CAMP LONELY LANDFILL FEASIBILITY STUDY

November 2006 Presentation

POCs-Bret Berglund, Bill Lawrence, Jessica Adema

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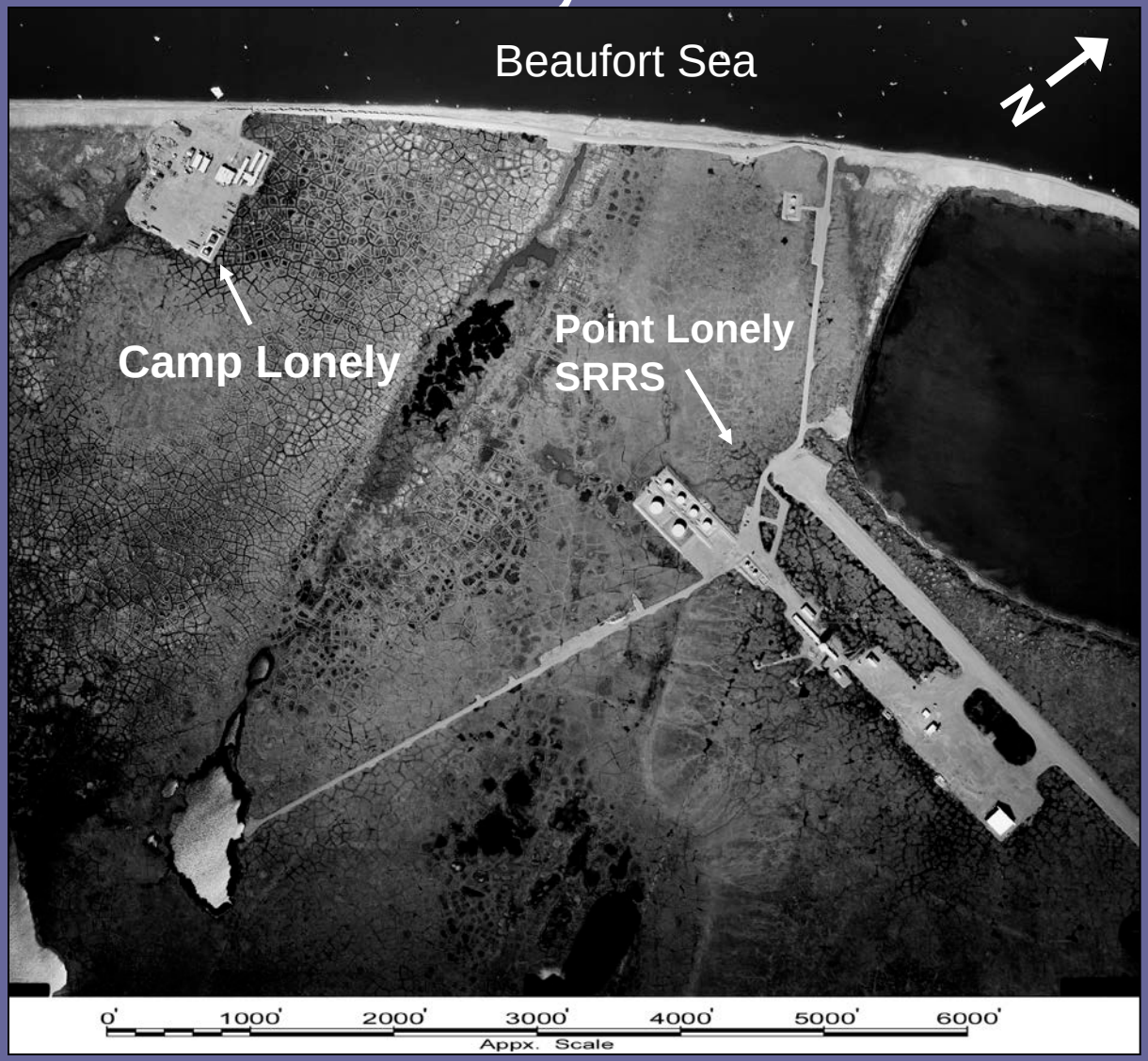
Background

1992 Aerial of Camp Lonely and Point Lonely SRRS



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Camp Lonely 1979, image courtesy BLM

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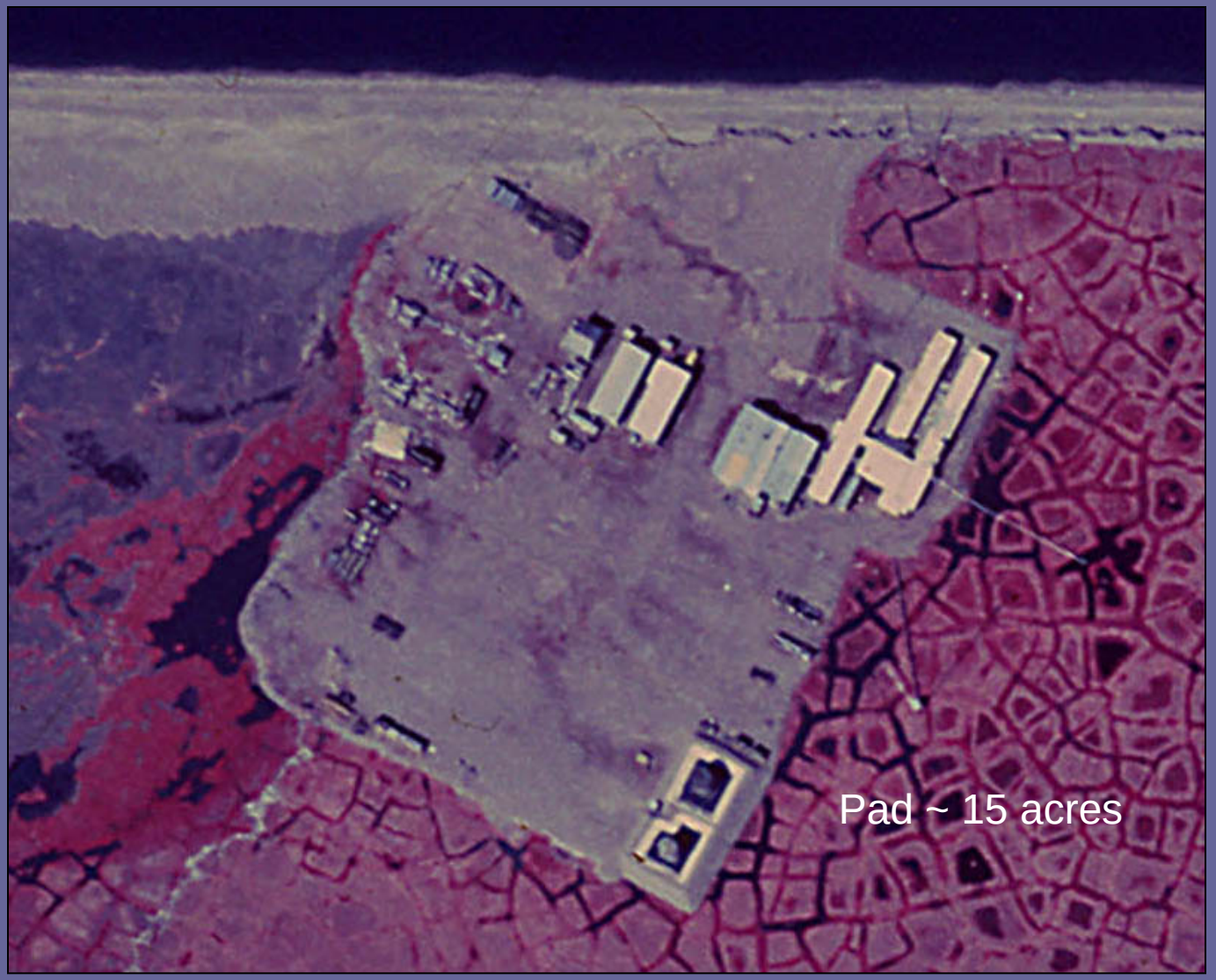
July 2002 Infrared Aerial Photo of Camp Lonely



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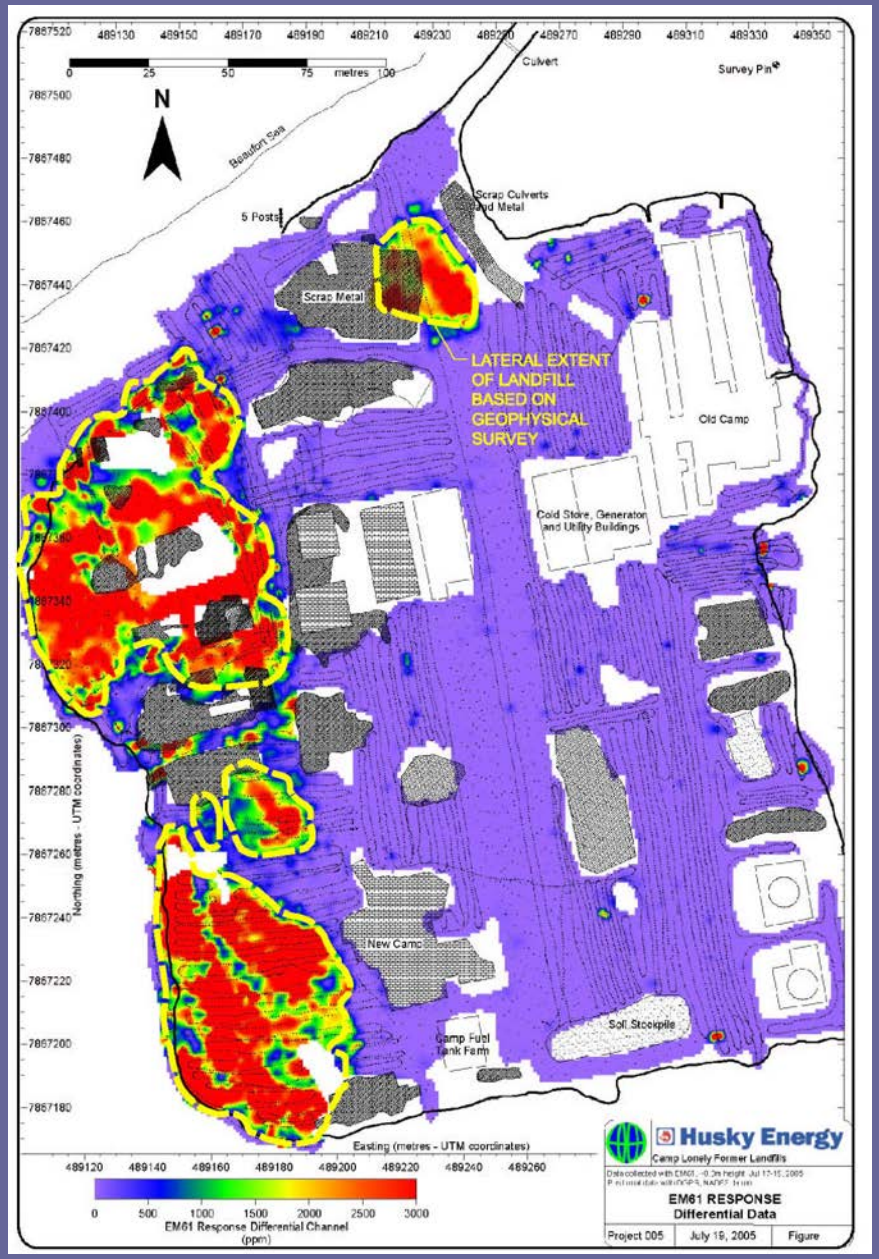
2005 Geophysical Survey



Summer 2005 Test Pits

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Western Side of Pad

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Debris on Western Side of Pad

