: no visible surface oil
7	Shallow Delta Marsh	Vegetation: non-sticky Coat (<0.1 cm thick). Sediments: no visible surface oil
8	Willow Stands	Non-sticky Coat (<0.1 cm thick)
9	Wetland Fringe	Non-sticky Coat (<0.1 cm thick).
10	Woody Debris	Stain (<0.01cm thick); stain is non-sticky, odourless, with no associated sheen

Treatment Techniques

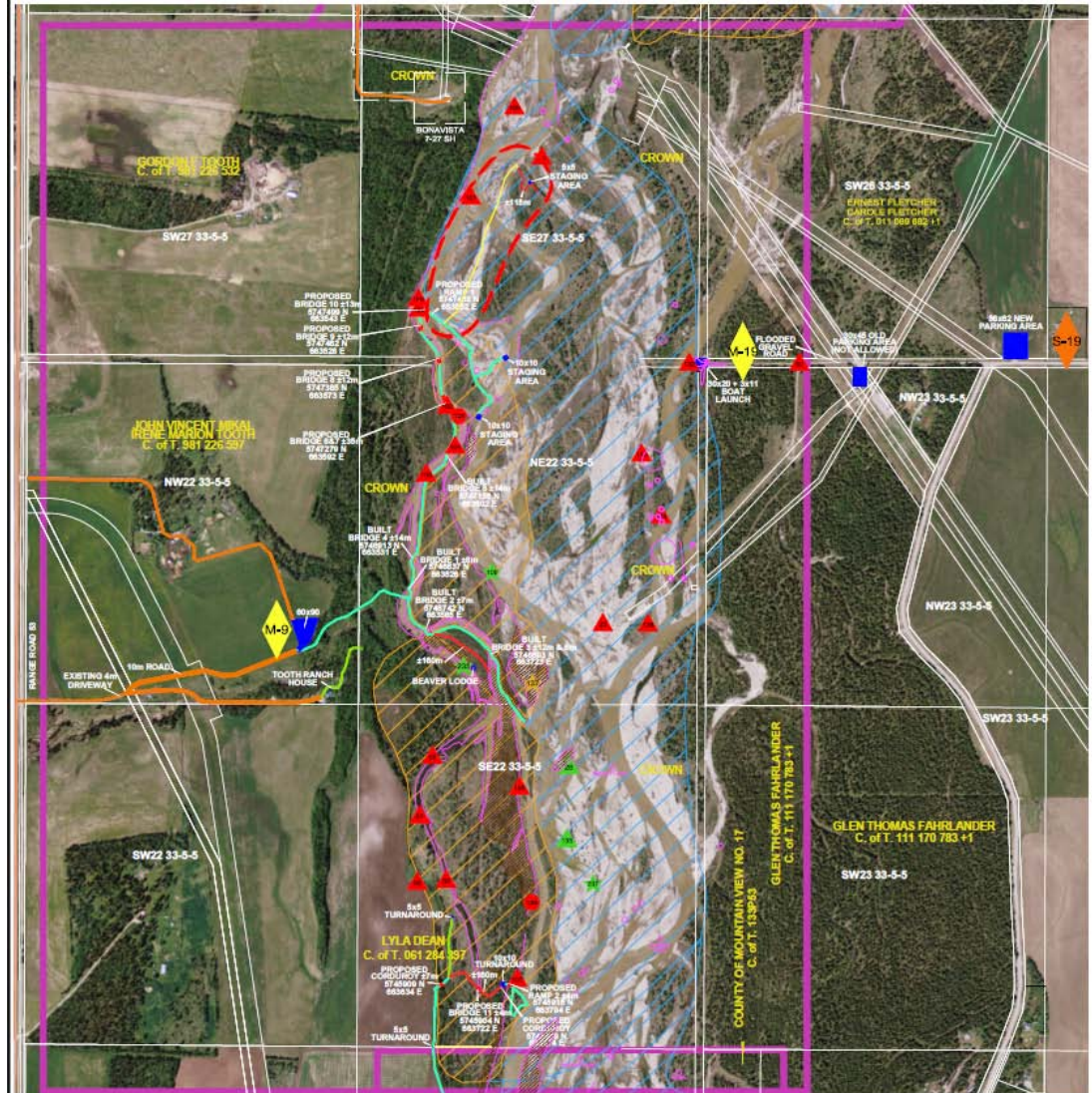
- Fixed to ensure that remediation efforts do not further impact affected areas
- treatment is specific to shoreline type
- less aggressive treatment techniques are preferred
- contingencies/approval required to apply other techniques

