RECORD OF DECISION

Former Joslyn Clark Controls Site

Lancaster County, South Carolina

Prepared by

South Carolina Department of Health and Environmental Control

Bureau of Land and Waste Management

November 2021

RECORD OF DECISION
FORMER JOSLYN CLARK CONTROLS SITE

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The former Joslyn Clark facility is located at 2013 West Meeting Street in Lancaster, South Carolina, approximately three miles west of downtown Lancaster. The subject property consists of 23 acres of land and is developed with two buildings. The manufacturing building was constructed in 1964 and consists of approximately 180,000 square feet of floor space. An employee/visitor parking lot is located on the north side of the manufacturing building and trailer parking is located on the southwest side of the manufacturing building. A railroad spur is located in the southwest corner of the Site, which is connected to a rail line that runs along the southern property boundary. The southeast portions of the Site are wooded and the northwest portions are grass-covered. The site location can be found on Figure 2.

2.0 Statement of Basis and Purpose

This Decision Document presents the Final Selected Remedy for the former Joslyn Clark Controls Site. This remedy was selected by the South Carolina Department of Health and Environmental Control (SC DHEC and/or the Department) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and to the extent practicable the National Contingency Plan (NCP). The decision is based on the Administrative Record for the Site.

3.0 Assessment of the Site

The response action selected in this Record of Decision (ROD) is necessary to protect the public health and welfare or the environment from actual or threatened releases of hazardous substances into the environment.

4.0 Description of the Selected Remedy

The Department has identified In-Situ Chemical Oxidation (ISCO) as the preferred remedy for the Site.

This Alternative would involve the injection of sodium permanganate solution into the aquifer via a direct push rig or in permanent wells. The oxidant solution will react with any organic compounds encountered and destroy or chemically transform the contaminants to a higher valence state. Typically, contaminants are converted to carbon dioxide and water. It is expected that there will be 5 injection events over a 5-6 year period.

An onsite pilot test was conducted with In-Situ Chemical Oxidation that successfully demonstrated that it can be implemented under the site-specific conditions at the site. A reduction of over 90 percent of the contaminant mass was achieved with very limited rebound over a five-year period.

This Alternative will substantially reduce contaminant concentrations in the source area. It is expected that the contaminant concentrations will be reduced by 90 percent by the end of active remediation. Long-term groundwater monitoring would be required and institutional controls would be established to restrict the use of groundwater at the site. It is expected that it will take greater than 10 years for contaminants in groundwater to be below EPA Maximum Contaminant Levels (MCLs).

5.0 Statutory Determinations

The selected remedy attains the mandates of CERCLA 121, and to the extent practicable, the NCP.

This remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions.

The selected remedy also satisfies the statutory preference for treatment as a principal element of the remedy; permanently and significantly reducing the toxicity, mobility, and volume of hazardous substances, pollutants, or contaminants.

6.0 Authorizing Signature

This ROD documents SCDHEC's selected remedy for contaminated soil and groundwater at the Former Joslyn Clark Controls Site.

Henry Porter, Chief
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control

Date 11-17-2021

PART II - THE DECISION SUMMARY

1.0 Site Name, Location, and Description

The former Joslyn Clark facility is located at 2013 West Meeting Street in Lancaster, South Carolina, approximately three miles west of downtown Lancaster. The subject property consists of 23 acres of land and is developed with two buildings. The manufacturing building was constructed in 1964 and consists of approximately 180,000 square feet of floor space. An employee/visitor parking lot is located on the north side of the manufacturing building and trailer parking is located on the southwest side of the manufacturing building. A railroad spur is located in the southwest corner of the Site, which is connected to a rail line that runs along the southern property boundary. The southeast portions of the Site are wooded and the northwest portions are grass-covered.

2.0 Site History and Enforcement Activities

2.1 Site History

The property was used to manufacture electrical control equipment for fire safety purposes from 1964 until 2009 when operations ceased. The property was vacant from 2009 until 2016 when it was purchased by Makrochem. The Site is currently used to transfer carbon black from bulk quantities (e.g., railcars and tankers) to smaller quantities (e.g., super sacks) for warehousing and subsequent distribution to offsite locations.

2.2 Previous Investigations

Soil investigation activities took place between 2009 and 2011. Eighteen borings were advanced at the Site to evaluate eight potential source areas. The borings were advanced to depths ranging from 4 feet bls to 47 feet bls, depending on the area of concern. Analyses of soil samples collected from the soil borings indicated that trichloroethylene (TCE) was present near the former metal plating area, former degreasing operation, and the former hazardous waste storage shed. TCE concentrations ranged from trace levels to above the Environmental Protection Agency (EPA) Screening Levels for the Protection of Groundwater. None of the concentrations exceeded the health-based residential or industrial standards.