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Test Pit 18

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Test Pit 38

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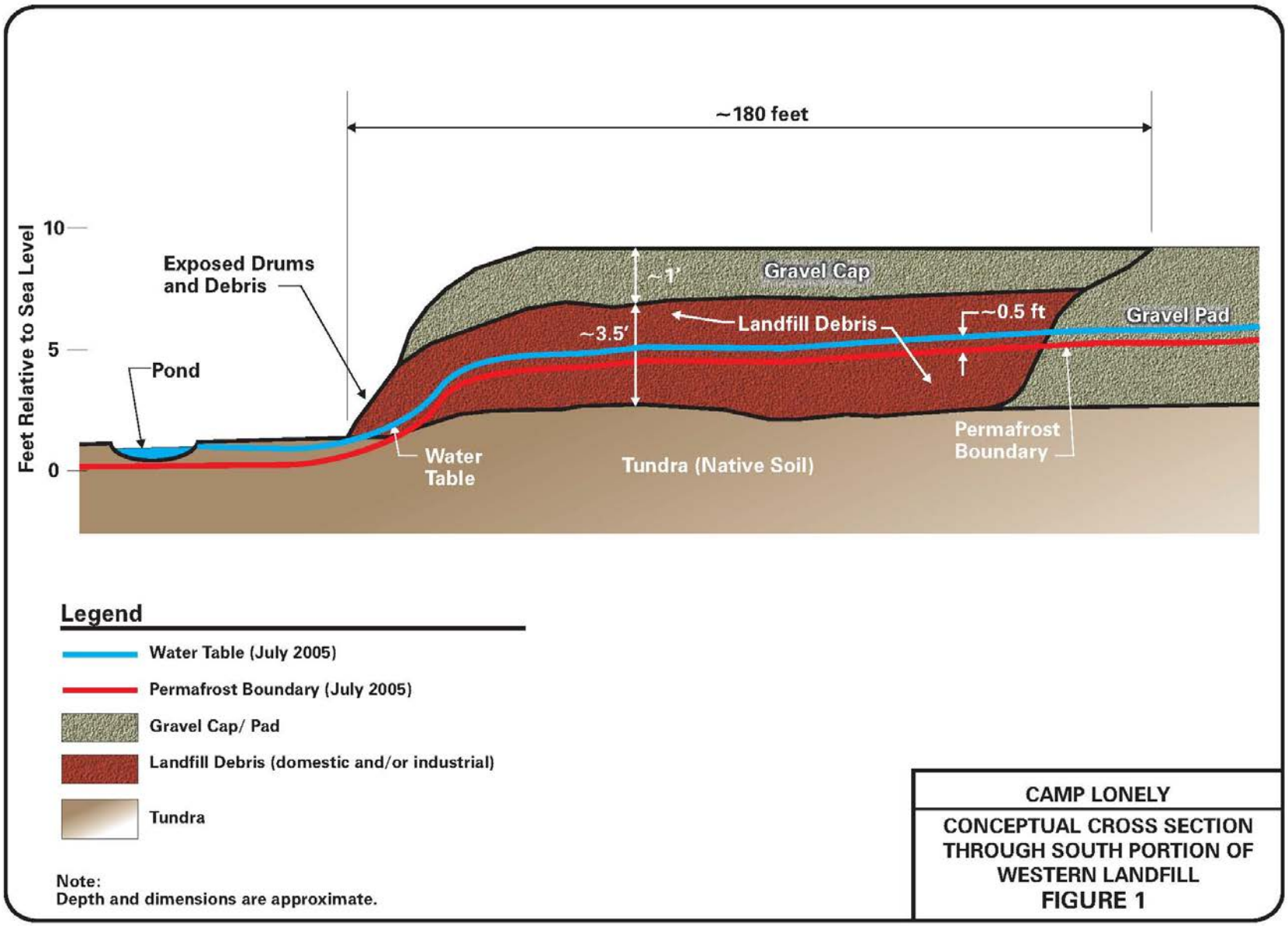
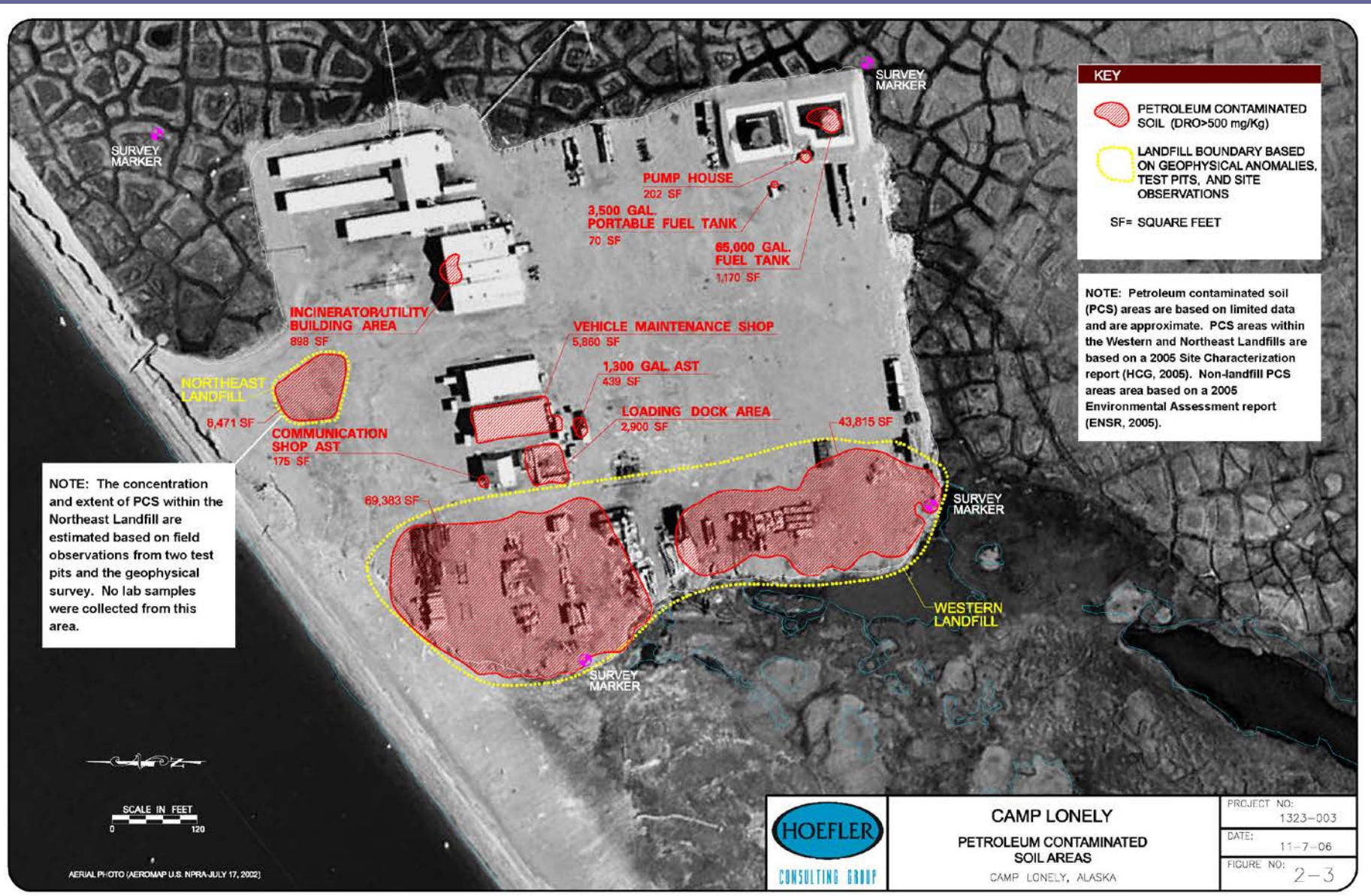
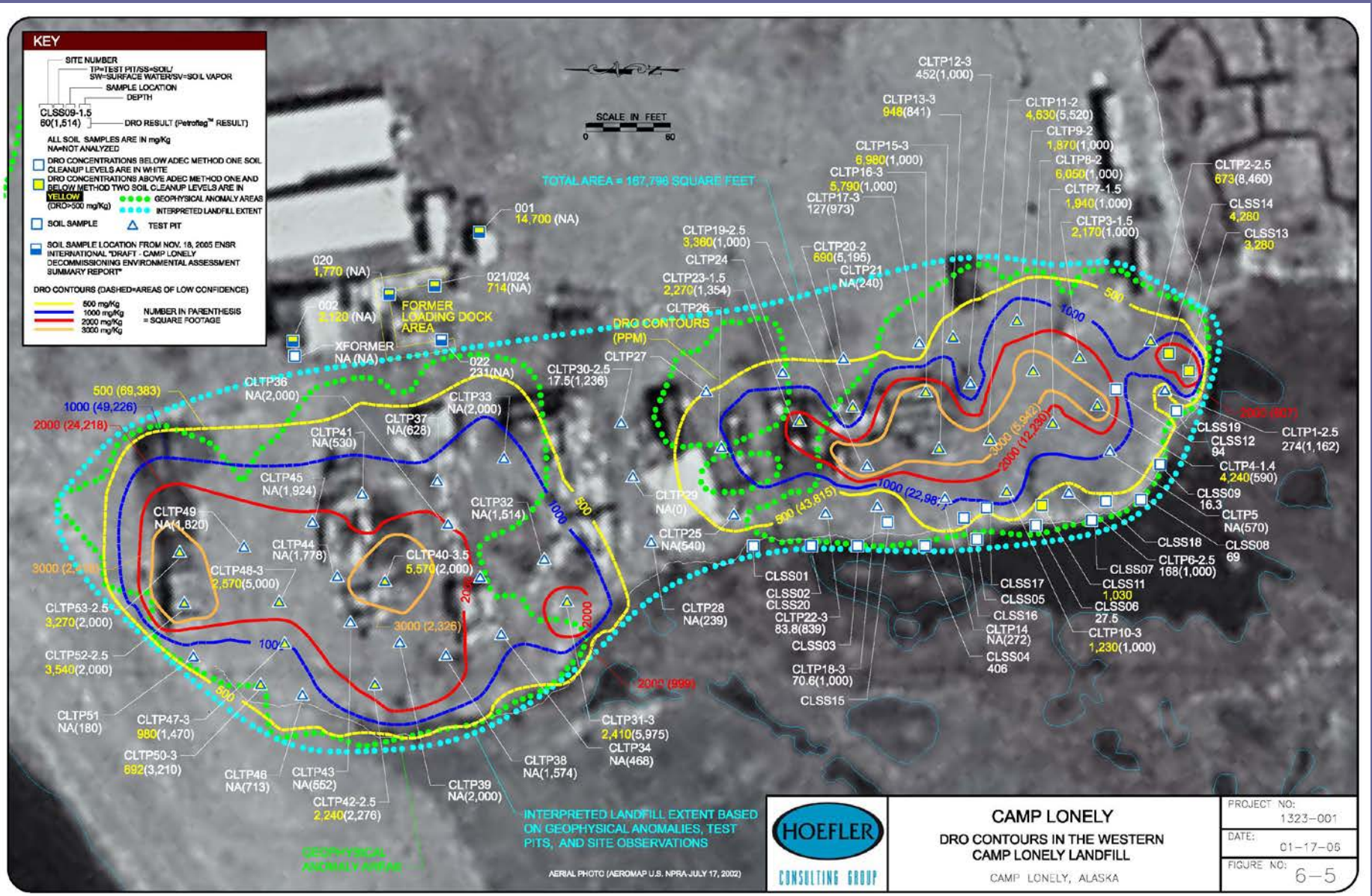
Cross-Section of Landfill



Camp Lonely Areas of Concern



Western Landfill -DRO Contours



2006 Water Sample Results

- Elevated BTEX detected in pore water of pad (well point samples)
- Downgradient surface water samples exceeded Alaska Water Quality Standards (AWQS) for benzene and Total Aqueous Hydrocarbons (TAH = Total BTEX)
- Results imply offsite migration of petroleum hydrocarbons is impacting surface water
- Elevates concern and need for action (current risk higher than assumed based on 2005 data)

