

# Remediation at Tununuk Point, NT (BAR-C)

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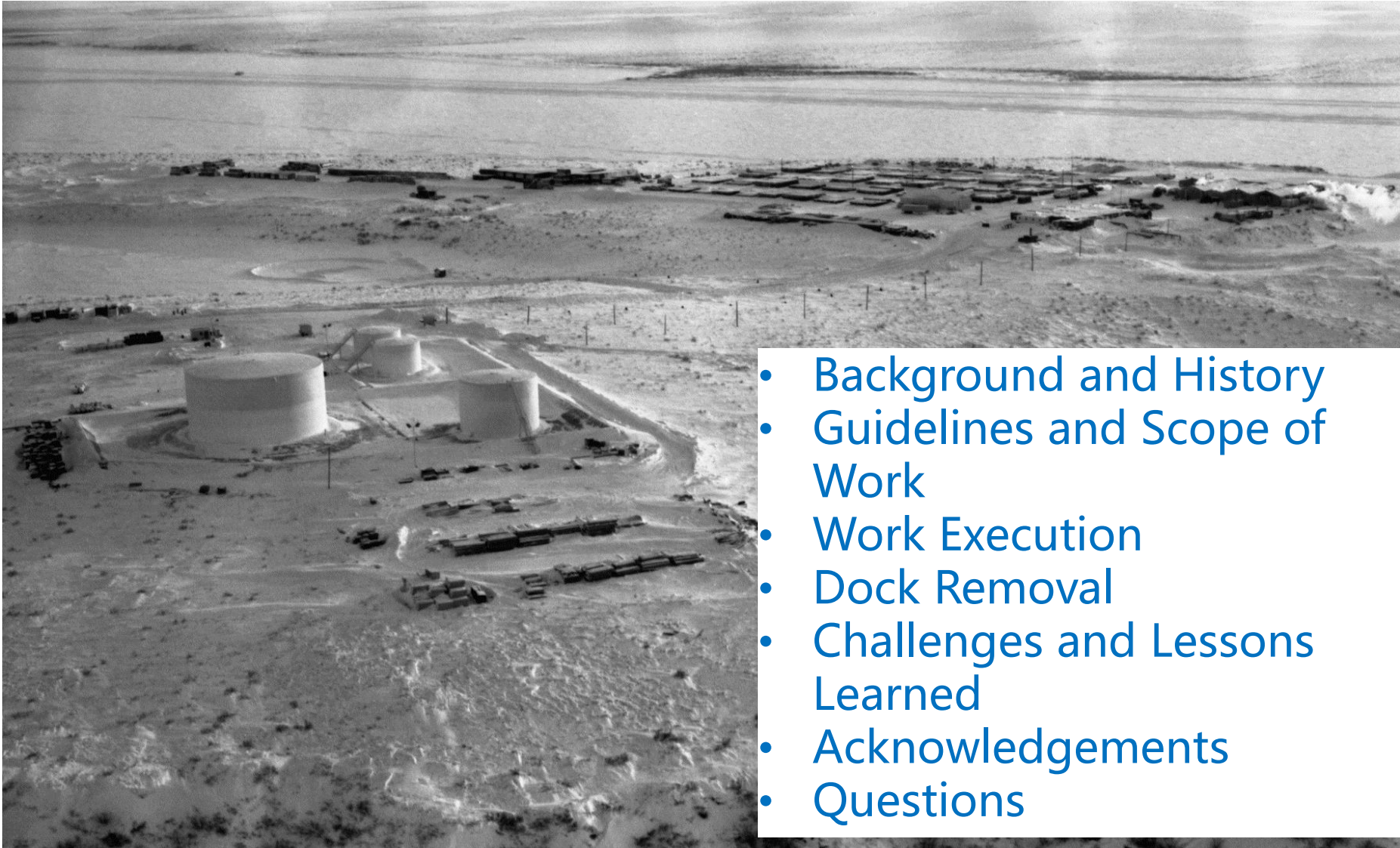
RemTech 2017



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# Agenda



- Background and History
- Guidelines and Scope of Work
- Work Execution
- Dock Removal
- Challenges and Lessons Learned
- Acknowledgements
- Questions



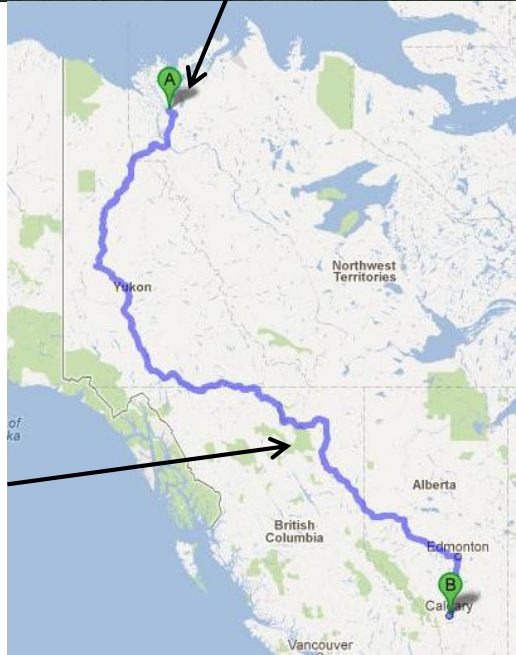
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# Background and History

