Former Cliffs-Dow Site

Remedial Alternatives Review Summary

City of Marquette

Commission Work Session

March 26, 2012

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Cliffs-Dow Operational History

- The Cleveland-Cliffs Iron Company developed the property in 1902 to manufacture charcoal pig iron.
- The production of charcoal pig iron continued at the Site until 1930.
- The Cliffs-Dow Chemical Company was created in 1935 and wood processing operations were installed in areas formerly occupied by the pig iron plant.
- Between 1935 and 1969, chemical production of acetic acid and methanol were the primary processes at the plant, with charcoal production taking a secondary role. By-products of plant processes included the generation of tar waste materials.
- In 1968, the Cliffs-Dow Chemical Company was sold to Georgia-Pacific and E.L. Bruce companies; the wood chemical refining process continued until the plant closed in 1969.

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Cliffs-Dow Operational History

Cliffs-Dow Historical Aerial Photos circa 1950's

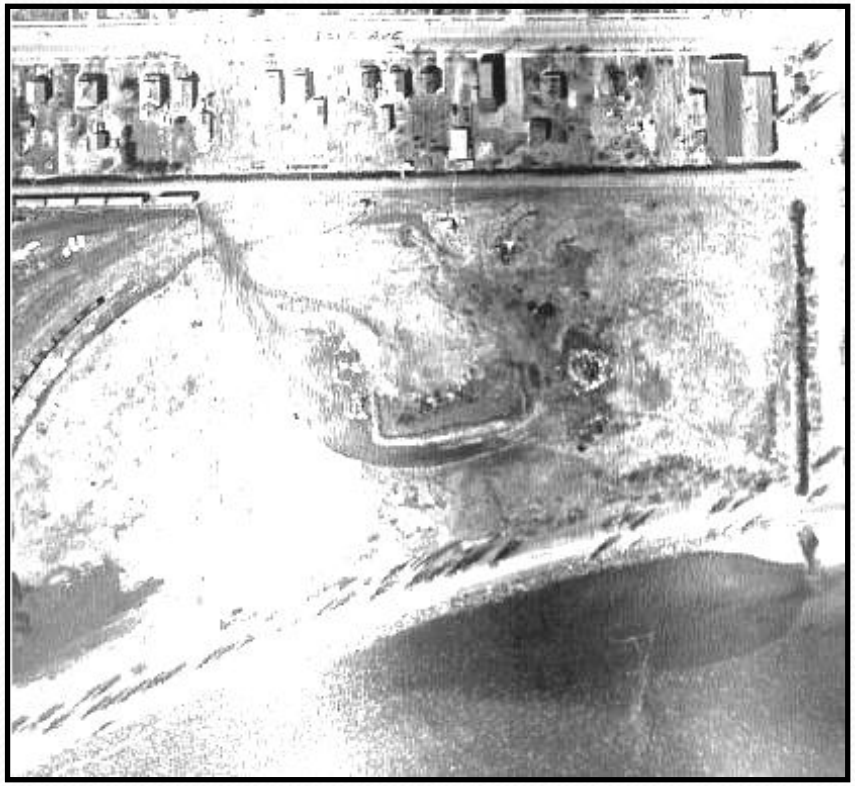

Photo of north 9-acre parcel with staining in Lake Superior

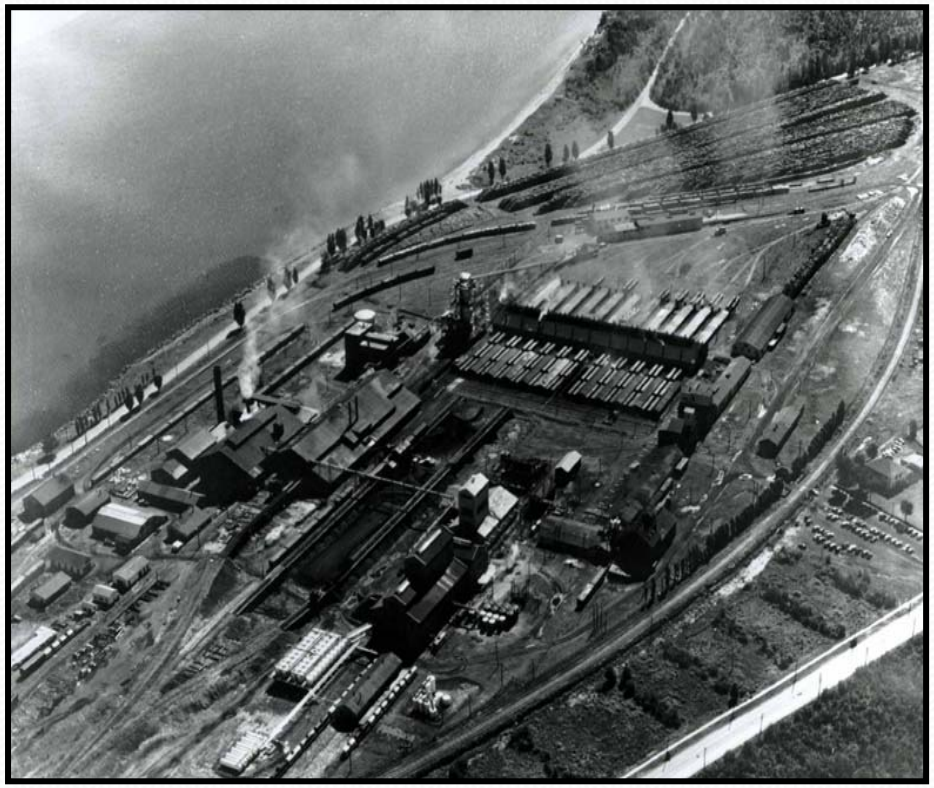

Photo of 46-acre parcel with staining in Lake Superior

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City of Marquette Ownership

- City of Marquette purchased 77-acre property in October 1997 for $1.00
- Barr Engineering Report issued March 1998 - Shallow test pits found areas of near-surface tar deposits. Barr report also identified groundwater contamination. Report submitted to MDEQ
- MDEQ found report deficient and required additional assessment and outlined obligations of responsible party which due to the purchase agreement fell to the City
- City initiated RFP process to meet obligations as owner of property
- North 9-acres and south 23-arces sold or developed
- Approximately 46 acres remain as portion of original site

Aerial photo 2010

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Liability as Owner of Property