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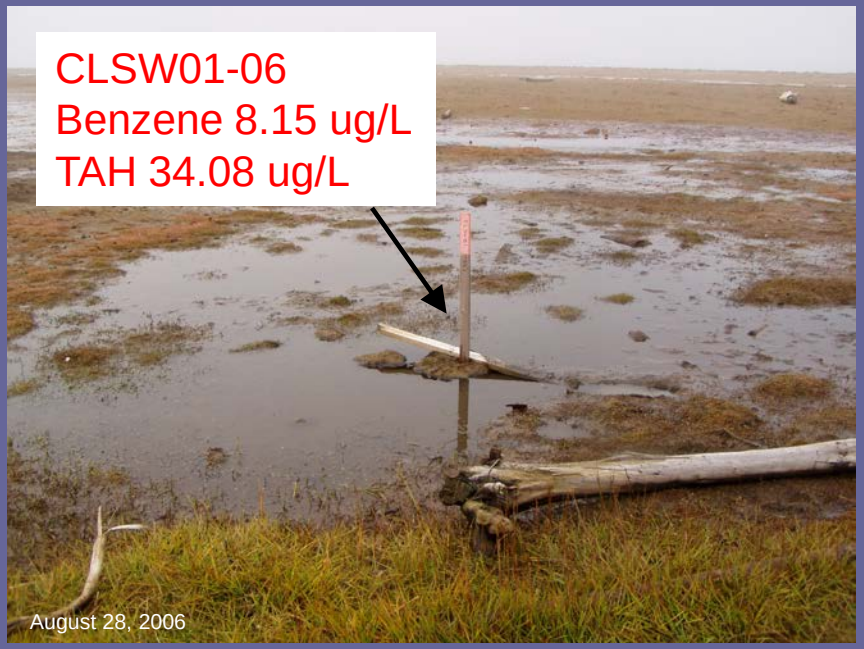
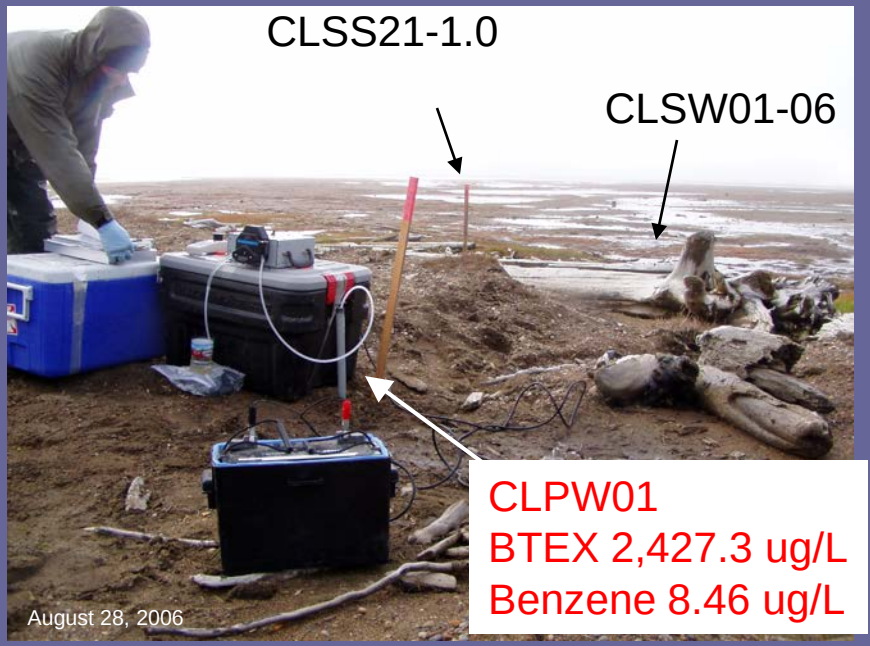
Camp Lonely 2006
Pore Water and Surface Water Sampling



Facing west.



Sampling pore water (looking west).

<u>AWQS (18 AAC 70)</u>
Benzene = 5 ug/L
TAH (total BTEX) = 10 ug/L

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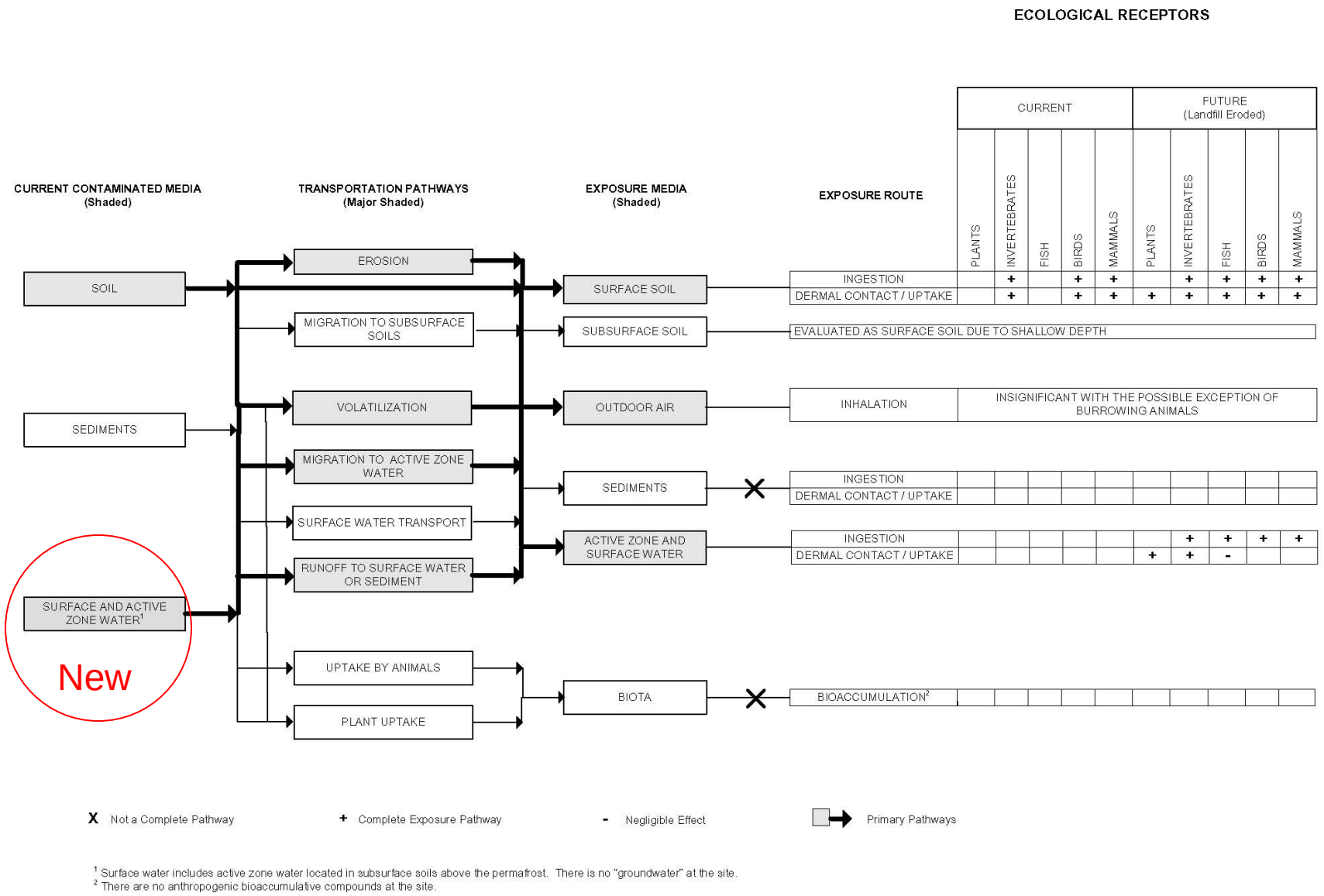
Water Sample Results

Ecological Conceptual Site Model



[1] Surface water includes active zone water located in subsurface soils above the permafrost. There is no "groundwater" at the site.
[2] There are no anthropogenic bioaccumulative compounds at the site.

Cleanup Levels

- What cleanup levels will be protective of human health and the environment, and acceptable to ADEC?
  - ADEC is generally advocating Method One cleanup levels (non-risk based cleanup levels) for sites with petroleum contaminated soil threatened by erosion, but should allow higher levels provided surface water is protected.
  - Method Two cleanup levels are conservative risk based cleanup levels (residential cleanup standards) which meet ADEC risk management standards (cancer risk of 1 in 100,000 and Hazard Index of 1)

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Summary of ADEC Cleanup Levels for Petroleum Hydrocarbons in the Arctic Zone

Petroleum Hydrocarbon	Method One Cleanup Level (mg/Kg)	Method Two Cleanup Level (mg/Kg)[1]
Gasoline Range Organics (GRO)	100	1,400
Diesel Range Organics (DRO)	200 to 500[2]	12,500
Residual Range Organics (RRO)	2,000	13,700

Notes:

[1] The lowest cleanup level for both ingestion and inhalation exposure pathways is listed for each petroleum hydrocarbon. In the arctic, the Method Two cleanup level must be demonstrated to be protective of migration to surface water to be considered appropriate for the site [18 AAC 18 75.340 (b)].

[2] 18 AAC 75.341 (Table A2) lists both 200 mg/Kg and 500 mg/Kg cleanup levels for DRO. Total BTEX must be < 15 mg/Kg for the the 500 mg/Kg cleanup level to be applicable.

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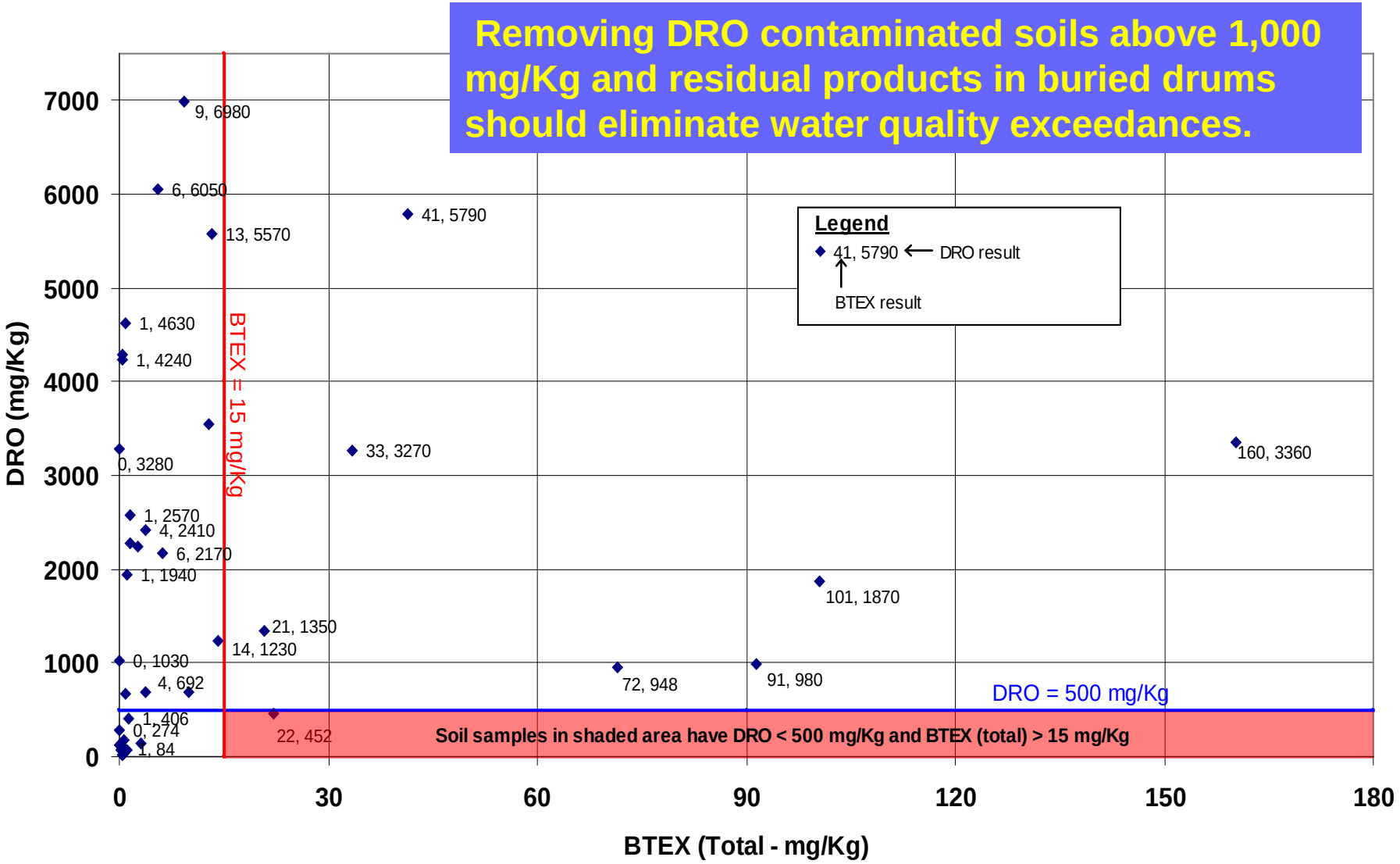
DRO vs. total BTEX in Camp Lonely Soil Samples



Note: BTEX exceeded 15 mg/Kg in 8 out of 33 samples. Only one sample with DRO < 500 mg/Kg had BTEX > 15 mg/Kg. Elevated BTEX tends to be associated with DRO concentrations > 1000 mg/Kg.

Source of Data: 2005 Site Characterization (HCG 2005)

Petroleum Sheens

- Past studies have demonstrated petroleum sheens pose little ecological or human health risk. However, their presence violates AWQS.
- Surface sheens are currently not being generated; however, in the future, eroding contaminated soil could cause sheens.
- Petroleum sheens are likely to be generated at a DRO soil concentration of around 500 mg/Kg (ball park!)

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Petroleum Sheens (continued)

- Therefore, a remedial objective is to prevent soils with DRO in excess of 500 mg/Kg from coming in contact with surface water
- Landfill soils are unlikely to undergo significant erosion in the next 10-15 years (longer if the shoreline is stabilized or for interior portions of the pad).
- Petroleum will naturally degrade during this period (especially if located near the surface and not water saturated).
- A higher DRO cleanup level (e.g.,1,000 mg/kg) should be protective of surface water provided soils are not in direct contact with surface water.

