



Obsidian Energy Ltd. SWAT Consulting Inc.

Remediation and Reclamation of a Wellsite

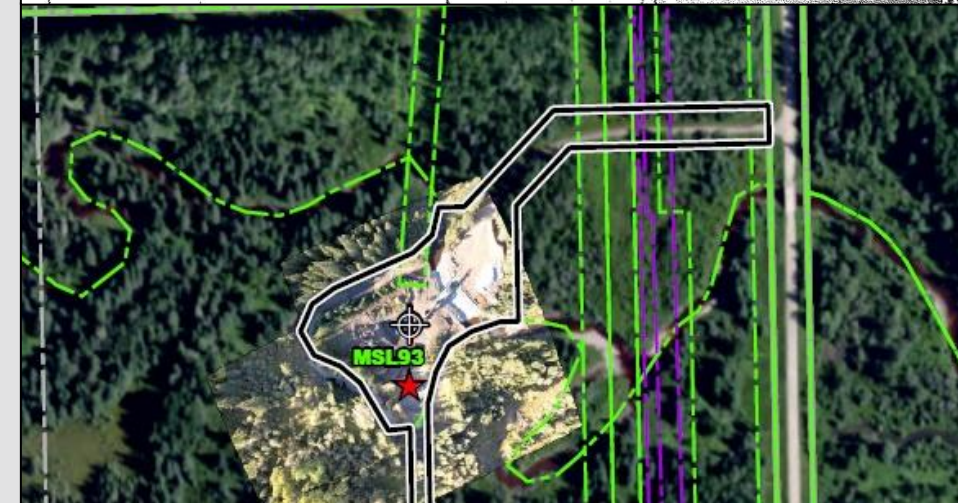
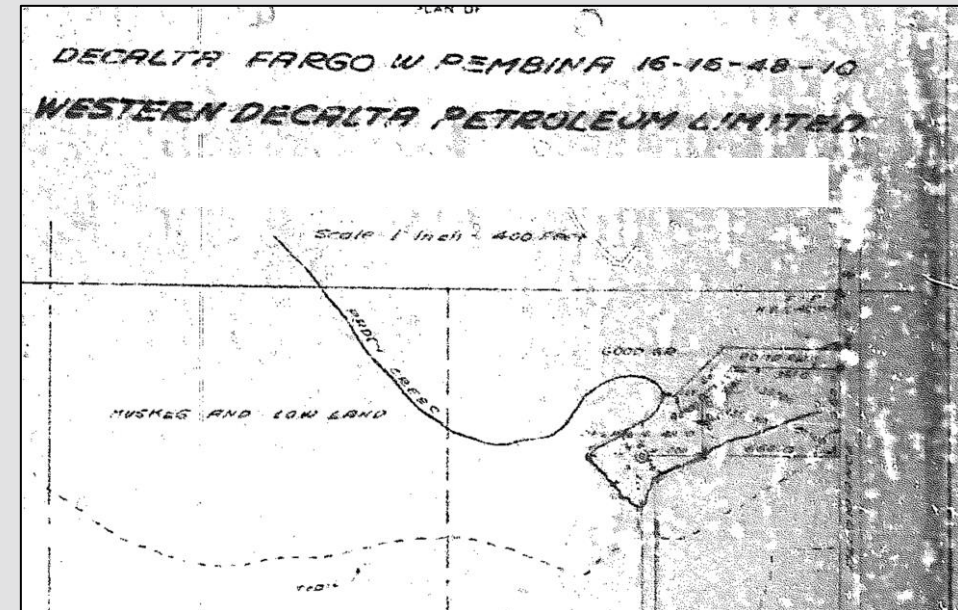
RemTech 2023





