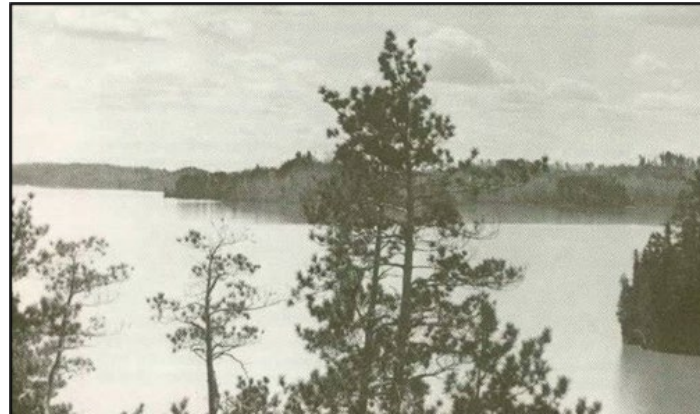
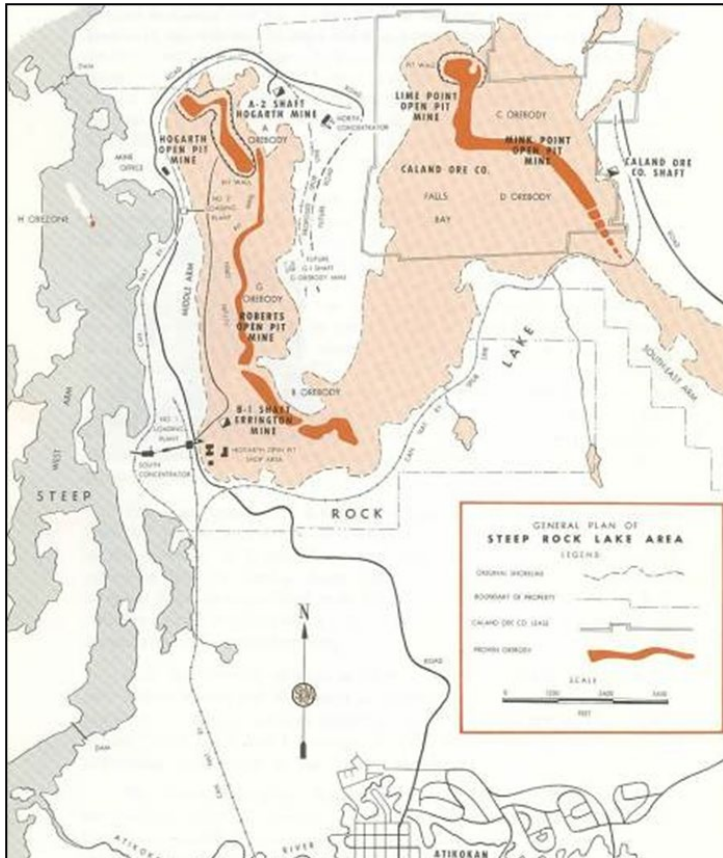




# Rehabilitation of the Former Steep Rock Iron Mine: The Past, Present and Future

CAG meeting Feb 12, 2024

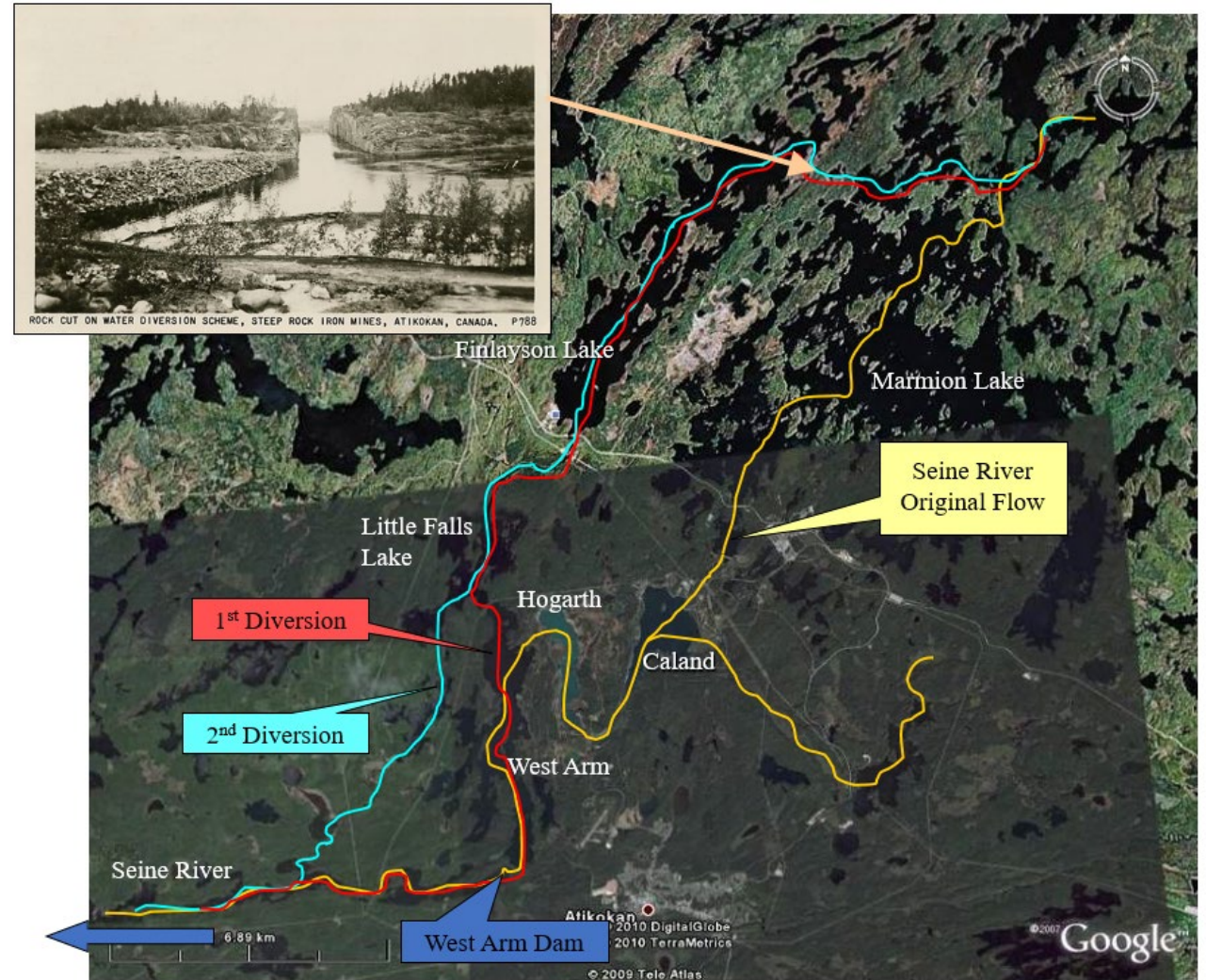
# Development of the Steep Rock Iron Mine



- Prior to mine development, Steep Rock Lake was a large, deep, clear “M” shaped lake, through which the Seine River flowed
- 1938 - The presence of iron ore was confirmed, 120 meters below Steep Rock Lake
- 1942 – Steep Rock Iron ore declared “essential to the war effort” by Canadian Government
  - War Measures Act
    - Develop the mine by whatever means possible