# Location



Landfill

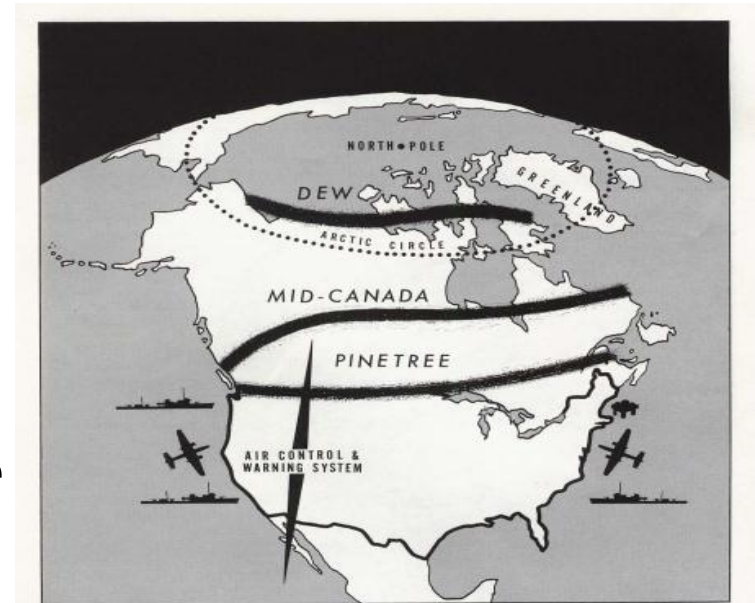


# Location



# History

- **1957:** BAR-C DEW Line site constructed
  - Warehouse, garage, air strip, fuel storage, module train
- **1963:** Radar operations cease
- **1972-1984:** Imperial exploration base
  - Year round on-shore/off-shore support
- **1980s:** Demobilization of infrastructure
- **1980s–2000s:** Left vacant
- **2001–2010:** Site Assessments
- **2012:** Demolition of Imperial infrastructure
- **2013:** Dock assessment and gap analysis



# History

## 1974 Imperial Exploration Base





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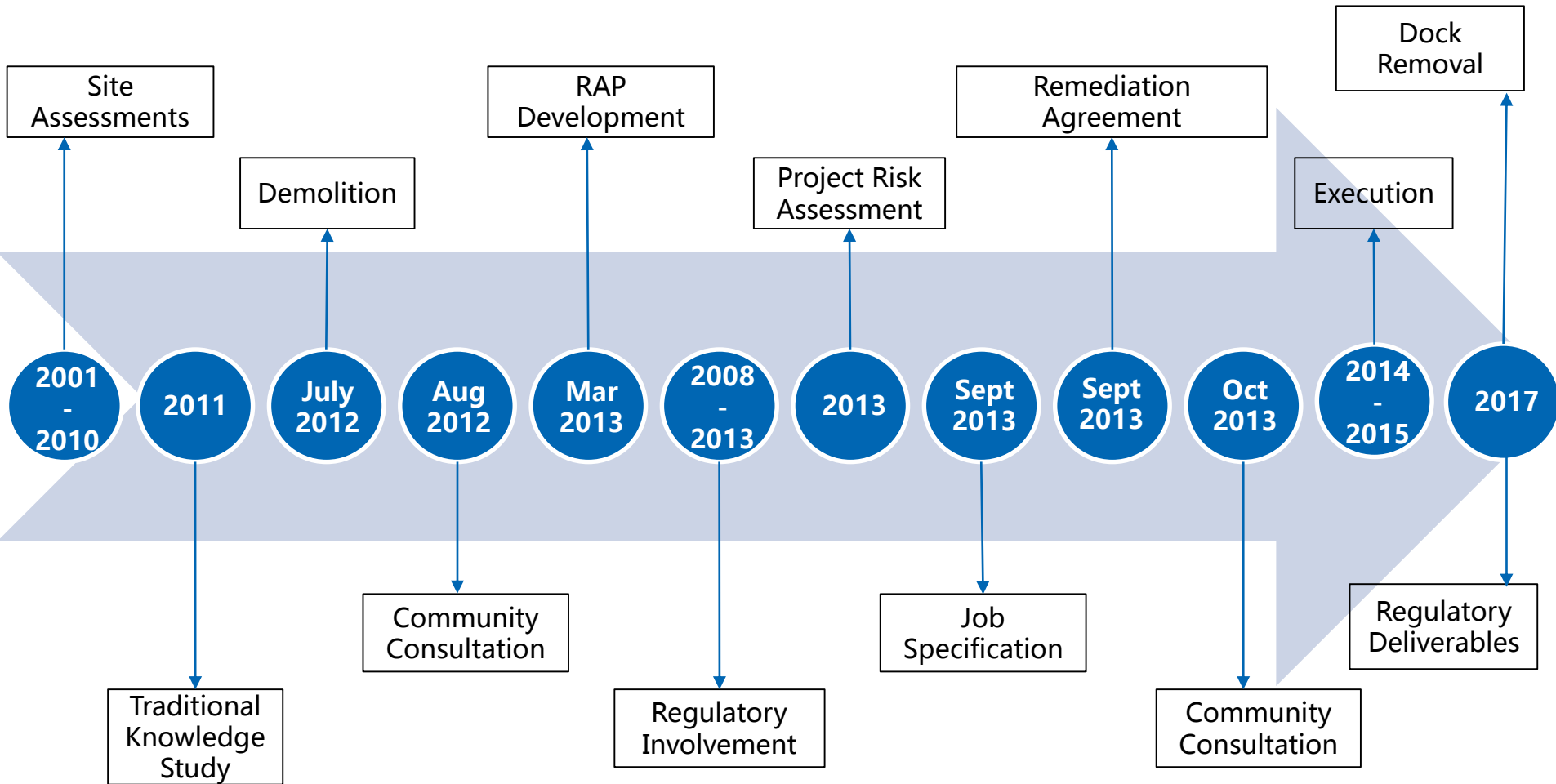
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# Guidelines and Scope of Work



