SOIL STERILANT REMEDIATION AT UTILITY SITES

Monica Brightwell & Jason Pentland, ATCO Utilities

ATCO UTILITIES OVERVIEW

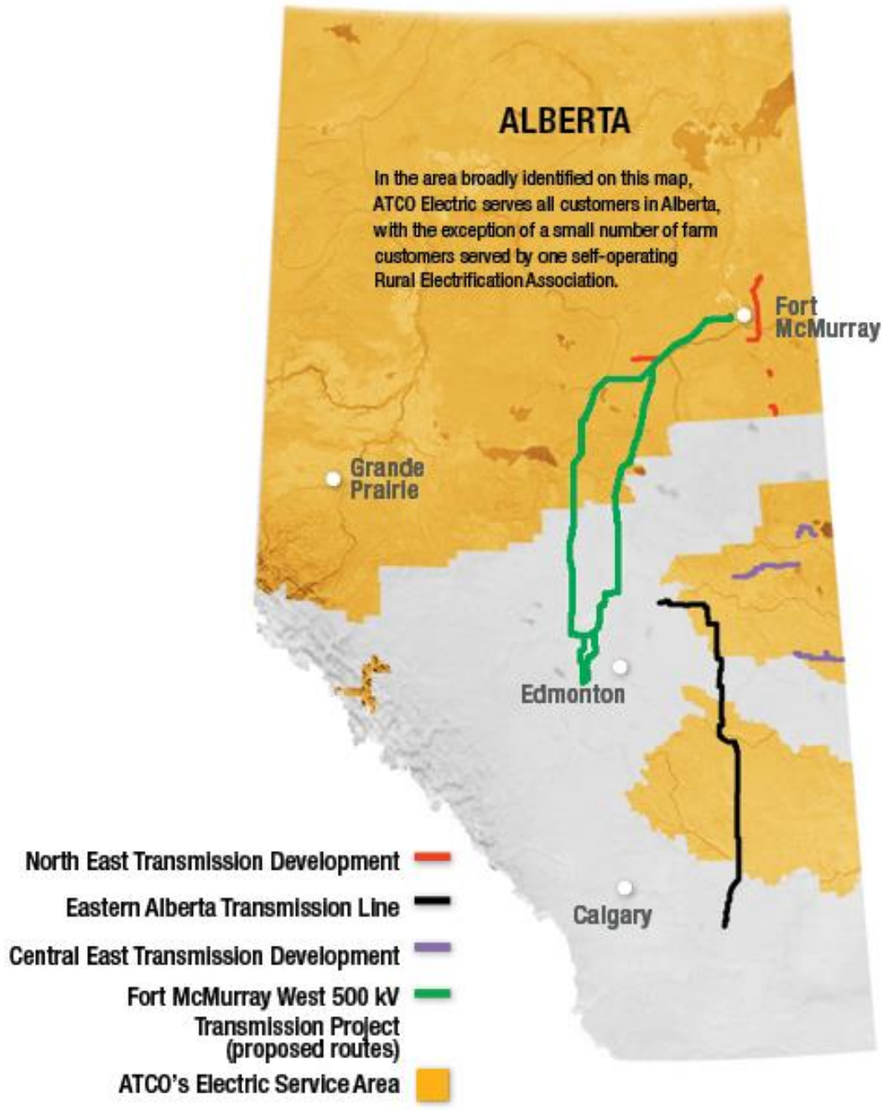
ATCO UTILITIES OVERVIEW

- Consists of:
  - ATCO Electric
  - ATCO Gas and Pipelines
  - ATCO Electric Yukon
  - Northland Utilities
- Different aspects of the utilities operate under different environmental regulators
  - Alberta Environment and Parks (AEP) – Electric and Gas Distribution
  - Alberta Energy Regulator (AER) – Gas Transmission
- Sites as old as 1923 in inventory, sites reaching end of useful life
- Sites located in urban and rural settings

ELECTRICITY TRANSMISSION & DISTRIBUTION

ATCO owns and operates electrical transmission and distribution facilities in Alberta and Canada's North