# Development of the Steep Rock Iron Mine

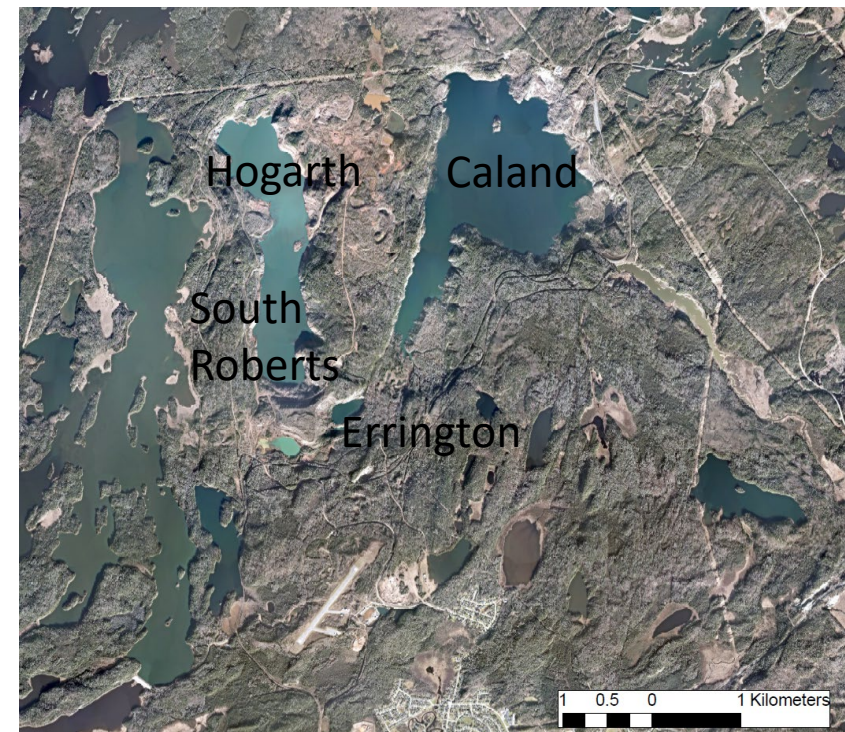
- In 1943 the Seine River was diverted around Steep Rock Lake through a series of dams and rock cuts
- Middle and East arms Steep Rock Lake were isolated from the rest of the watershed, and drained of water
- West Arm Dam was built to isolate the settling basin from the Seine River, and a second diversion was created





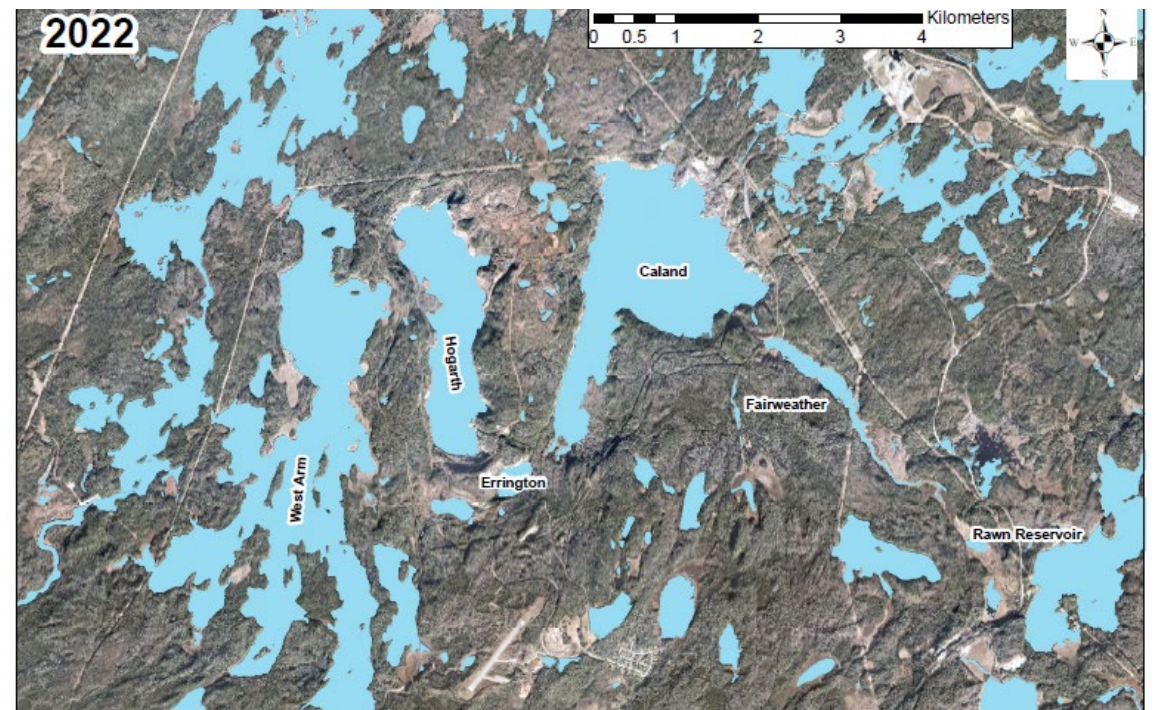
## Mine Operations

- Hogarth, South Roberts, Errington and Caland open pit mines excavated from the former Steep Rock Lake bed
- Mining continued from 1955 – 1979
- By the time mining was complete, more material had been moved than to construct Panama Canal

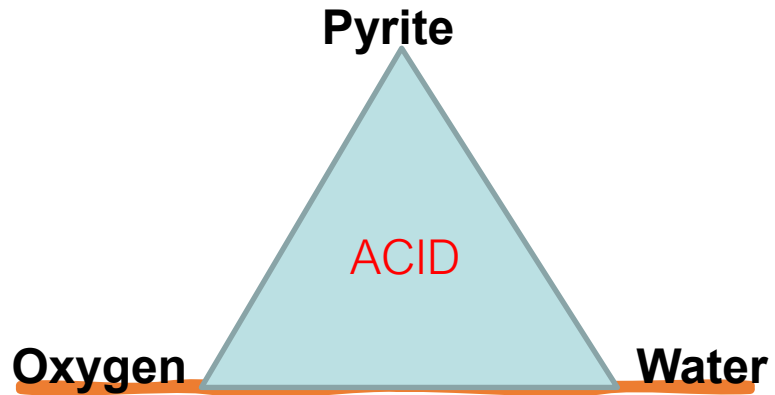


## Mining Legacy

- Mining ceased in 1979 and by 1988 the land was surrendered to the Crown, with MNRF taking responsibility for the Site.
- After mine closure, pits began filling with water
- 3 pit lakes currently present on landscape
- Water Quality Issues
  - Mine waste and acid rock drainage
  - Contaminated soil and groundwater



## Mine Waste and Acid Rock Drainage



- During mining, some mine waste material was piled around the open pit mines
- Challenges of mine waste:
  - Vegetation establishment
  - Acid Rock Drainage
    - Occurs when waste rock exposed to air and water
    - Water and oxygen react with sulfur in disturbed material
    - Results in acidic runoff that can be high in heavy metals and sulphate