# Timeline of Execution



# Guidelines

## Abandoned Military Site Remediation Protocol (AMSRP)

- Risk-Based Closure - Federal government involvement
  - DEW Line Criteria

- Objectives

- Restore sites to meet Northern environmental objectives;
- Prevent migration of contaminants into the Arctic ecosystem;
- Remove physical hazards for the protection of human health; and
- Implement cost effective remediation solution.

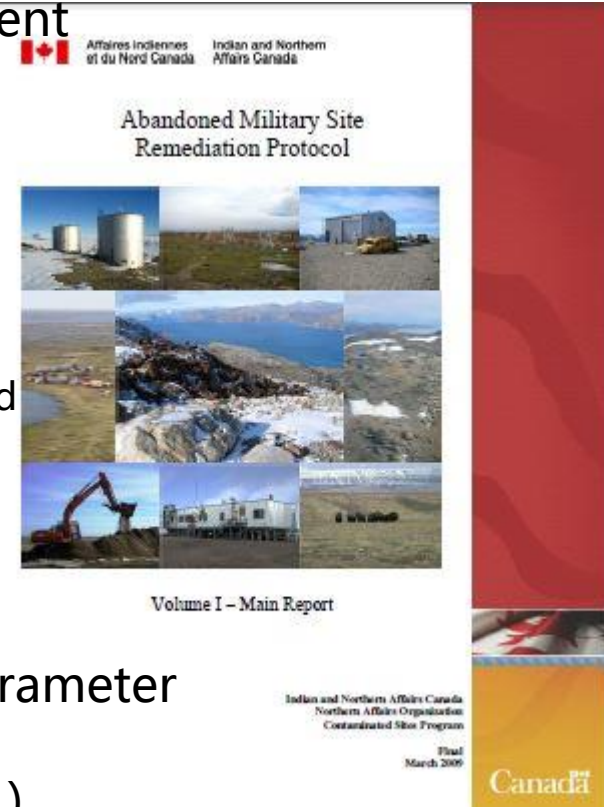
- Criteria developed consistent with CCME Tier 3

- Alberta Barite added as barium is not an AMSRP parameter

- Assessment Protocol (contaminated soil, debris, etc.)