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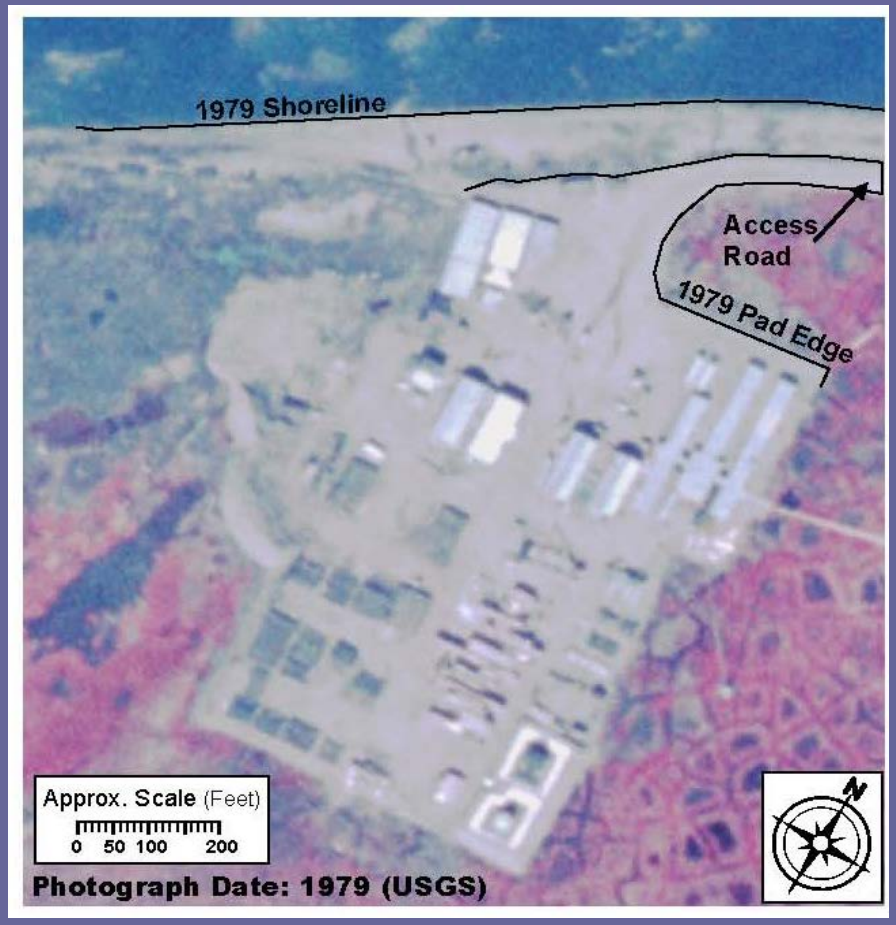
Shoreline Erosion 1979-2002



Note: Shoreline position and scale are approximate.

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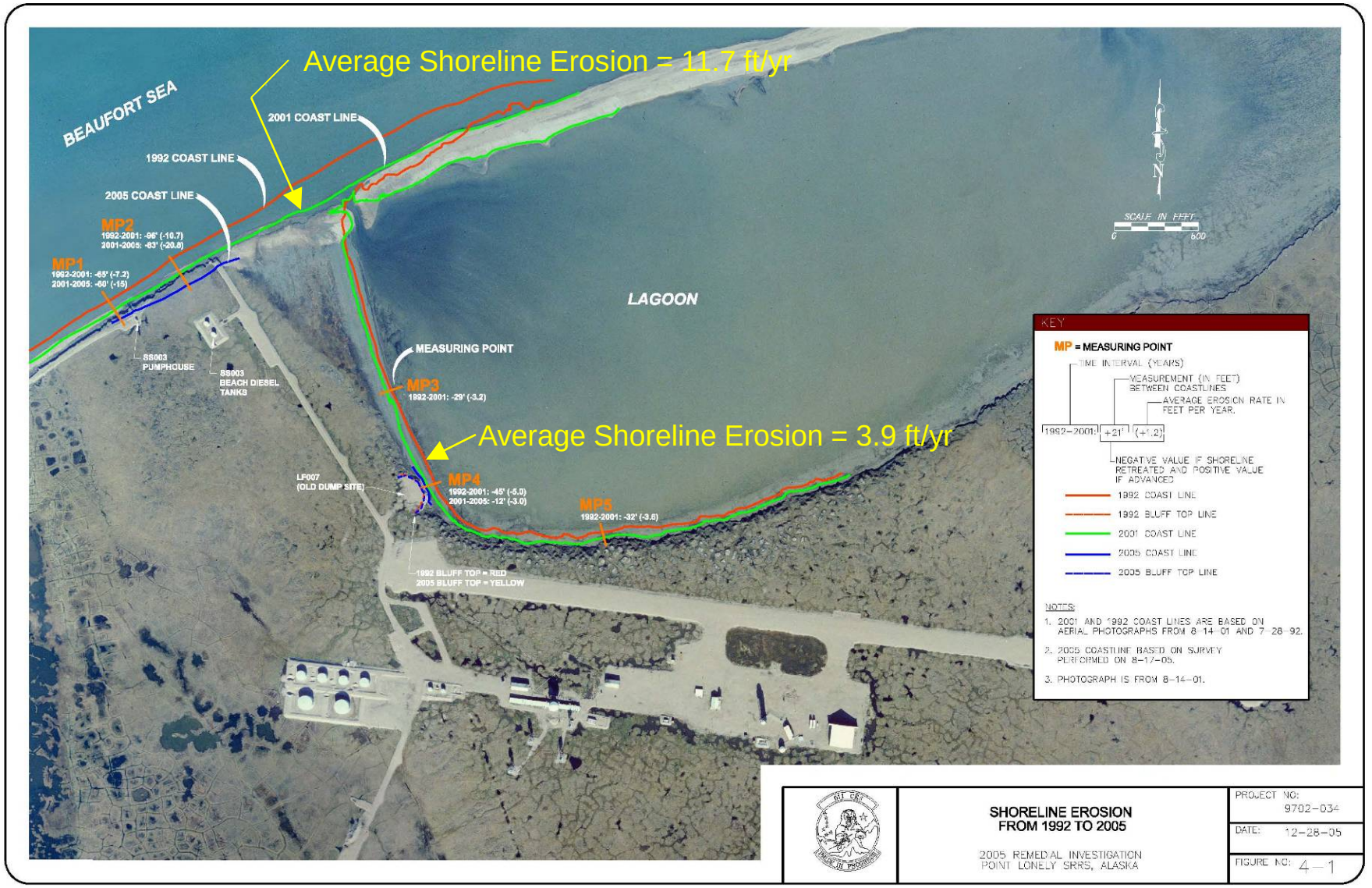
Shoreline Erosion at Point Lonely SRRS



Point Lonely Shoreline Erosion – Outer Beach Area

Shoreline north of the beach diesel tanks. The bluff is actively eroding as evidenced by the slumping and faulting. The lack of peat and fine-grained sand on the beach indicates coastal waves rapidly remove the eroding material.

View of shoreline looking east. Note thermokarst cracking, and block faulting and debris flow along the bluff.

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Point Lonely 2002 Storm

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Camp Lonely – Beach Bordering Landfill

Note lack of coastal bluff. Well developed beach dissipates wave energy.

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Contaminants of Concern

Matrix	COCs	2005-2006 Maximum Concentration (mg/Kg)	Basis for Concern (or Exceedance)			Preliminary Remediation Goals (PRGs) used for FS
			Regulatory Standard and/or Screening Criteria (mg/Kg)	Citation	Frequency of Exceedance of Screening Criteria out of Total Samples	
Soil	GRO[1]	930	100	18 AAC 75.341, Table A2	9/30	<u>Cleanup Levels Evaluated for Soil</u> a) DRO = 500 mg/Kg b) DRO = 1,000 mg/Kg c) DRO = 2,000 mg/Kg <u>Water</u> None
	DRO[1]	6,980	500 (200)[2]	18 AAC 75.341, Table A2	27/39	
	RRO[1]	31,200	2,000	18 AAC 75.341, Table A2	5/39	
	Total xylenes	134.1	81	18 AAC 75.341, Table B1	1/30	
	Chromium	6,010	Cr^{6+} 410 (Cr^{3+} 200,000)	18 AAC 75.341, Table B1	3/17	
Water	Benzene	8.15 ug/L	5 ug/L	18 AAC 70	2/5	
	Toluene	5.96 ug/L	1,000 ug/L	18 AAC 70	0/5	
	Ethylbenzene	2.86 ug/L	700 ug/L	18 AAC 70	0/5	
	Total xylenes	17.11 ug/L	10,000 ug/L	18 AAC 70	0/5	
	TAH	34.08 ug/L	10 ug/L	18 AAC 70	2/5	

Notes

1 No samples exceeded ADEC Method Two cleanup levels for the Arctic Zone (18 AAC 75.341, Table B2) for GRO, DRO, and RRO of 1,400 mg/Kg, 12,500 mg/Kg, and 13,700 mg/Kg, respectively.

2 The Method One cleanup level for DRO can be raised from 200 mg/Kg to 500 mg/Kg for diesel spills on gravel pads if the total BTEX concentration is < 15 mg/Kg and benzene is < 0.5 mg/Kg.

3 Mercury and glycol were detected in surface water samples in 2005 and are retained as contaminants of potential concern (COPCs). Subsequent sampling in 2005 and 2006 has not detected these compounds.

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Tar-like Material with Elevated Chromium

Maximum concentration of 6,010 mg/Kg. No hexavalent chromium detected.

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Table A-11: Rollup of Camp Lonely Landfill and Non-Landfill Petroleum-Contaminated Soil Volumes at different DRO Soil Concentrations

Soil Classification (Contamination Concentrations)	[1,2] Approximate Total In-Place Soil Volumes Based on Specified DRO Concentration Ranges (yd^3)			[2] TOTAL In-place (Bank) Volume (yd^3)	Percent of Total Volume	[3] Excavated Volume (yd^3)	[4] Weight (Tons)
	Petroleum-Contaminated Soil (DRO ≥ 500 and <1000mg/Kg)	Petroleum-Contaminated Soil (DRO ≥ 1000 and <2000mg/Kg)	Petroleum-Contaminated Soil (DRO ≥ 2000mg/Kg)				
Western Landfill	3,719	3,100	3,453	10,272	86.0%	12,840	16,640
Northeast Landfill	134	112	125	370	3.1%	463	600
Pad (Non-Landfill Areas)	895	382	24	1,301	10.9%	1,626	2,108
Total	**4,748**	**3,593**	**3,602**	**11,943**	**100.0%**	**14,929**	**19,348**
Percent of Total (in-place volume)	**40%**	**30%**	**30%**				
Total (excavated volume yd^3)	**5,935**	**4,492**	**4,502**	**14,929**			

Notes and Assumptions:

[1] Based on the limited amount of analytical data available, estimates of total volumes at any given soil concentration could be off by 40%.

[2] The thickness is assumed to be the same for all contour intervals because there is insufficent data to verically segregate the soils (generally one sample depth per location).
The volumes of contaminated soil estimated for any concentration range from available data could vary significantly from actual.

[3] Excavated volume includes 25% fluff factor.

[4] The soil density is based on the standard density for gravel with sand (Glover, 1996), which is 3,240 lbs/yd [3].
Weight was calculated from the in-place soil volume.

[5] Maximum detected level of DRO in Camp Lonely soil was 6,980 mg/Kg from Test Pit 15.