	River Shoreline Type	Treatment Technique
1	Sand or Mixed Sand/Gravel/Pebble/Cobble	Use hand-tools (e.g., rakes, shovels) to collect oiled debris and remove just the oiled surface sediment and debris. Limit the amount of clean sediment removed. Do not remove more than a 5-cm layer
2 & 3	Natural Cobble/Boulder & Manmade Cobble/Boulder, Riprap, or Concrete	Manually wipe with sorbent pad, brushes, or other manual methods to remove gross oiling. If oiling cannot be removed using the above methods, additional techniques and options would be evaluated as needed (e.g., removal with/without replacement, water flushing, natural recovery, etc.)
4	Steep Mixed Sediments Bank	Where safely accessible, manually wipe with sorbent pad, brushes, or other manual methods to remove gross oiling, or use hand-tools to collect oiled debris and remove just the oiled surface sediment and debris. If oiling cannot be removed using the above methods, additional techniques and options would be evaluated as needed (e.g., removal with/without replacement, water flushing, natural recovery, etc.) Do not remove more than a 5-cm layer.
5	Vegetated Cut Bank with Fine Mixed Sediments	<p>If only vegetation (e.g. grasses) is oiled, then cut vegetation and collect. Cut bank vegetation no more than 10 cm</p> <p>If oil is on a fine sediment bank then use shovels to cut the oiled bank and remove as little unoiled bank as possible. Do not remove more than a 5-cm layer.</p> <p>If exposed tree/shrub stems and roots are oiled, wipe with sorbent pad, brushes, or other manual methods to remove gross oiling. If gross oiling cannot be removed using the above methods, additional techniques and options would be evaluated with ESRD as needed (e.g., cut-out affect roots, etc.)</p>
6	Vegetated Flat with Fine Mixed Sediments	Cutting of stems with oiling greater than a Coat. On fine mixed sediments, manually remove sediment with hand-tools without entering water saturated sediments (e.g., by using portable boardwalks). Do not remove more than a 5-cm layer of sediment/soil. If wetted: deploy wildlife deterrents to haze or discourage use during rehabilitation; stranded fish in wetted areas with oil will be relocated to the Red Deer River main stem. ESRD should be contacted to give specific instructions if questions arise during treatment
7	Shallow Delta Marsh	Cutting of stems with oiling greater than a Coat. On mudflats, manually remove sediment with hand-tools without entering the sediment (e.g., by using portable boardwalks). Do not remove more than a 5-cm layer of sediment/soil. ESRD should be contacted to give specific instructions if questions arise during treatment.
8	Willow Stands	Manually wipe with sorbent pad or other manual methods to remove gross oiling. If oiling cannot be removed using the above methods, additional techniques and options would be evaluated as needed (e.g., manual removal, natural recovery, cutting, flushing etc.). ESRD should be contacted in the event more aggressive techniques are required to minimize ongoing impacts to wildlife.
9	Wetland Fringe	Cutting of stems with oiling greater than a Coat at surface water or alternatively sediment interface if standing water is not present.
10	Woody Debris	If endpoint exceeded, remove affected debris through either manual (for small stem diameter, particulate, peat) or mechanical (for larger logs/trees) techniques.

*Applying Peat as an absorbent to oiled shoreline features is not an approved treatment technique and will require special approval for use in this Segment. Peat applied during the emergency response will be removed were possible such that Treatment Endpoints in the segment can be evaluated by the Shoreline Assessment Team.

Detailed Access and Treatment Plans

- Limit access to defined areas
- Establish staging areas and decontamination sites
- Water crossing location (bridge, wading, fording)
- Oil location, priority and progress
- Identify affected land owners / lease holders
- List high risk wildlife habitat or animal location



Total Length of Proposed ATV Trail (New Cut): ±160m

Amendment 3 Totals

Total Length of Proposed Walking Trail (Existing Cut): ±426m

Total Length of Proposed Walking Trail (New Cut): ±115m

Total Area for Staging Area: 0.003 ha (0.01 ac)

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LEGEND:

Waypoint - High Priority:
Waypoint - Medium Priority:
Waypoint - Low Priority:
Waypoint - Not Started:
Waypoint - In Progress:
Waypoint - Completed:



Vehicle Trail:
Existing ±3m ATV Trail:
Proposed ±3m ATV Trail (Existing Clearing):
Proposed ±3m ATV Trail (New Cut):
Walking Trail:

Segment Boundary:
Security Check Point:
Medic:
Boom Watch:

Staging Area:
Oil Area:
Helicopter Access:
Foot Access:
Boat Access:



Staging debris for removal



Vegetation removal / standing oil recovery



Stinger – accelerates release of trapped oil in sediments and coarse woody debris