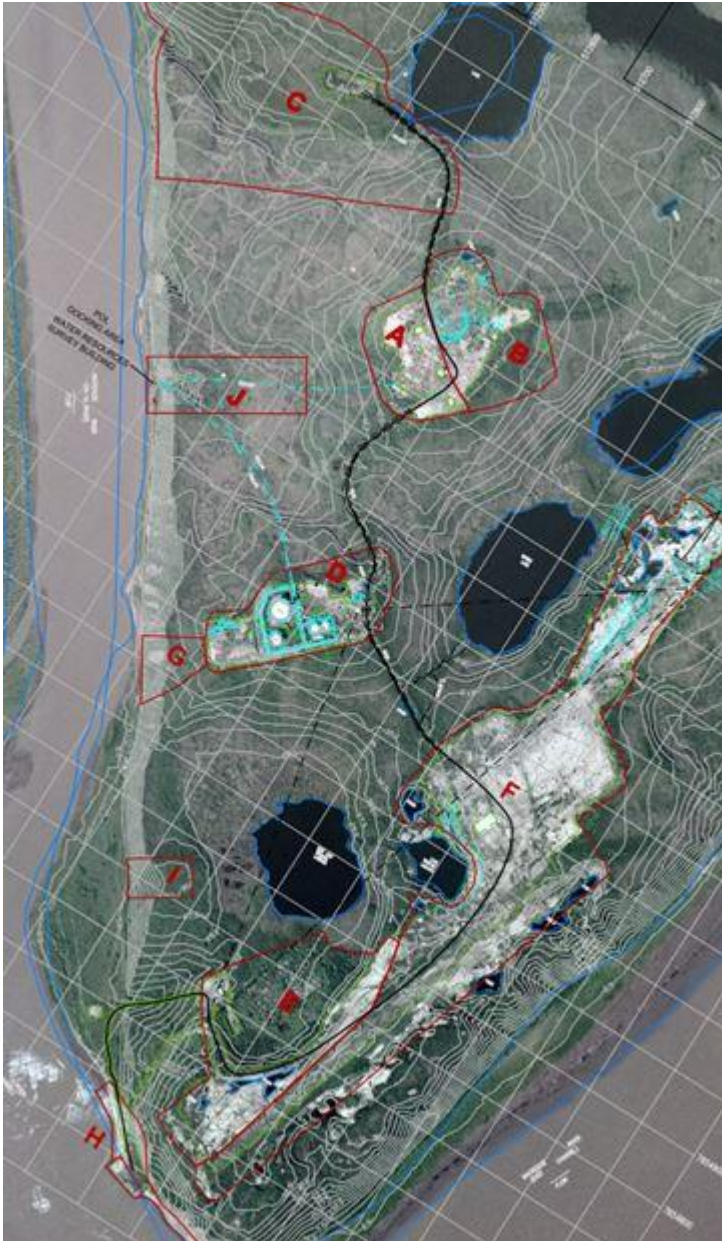
- Remediation Protocol (soil treatment/disposal, landfills, borrow sources, etc.)

- Construction requirements and post-construction monitoring

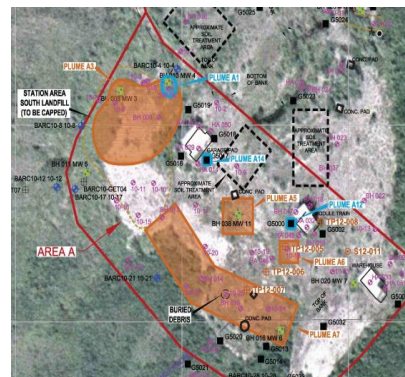


# Scope of Work

Remedial Action Plan focused on 10 areas



Location	Description
Area A	DEW Line Station
Area B	DEW Line Station North of Area A
Area C	IOL Explosives Storage
Area D	IOL Tank Farm
Area E	IOL Landfill
Area F	Airstrip and Former IOL Camp
Area G	Ravine Landfill
Area H	Western Shoreline and Barge Dock
Area I	Inuit House
Area J	POL Lines and Loading Dock



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# Scope of Work

1. Removal of remaining on-Site infrastructure & debris
2. Engineered capping of two historical landfills and three waste disposal areas (WDAs)
3. Full excavation of a third historical landfill
4. Ravine clean-up activities
5. On-Site treatment of Type B impacted soil
6. Off-Site disposal of non-treatable materials (Type A, metals, PCBs)
7. Restoration of excavation areas
8. Dock removal
9. Long term verification monitoring
  - Monitoring Wells and Thermistors





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# Work Execution

# Facilities and Equipment

- John Wurmlinger Barge Camp
  - 40 person capacity (+20 on deck)
  - Full maintenance shop area
- 802 Camp Barge
  - 60 person capacity
- 6 Excavators
- 5 Articulated Dump Trucks
- 3 Bulldozers
- 2 Wheel Loaders
- 2 Compactors
- Support (Fuel, Water, Vac, Mechanic, Spill SeaCan)
- Averaged 60 staff on-Site and peaked at 92 with night shift activities (Summer 2014)



# Execution

## Removal of Remaining On-Site Infrastructure

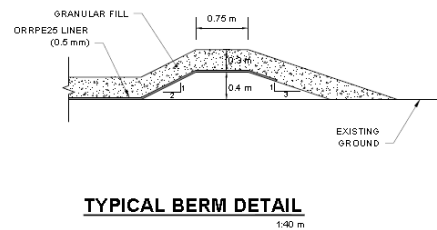
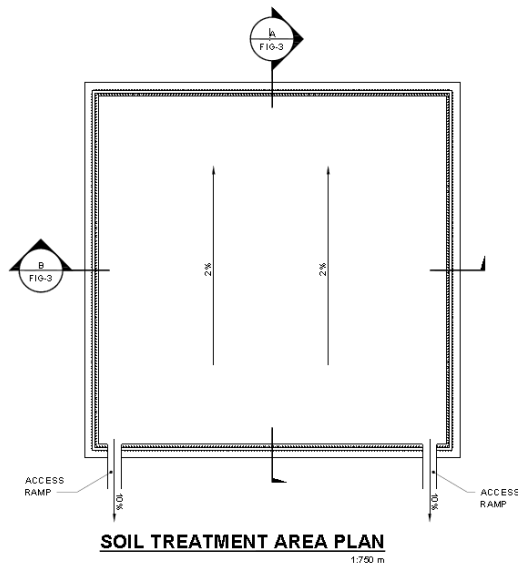