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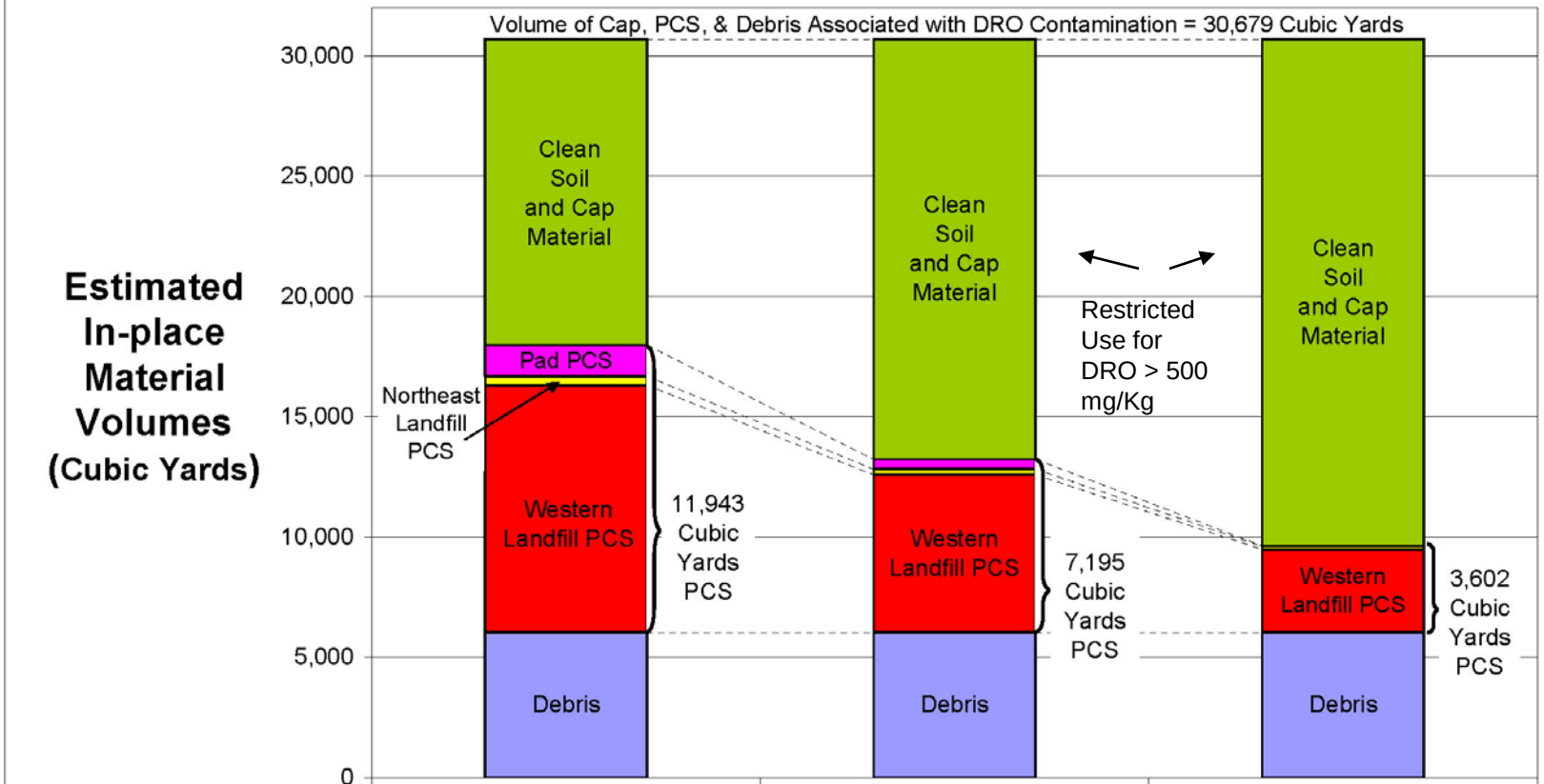
Materials Associated with DRO Contamination at Camp Lonely



	DRO > 500 mg/Kg	DRO > 1000 mg/Kg	DRO > 2000 mg/Kg
Clean Soil and Cap Material	12,709	17,457	21,050
Pad (Non-Landfill Areas) PCS	1,301	406	24
Northeast Landfill PCS	370	236	125
Western Landfill PCS	10,272	6,553	3,453
Debris	6,027	6,027	6,027

DRO Cleanup Limits (mg/Kg) and Associated Volumes of Materials (Cubic Yards)

Key
PCS - Petroleum Contaminated

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Material Volumes

Table A-12: Rollup of Classification and Estimated Volume of Camp Lonely Contents with respect to Potential Cleanup Levels (0 - 4.5 Foot Depth Interval)

Item	Material/Waste	Volumes (yd^3) by Material Type					
		Assuming contaminated soil defined as DRO > 500 mg/Kg		Assuming contaminated soil defined as DRO > 1,000 mg/Kg		Assuming contaminated soil defined as DRO > 2,000 mg/Kg	
		[1] In-place Volume	Percent of Total	[1] In-place Volume	Percent of Total	[1] In-place Volume	Percent of Total
Western Landfill	[2] Clean Soil and Cap Material	11,877	42%	15,596	56%	18,696	67%
	Petroleum Contaminated Soil	10,272	37%	6,553	23%	3,453	12%
	Debris	5,818	21%	5,818	21%	5,818	21%
	SubTotal	**27,966**	100%	**27,966**	100%	**27,966**	100%
Northeast Landfill	[2] Clean Soil and Cap Material	832	59%	966	68%	1,078	76%
	Petroleum Contaminated Soil	370	26%	236	17%	125	9%
	Debris	210	15%	210	15%	210	15%
	SubTotal	**1,412**	100%	**1,412**	100%	**1,412**	100%
[3] Pad (Non-Landfill Areas)	[2] Clean Soil and Cap Material	0	0%	895	69%	1,277	98%
	Petroleum Contaminated Soil	1,301	100%	406	31%	24	2%
	Debris	0	0%	0	0%	0	0%
	SubTotal	**1,301**	100%	**1,301**	100%	**1,301**	100%
CAMP LONELY TOTALS	[2] Clean Soil and Cap Material	**12,709**	41%	**17,457**	57%	**21,050**	69%
	Petroleum Contaminated Soil	**11,943**	39%	**7,195**	23%	**3,602**	12%
	Debris	**6,027**	20%	**6,027**	20%	**6,027**	20%
	TOTAL	**30,679**	100%	**30,679**	100%	**30,679**	100%

Notes and Assumptions:

[1] Areas used to calculate In-place volumes are based on geophysical anomalies mapped in 2005, test pits, and site observations.

[2] 1 to 2 feet of fill material "Cap" covers the existing landfill areas. A thickness of 1 foot is a conservative estimate. This material is classified as "clean" soil for cost estimating purposes, although small localized areas of contamination are present.

[3] In-place volumes are those estimated by ENSR in 2005 for soil having DRO concentrations exceeding ADEC Method One Cleanup Levels. (see ENSR, Nov.18, 2005 report)

[4] Volume calculations are based on adding the appropriate items from the referenced table(s).

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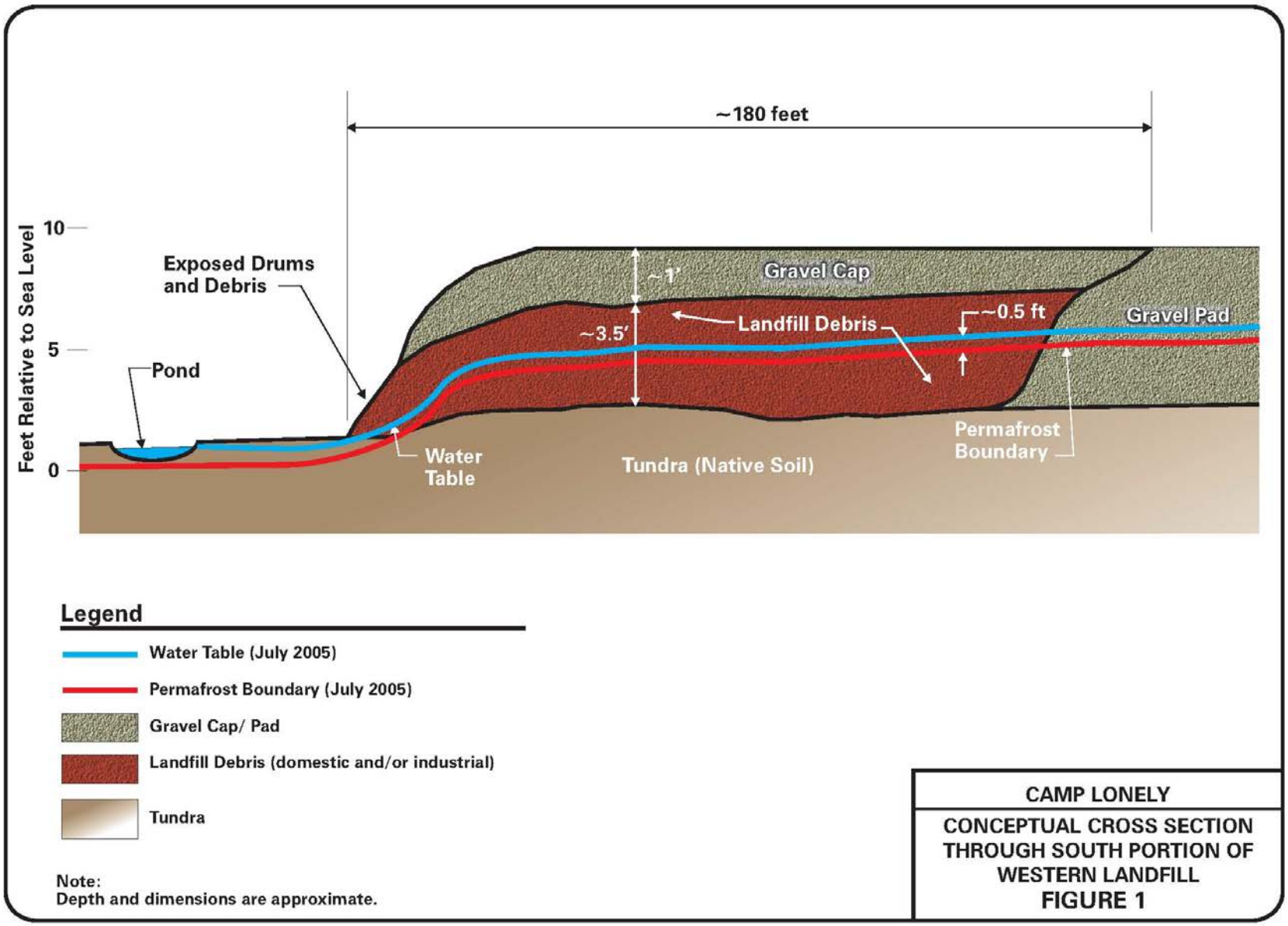
Feasibility Study

Cross-Section of Landfill



Evaluation of Landfill Removal Alternatives

Remedial Action	Threshold Criteria	Balancing Criteria		Comments	Cumulative Evaluation Result
	Effectiveness	Implementability	Relative Cost		
No Action				Fails Threshold Criteria	Fails
Institutional Controls				Fails Threshold Criteria	Fails
Containment (Shoreline Stabilization)				Not practical or effective for the long term.	
Excavation and Onsite (local) Landfilling of Debris				Currently not implementable. Lower cost than offsite landfill, if permitted.	
Excavation and Offsite (remote) Landfilling of Debris				Provides permanent solution. May require more than one barge season. Considered the only viable option.	

Symbol Key

Best 
Better than Average 
Average 
Worse than Average 
Worst 

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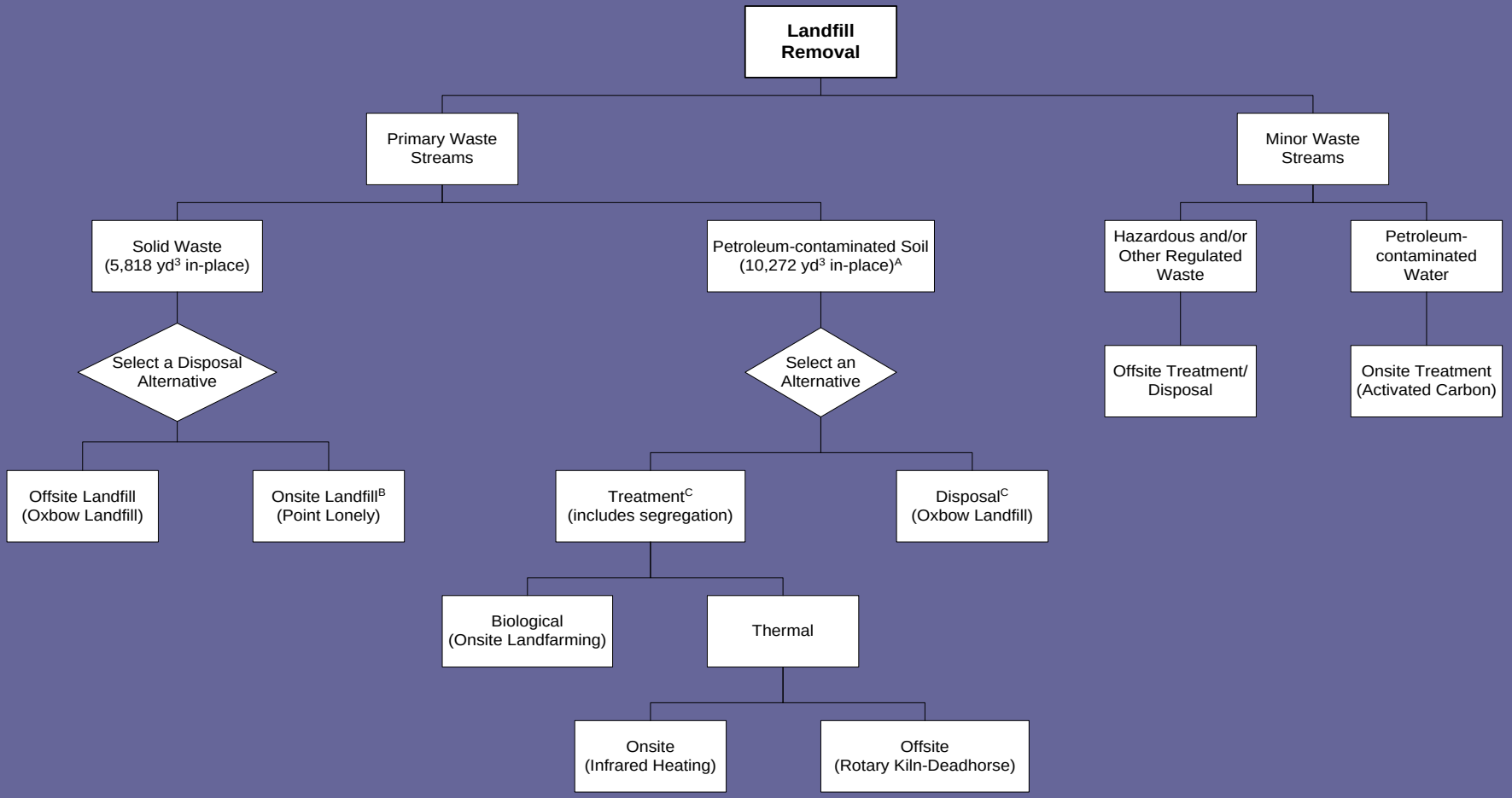
Camp Lonely Landfill Removal