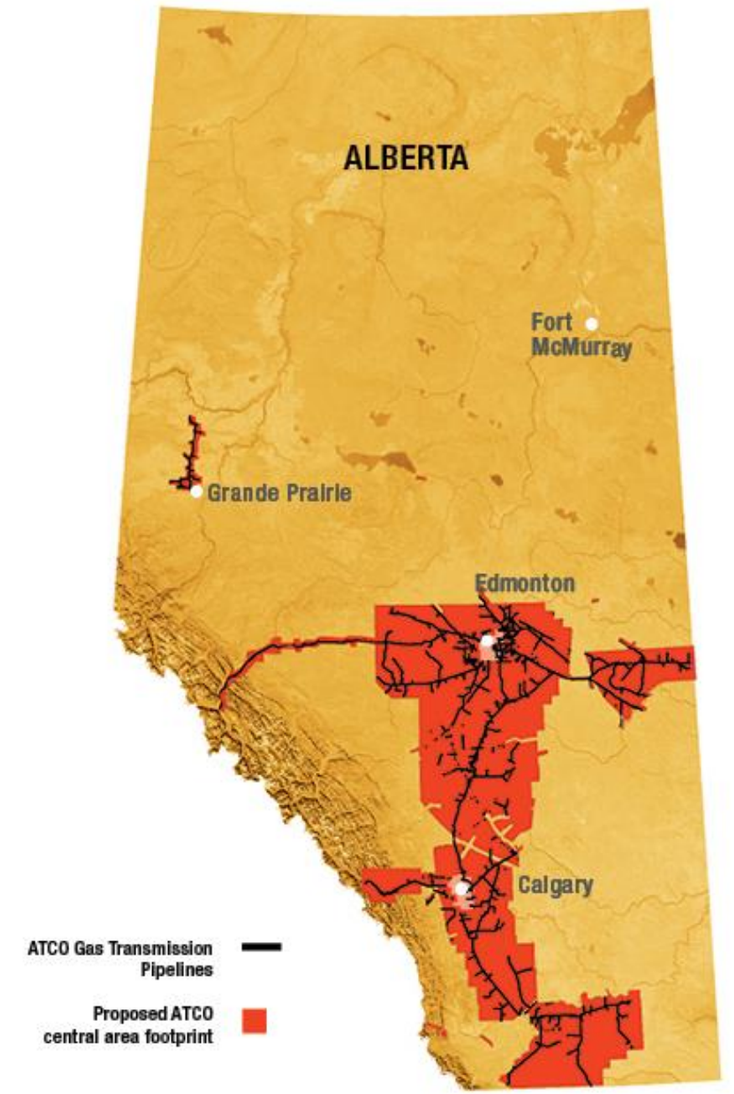
- Serving 260,000 farm, business and residential customers in 240 communities
- Approximately 70,000 km of powerline
- Facilities include transmission and distribution substations, service centres, telecommunications towers and isolated generation power plants



NATURAL GAS TRANSMISSION

ATCO owns and operates high-pressure natural gas transmission facilities in Alberta

- Approximately 9,000 km of natural gas transmission pipelines in Alberta
- Nearly 3,700 receipt and delivery points



NATURAL GAS DISTRIBUTION

ATCO delivers natural gas to homes and businesses throughout Alberta

- Approximately 40,000 km of natural gas distribution pipelines
- Facilities include gate stations, historic production wells

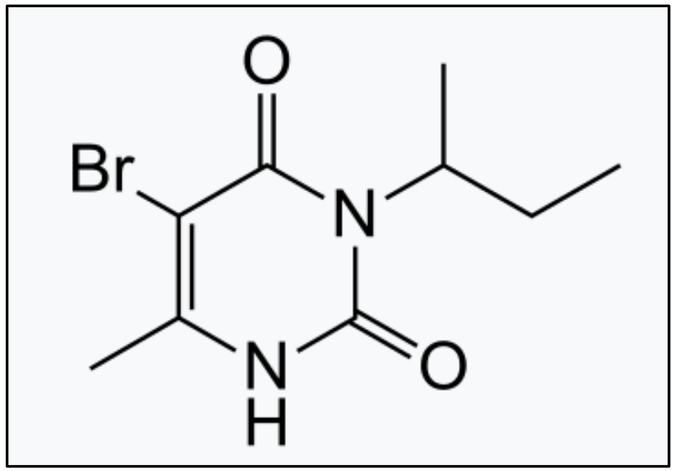
SOIL STERILANTS - WHAT IS THE ISSUE?