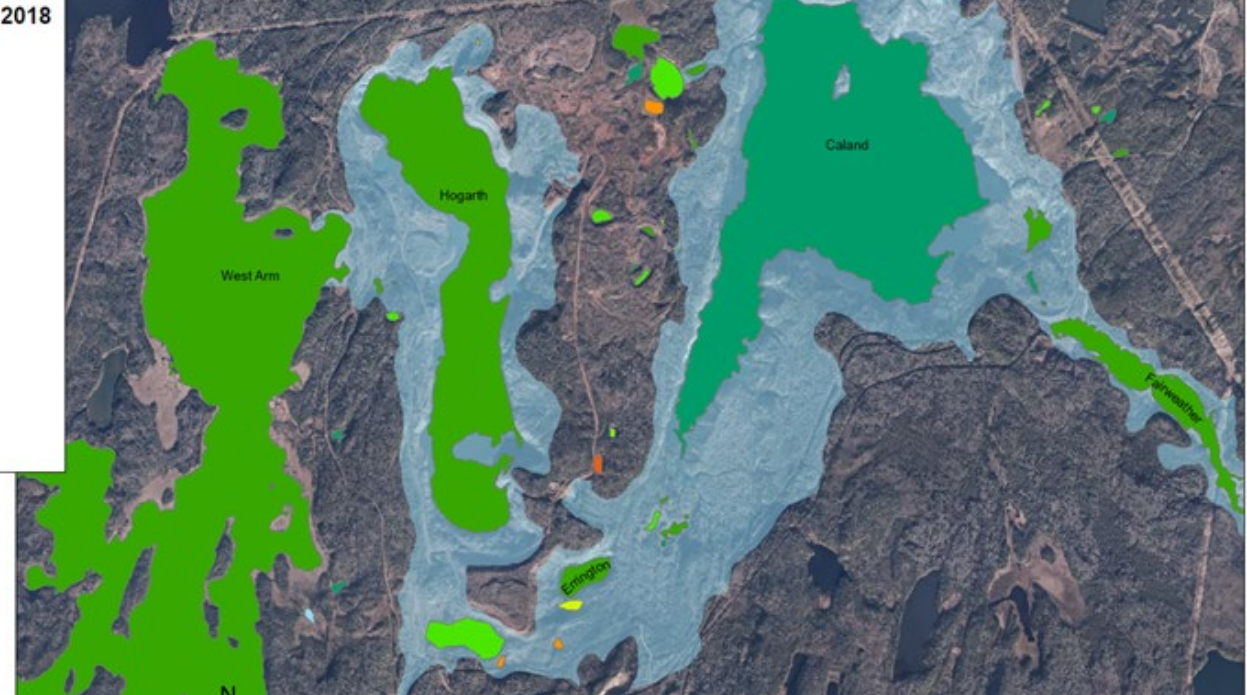


# Steep Rock Water Quality – pH and Metals

- Due to high quantities of carbonate rock, all three Steep Rock Pit lakes have a neutral pH
- Metals in the surface waters in Hogarth and Caland are within Provincial Water Quality Objectives
- Some ponds on site are very acidic and elevated in heavy metals

Surface water pH 2017 - 2018

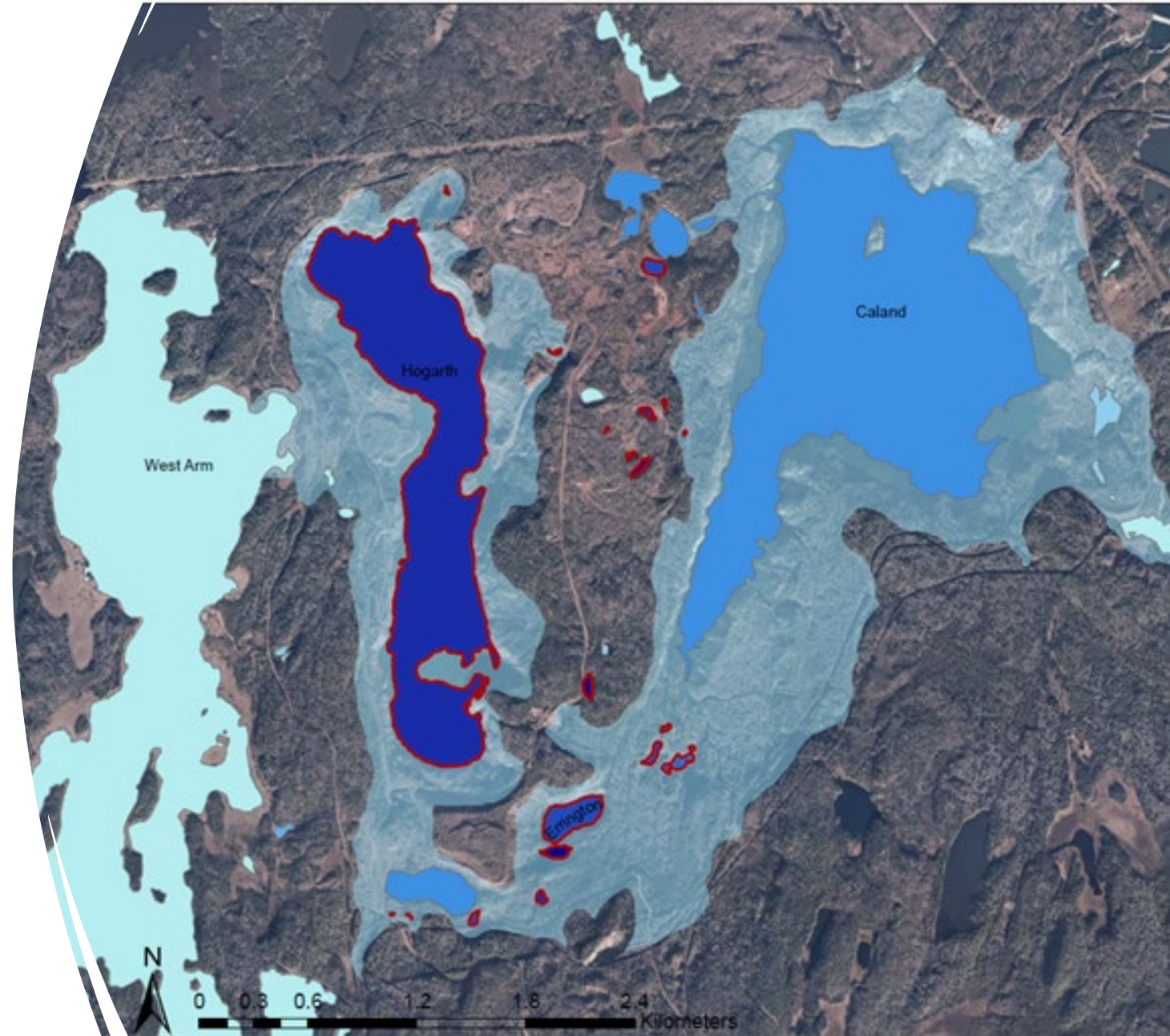
Color	pH Result
Light Blue	0.0 - 1.0
Yellow	6 - 2.0
Orange	- 2.5
Red	3.0
Dark Red	4.0