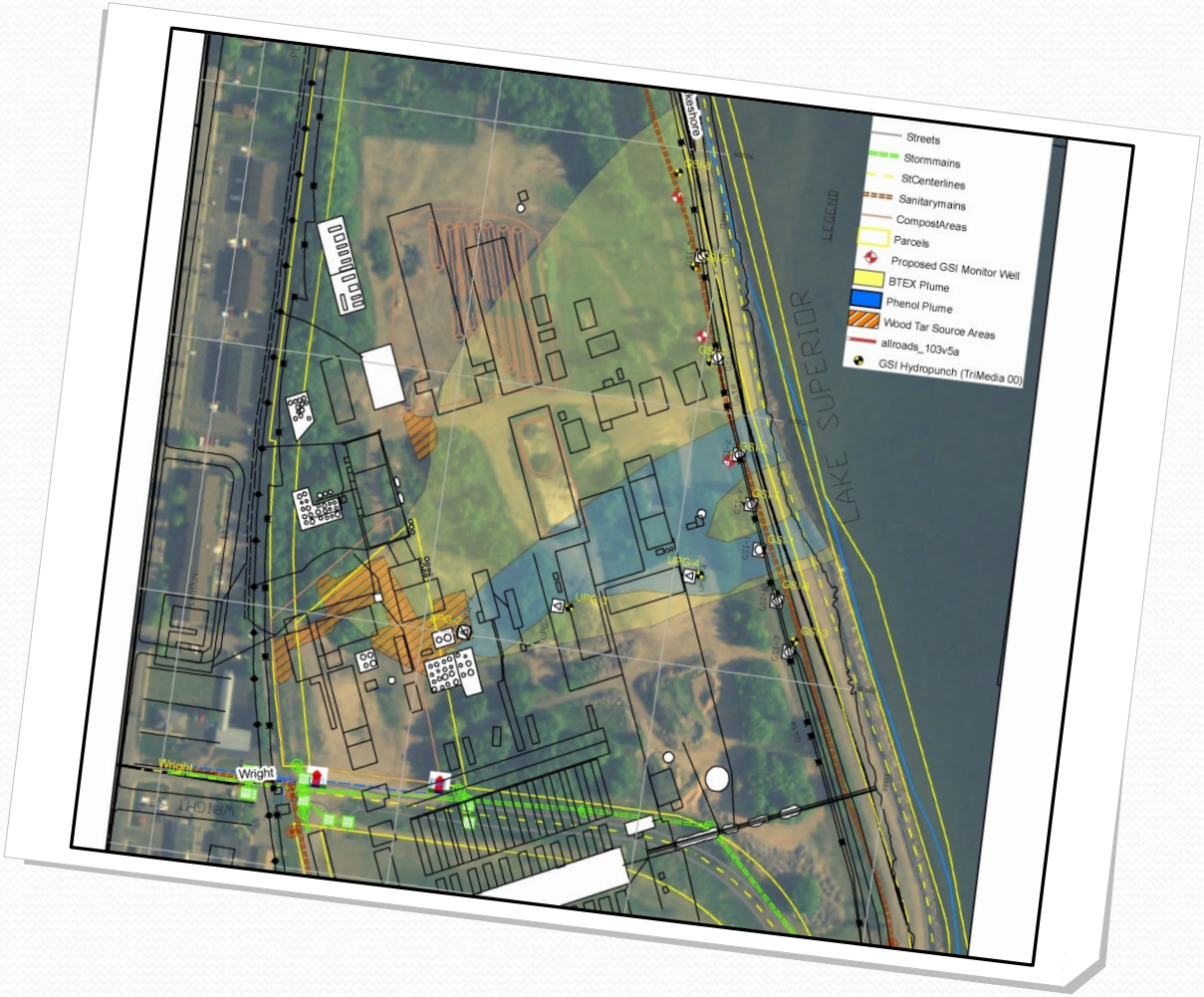
Groundwater assessment in 2000 initiated by City in response to enforcement of statutory obligations laid out by MDEQ following purchase of property and receipt of Barr 1998 report

Temporary GSI wells installed along east property line and site interior.

Results yielded exceedances of both MDEQ GSI Protection and FAV criteria for several contaminants associated with waste tar deposits

Results of sampling were compiled and submitted to MDEQ during mid-2001

MDEQ reviewed site data in late-2001 and provided written and verbal recommendations to City for further response actions



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MDEQ Requests City Prioritize Response Action

- April 22, 2009 Letter from MDEQ to City
  - Outlined specific statutory requirements for environmental response under Part 201 Section 20114(1)(a) through (g)

- August 7, 2009 Interim Response Work Plan Submitted to MDEQ
  - Plan included investigations of:
    - Near-surface buried tar investigations
    - Groundwater well installation and monitoring
    - Methane from contaminant degradation

- September 15, 2009 Letter from MDEQ to City
  - Summary report of investigation findings and recommendations by December 15, 2009
  - Initiate actions by June 15, 2010
  - November 2009, City retains FBM PLLC as Environmental Counsel

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Interim Response Action Goals – Aug. 2009

- Groundwater Monitoring
  - To determine if contaminant concentrations continue to decrease and evaluate seasonal variations in concentration data
- Geophysical Study
  - To better identify locations of buried debris, remaining structures/foundations, areas of interest
  - Intended to improve efficiency of planned soil borings
- Soil Borings to Deeper Intervals
  - To determine if deeper waste tar deposits exist, corresponding distribution (diffuse vs. discrete) and feasibility of removal
- In correspondence dated March 31, 2010 and during discussions, MDEQ concurred with recommendation to continue groundwater monitoring to identify seasonal fluctuations and long-term trends in chemical concentrations discharging to Lake Superior; and
- MDEQ suggested assessment of the Site's deeper aquifer intervals with the goal of identifying the source or sources of groundwater contamination

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Additional Investigation Work Plan – May 2010

- Interim Response Work Plan Submitted to MDEQ on May 27, 2010 as approved by City Commission
  - Collection of Quarterly Groundwater Monitoring Data
  - Installation of Additional Wells
  - Ground Penetrating Radar (GPR)/Electromagnetic (EM)Surveys