SOIL STERILANTS – WHAT IS THE ISSUE?

- Long lasting herbicides historically used for non-selective vegetation control to maintain bare-earth conditions at critical infrastructure locations (for fire protection)
- Includes the chemicals bromacil, tebuthiuron, atrazine, simazine, diuron and linuron
- Bromacil is most encountered at ATCO sites, followed by tebuthiuron
- Used at ATCO sites (urban and rural) from the 1960s to mid-1990s. **No longer used**
- Soil and groundwater quality guidelines introduced in 2007 (tebuthiuron) and 2010 (bromacil)
- Concentrations commonly encountered more than 25 years later at sites above remediation guidelines = **Environmental Liability**

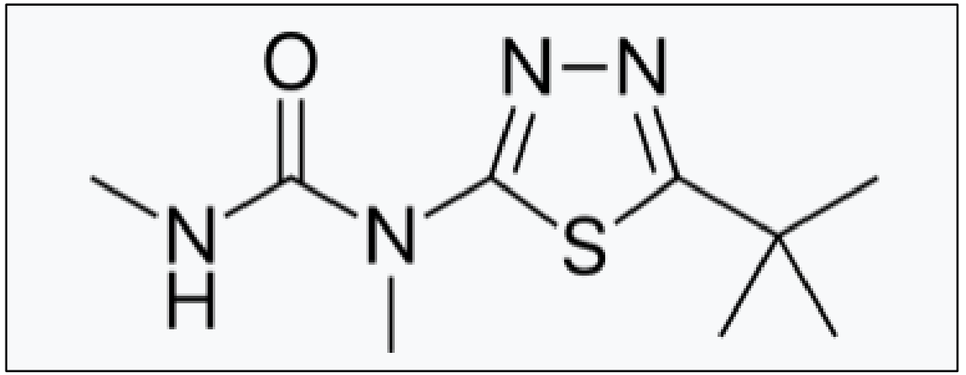
Bromacil

- Chemical name: 5-bromo-3-(butan-2-yl)-6-methylpyrimidine-2,4(1H,3H)-dione
- Product names: **Bromazil, Uragan, Hyvar X, Calmix, Krovar**
- Inhibits photosynthesis in grasses, broadleaf weeds and certain woody species



Tebuthiuron

- Chemical name: 1-(5-tert-Butyl-1,3,4-thiadiazol-2-yl)-1,3-dimethylurea
- Product names: **Spike, Graslan, Perflan, Brulan, Herbec 20P**
- Inhibits photosynthesis for total vegetation control