Outline

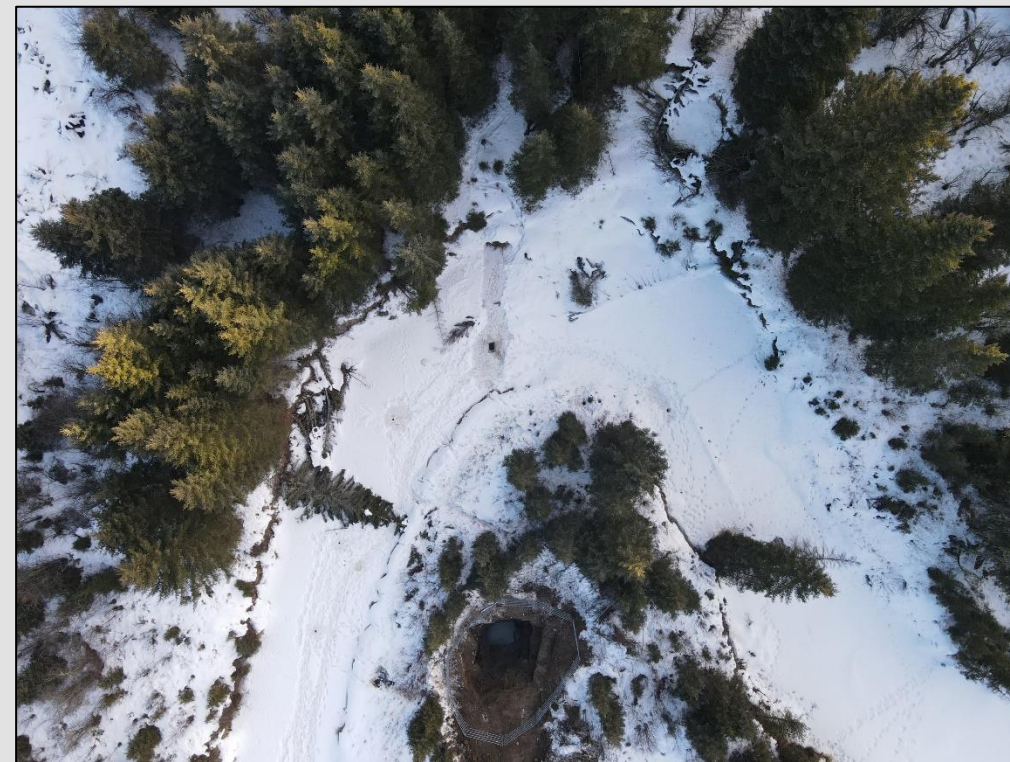
- Site Setting and Background
- Summary of Initial Details
- Regulatory Support and Engagement
- Overview of Remediation
- Overview of Reclamation
- Remaining Remediation and Reclamation Work
- Summary of Environmental Benefits of the Program





Site Setting and Background

- The well was spud August 8, 1958, and abandoned on March 16, 2022.
- The wellsite was constructed within a meander bend of fish-bearing Paddy Creek which contains multiple species of sport and non-sport fish, as well as the potential for Bull Trout (provincially *At Risk* and federally *Threatened*).