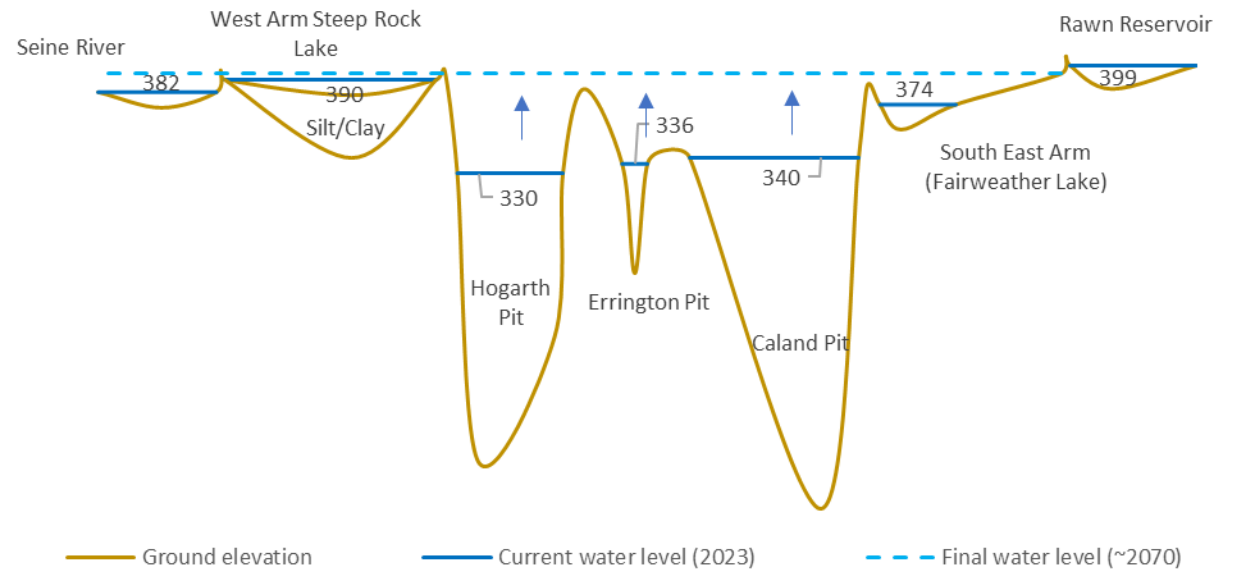
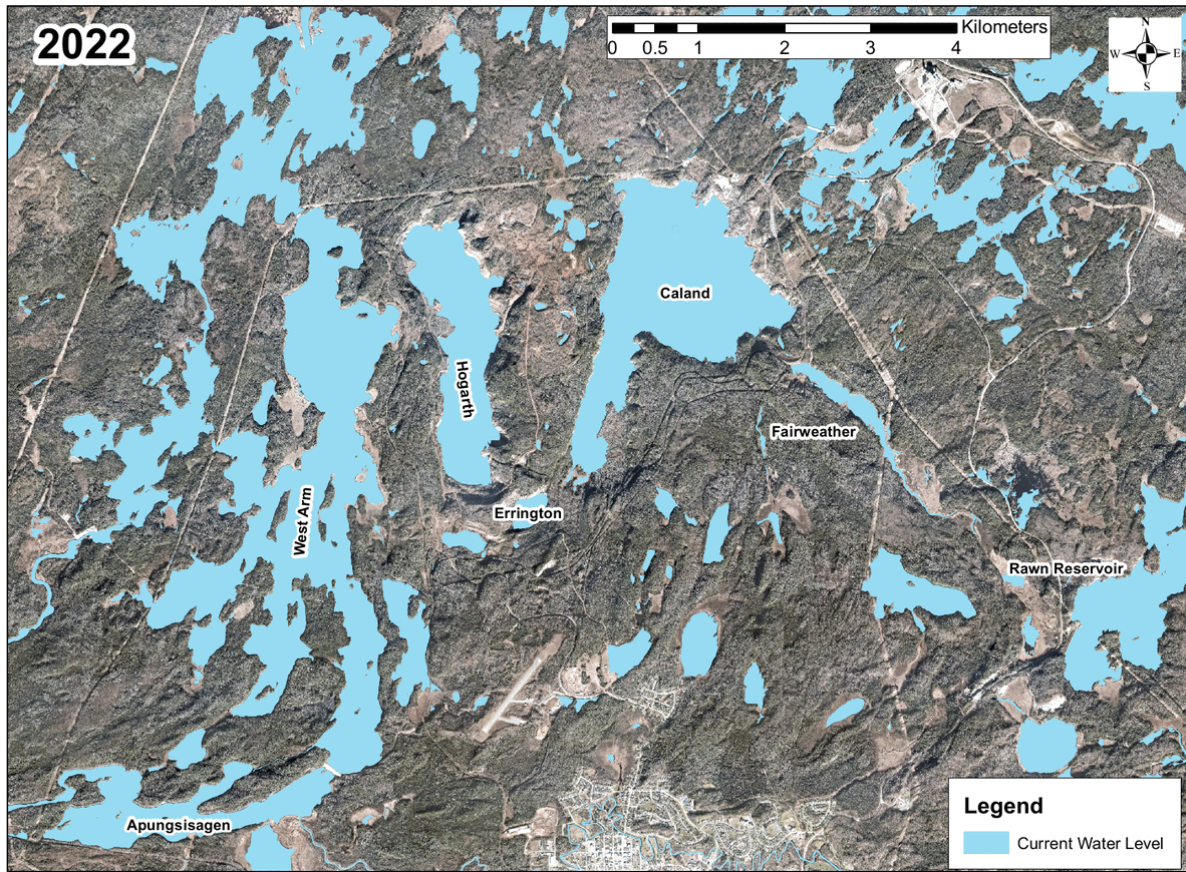


# Steep Rock Water Quality - Sulphate

Sulphate

- The primary parameter of interest in Steep Rock Pit Lake waters is Sulphate
- Expected to remain elevated beyond natural levels at decant
- No PWQO for sulphate
- Potential issues
  - Wild rice productivity
  - Mercury methylation





- Pit Lake water levels are rising at a rate of 1 – 3 m per year
- Water from the Steep Rock site will eventually rejoin the Seine River watershed (~2070)