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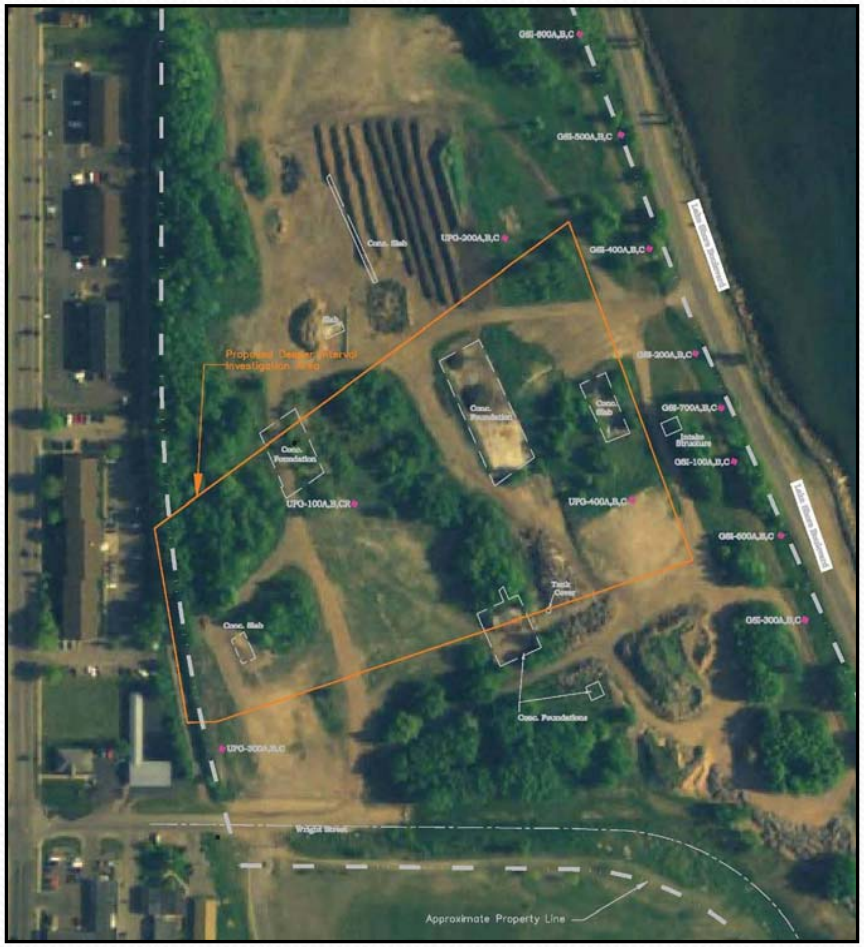
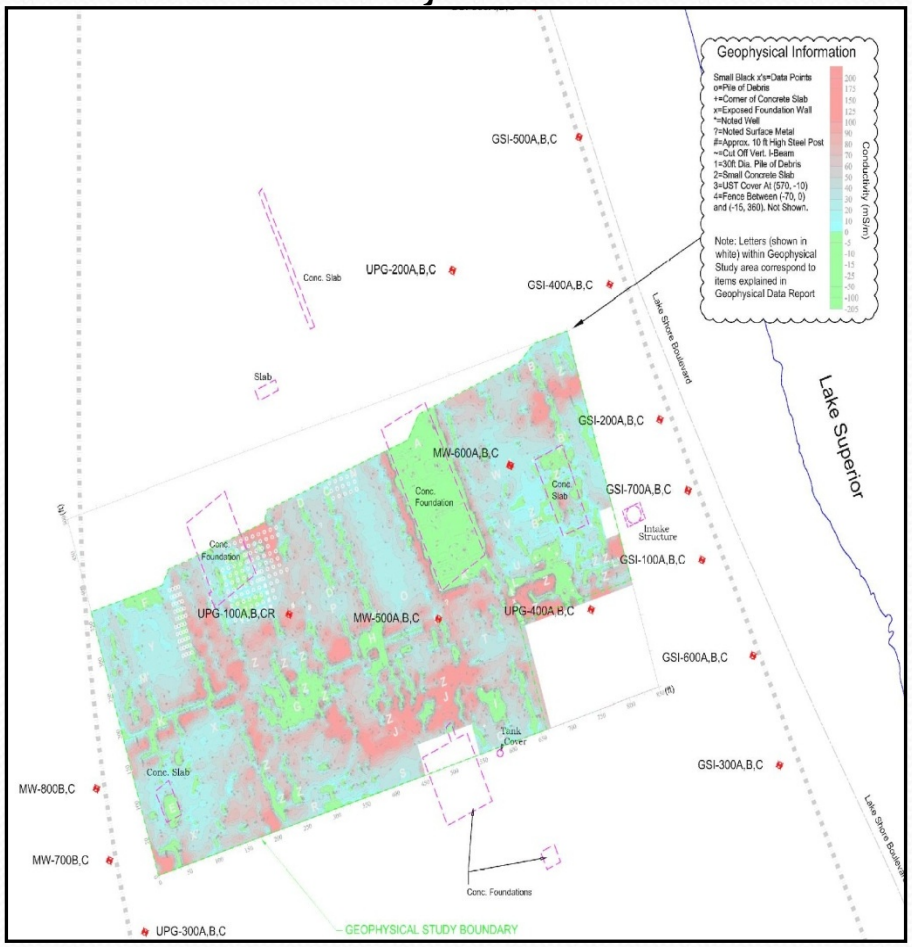
Geophysical Survey