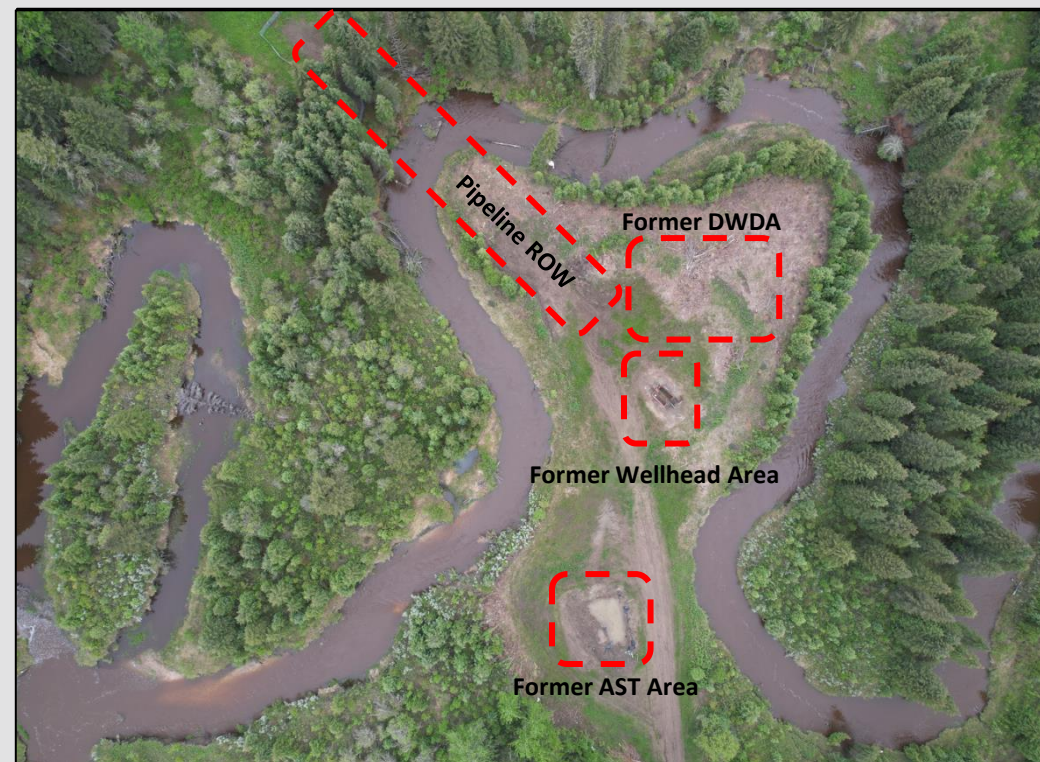
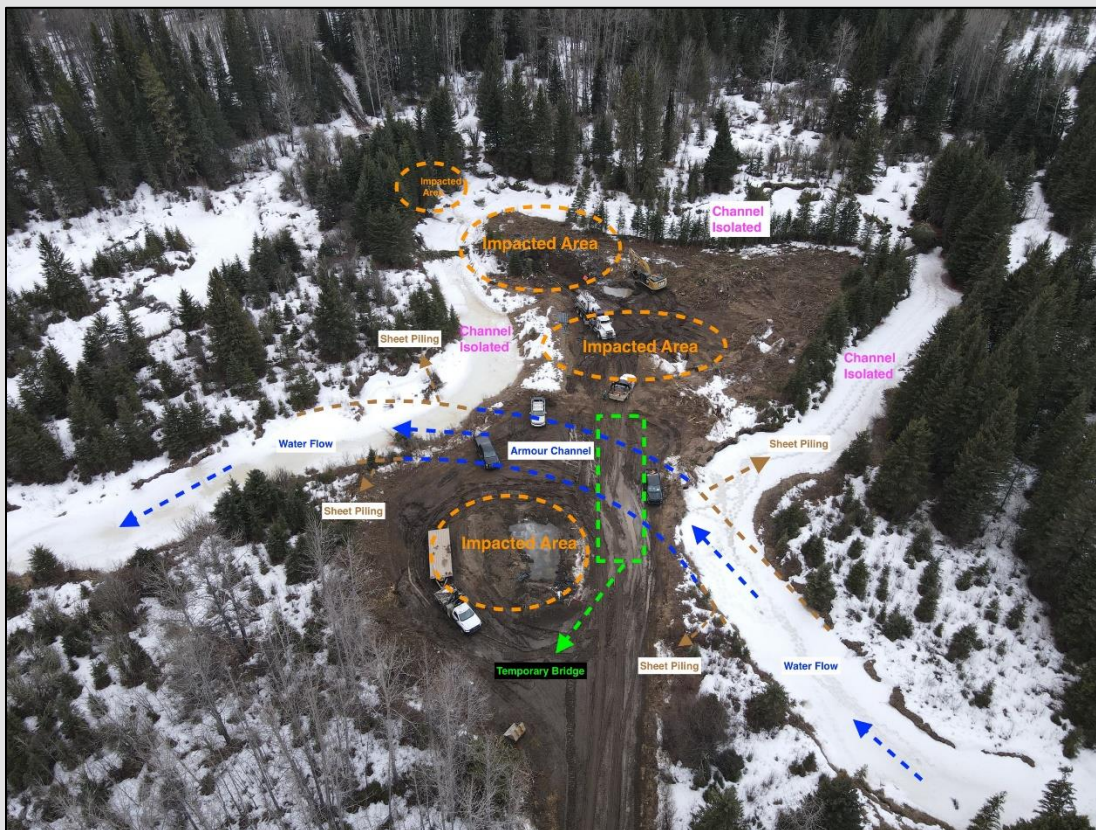


- Surrounding land is natural forested area and the site is located within a Grazing Lease.
- A wildlife sweep of the area identified Blue Jay, Common Yellowthroat, Black-capped Chickadee, Deer, and Red Squirrel near the site. Cougar and Grizzly Bear are also listed as potential sensitive species present in the area.