# Execution

## On-Site Bio-Treatment



- Type B (i.e. diesel) soil
- ~ 8,200 m<sup>3</sup> remediated



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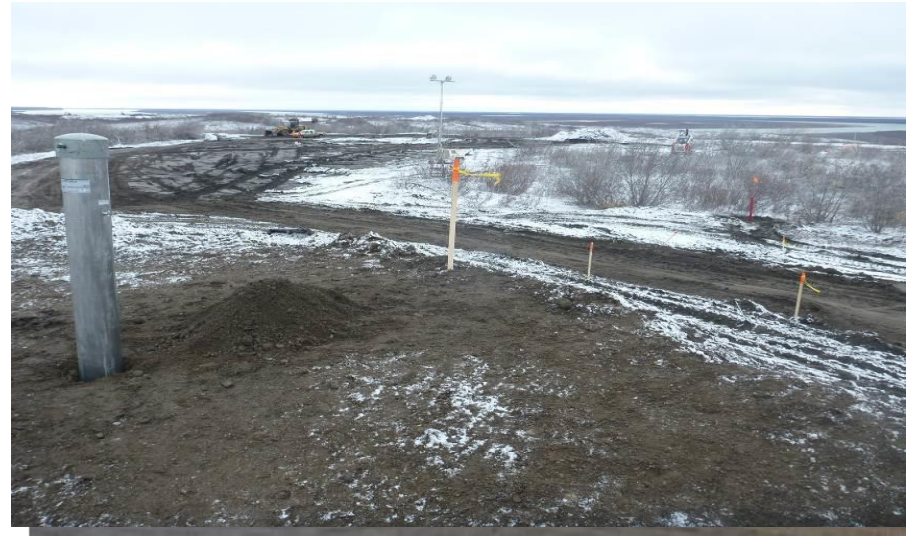
# Execution - Landfills

- Based on AMSRP Classifications
- Engineered capping of two landfills ( Areas A + B)
- Full excavation of one landfill (Landfill E)
- Ravine clean-up activities (Area G)
- Additional cover at three waste disposal areas (Area F)

Landfill or WDA	Geotechnical Stability	Contaminant Migration	AMSRP Class and Recommendation
Area A - Station Area South Landfill	Good	Yes	Class B: Leave in place, install an engineered containment system and place additional granular cover.
Area B - Station Area North Landfill	Good	No	Class C: Leave in place, install an engineered containment system and place additional granular cover.
Area E - Landfill	Poor	No	Class A: Excavate and remove contents for disposal.
Area G - Ravine Landfill	Conditional on permafrost	No	Class A: Excavate and remove contents for disposal.
Area F - WDAs	Good	No	Class C: Leave in place and place additional granular cover.