Groundwater at the Site is affected by contamination from volatile organic compounds (VOC). The VOC-affected groundwater originates in the northwest portion of the manufacturing building and extends southward towards the southern property boundary. The source of this contamination is likely the former paint booth and sump area located in the southwestern portion of the building.

The highest TCE concentrations in groundwater are in the former paint booth and sump area. The bulk of the VOC contamination is in the shallow aquifer with lower concentrations in the bedrock. The May 2020 groundwater sampling shows TCE in the shallow saprolite aquifer extending almost to the downgradient property boundary. The TCE plume within the fractured bedrock extends approximately 400 feet south of the property boundary and onto an undeveloped parcel.

Soil vapor has been assessed in the former manufacturing building through a passive soil gas survey in 2012, a sub-slab and indoor sampling event in 2014, and then a follow-up sub-slab sampling event in 2015. The passive soil gas investigation included 60 soil gas points that were installed in the northwest portion of the manufacturing building.

Vapor intrusion was evaluated in the building by the collection of six sub-slab soil gas samples along with six co-located indoor air samples, plus a seventh standalone indoor sample in the office area. Indoor air concentrations of TCE were below the screening level for industrial air which indicates that vapor intrusion is not a risk for workers at the Site.

3.0 Community Participation

Public participation activities prior to the issuance of this ROD included an online presentation of the Proposed Plan, maintenance of a website which included site-specific information, and the publication of notices to the surrounding community. All reports and documents that formed the basis for the selection of the response action are contained in the Administrative Record. The Administrative Record is available for review at the Lancaster County Public Library and on the Department's website, www.scdhec.gov/JoslynClarkControls. The notice of the availability of these documents was published in the Lancaster News on September 4, 2021.

On September 1, 2021, a presentation of the Proposed Plan was available on the Department's website. Representatives of the Department presented the results of recent investigation work, explained the remedial alternatives evaluated in the Focused Feasibility Study, and presented the Department's preferred alternative (the Proposed Plan). This meeting initiated the official public comment period, which concluded on October 15, 2021. There were no formal comments during the comment period.

4.0 Scope and Role of Response Action

This action will be the final cleanup action for the Site. The remedial action objectives will prevent human ingestion of groundwater, minimize the time for groundwater contaminants to reduce below maximum contaminant levels, and restore groundwater to drinking water standards.

5.0 Site Characteristics

5.1 Overview of Site Characteristics

The Site property generally slopes to the southeast and southwest towards two off-site drainage features. One feature is located approximately 500 feet southeast of the eastern property boundary and the second is located approximately 1,100 feet west of the western property boundary. Both drainage features discharge into Cane Creek, which is located approximately one mile south-southeast of the Subject Property.

5.2 Geology/Hydrogeology

The Site is located within the Western Piedmont Physiographic Province of South Carolina. According to the Geologic Map of South Carolina (1997) and the The Geology of the Carolinas (Horton and Zullo, 1991), the Lancaster area is located within the Charlotte Belt and is specifically underlain by mica gneiss.

The shallow subsurface consists of saprolite, a layer of weathered and variably decomposed bedrock that is an orangish-brown, fine-grained, sandy silt. The saprolite thickness varies across the site, but generally extends to depths of 50 to 110 feet below land surface (bls). The saprolite grades to a partially weathered rock (PWR) zone (transition zone) which occurs between the saprolite and the underlying competent bedrock. PWR is a tan siltstone that is present at 50-75 feet bls beneath the building and midway between the building and the southern property line. Additionally, PWR is absent at the MW-15 offsite location, where the saprolite grades directly into competent bedrock at approximately 70 feet below grade. Competent bedrock was encountered at 143 feet beneath the manufacturing building and approximately 108 feet bls along the southern property boundary.

The groundwater at the site occurs within the Piedmont province within two separate, but interconnected, water bearing zones. A shallow water-bearing zone generally occurs within the saprolite zone, and a deeper aquifer zone occurs within the underlying bedrock.