2004

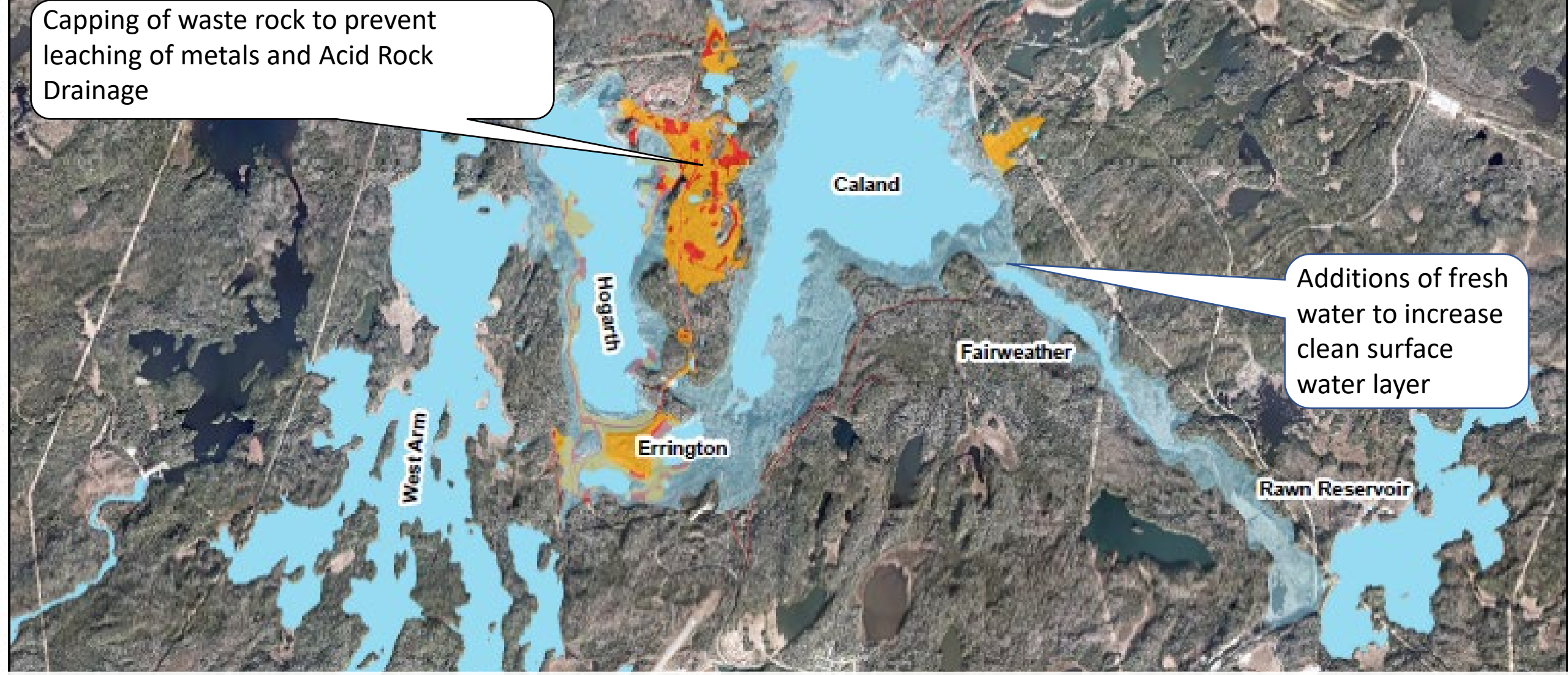


2012



2022

Capping of waste rock to prevent leaching of metals and Acid Rock Drainage



## Possible Pit Lake Water Remediation Strategies



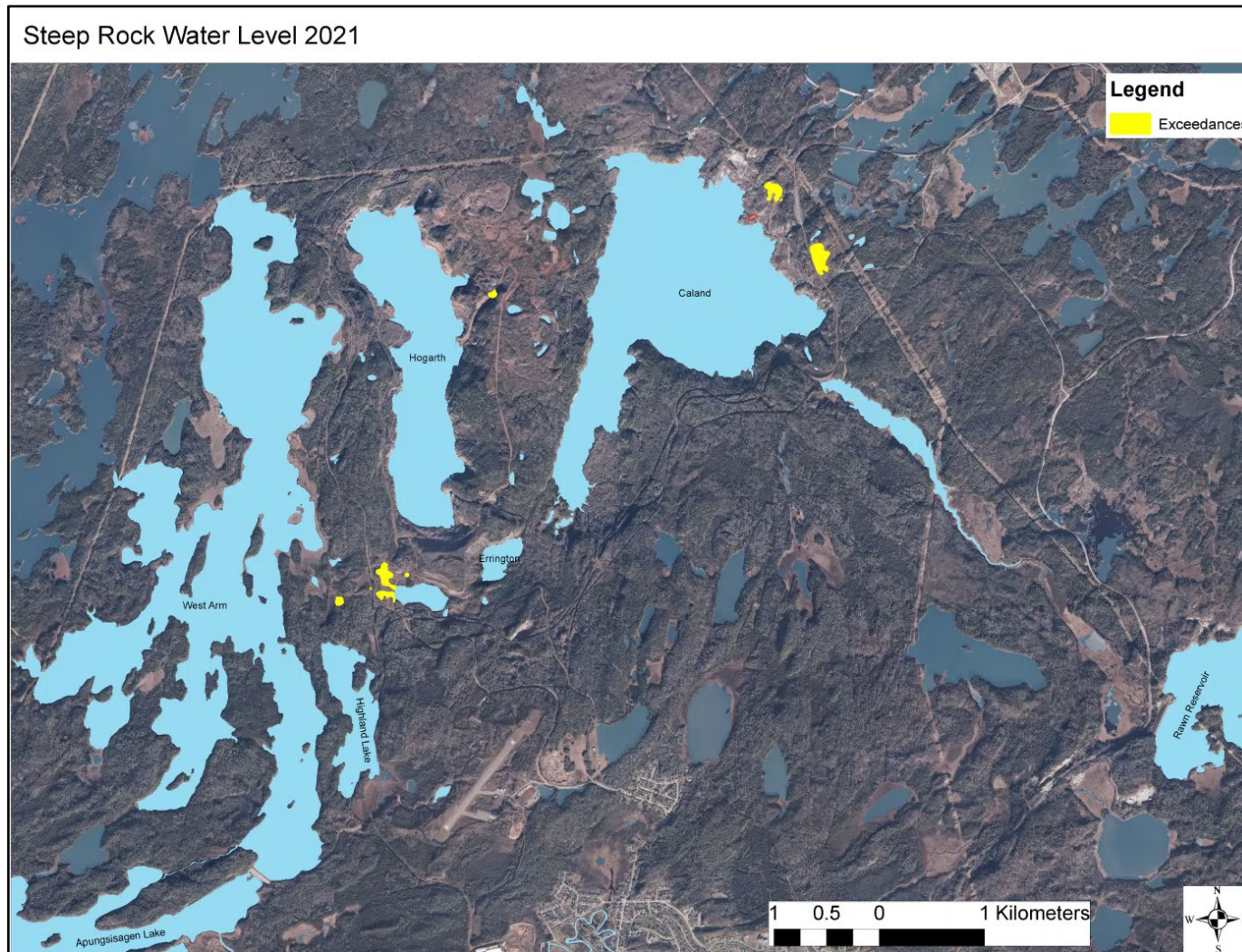
# Caland Area

The Caland Area consists of:

1. Former Caland Euclid Shop
2. Former Transformer Station



# Inundation Timeline



# Caland Area Contamination

Soil and or groundwater contamination with:

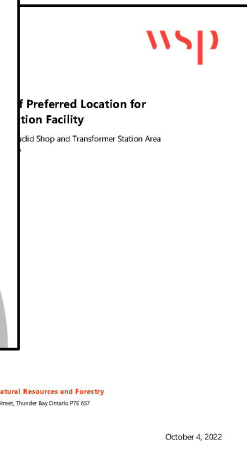
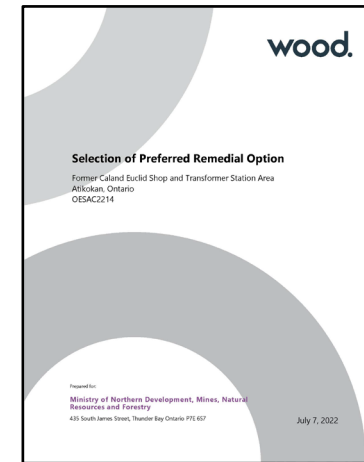
- Metals.
- Petroleum Hydrocarbons (PHCs).
- Polycyclic Aromatic Hydrocarbon (PAHs).
- Volatile Organic Compounds (VOCs).
- Polychlorinated Biphenyls (PCBs).
- Light Non-Aqueous Phase Liquid (LNAPL).