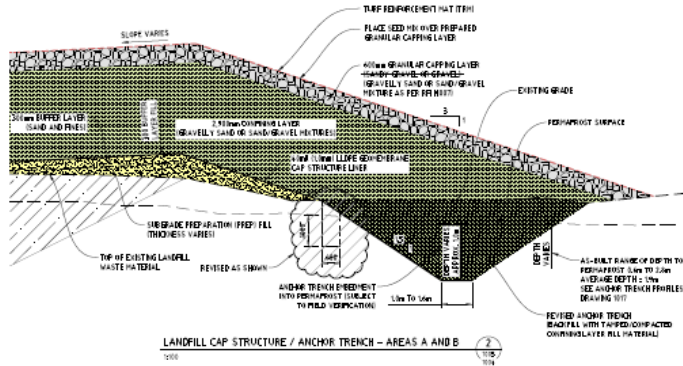
# Execution

## Engineered Capping of Historical Landfills

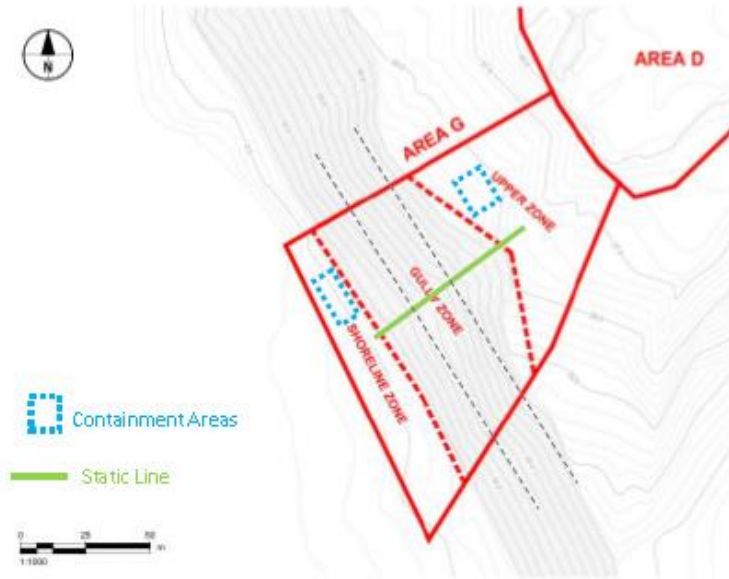


# Execution

## Engineered Capping of Historical Landfills



# Area G - Ravine Clean-Up



# Scope of Work – Soil / Debris

- Type A (i.e. waste oil) PHC, PCBs and metals = Landfill off-Site ( $\sim 2300 \text{ m}^3$ )
- Debris = off-Site disposal ( $\sim 3,000 \text{ m}^3$ )



# Execution

## Final Soil Removal





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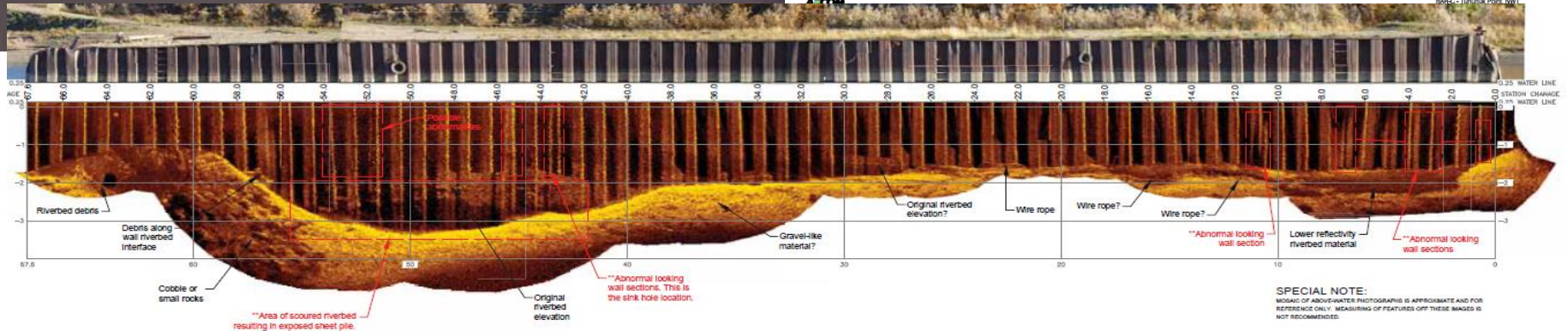
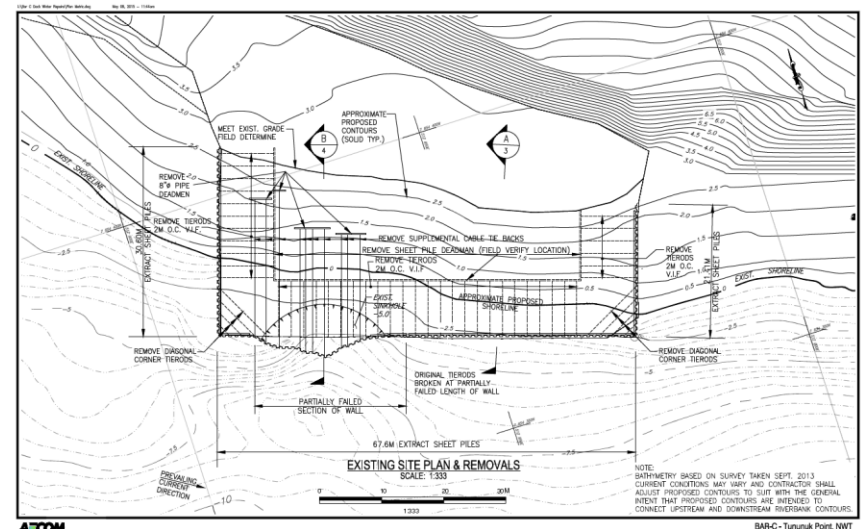


# Dock Removal

# Dock - Background

Sheet Pile Dock constructed in 1973 by Imperial

Condition assessment needed to determine whether to decommission or refurbish / transfer ownership.