Vegetation removal / skimmers

Coffer dam



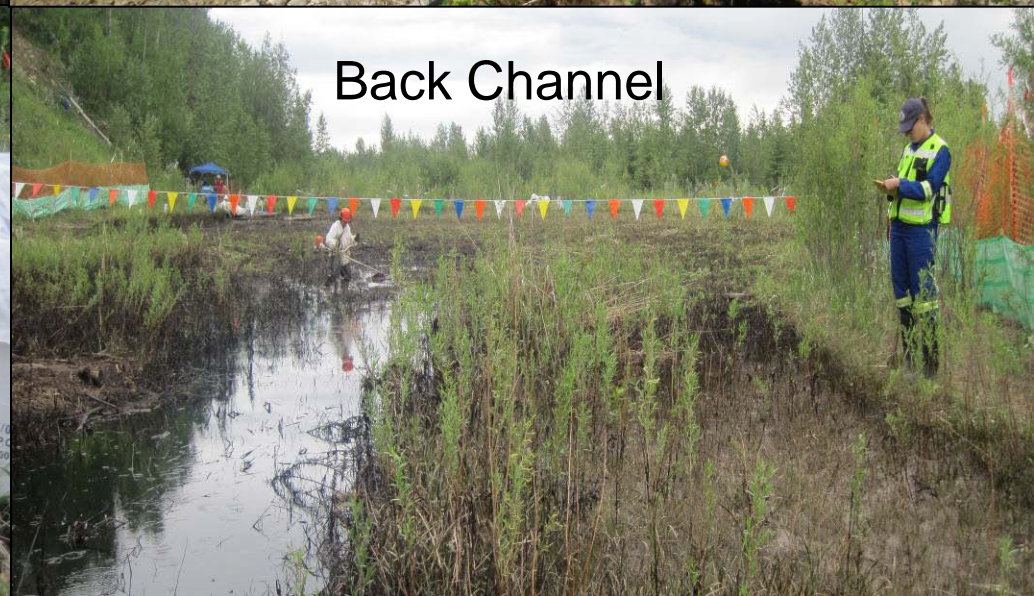
Reservoir



Beaverdam



Back Channel





Removing oiled
woody debris



Reservoir debris removal



Standing oil recovery

Work Plans and Progress Reports

- Provide accurate clean up progress reporting to Agencies and stakeholders

- Direct support to Operations

- Allow for more detailed site-specific work plans (crew size, equipment, etc)

		Plains Midstream Canada - MP 212						
Completed Work Plans								
In Progress								
Completed								
		High Priority Sites						
Waypoint	Zone	Easting	Northing	Shoreline Type	Work Plans	In Progress	Completed	Tentative Completion Date
106	11U	663719.00 m E	5746886.00 m N	1, 10				31-Jul-12
235	11U	663660.00 m E	5746662.00 m N	6, 10				31-Jul-12
		Medium Priority Sites						
Waypoint	Zone	Easting	Northing	Shoreline Type	Work Plans	In Progress	Completed	Tentative Completion Date
26	11 U	663916 m E	5746432 m N	1, 2				31-Jul-12
100	11U	663732.00 m E	5747983.00 m N	1				31-Jul-12
101	11U	663637.00 m E	5747767.00 m N	1				31-Jul-12
102	11U	663599.00 m E	5747272.00 m N	5				31-Jul-12
104	11U	663621.00 m E	5747178.00 m N	5				31-Jul-12
105	11U	663555.00 m E	5747110.00 m N	5				31-Jul-12
107	11U	663813.00 m E	5745927.00 m N	2,5				31-Jul-12
110	11U	664062.00 m E	5747176.00 m N					31-Jul-12
24	11 U	663801.80 m E	5747867.96 m N					31-Jul-12
25	11 U	663985.65 m E	5746773.49 m N					31-Jul-12
56	11U	663637.00 m E	5746154.00 m N					31-Jul-12
57	11U	663569.00 m E	5746304.00 m N	9				31-Jul-12
58	11U	663594.00 m E	5746445.00 m N					31-Jul-12
59	11U	663569.00 m E	5746147.00 m N	6,9,10				31-Jul-12
60	11U	664427.00 m E	5747403.00 m N					31-Jul-12
132	11U	664166.58 m E	5747393.99 m N					31-Jul-12
133	11U	663918.25 m E	5746259.91 m N	2,10				31-Jul-12
134	11U	663523.95 m E	5747498.22 m N	1,5				31-Jul-12
135	11U	664112.93 m E	5747032.24 m N					31-Jul-12
136	11U	664091.70 m E	5746775.07 m N					31-Jul-12
137	11U	663833.39 m E	5746478.87 m N	1,10				31-Jul-12
138	11U	663802.08 m E	5746379.89 m N	1,6,10				31-Jul-12
186	11U	663521.00 m E	5747523.00 m N	2				31-Jul-12
		Low Priority Sites						
Waypoint	Zone	Easting	Northing	Shoreline Type	Work Plans	In Progress	Completed	Tentative Completion Date
103	11U	663627.00 m E	5747251.00 m N	5				31-Jul-12
139	11U	663840.87 m E	5746110.55 m N	5				31-Jul-12

Interim Closure

- Multi–agency evaluation of each Segment to assess achievement of endpoint criteria
- Continue long-term monitoring program to assess impact to receptors of concern
- Transition to Reclamation Phase at work site areas (removal of ATV access, stairs, bridges, paths, staging areas, re-vegetation)



June



August



October

Multi-agency Shoreline Treatment Evaluation



Principles

- Multi–agency, stakeholder, and Responsible Party participation
- Responsible Party (RP) and Lead Regulatory Agency should co-lead delivery of Remediation Program
- Regulator approved shoreline classification, treatment endpoints, techniques and access Plans
- Development of Treatment Endpoints are critical to a successful and timely remediation program
- Remediation program must address/balance environmental, social and economic impacts of the release
- Require high resolution spatial delineation of oiling conditions and remediation progress
- Multi-agency assessment of treatment objectives enhance public assurance and consensus on clean-up progress

A wide river with rapids flowing over rocks, with a forested shoreline in the background.

Questions?