Survey Area



Survey Results



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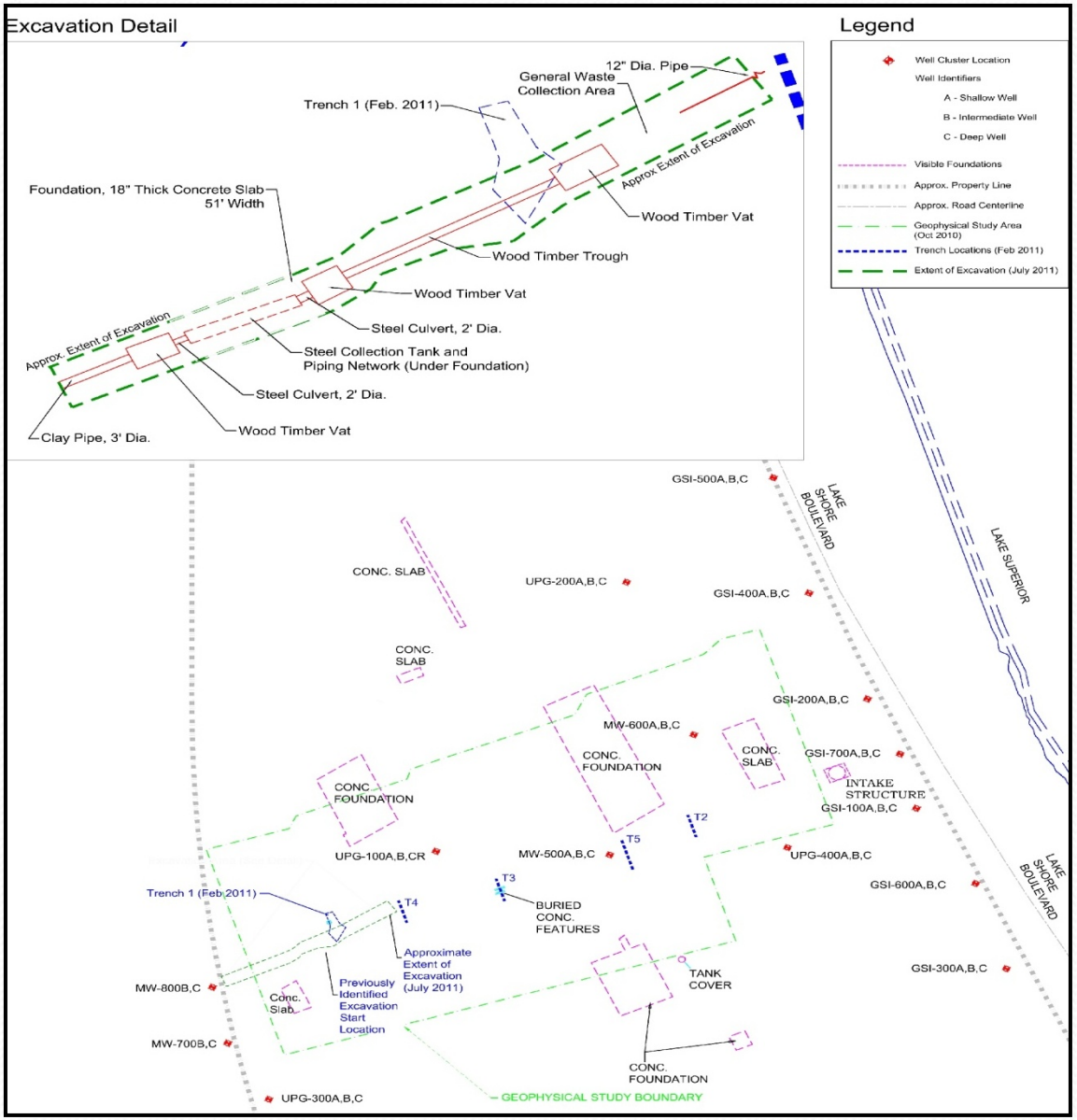
Limited Soil Excavation