Initial Details

- A Phase 1 ESA and Phase 2 ESA drilling program were completed in February 2022 and identified historical impacts within key APECs (former AST area, former wellhead, and along the former pipeline ROW).
- Primary CoCs were PHCs and PAHs.



- Delineation concluded potential impacts within the banks of the creek and possibly within the creek bed along the south edge of the 'peninsula' where impacts were also identified along the ROW south of the creek.
- Initial tree clearing and some minor remediation work along the pipeline ROW was completed in February 2022 during site decommissioning.



Initial Details -Phase 2 Drilling





Regulatory Support and Engagement

- **Provincial:** Alberta Energy Regulator
 - *Temporary Field Authorization (RTF)* for required work outside of the lease boundary (MSL93)
 - *Water Act Approval* for work being conducted within Paddy Creek which included:
 - Design and construction of the diversion channel
 - Installation and removal of sheet piling dams to isolate the work area within the creek
 - Remediation work within and along the creek bed and banks
 - Reclamation of the disturbed section of the creek
- **Provincial:** Ministry of Environmental and Protected Areas
 - *Fish Research License (FRL)* for fish salvage conducted within the isolated channel
- **Federal:** Department of Fishers and Oceans Canada (DFO)
 - *Fisheries Act Request for Review* and approval for work being conducted within a fish-bearing watercourse that may alter or destroy fish habitat.
 - *Species at Risk Act (SARA) Permit* required for due to potential presence of Bull Trout in the creek.