Groundwater in the shallow saprolite zone occurs in the interstitial pore space of the saprolite. The depth to groundwater in the saprolitic zone at the subject Site ranges from 42 to approximately 50 feet bls. Subsurface investigation activities at the Site indicate that the saprolite aquifer zone extends from depths of 42 feet to 143 feet. Groundwater flow in the saprolite and PWR zones is governed by water table conditions. This means that groundwater will flow under unconfined conditions and generally mimic topography. Therefore, groundwater movement will be from upland areas (recharge zones) to nearby surface streams (discharge zones, such as Cane Creek and its tributaries). Contaminant transport of VOCs typically follows the advective flow of groundwater. Groundwater in all wells at the Site flow to the south-southwest, towards Cane Creek, which is approximately 4,800 feet south-southwest of the southern property border at its closest point.

5.3 Nature and Extent of Contamination

During the course of the remedial investigation activities, three possible sources of the onsite TCE affected groundwater were identified. The first two source areas are suspected to involve a former TCE aboveground storage tank or possible degreaser of unknown capacity. The location of the tank/degreaser was not known by facility personnel during interviews in 2009, except that is was somewhere in the northwestern portion of the building. This area is believed to be in the vicinity of monitoring well MW-3, which until the ISCO Pilot Test consistently exhibited the highest TCE concentrations.

The second area is also in the northwestern portion of the building, around a single soil gas sample (SG-2) which detected elevated VOCs. Soil samples in this area did not detect TCE or its daughter products, but TCE was present in a groundwater sample from this location.

The third area is in the southwestern portion of the building, in the former paint booth and cleaning line sump area. Multiple soil gas points installed in this area exhibited the highest soil gas concentrations for TCE and other VOCs. TCE was not detected in soil in this area but was detected in groundwater samples.

Based on all of the lines of evidence, the former paint booth/sump area and the MW-3 area were thought to be the most significant sources of VOC mass for the site. The ISCO Pilot Study in the MW-3 area was successful in remediating that area. Future remediation efforts will focus on the former paint booth and sump area.

5.3.1 Soil

Unsaturated soil investigation activities took place between 2009 and 2011. Eighteen borings have been advanced at the Site to evaluate eight potential source areas. The borings were advanced to depths ranging from 4 feet bls to 47 feet bls, depending on the area of concern. Analyses of soil samples collected from the soil borings indicated that TCE was present in soil samples collected near the former metal plating area, the former degreasing operation, and the former hazardous waste storage shed on the Subject Property. TCE concentrations ranged from trace levels to above the EPA Screening Level for the Protection of Groundwater. None of the concentrations exceeded the health-based residential or industrial standards. Therefore, no further assessment or remediation of soil is planned.

5.3.2 Groundwater

Based on the most recent sampling results from May 2020, the following contaminants remain in groundwater above South Carolina Maximum Contaminant Levels (MCLs): trichlorethene, tetrachloroethene, cis-1,2-dichloroethene, and 1,1-dichloroethene. The VOC affected groundwater originates in the northwest portion of the manufacturing building and extends southward towards the southern property boundary. The source area is the former paint booth and sump area located in the southwestern portion of the building. TCE is the predominant contaminant and is used as the plume indicator.

The highest TCE concentrations in groundwater are in the former paint booth and sump area. The bulk of the source area VOC mass is in the shallow aquifer with lower concentrations in the bedrock. The May 2020 groundwater TCE analytical results for the shallow saprolite aquifer indicate that the plume extends almost to the downgradient property boundary. The TCE plume within the fractured bedrock extends approximately 400 feet south of the property boundary and onto an undeveloped parcel.

5.3.3 Vapor Intrusion

Soil vapor has been assessed in the former manufacturing building through a passive soil gas survey in 2012, a sub-slab and indoor sampling event in 2014, and then a follow-up sub-slab sampling event in 2015. The passive soil gas investigation included 60 soil gas points that were installed in the northwest portion of the manufacturing building.

In order to evaluate the potential for vapor intrusion in the building, six sub-slab soil gas samples were collected along with six co-located indoor air samples, plus a seventh standalone indoor sample in the office area. These samples were collected during May 2014. A follow-up sub-slab and indoor air sampling event took play in February 2015, which was a seasonal "worst case scenario" with sub-slab and indoor air sample at the same locations as the May 2014 event. Indoor air concentrations of TCE were below the Regional Screening Levels for Industrial Air, indicating that vapor intrusion is not a risk for workers at the site.

6.0 Current and Potential Future Site and Resource Uses

The property was vacant from 2009 until 2016 when it was purchased by Makrochem. The Site is currently used to transfer carbon black from bulk quantities (e.g., railcars and tankers) to smaller quantities (e.g., super sacks) for warehousing and subsequent distribution to offsite locations.