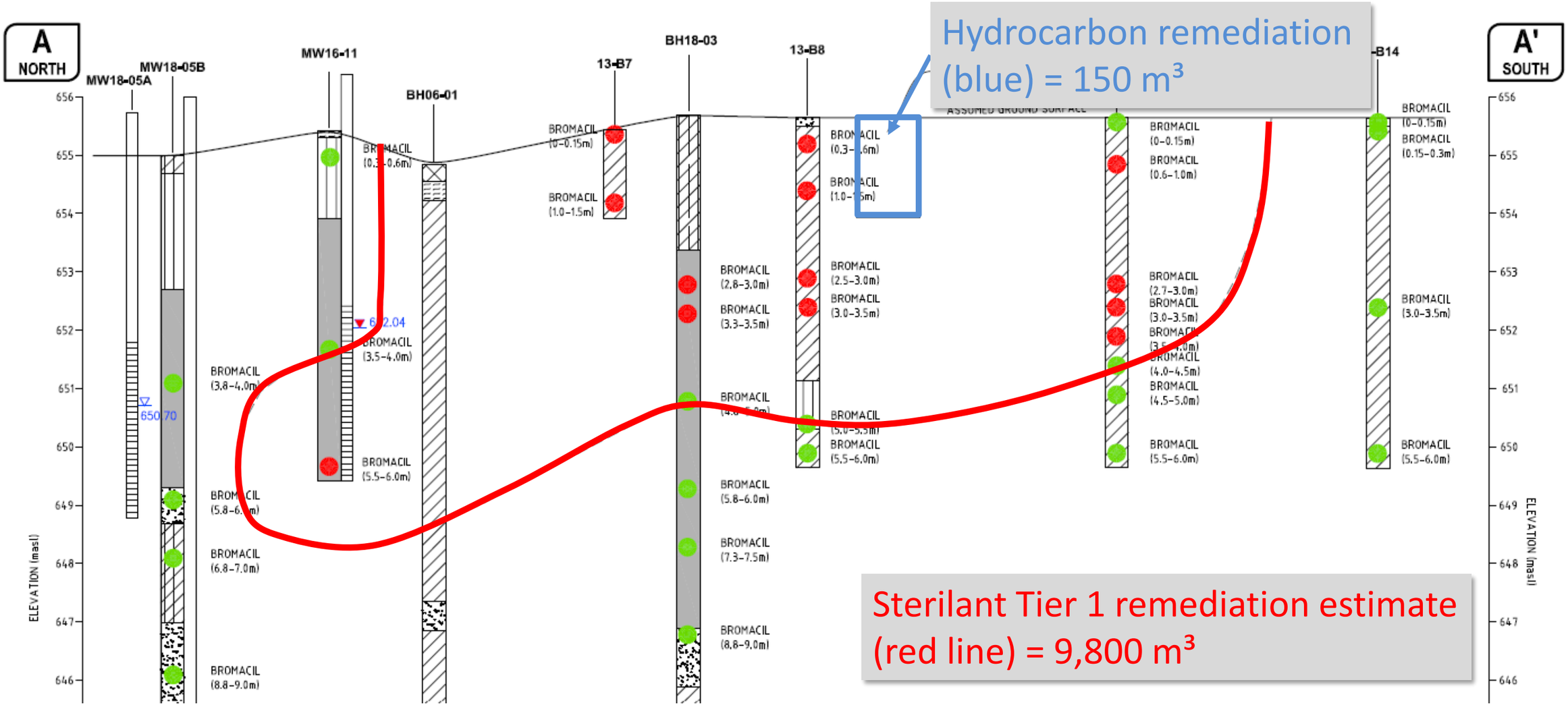
SOIL STERILANTS AT ATCO SITES

- Environmental concern is vegetation damage or growth impairment in soil directly impacted with sterilants or offsite migration to impact to vegetation on adjacent properties
- Has not degraded as expected (examples below from application 25+ years ago)

Substance	Max. Soil Concentration (mg/kg)	Tier 1 Guideline - AG (mg/kg)	Max. Groundwater Concentration (mg/L)	Tier 1 Guideline - AG (mg/L)
Bromacil	6.9	0.009	0.17	0.0002
Tebuthiuron	1.9	0.046	0.044	0.00043

- Main driver of remediation at Electric
- Often only driver of remediation at Natural Gas sites
- Also were used at other oil and gas and industrial sites in Alberta

ELECTRIC SUBSTATION EXAMPLE



Hydrocarbon remediation (blue) = 150 m³

Sterilant Tier 1 remediation estimate (red line) = 9,800 m³

FORMER APPROACH

FORMER APPROACH

- Defer work to the future, due to historic lack of guidelines
- Remediation to Tier 1 Guidelines
- Remediate source areas, risk manage the rest

FORMER APPROACH – EXCAVATION TO TIER 1

- Sterilants were applied at this site from the 1970s to 1990s
- Sterilant impacted sites did not always show signs of vegetation stress, but assessment indicated soil and groundwater impact above Tier 1 Guidelines
- Remediation option was limited to excavation and disposal
- ~11,000 m^3 were excavated from this site and the same amount had to be backfilled.