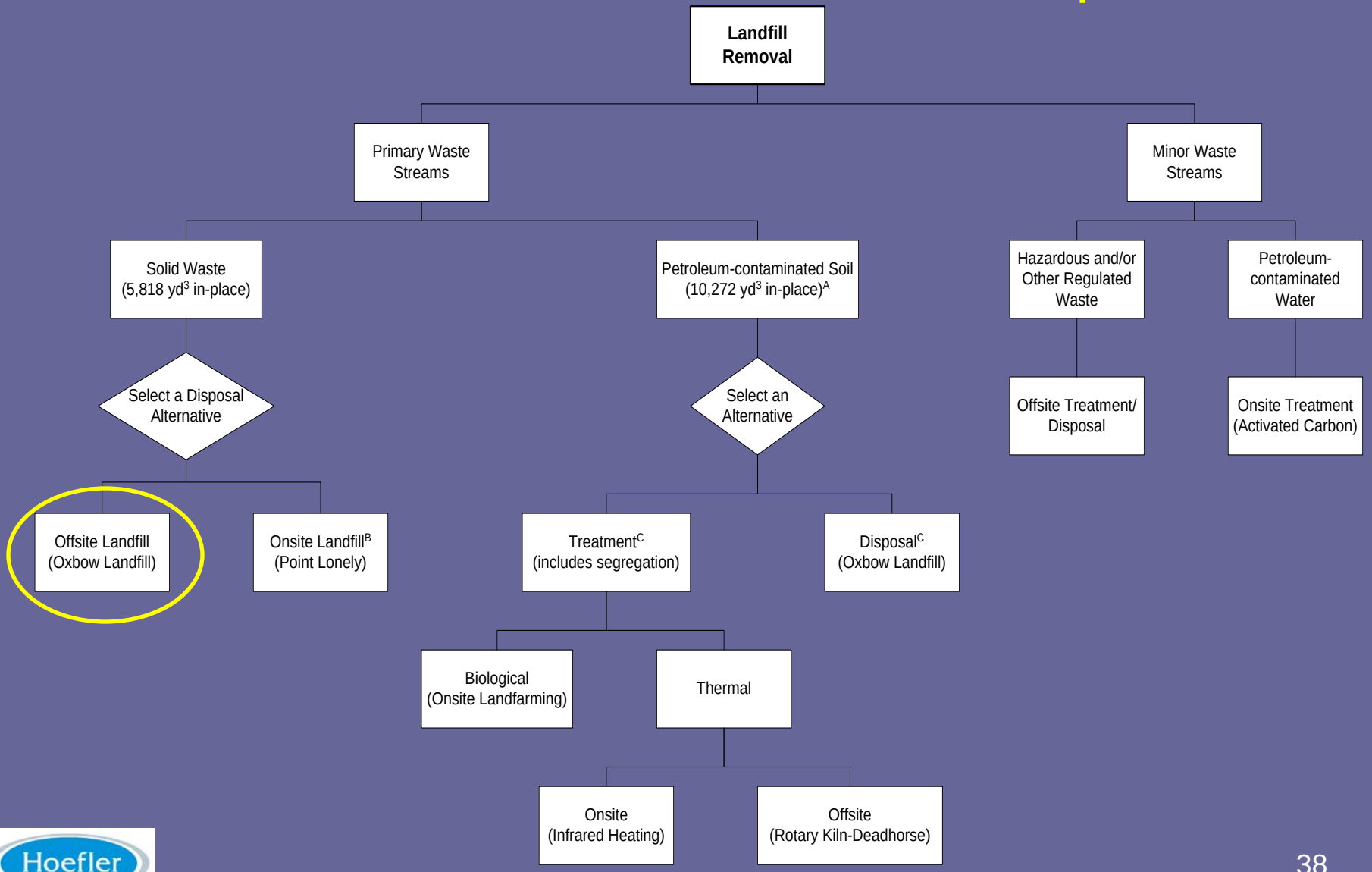
NOTES

A In-place volume listed for a 500 mg/Kg DRO cleanup level. If the cleanup level were 1,000 mg/Kg, the in-place volume of petroleum-contaminated soil would be 6,553 yd3. If the cleanup level were 2,000 mg/Kg, the in-place volume of soil would be 3,453 yd3.

B At present, the Point Lonely Landfill is not considered to be implementable. The landowner (BLM) has stated it is not in favor of a new landfill being built on the property.

C Treatment of petroleum-contaminated soil will require segregation of the soil and solid waste. If disposal of the petrleum-contaminated soil is permitted at the Oxbow Lnadfill, segregation will not be necessary and both solid waste and soil will be shipped and disposed of as one waste stream. The Oxbow Landfill currently allows the disposal of petroleum-contaminated soil to the following limits in mg/Kg: GRO = 1,400, DRO = 12,500, and RRO = 9,700.

Recommended Alternative: Landfill Removal and Offsite Disposal



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Landfill Removal Summary

- Mobilize equipment by barge, set up camp
  - Crew (~ 5 operators, 4 laborers, 2 technical staff)
  - Equipment (three excavators, three loaders, containers etc.)
- Excavate landfill, segregate waste streams (slow process)
  - Debris - Ship by barge to Oxbow Landfill (12 trips, 450 tons/trip, ~$55,000 each RT)
  - Contaminated soil – treat onsite or ship offsite
- Landfill will need to be progressively thawed, water management is an integral component
- Duration of mobilization, excavation and segregation phase ~ 1.5 months
- Shipping = 1 month to 5 months (concurrent, length varies with remedial option selected for PC soil)

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Camp Lonely 2005
Site Characterization: Test Pits

Debris from Test Pit 2.

Heavy gauge green drum and debris from Test Pit 14. Note the standing water in the excavation.

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Camp Lonely 2005
Site Characterization: Test Pits

Debris from Test Pit 18.

Four heavy gauge, green, crushed drums from Test Pit 54.

Drums will need to be inspected during removal process.

Camp Lonely 2005 Interim Actions

Oil and water seeping into excavation at Test Pit 16. Buried drum was punctured during excavation of test pit. Depth of excavation ~3 ft.

Test Pit 16 free product (oil) on top of water during recovery operations. Drum was located below water table and oil rose to the surface.

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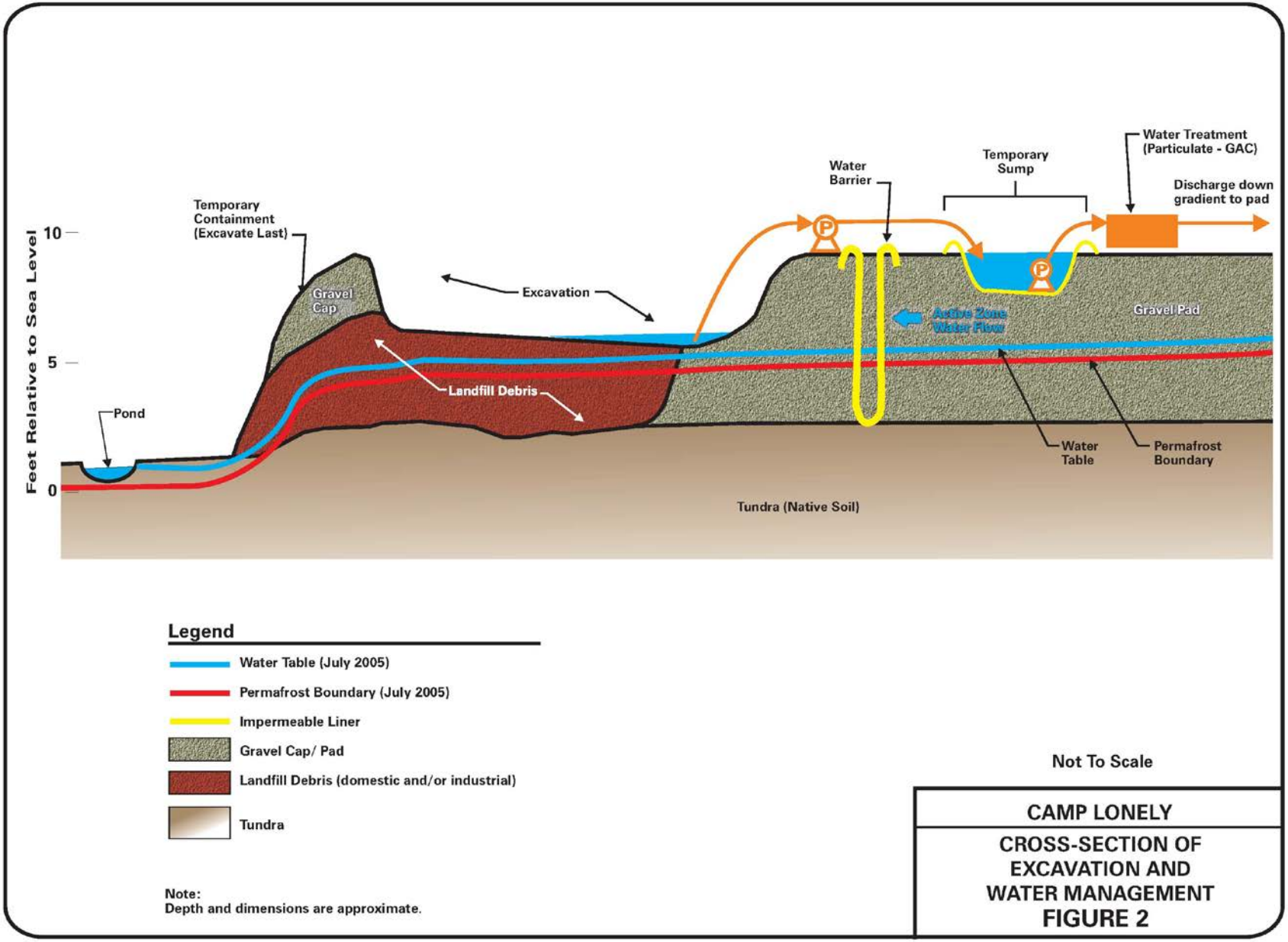
Water Management Cross-Section



Proposed Restoration

- Underlying native soils will not be removed [unless grossly contaminated (saturated) and capable of discharging free product].
- Landfill area will be backfilled and graded with clean fill to replicate natural grade and prevent surface water ponding.
- No active revegetation (surrounding area is sparsely vegetated, beach environment).
- Alternative would be to backfill landfill area to pad grade, but that would require new fill and possibly permitting (404 permit). This component is not considered part of the cleanup.