# Caland Area

## 1. Former Caland Euclid Shop: Recent Accomplishments:

- Remedial options analysis (2022).
- Recommended remedial option (2022).
- Remediation facility locations assessment (2022).
- Excavation design and drawings (2022/2023).
- Remedial facility design and drawings (2022/2023).
- Continuous Ministry groundwater quality sampling and analysis.
- Review of most recent advances of remediation techniques (2022).



ALS ID	Client Sam	ALS Test C	Parameter	Results	Units	Detection	Date Sampled	Time Sam	Prep Date	Analysis Date	QC Lot	QC Eval	Hold Time	Matrix	Class	loc. equ
601990-MW16-10-P-T-COL-T	Phosphorus (P)-Total			0.0034	mg/L	0.003	06/14/2021	15:40	06/24/2021	06/24/2021	1493260	TRUE	TRUE	Water	Anions on MW16-10	
601990-MW16-10-SO4-IC-N-	Sulfate (SO4)			168	mg/L	0.3	06/14/2021	15:40	06/18/2021	06/22/2021	1491033	TRUE	TRUE	Water	Anions on MW16-10	
601990-MW16-10-MET-T-CC	Aluminum (Al)-Total			0.0695	mg/L	0.003	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Antimony (Sb)-Total			<0.00010	mg/L	0.0001	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Arsenic (As)-Total			0.00129	mg/L	0.0001	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Barium (Ba)-Total			0.0395	mg/L	0.0001	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Beryllium (Be)-Total			<0.000020	mg/L	2.00E-05	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Bismuth (Bi)-Total			<0.000050	mg/L	5.00E-05	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Boron (B)-Total			0.07	mg/L	0.01	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Cadmium (Cd)-Total			0.00001	mg/L	5.00E-06	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Calcium (Ca)-Total			157	mg/L	0.05	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Cesium (Cs)-Total			0.000034	mg/L	1.00E-05	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Chromium (Cr)-Total			0.00114	mg/L	0.0001	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Cobalt (Co)-Total			0.00049	mg/L	0.0001	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Copper (Cu)-Total			0.00151	mg/L	0.0005	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Iron (Fe)-Total			0.815	mg/L	0.01	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	
601990-MW16-10-MET-T-CC	Lead (Pb)-Total			0.000128	me/l	5.00E-05	06/14/2021	15:40	06/21/2021	06/23/2021	1491834	TRUE	TRUE	Water	Total Met: MW16-10	

# Caland Area

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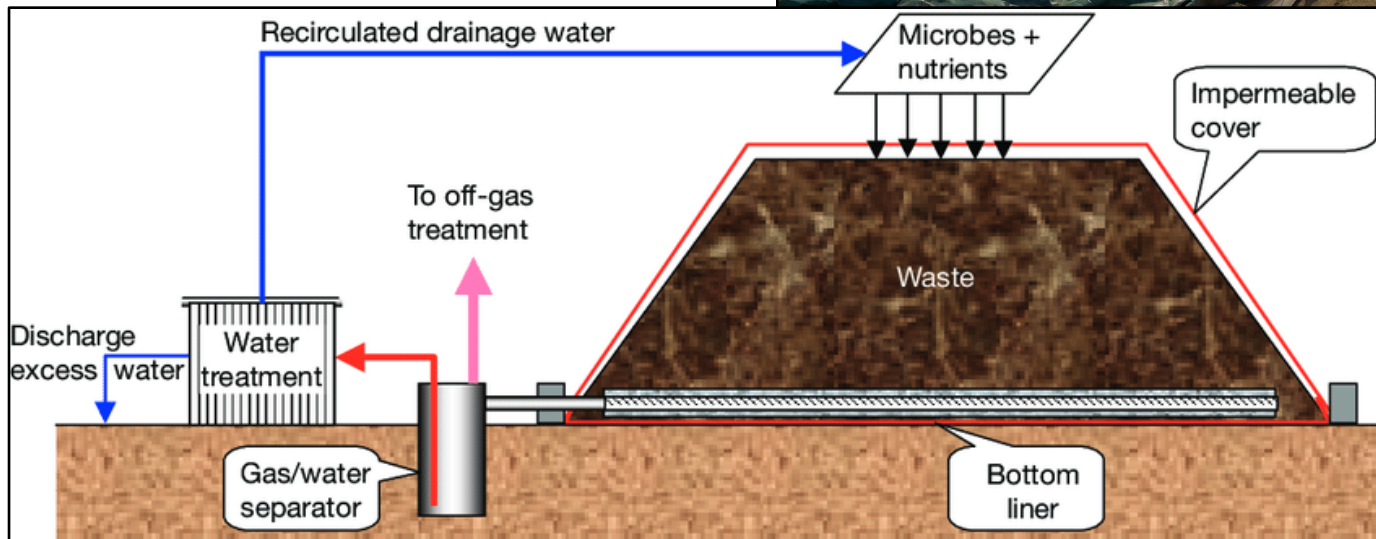
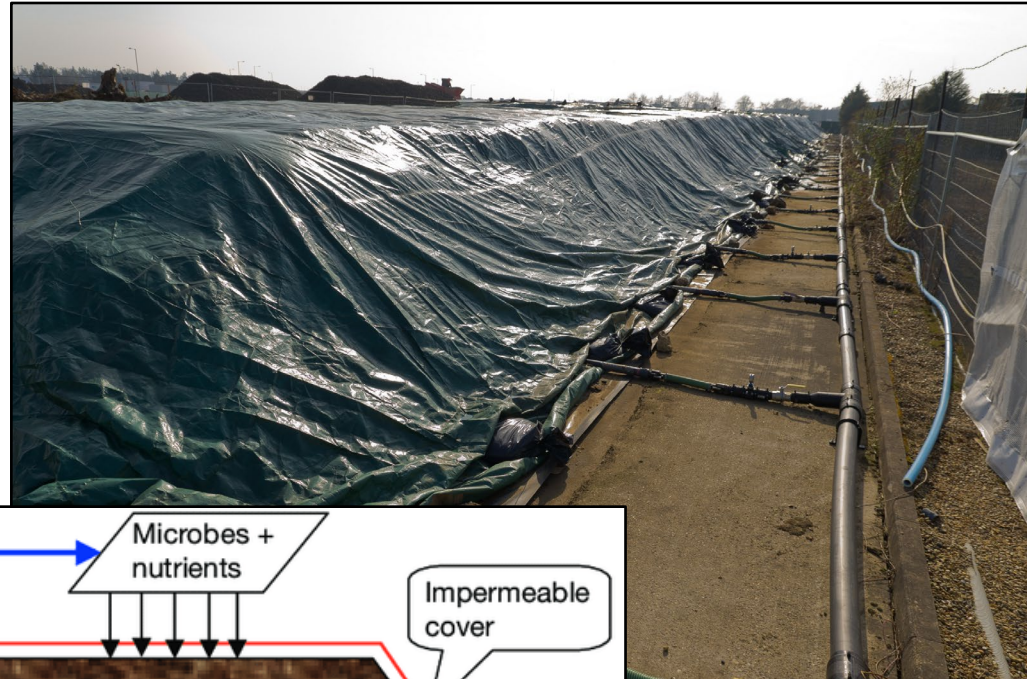
## Key notes:

- Refined remedial options analysis for petroleum hydrocarbons (PHCs), polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), and sheen.
- PCBs to be disposed off at a licensed facility.
- Remaining metals subject to risk assessment and or capping if feasible.
- Two final options to consider: (1) Biopiles, (2) Landfarming (Treatment Cells or Windrows).

How it looks:

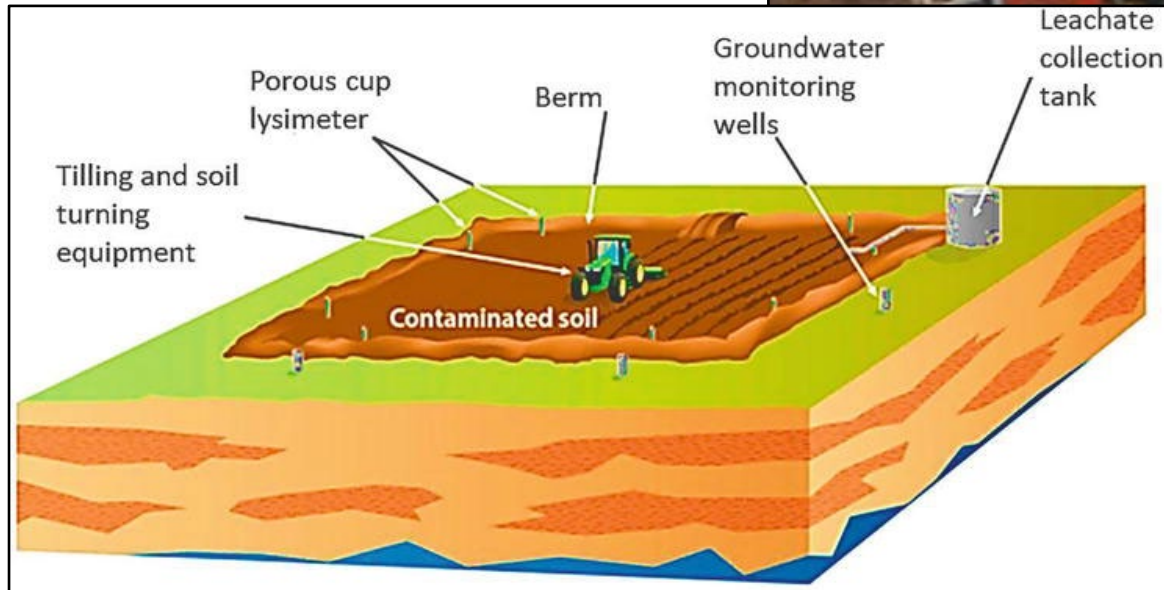
# Caland Area

## Biopiles (Assessed – Not Selected)



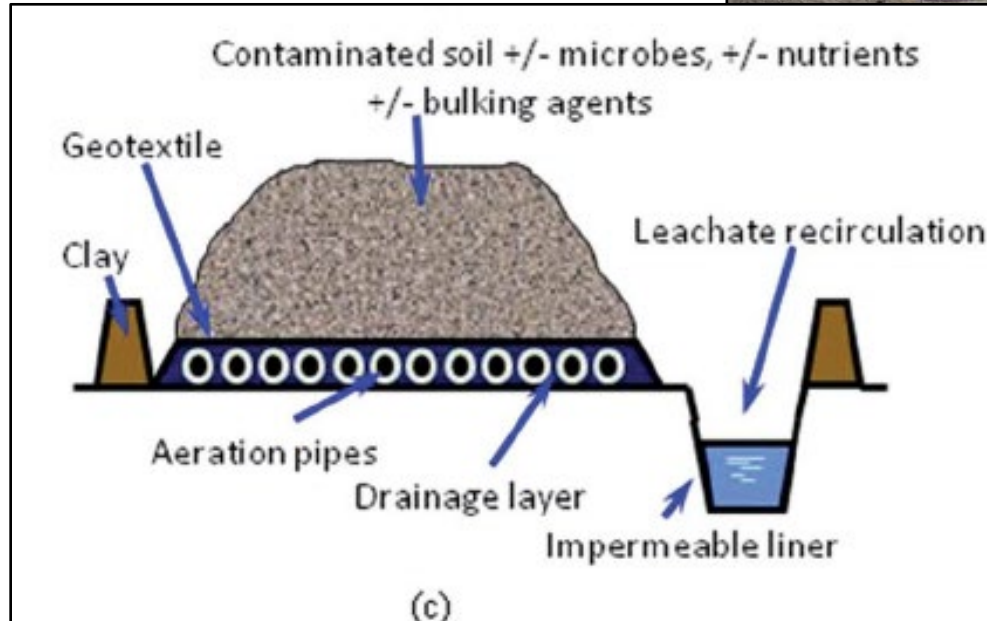
# Caland Area

## Landfarming Treatment Cells (Assessed – Not Selected)



# Caland Area

## Landfarming Windrows



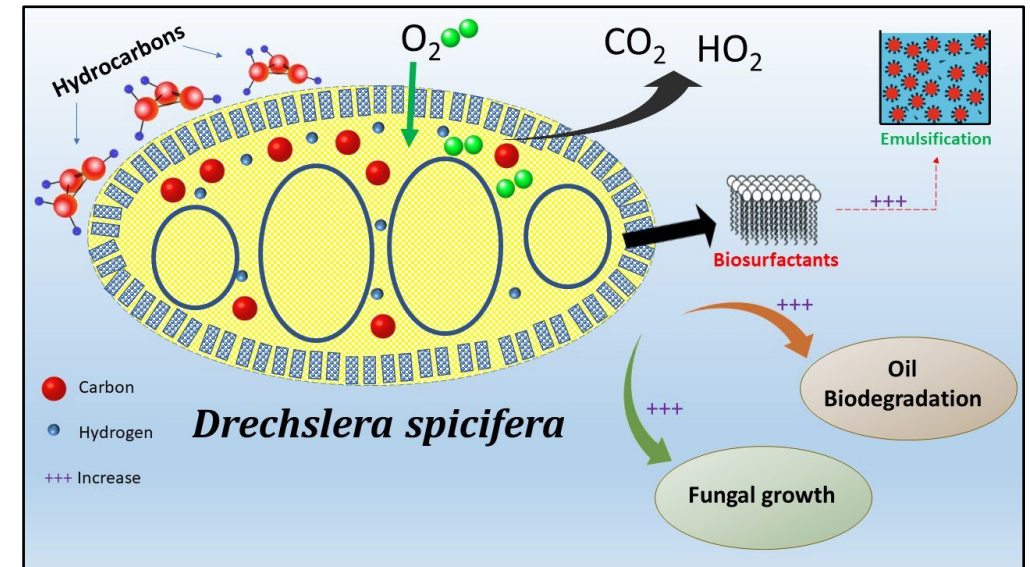
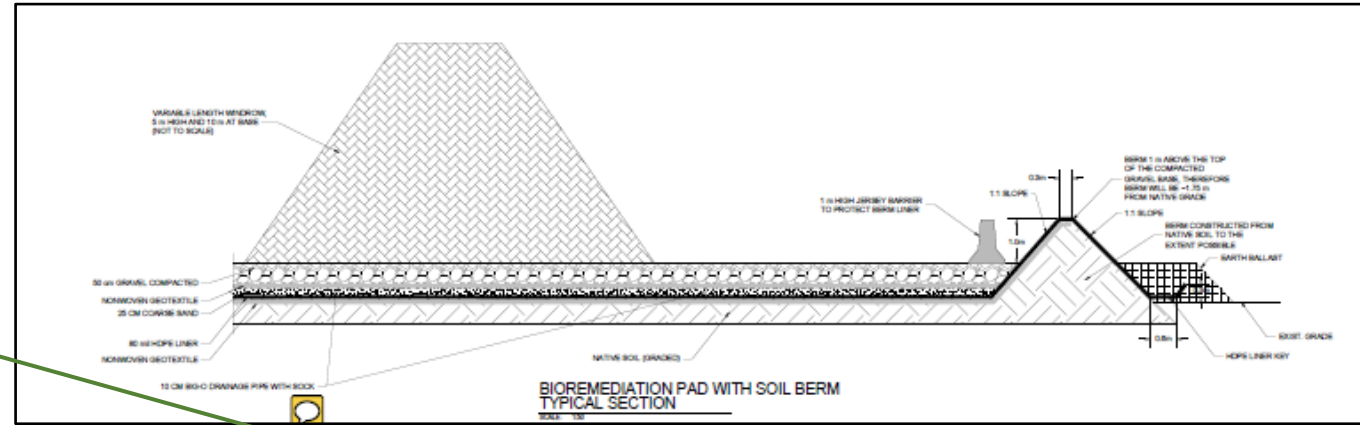
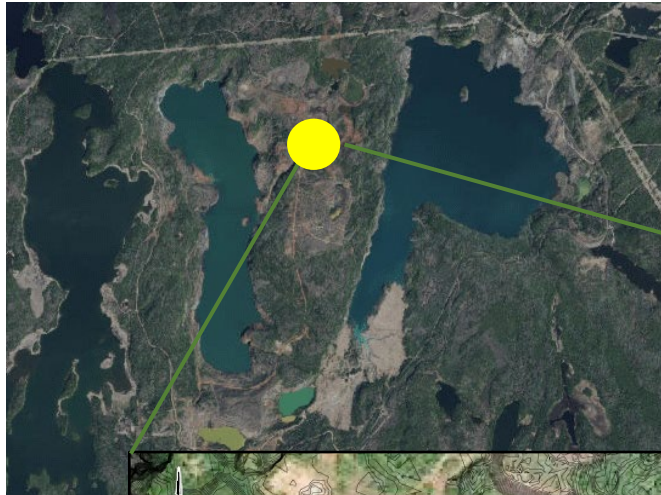