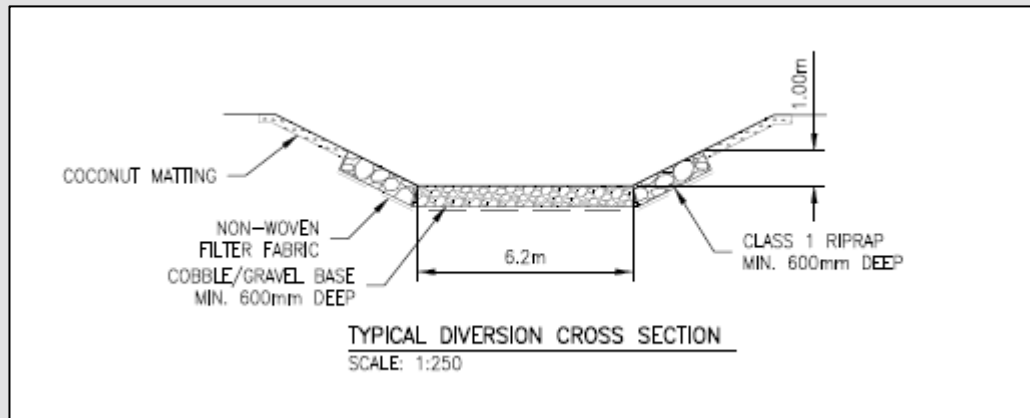
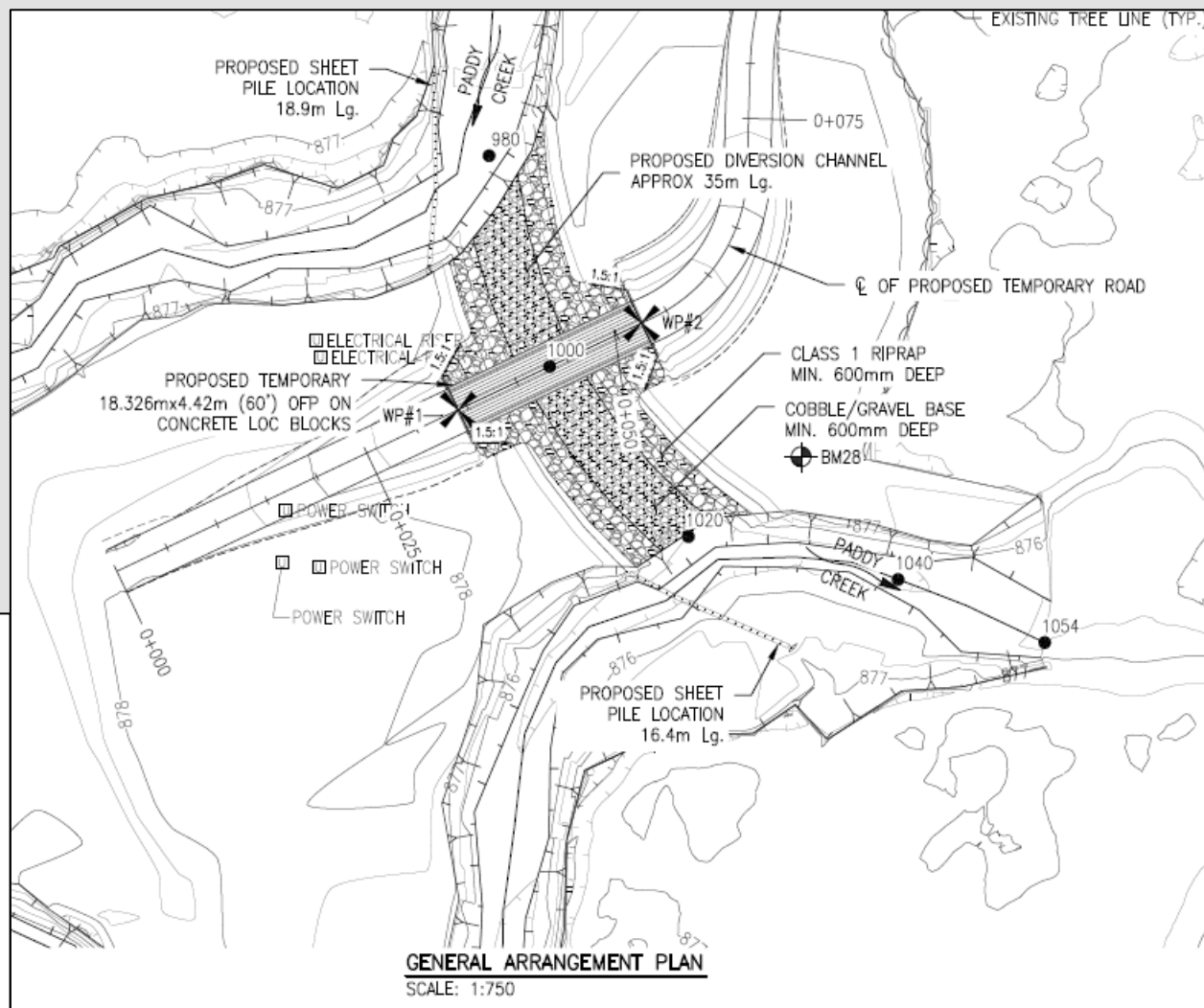
Mountain Whitefish captured and relocated during fish salvage operations.



Remediation – Diversion Channel Design

• Channel Location and Design:

- Constructed to bisect the lease in an area where the geomorphology and natural hydrology of the creek would have naturally eroded away over time.
- Designed to act as an overflow channel following the completion of the remediation and reclamation program so as not to disrupt primary flow through the original creek channel.
 - Diversion channel was constructed with a base 0.3 m higher than the natural base of the creek.
- Design included cobble/gravel base to mimic the substrate within Paddy Creek and rock armoring along the banks to prevent erosion, as well as coconut matting along the top of the banks.





Remediation – Diversion Channel Construction

- **Channel Construction:**
 - Constructed between August 27 and 30, 2022.
 - Per the design, gravel was spread across the base of the channel and the banks where rock armored with coconut matting installed across the top portion of the bank.
 - A temporary access bridge was placed across the channel to facilitate remediation and reclamation work. Concrete lock blocks abutments were used to support the bridge.





Remediation – Diversion Channel Construction







Remediation – Sheet Piling Dams

- Sheet piling dam locations were isolated with block netting and fish salvage operations were completed within the isolated sections to avoid fish mortalities.
- The sheet piling dams were installed on September 1, 2022.
- Following installation, fish were captured and relocated from the isolated section of the creek before and during dewatering activities.
 - A total of 894 fish were captured and relocated; species included Burbot, Longnose Dace, Longnose Sucker, White Sucker, Lake Chub, Trout Perch, Northern Pike, Spoonhead Sculpin, and Mountain Whitefish
- Clay plugs were installed on the isolated side of the sheet piling dams after dewatering to control water infiltration, to help maintain water levels within the flowing section of the creek, and to encourage flow through the diversion channel.