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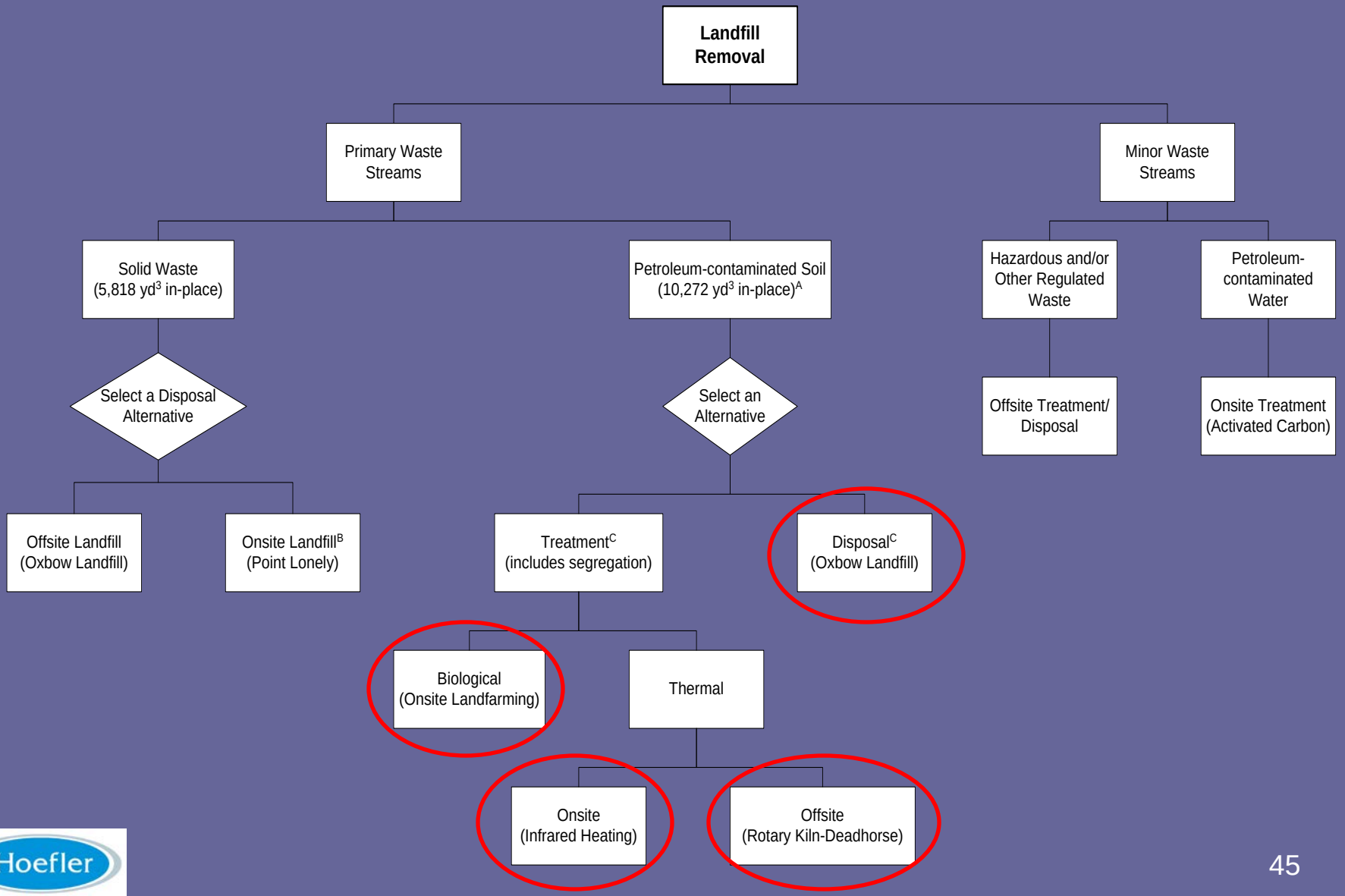
Petroleum-Contaminated Soil Remedial Alternatives



Petroleum-Contaminated Soils

Alternative (1) – Offsite Disposal

- Soils barged to Oxbow Landfill in Deadhorse (44 trips [~275 cy/trip], each trip takes 2.5 days, completed over two field seasons assuming one dedicated barge).
- Oxbow Landfill should be able to take all the impacted soil (except for saturated soils).
- Only large debris needs to be separated from soils, saving labor.
- Effective at reducing current risks. The contaminants are not treated so there is some long-term risk (liability).
- Does not utilize the existing pad or interfere with site operations.
- Cost relatively high.

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Oxbow Landfill – October 2006

Petroleum-Contaminated Soils Alternative (2) – Offsite Thermal Treatment

- Soil would be transported by barge to Deadhorse and treated by rotary kiln
- Low risk overall – highly effective
- Barge shipments may be subject to delays
- Does not use existing pad or interfere with site operations
- Highest cost alternative, but similar to onsite thermal treatment
- Completed over two field seasons assuming one dedicated barge

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Petroleum Contaminated Soils
Alternative (3) – Onsite Thermal Treatment

- Soil would be dried and thermally treated in a portable treatment unit on site
- Treated soil is available for reuse on site
- Effective at reducing levels of hydrocarbons and risk
- Logistical problems (breakdowns and shipping delays) could result in delays
- Large quantity of fuel must be shipped and stored onsite (235,000 gallons)
- Utilizes less pad space than landfarming
- Relatively high cost but soil available for reuse
- Duration of 1 to 2 years

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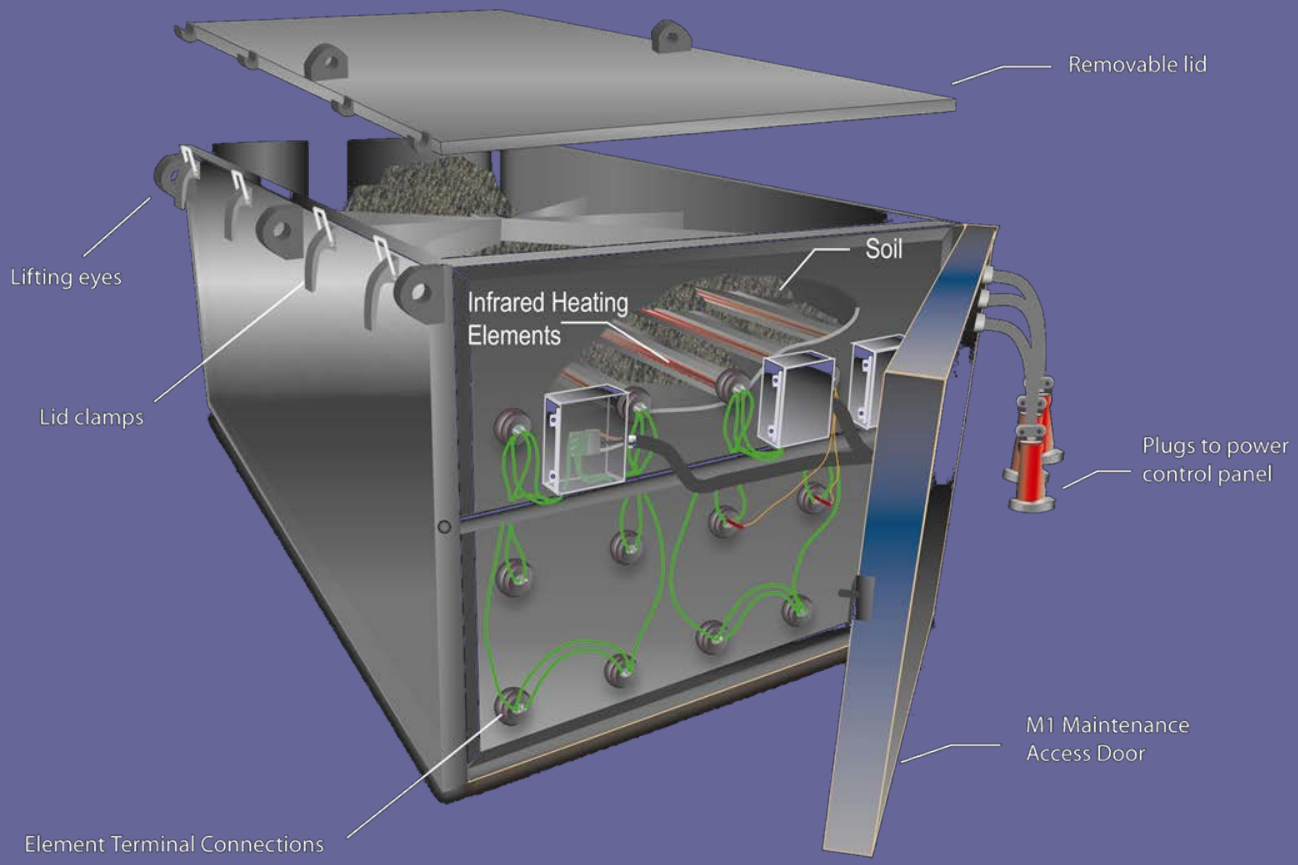
Onsite Thermal Treatment: Infrared Technology



- Five M1-12 Units (shown above): 1.25 CY treated/hour; 12 CY/unit
- Two ETC Units would be used: 4.5 CY treated/hour; 537 CY/unit
- Fuel consumption: 15 gallons/hour/unit

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Onsite Thermal Treatment: Typical Site Layout (Infrared Units)

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Petroleum-Contaminated Soils Alternative (4) – Onsite Landfarming

- Soil would be placed in a treatment cell 1.5 feet thick and tilled at regular intervals
  - nutrients may be added to promote degradation
- Effective at reducing mid- to light-weight hydrocarbons (GRO and DRO) given enough time, may be impractical for high RRO (>5,000 mg/Kg, areas of spilled lube oil)
- Requires a large dedicated space on the pad (7.2 acres for entire volume > 500 mg/Kg DRO) and regular maintenance
- Treatment time varies based on concentrations, but estimated to require two summer seasons
  - Easier to implement if other operations are occurring in the area
- Lowest cost treatment alternative
- Gravel available for reuse
- Moderate risk due to uncertain duration (treatment time)

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Evaluation of Petroleum-Contaminated Soil Alternatives

Remedial Action	Threshold Criteria	Balancing Criteria		Comments	Cumulative Evaluation Result
	Effectiveness	Implementability	Relative Cost		
No Action / Monitored Natural Attenuation				Fails Threshold Criteria	Fails
Offsite Disposal				Does not use existing pad. Cost relatively high. Some long-term liability.	
Onsite Thermal Treatment (low temperature)				Highest cost (barely). Some uncertainty due to equipment breakdowns. Less risk and pad use than landfarming.*	
Offsite Thermal Treatment (low temperature)				High cost, but low risk. Does not use existing pad.	
Onsite ex-situ Biological Treatment (landfarming)				Most cost effective, but some risk due to duration of treatment time. Uses large portion of pad.*	

***** Gravel available for reuse.

Symbol Key

Best 

Better than Average 

Average 

Worse than Average 

Worst 

Current Cost Estimates

- Primary purpose is to compare relative cost to identify preferred alternative.
- HCG consulted with independent remediation contractor focused on the North Slope to ground truth approaches, estimated durations and costs.
- Many variables will affect final cost
  - Changes in types and volumes of waste
  - Other projects in area (cost saving efficiencies versus completion for resources)
  - Weather/Site conditions (e.g., shore ice, barge landing, temperatures)
  - Contract mechanism (who incurs risk of uncertainties)

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Cost Summary - Western Landfill (500 mg/Kg DRO Cleanup Level)