Groundwater contamination is the primary area of concern. Groundwater will be remediated through the use of this remedial action which will include monitored natural attenuation and land use controls to control access and use as a drinking water source.

7.0 Summary of Site Risks

It is the Department's current judgment that the response action selected in this ROD is necessary to protect public health or the environment from actual or threatened releases of hazardous substances into the environment from the former Joslyn Clark Site.

Human health and risk assessments have been prepared in 2013 and 2020 to evaluate potential health impacts for current and future occupants of the former Joslyn Clark facility. Both carcinogenic and non-carcinogenic hazards were evaluated as part of the risk assessment. The primary risk at the Site is exposure of humans to affected groundwater. However, there is currently no use of groundwater in the plume area and this risk will be administratively mitigated in the future through the use of institutional controls prohibiting the use of groundwater for drinking or irrigation without the approval of SCDHEC. The potential for human receptors to be in contact with compounds of concern is unlikely based on the depth at which groundwater is present. Therefore, the results of the Human Health Risk Assessment indicate that there is no unacceptable risk/hazard to human health receptors at the former Joslyn Clark facility. Further, using data collected in 2019 and 2020 from off-site downgradient monitoring wells, there is no unacceptable risk for hypothetical site workers who may conduct subsurface excavation/trenching activities or work in buildings constructed offsite under future conditions.

8.0 Remedial Action Objectives

Remedial action objectives (RAOs) are developed in order to set goals for protecting human health and the environment. The RAOs for the Joslyn Clark Controls Site are to:

- Remediate groundwater to prevent human ingestion of groundwater exceeding federal and state maximum contaminant levels;
- Reduce the contaminant concentrations below federal and state maximum contaminant levels through active treatment of the contaminate source area; and
- Monitor groundwater quality until groundwater is restored to drinking water standards.

9.0 Remedial Alternatives

Based on information collected during the previous investigations, a Focused Feasibility Study (FFS) was conducted to identify, develop, and evaluate cleanup options and remedial alternatives. The FFS process used the information on the nature and extent of contamination and associated potential human health risks developed during the remedial investigation and associated studies to develop and evaluate potential remedial alternatives and their overall protection of human health and the environment. Each remedial alternative evaluated by the Department is listed below.

- Alternative 1: No Action
- Alternative 2: Monitored Natural Attenuation (MNA)
- Alternative 3: Zero Valent Iron (ZVI)
- Alternative 4: Hydraulic Containment
- Alternative 5: In Situ Chemical Oxidation (ISCO)
- Alternative 6: Anaerobic Bioremediation

Institutional controls would be implemented to restrict groundwater use at the property. It is assumed that institutional controls would remain in place until the groundwater remedial goals (RGs) are achieved. The underlying assumption for all the alternatives discussed and evaluated is that measures will be implemented until the groundwater RGs are achieved.

9.1 Description of Remedial Alternatives

9.1.1 Alternative 1: No Action

The regulations governing the Superfund program require the Department consider a No Action alternative. The No Action alternative serves as a baseline against which the other remedial alternatives can be compared. Under this alternative, there would be no action taken to prevent exposure to the soil contamination. No institutional controls or active remediation would be implemented under this alternative.

There would be no capital or operation and maintenance (O&M) costs associated with this alternative.

9.1.2 Alternative 2: Monitored Natural Attenuation (MNA)

This alternative proposes to monitor the natural subsurface processes such as dilution, dispersion, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials that will bring about the decrease in Contaminants of Concern (COC) concentrations over time. Monitoring would verify the effectiveness of the natural attenuation processes and show that remediation of a groundwater aquifer can occur within a reasonable time frame without active treatment.

MNA is a passive approach that monitors the natural degradation or reductions of COCs in groundwater. A typical MNA approach centers on monitoring groundwater regularly to evaluate and confirm that site conditions are supportive of COC degradation. Additionally, land use controls would be implemented to protect human health and the environment by restricting development and groundwater use. MNA would be expected to take approximately 50 years.

The net present value of this alternative is estimated at $500,000.

9.1.3 Alternative 3: Zero Valent Iron (ZVI)

Zero Valent Iron (ZVI) involves the introduction of iron particles to act as a reducing agent to chemically reduce contaminants. The process involves a contact reaction whereby the chlorinated ethenes dissolved in groundwater come into contact with the iron surface. ZVI can be delivered to the subsurface either through soil blending or via pressurized injection MNA and institutional controls would then be included in this remedy.