FORMER APPROACH – SOURCE REMOVAL

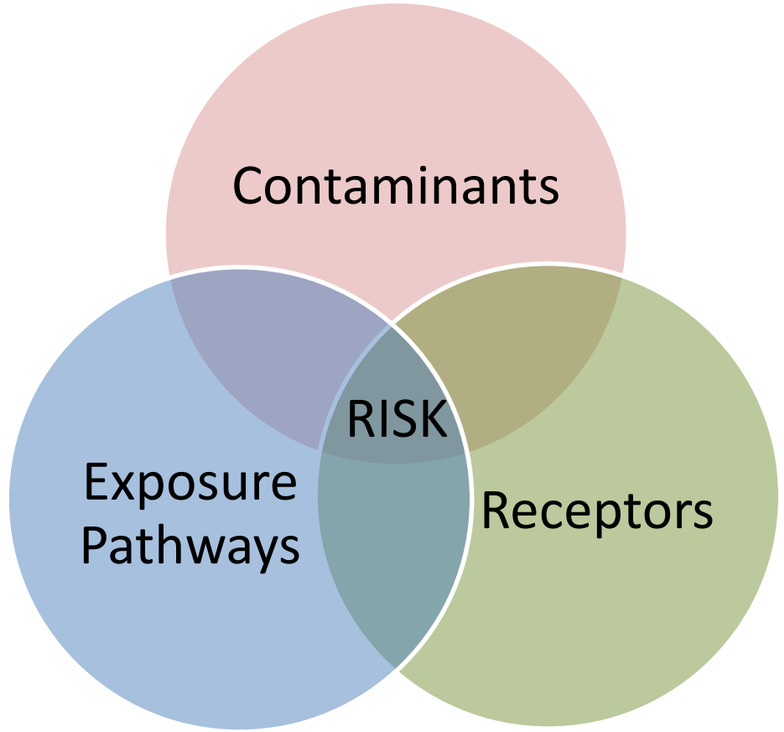
Source removal and long-term risk management

CURRENT APPROACH

SUSTAINABILITY GOAL & RISK REDUCTION

Goal is to deal with the ACTUAL risk of the soil sterilants in a sustainable manner

- Reduce soil sent to landfill
- Reduce cost
- Reduce health and safety risks
- Reduce greenhouse gas (GHG) emissions caused by remediation
- Lower regulatory risk by getting sites to closure faster



NEW APPROACH

- ATCO Electric and ATCO Gas and Pipelines are funding participants on InnoTech Alberta's Sterilant Research Program with 3 focus areas:
  - Identification and delineation
  - Risk assessment and management
  - Remediation

- Site specific risk assessments (SSRA) completed on all larger/complicated sites:
  - Re-calculating guidelines based on distance to receptors
  - Ecological contact guidelines applied to rooting zone/surface soil

INNOTECH ALBERTA STERILANT PROGRAM

- In 2018, **InnoTech Alberta** in consultation with industry proposed developing a program to try to figure out best approaches to deal with sterilant impacted sites
- Knowledge gaps identified:
  - Research on fate and behavior not specific to Alberta conditions
  - What is a reasonable half-life?
  - What is the risk of sterilants in soil actually reaching receptors that could be impacted?
  - What is the impact of sterilants on native species in Alberta?
  - How can we field screen for these chemicals to more rapidly assess and remediate sites?
  - Are there ways to remediate these chemicals in place to reduce costs?

INNOTECH PROGRAM OUTCOMES

- Currently in year 4 of the 5-year program
- Various projects complete or in progress, including:
  - Sampling best management practice
  - Laboratory methods
  - Risk management and assessment

- Some challenging results:
  - Field screening methods
  - Half life
  - Native plant ecotoxicity

SSP
Soil Sterilants Program

INNOTECH PROGRAM OPPORTUNITIES

- Further learnings from the InnoTech program that have potential for further improvements in remediation of sterilants:
    - Improved and standardized risk assessment approaches
    - Potential for adjustment of the eco-contact guidelines base on bio-available concentrations – eco-contact is often the limiting pathway under risk assessment scenarios
    - New remediation options
    - Sample hold times

SITE SPECIFIC RISK ASSESSMENT APPROACH

- Adjustment/elimination of soil guidelines for groundwater pathways based on site specific conditions
- Site specific risk objective (SSRO) calculated; ecological direct soil contact ends up being limiting pathway in most cases (0.20 mg/kg for bromacil)
- Applying ecological direct soil contact to 1.5 m or 3 m depth
- Statistical analysis of excavation results to confirm that residual sterilants concentrations do not pose a risk to receptors