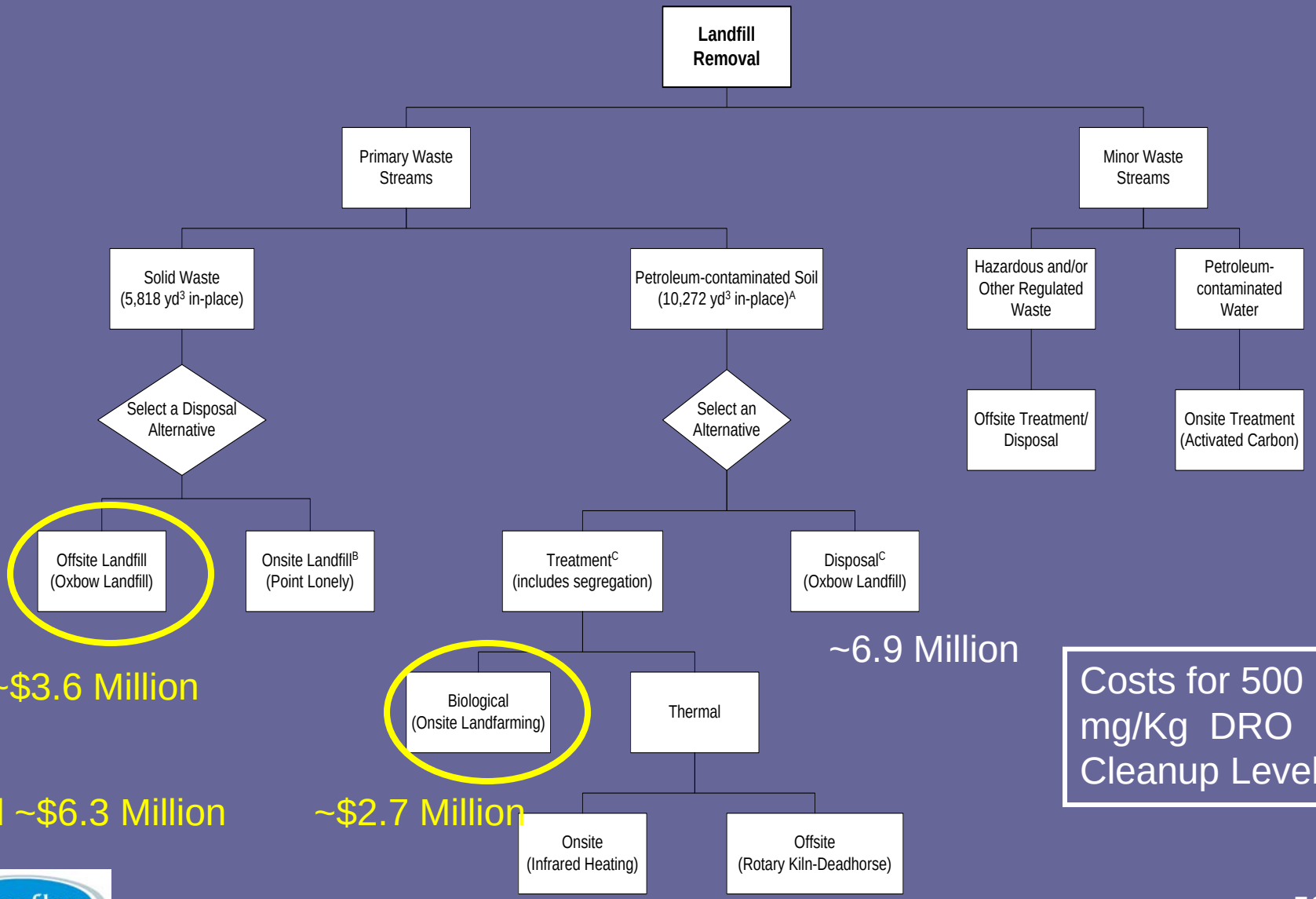
Item	Disposal/Treatment Option	[1] Material/ Waste	Volumes (yd^3) by Material Type Assuming contaminated soil defined as DRO > 500 mg/Kg		
			Tons	Cost	[2] Cost per Ton
Western Landfill	Offsite Disposal of Debris and Soil at Oxbow	PCS	16,640	$ 6,873,021	$413
		Debris	4,363	$ 3,585,374	$822
		Total	**21,003**	**$ 10,458,395**	**$498**
	Offsite Disposal of Debris and Onsite Landfarming	PCS	16,640	$ 2,663,317	$160
		Debris	4,363	$ 3,585,374	$822
		Total	**21,003**	**$ 6,248,691**	**$298**
	Offsite Disposal of Debris and Offsite Thermal Remediation (Rotary Kiln)	PCS	16,640	$ 8,388,929	$504
		Debris	4,363	$ 3,585,374	$822
		Total	**21,003**	**$ 11,974,303**	**$570**
	Offsite Disposal of Debris and Onsite Thermal (Infrared)	PCS	16,640	$ 8,641,485	$519
		Debris	4,363	$ 3,585,374	$822
		Total	**21,003**	**$ 12,226,859**	**$582**

Assumptions:

[1] PCS costs consist of cost to treat or dispose of petroleum-contaminated soil (PCS) once it is excavated and will include per diem for the duration of those tasks. Debris costs include excavation of landfill debris and soil, and disposal of debris. It also includes associated mobilization and demobilization costs of camp, personnel, and equipment.

[2] Unit rates for each disposal alternative were calculated based on the soil volumes in the Western Landfill and applied to other areas of the pad.

Recommended Alternatives



Costs for 500 mg/Kg DRO Cleanup Level

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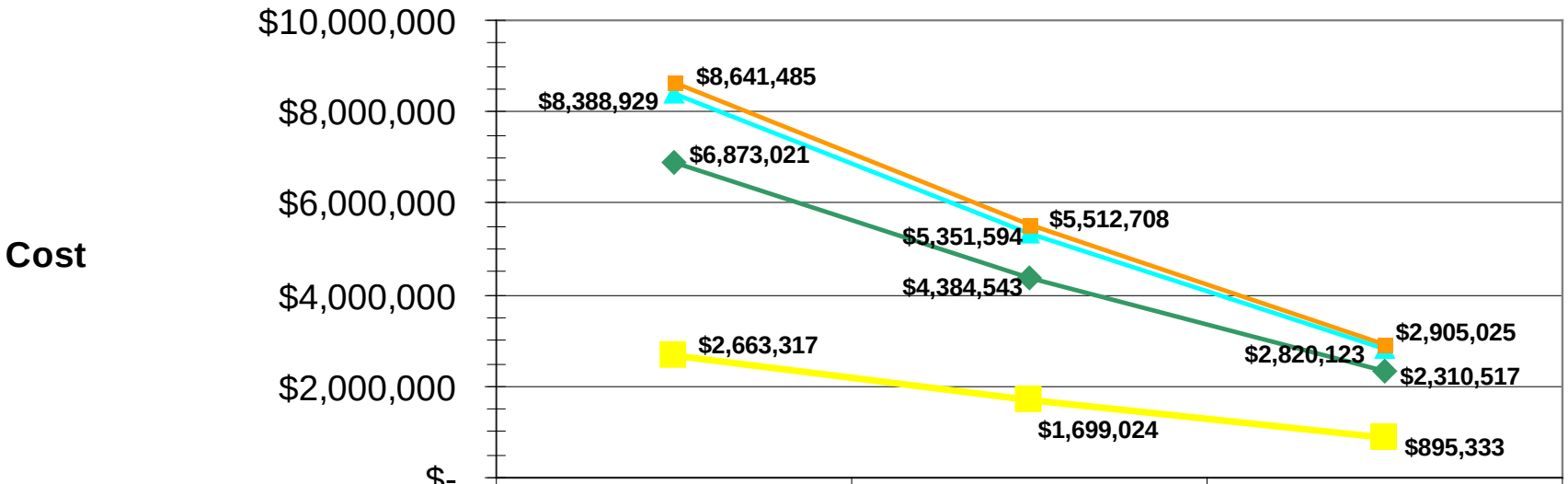
Cost Comparison of Cleanup Levels

Note – currently does not account for fluctuation in unit pricing (cost per ton assumed constant)

Soil Remediation Costs for Western Landfill



	DRO > 500 mg/Kg	DRO > 1,000 mg/Kg	DRO > 2,000 mg/Kg
Offsite Disposal at Oxbow	$6,873,021	$4,384,543	$2,310,517
Onsite Landfarming	$2,663,317	$1,699,024	$895,333
Offsite Thermal Remediation (Rotary Kiln)	$8,388,929	$5,351,594	$2,820,123
Onsite Thermal Remediation (Infrared)	$8,641,485	$5,512,708	$2,905,025

Cleanup Levels

DRO Cleanup Level Evaluation

Evaluation Criteria	DRO Cleanup Level (mg/Kg)		
	500	1,000	2,000
Estimated Contaminated Soil Volume (yd^3, in-place)	W. Landfill: 10,272 Entire Pad: 11,789	W. Landfill: 6,553 Entire Pad: 7,129	W. Landfill: 3,453 Entire Pad: 3,591
Initial Site Status	Closure	Conditional Closure	Conditional Closure
Probable Institutional Controls or Monitoring Requirements	None (surface water sampling may be required the first few years to demonstrate AWQS are not exceeded)	ADEC must be notified prior to moving soil, and approve of placement location (no placement in wetlands or surface water). Annual monitoring to verify contaminated soil is not eroding or creating surface sheen. Periodic (~5 year) surface water sampling to verify AWQS are not exceeded. Confirmation sampling to demonstrate soils attenuated to 500 mg/Kg (Note 1).	Same as for 1,000 mg/Kg, but monitoring may be slightly more rigorous due to greater regulatory concern regarding water quality issues.
Risk Reduction	Good (best). No long-term liability.	Moderate: The residual contamination in the soil will likely require 5-15 years to degrade to 500 mg/Kg during which there is a slight risk of AWQS exceedances. Future corrective actions are relatively easy to implement if the site is active. Difficult and expensive if the site abandoned.	Fair. Similar to 1,000 mg/Kg level but soils will take longer to natural attenuate to 500 mg/Kg (15-30 years). Some potential that leachate from landfill will contain detectable BTEX, although AWQS exceedances are considered unlikely.
Implementability	Hardest to implement.	Moderate.	Easiest.
Relative Cost for Soil Remediation (Landfarming ⟶ Onsite Thermal Treatment)	High W. Landfill: $2.7M - $8.6M Entire Pad: $3.1M - $10M	Moderate W. Landfill: $1.7M - $5.5M Entire Pad: $1.9M - $6.1M	Low W. Landfill: $900K - $2.9M Entire Pad: $930K - $3.0M
Evaluation Comments	Best if PRPs want to eliminate uncertainty and management associated with the site ASAP. Best if immediate, unrestricted site use is desired.	Best balance of cost versus risk. The likelihood that those corrective actions will be required beyond the initial cleanup phase is considered low.	Lowest cost, but there is moderate risk that corrective action will be required at some point over the natural attenuation phase. The period of long-term liability is longer, requiring greater long-term management.

Key
O&M – Operations and maintenance PRP – Potentially responsible party
AWQS – Alaska Water Quality Standards
Note: (1)There will probably need to be a butter zone (10-20 feet) between the surface water and soil above 500 mg/kg. Placement of soil excavated from the landfill area back in its original location or on the pad may be a challenge due to limited space and site operations.

Cost Versus Risk

Costs For Cleanup of Entire Pad

Item	Disposal/Treatment Option	Material/ Waste (Note 1)	Volumes (yd^3) by Material Type					
			Assuming contaminated soil defined as DRO > 500 mg/Kg		Assuming contaminated soil defined as DRO > 1,000 mg/Kg		Assuming contaminated soil defined as DRO > 2,000 mg/Kg	
			Tons	Cost	Tons	Cost	Tons	Cost
CAMP LONELY TOTALS	Offsite Disposal of Debris and Soil at Oxbow	PCS	19,348	$ 7,991,389	11,656	$ 4,814,312	5,835	$ 2,409,892
		Debris	4,521	$ 3,714,661	4,521	$ 3,714,661	4,521	$ 3,714,661
		Total	**23,868**	**$ 11,884,985**	**16,176**	**$ 8,528,973**	**10,355**	**$ 6,124,553**
	Offsite Disposal of Debris and Onsite Landfarming	PCS	19,348	$ 3,096,688	11,656	$ 1,865,561	5,835	$ 933,841
		Debris	4,521	$ 3,714,661	4,521	$ 3,714,661	4,521	$ 3,714,661
		Total	**23,868**	**$ 7,101,052**	**16,176**	**$ 5,580,222**	**10,355**	**$ 4,648,502**
	Offsite Disposal of Debris and Offsite Thermal Remediation (Rotary Kiln)	PCS	19,348	$ 9,753,963	11,656	$ 5,876,152	5,835	$ 2,941,416
		Debris	4,521	$ 3,714,661	4,521	$ 3,714,661	4,521	$ 3,714,661
		Total	**23,868**	**$ 13,607,672**	**16,176**	**$ 9,590,813**	**10,355**	**$ 6,656,077**
	Offsite Disposal of Debris and Onsite Thermal (Infrared)	PCS	19,348	$ 10,047,615	11,656	$ 6,053,059	5,835	$ 3,029,970
		Debris	4,521	$ 3,714,661	4,521	$ 3,714,661	4,521	$ 3,714,661
		Total	**23,868**	**$ 13,894,678**	**16,176**	**$ 9,767,720**	**10,355**	**$ 6,744,631**

Assumptions:

[1] PCS costs consist of cost to treat or dispose of petroleum-contaminated soil (PCS) once it is excavated and will include per diem for the duration of those tasks. Debris costs include excavation of landfill debris and soil, and disposal of debris. It also includes associated mobilization and demobilization costs of camp, personnel, and equipment.

Potential Discussion Items

- Cleanup Levels (Pad & Tundra)
- Future Site Use Considerations
  - Final site conditions
  - Impact of cleanup on ongoing operations
- Time Line or Time Constraints
- Others?

THE END

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