# Execution Summary

- Condition Assessment (Fall 2013)
- Partial Collapse (Summer 2014)
- Emergency Repairs (Summer 2014)
- Reinforcements (Winter 2015)
- Removal Permitting (Fall 2016)
- Demolition & Monitoring (Winter 2017)



# Dock Removal



# Dock Removal



**March 2017**



**August 2017**





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# Challenges and Lessons Learned

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- Execution Time Window
  - July – October
  - Barging Capabilities
- Personnel Turn-around and Mobilization
  - Night Shift
  - Training
- Equipment Management & Maintenance
  - Inspections and Preventative Maintenance
  - On-Site Repair Shop
- Emergency Response Capabilities
  - Pre-planning and Emergency Exercise
  - On-Site Medic



# Challenges and Lessons Learned

- Guideline Knowledge
  - Fit for Purpose
- Short Service Workers
  - Proven Program
- Laboratory Requirements
  - On-Site Mobile Laboratory
  - Sample Shipment Requirements
- Wildlife Monitoring
  - Proper Qualification
- Environmental Factors
  - Water Levels
  - Weather / Winter Conditions



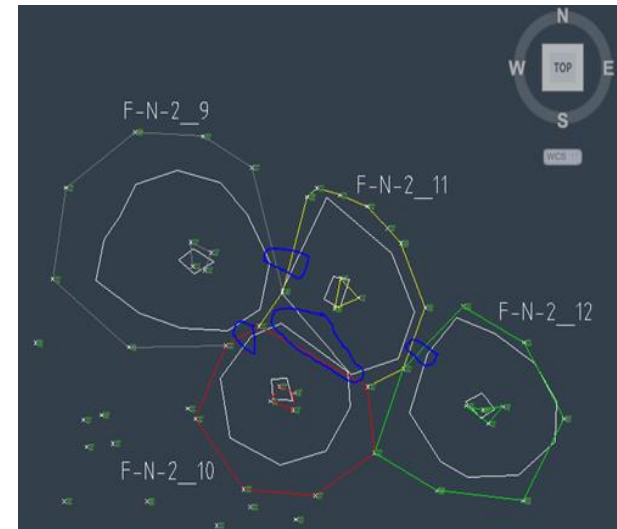
# Engineer's Perspective

## The "initial" team

- Contaminated Sites
- Civil
- Geotechnical
- HSE

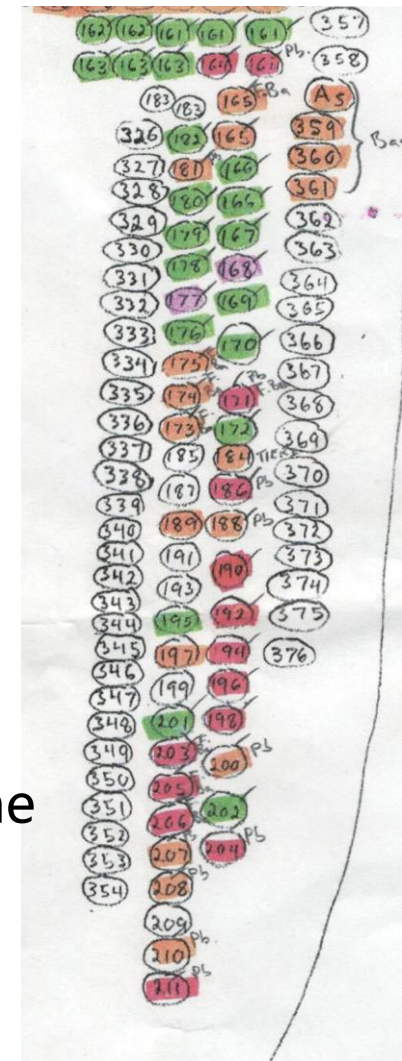
## "Extra" team members

- Geophysics
- Marine Engineer
- Aquatics
- Risk Assessment
- IM / Database
- ACAD / GIS



# Engineer's Perspective – Data Management

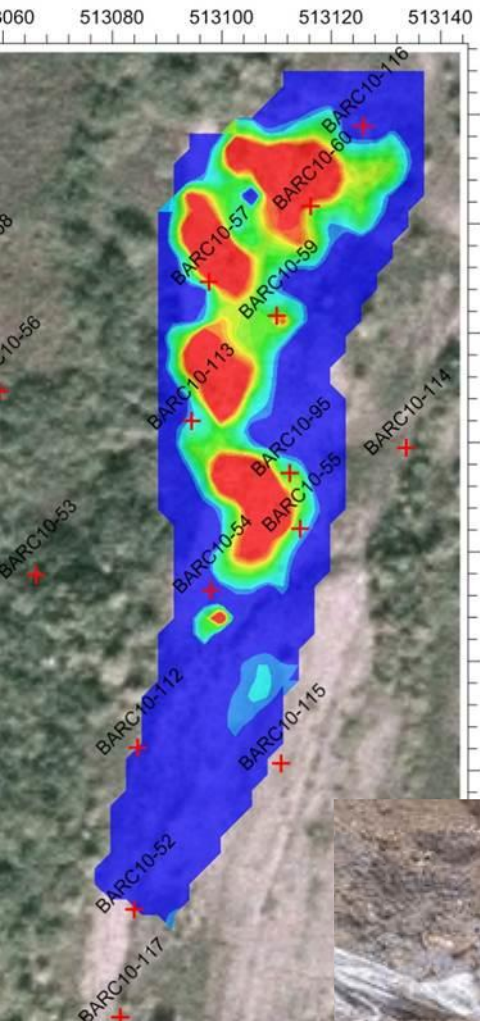
Type/Location	Volume	# Samples
Excavations	13,159	514
Landfill E Stockpiles	6,700	564
Landfill E Overburden	3,800	20
Type B Treated Soil	13,591	40
Borrow	5,000	12
QA/QC @ 10%		115
<b>Total (Confirmatory Sampling Plan)</b>		<b>1265</b>
No. Samples by Maxxam Edmonton		1732
No. Samples by Maxxam On-site Lab		955