Remediation – Sheet Piling Dams







Remediation – Excavation of Contaminated Soils



- Most of the excavation of PHC and PAH impacted soils occurred between September 8 and November 16, 2022, with final hot spot removal completed on June 7, 2023.
 - 9,301.28 tonnes of contaminated soil was excavated and transported to an accredited facility for offsite disposal.
 - 135.8 m³ of impacted fluid and hydrovac slurry was recovered and transported to an accredited facility for offsite disposal.
- Final confirmatory samples collected from the walls and bases of the excavation areas met applicable guidelines for all CoCs.



Remediation – Excavation of Contaminated Soils



Remediation – Excavation of Contaminated Soils



Reclamation – Backfilling, Contouring, and Erosion Control



- The following reclamation work was completed at the site in October and November 2022:
 - Cut and cap the abandoned well to a depth 1.0 m below the natural creek bed to ensure adequate soil cover should the creek erode that section of the island.
 - Unimpacted material salvaged during remediation (topsoil and subsoil) and the clean material excavated during the construction of the open water pool was used to backfill the open excavations and contouring was completed to maintain drainage across the site.
 - Erosion control measures were installed and included coconut matting along the reconstructed creek banks, straw wattles installed along the top of the rock armoring on the banks, and live staking using willows harvested from the area.

Reclamation – Paddy Creek

- As part of the reclamation plan approved by the AER, Obsidian proposed to redefine the creek banks and bed on the south edge of the island to enhance fish habitat while minimizing the risk of sedimentation that would result by re-establishing the excavated section of the island. An open water pool for overwintering was constructed in the area and woody debris was buried along the base of the pool to enhance fish habitat within the creek.
 - Excavated to a maximum depth of 4 to 5 m below the natural creek bed.
 - Salvaged woody debris was buried in the base of the pool and gravel was spread across the base of the pool and any disturbed section of the creek to mimic the natural substrate.
 - Water from the upstream side of the creek was pumped into the open water pool and rock check dams were installed along the approach to limit sedimentation once flow was restored to the isolated section of the creek.
- The disturbed banks of the creek were reconstructed and contoured to match surrounding topography. The base of the banks were armored with rock and coconut matting was placed across the top portion of the bank to limit erosion and sedimentation within the creek. Straw wattles were installed along the top edge of the rock armoring.
- Once most of the earthwork within the isolated work area was completed and the open water pool was full the sheet piling dams were removed.



Reclamation – Paddy Creek



Reclamation – Paddy Creek



Reclamation – Bridge Removal and Final Site Overview



Reclamation – Access Road

- Between June 5 and 10, 2023, reclamation of the north portion of the site and the access road was completed and included stripping, recompacting, and recontouring the north portion of site and access road. The final approach has not yet been reclaimed but the work will be completed later this year.
- On June 19, 2023, tree planting and additional willow staking was completed within the disturbed areas.
 - 1,080 white spruce seedlings were planted.



Before



During



After



After



After



After



After



After



After



After



Summary of Environmental Benefits

- The remediation and reclamation of the wellsite was completed in such a way as to reduce negative impacts to the environment while enhancing current environmental conditions. The overall environmental benefits of this work are as follows:
 - Limited the environmental impact of the diversion channel by constructing it in a location that would naturally erode over time and raising the base of the diversion channel 0.3 m above the base of the creek to ensure that primary flow would revert to the original creek channel.
 - Reduced carbon footprint by salvaging clean soil where feasible and utilizing the clean material excavated to create the open water pool to backfill all open excavations, thus limiting the need to import backfill.
 - Salvaged trees cleared from the site to use as woody debris within the creek bed and across the reclaimed lease to enhance fish and wildlife habitat at the site and help prevent erosion.
 - Enhanced fish habitat within Paddy Creek by constructing additional over wintering habitat.
 - Enhanced wildlife habitat and additional nesting for birds once tree planting has been completed and the trees reach maturity.

Reclamation In Progress