# Caland Area

## Key notes:

- Assessment of four site locations:



# Caland Area Soil Remediation – Scope of Work

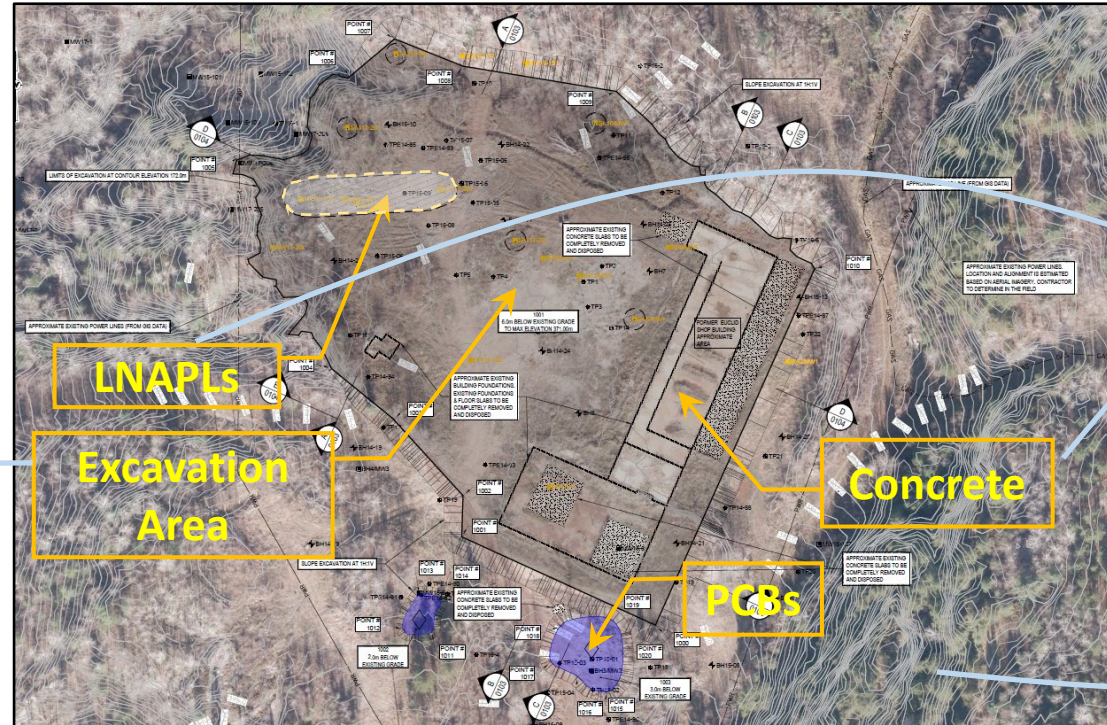


# Caland Area

Excavation depth: approx. 6 meters.

Excavation area: approx. 1.7 hectares.

Bioremediation Facility



Disposal to a Regulated Landfill

Former Caland Euclid Shop

# Caland Area

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## **Timeline:**

- 2023-24: EA, permitting, approvals, contracting.
- 2024: remove PCB and send to regulated landfill
- 2025: Start to excavate and haul contaminated soil from the Caland Area.  
Contaminated groundwater treatment. Staging/building the bioremediation facility.
- Bioremediation facility operation over tentatively 2 to 5 years after construction.

# Thank you for your time Questions?