CURRENT APPROACH – SITE 1

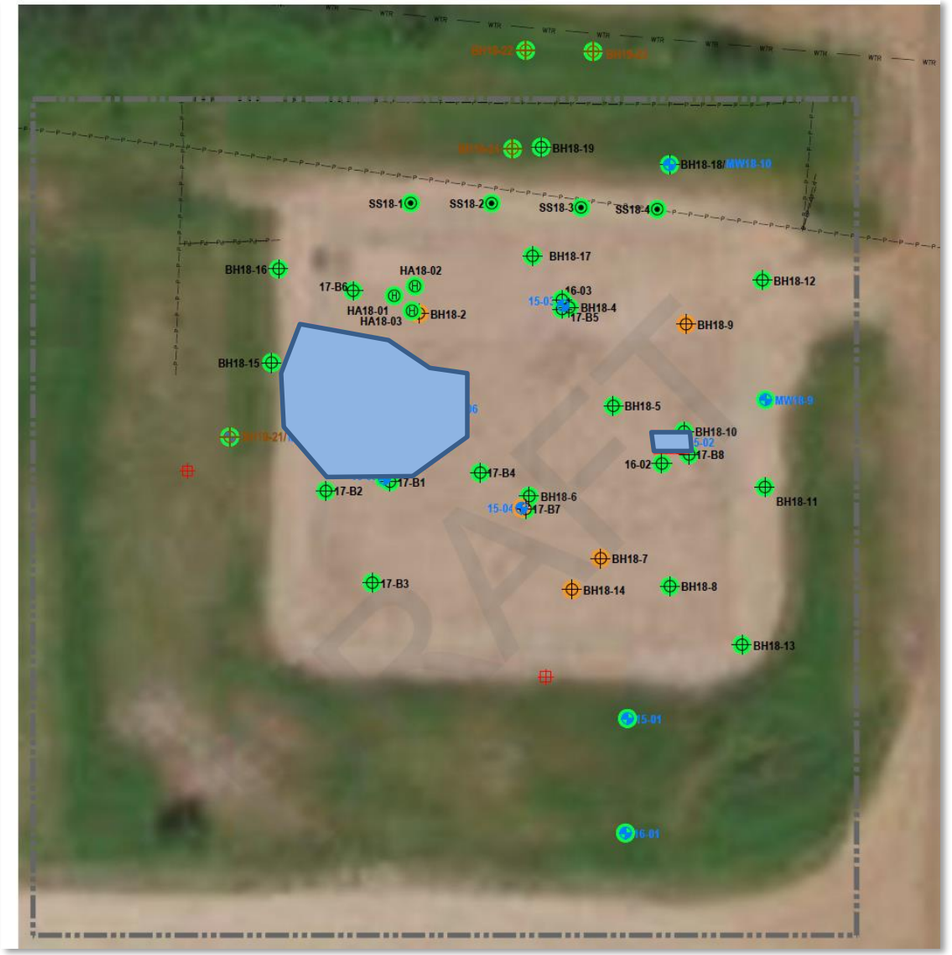
- **2,200 m³** of soil excavated and disposed of in landfill in 2019
- Remediation not completed due to available budget
- **740 m³** was estimated for further remediation under the previous approach
- **130 m³** of soil ended up being removed in 2021 after re-assessment

CURRENT APPROACH - SITE 2

Tier 1 = 9,000 m³

Initial SSRA = 2,976 m³

Final SSRA = 260 m³



CURRENT APPROACH – SITE 3

- Sensitive site due to wetland, irrigation canal, and wildlife
- Excavation of impacts not feasible due bank stability
- No vegetation impacts identified in impacted bank area
- SSRO completed and a small excavation on higher ground for other contaminants
- Site currently going to regulator for approval

CURRENT APPROACH – SITE 4

- Tier 1 Estimate = 800 m^3
- Final remediation using SSRA = 300 m^3
- A portion of the soil was sent to InnoTech Alberta for use in remediation demonstration project

THANK YOU