- Soil Excavation Work Plan Submitted to MDEQ – June 2011
- Limited Excavation Activities – July 2011
  - Excavated soil 200'L x 15'-20' W x 6' D
  - Timber vats, troughs, conveyances
  - Tar-filled steel pipes – flowing tar
  - 3' diameter clay pipe leading off site
  - Clay pipe believed connected to off-site settling lagoon
  - Landfilled ~845 tons of waste
  - Backfilled with sand from site
- Limited Excavation Technical Memo submitted to MDEQ – August 2011
- Discussions with MDEQ following Limited Excavation received praise from MDEQ for removal of source area waste tar and impacted materials



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Limited Excavation

Tar contamination oozes out of the ground at the former Cliffs Dow site Wednesday. The city of Marquette is doing limited excavation at the former industrial site on Lakeshore Boulevard all this week. (Bill Vajda photo)

Current Project Status

- October 2011 - groundwater monitoring to assess initial effects of the source area excavation
- May 2012 - additional groundwater monitoring scheduled
- MDEQ Upper Peninsula District Staff on board with the City's efforts
- Evaluation of changes in groundwater quality is on-going
- Continued dialogue with MDEQ
- Preparation of the Remedial Alternatives Review
- Land Use Planning

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Remedial Alternatives Review

- Formulate a reasonable path forward that meets the City's objectives of addressing their responsibilities
- Give City options for returning the property to productive use, as defined by the City
- Framework for discussion of future land use planning, financial strategy, and economic development priorities

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Additional Excavation and Landfill Disposal (Limited Source Area Removal)

- Technology Overview
  - Removal of near-surface tar, debris, and soil materials from the Site for landfill disposal using excavation-related heavy machinery and trucking equipment
- Disadvantages
  - Has potential to expand into a more significant operation as a result of largely unknown subsurface conditions at the Site
- Advantages
  - Removes impacts from the Site immediately that may otherwise continue to leach contaminants to groundwater over a long period of time if left in place or untreated
- Estimated Costs
- $50,000 to $1,130,000, depending on the volume(s) excavated

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Air Sparging with Soil Vapor Extraction

- Technology Overview
  - Air Sparging with Soil Vapor Extraction (AS/SVE) involves injecting air below the water table (air sparging) and capturing the volatilized contaminants by vacuum recovery wells (vapor extraction).
- Disadvantages
  - High cost of capital equipment and maintenance
  - Site conditions may not be conducive to a successful application of AS/SVE
- Advantages
  - AS/SVE is effective in remediating petroleum-based soil and groundwater impacts
  - AS/SVE could be effective at mitigating the migration of groundwater impacts above GSI criteria off the Site.
- Estimated Costs
  - $800,000 to $1,500,000

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Groundwater Pump and Treat

- Technology Overview
  - Manipulation of groundwater to contain or remove a contaminant plume often utilized in conjunction with a water treatment technology, such as granular activated carbon (GAC) adsorption
- Disadvantages
  - High cost of capital equipment, as well as high costs associated with operation and maintenance
  - Effectiveness of conventional groundwater pump and treat can be limited since the rate of desorption may be slow
- Advantages
  - Can be used to hydraulically control and mitigate the flow of impacted groundwater
- Estimated Costs
  - $650,000 to $950,000