- On-Site lab (certified for which parameters?)
- Early Notification to Lab of Rush / Large Volume
- Macros for processing
- Team coordination
- Review Time → Field instructions / Closure



# Engineer's Perspective - Landfills



# Engineer's Perspective – Units of Measure



Estimated / Tendered / Excavated / Checked



Consultant



Owner



Contractor



Owner's Rep



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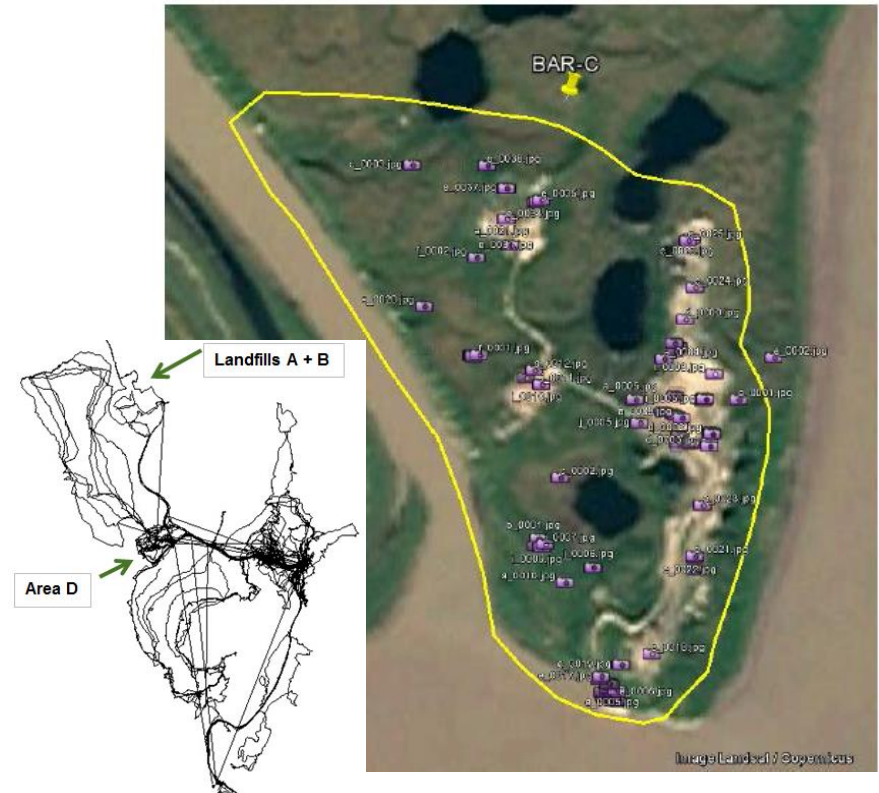


# Engineer's Perspective – Technology

Consider “New Tools” for Assessment, Remediation Planning and Verification



Figure A Identified Large Debris Locations (June 14-15, 2017)



# Success in the North – Owner's Perspective

- Regulatory Engagement
- Pre-project Planning
- Comprehensive Job Specification
- Site visit prior to mobilization
- Community Involvement
  - Consultations
  - Utilization of local contractors
- On-Site Leadership
- Interface Management
- Management of Change
- Know your guidelines!



# Collaborative Effort

- Aboriginal Affairs and Northern Development Canada (AANDC) partnership
  - Technical contributions
  - Financial responsibility
- Community consultations
  - Inuvik and Tuktoyaktuk
- Regulatory involvement
  - Inuvialuit Land Administration (ILA)
  - Inuvialuit Water Board (IWB)
  - Government of the Northwest Territories (GNWT)
  - Environmental Impact Screening Committee (EISC)
  - Transport Canada / Department of Fisheries & Oceans (DFO)



# Acknowledgements

- Aboriginal Affairs and Northern Development Canada (AANDC)
- AECOM
- Golder Associates Ltd.
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- Hazco
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- Inuvialuit Water Board (IWB)
- Maxxam Analytics
- MDIOS (E. Grubens / Northwinds / Allen Services)
- Tervita



# Questions



## Quyanaq





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