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Non-Permeable Barrier (slurry wall)

- Technology Overview
  - Vertically excavated trench that is filled with cement/clay slurry used to contain contaminated groundwater or divert contaminated groundwater
- Disadvantages
  - Inability to actively remediate soil and groundwater impacts at the Site; rely on natural attenuation processes to reduce the concentrations of groundwater impacts
- Advantages
  - Ability to contain impacted groundwater itself
- Estimated Costs
  - $600,000 to $900,000

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Permeable Reactive Barrier (Sheet Piling Treatment Zone)

- Technology Overview
  - In-situ method for remediating contaminated groundwater that combines a passive chemical or biological treatment zone with subsurface fluid flow management
- Disadvantages
  - Potential need to replace reactive media due to plugging of the reactive media or surrounding soil pore spaces, or the need to replenish or regenerate the reactive media after it is depleted or has lost its ability to absorb additional impacts
- Advantages
  - Ability to control the flow of groundwater at the Site and remediate impacted groundwater before it leaves the Site
- Estimated Costs
  - $750,000 to $1,000,000

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IN-SITU BIOREMEDIATION

- Technology Overview
  - In-situ techniques directed toward stimulating microorganisms to grow and use the contaminants as a food and energy source by creating a favorable environment for the microorganisms.
- Disadvantages
  - Limitations in treating soil impacts in the vadose zone and the possibility of multiple injection events if remediation goals are not achieved from the initial injections
  - In-situ treatment requires completion of pilot study
- Advantages
  - Ability treat impacts in-situ without the need to bring impacted media to ground surface for treatment and no maintenance tasks associated with in-situ treatment
- Estimated Costs
  - $350,000 to $550,000 per application

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GROUNDWATER MONITORING

- Technology Overview
  - On-going groundwater monitoring to assess contaminant concentration trend changes as a result of the July 2011 source area excavation activities
- Disadvantages
  - Groundwater monitoring is not a remedial action that will reduce contaminant mass in the source area or in downgradient locations
- Advantages
  - Continued groundwater monitoring will provide data necessary to establish contaminant concentration trends and determine whether contaminants in GSI wells have decreased to concentrations that are below Part 31, Rule 57 FAVs. If subsequent groundwater data provide adequate information to conclude that contaminant concentrations are below 10xGSI and FAVs, then a mixing-zone determination request, pursuant to Section 3109a of NREPA, to establish site-specific GSI criteria may be appropriate for this Site.
- Estimated Costs
  - $75,000 to $180,000

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Remediation Alternatives Considered in the Event a More Aggressive Approach is Warranted

Technology	Estimated Cost
➢Additional Excavation and Landfill Disposal	➢($50,000 to $1,130,000)
➢Air Sparging with Soil Vapor Extraction	➢($800,000 to $1,500,000)
➢Groundwater Pump and Treat	➢($650,000 to $950,000)
➢Non-Permeable Barrier (slurry wall)	➢($600,000 to $900,000)
➢Permeable Reactive Barrier	➢($750,000 to $1,000,000)
➢In-Situ Bioremediation	➢($350,000 to $550,000)
➢Groundwater Monitoring	➢($75,000 to $180,000)

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Conclusions

- Alternatives considered remediation of source area tar impacted materials and downgradient groundwater
- Costs estimates for the alternatives considered range from tens of thousands to over a million dollars.
- The selection of a remedial alternative(s) for the Site by the City will depend on:
  - Future land use;
  - Financial strategy; and
  - Economic development priorities

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Recommendations

- Presently it appears the City's most viable option is continued groundwater monitoring to assess effects of source area tar-impacted material removal and assess changes in groundwater quality
- MDEQ Upper Peninsula District Staff currently are on board with the City's efforts completed and planned at the Site
- If, based on results of monitoring and discussions with MDEQ, preparation of a mixing zone determination is not appropriate, TriMedia recommends the City discuss these remedial alternatives and consider additional source area excavation of tar-impacted materials
  - Continue monitoring to evaluate the impact of the activity
- Potential future changes to the regulatory requirements as part of the MDEQ - CSI process will continue to be evaluated with regard to the project goals

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