The active manufacturing facility present at the Site would not allow for the use of large diameter auger blending and the treatment depth is too deep for soil blending with an excavator arm. Consequently, ZVI application at the Site, if implemented, would be limited to pressurized injection.

This Alternative is expected to reduce site COCs to the RAOs in greater than 10 years. The net present worth is expected to be $6,300,000.

9.1.4 Alternative 4: Hydraulic Containment

Hydraulic containment involves a series of groundwater extraction wells perpendicular to groundwater flow to capture the contaminant plume and prevent further downgradient migration. The main components of a hydraulic containment system include groundwater extraction, groundwater treatment, and discharge of treated water.

Groundwater extraction wells are installed within or downgradient of affected areas to intercept the dissolved-phase COC plume. The extracted groundwater would then be treated, if necessary, to achieve discharge limits by the use of air stripping, activated carbon, or chemical/ultraviolet oxidation. The treated groundwater would then be discharged to surface water or the local publically owned treatment works or re-injected into the aquifer under respective permits. Hydraulic containment is a proven technology that is effective at reducing off-site COC migration but is limited in reducing COC concentration mass.

This Alternative is expected to reduce site COCs to the RAOs in greater than 30 years. The net present worth is expected to be $2,200,000.

9.1.5 Alternative 5: In Situ Chemical Oxidation (ISCO)

Chemical oxidation is a direct chemical reaction involving the injection of oxidants into groundwater to destroy or chemically transform the contaminants. The oxidant is usually injected into the aquifer via a direct push rig or through a permanent well. The oxidant likely to be used is sodium permanganate. An onsite pilot study was conducted that successfully demonstrated that ISCO can be implemented under site-specific conditions. A reduction of over 90 percent of the contaminant mass was achieved with very limited rebound over a five year period.

A conceptual design looking at the source area of the Site would involve utilizing 12 injection wells with a total of 2,000 gallons of oxidant solution. This alternative would require multiple injection events to meet groundwater standards. Monitored natural attenuation would be required to treat the downgradient plume. Institutional controls would be implemented to reduce risk.

This Alternative is expected to reduce site COCs to the RAOs in approximately 10 years. The net present worth is expected to be $1,100,000.

9.1.6 Alternative 6: Anaerobic Bioremediation

Site contaminants can be biologically transformed by bacteria into non-chlorinated organic compounds under anaerobic conditions. Bacteria sequentially replace chlorine atoms in chlorinated ethenes with hydrogen. This process is called reductive dechlorination. The reaction provides energy for growth to the bacteria and reduces chlorinated compounds to naturally occurring non-chlorinated organic compounds such as ethane and ethene. Carbon substrate can be delivered to the subsurface either through permanent injection wells or direct push injection points.

The lack of naturally occurring carbon and the aerobic nature of the shallow aquifer in the source area indicate that enhanced bioremediation may not be the best remedial option for the source area. Also, the lack of widespread TCE daughter products in groundwater at the Site indicate that bioremediation is not occurring naturally under the current Site conditions, and therefore biostimulation will likely take a prolonged timeframe to effectively implement. Monitored natural attenuation would be required to treat the downgradient plume and institutional controls would be implemented to reduce risk of groundwater use.

This Alternative is expected to reduce site COCs to the RAOs in greater than 10 years. The net present worth is expected to be $1,700,000.

10.0 Comparative Analysis of Alternatives

The NCP requires the Department use specific criteria to evaluate the different remediation alternatives individually and against each other in order to select a remedy. Two of these criteria, overall protection of human health and the environment and compliance with State and Federal regulations, are threshold criteria. If an alternative does not meet these two criteria, it cannot be considered as the Site remedy. Five of the criteria are balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume of contaminants through treatment; short-term effectiveness; implementability; and cost. These criteria are used to weigh the strengths and weaknesses of the alternatives. Community response to the preferred alternative and the other considered alternatives is a modifying criterion that was carefully considered by the Department prior to the final remedy selection.

The following section of the ROD profiles the relative performance of each alternative against the criteria, noting how it compares to the other options under consideration.

10.1 Overall Protection of Human Health and the Environment

When evaluating alternatives in terms of overall protection of human health and the environment, consideration is given to the manner in which Site-related risks are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

ISCO received the highest score for protection of site specific exposure pathways because the technology has been successfully pilot tested at the Site and has been shown to result in a sustained decrease of contaminant concentrations. Bioremediation received a moderate score for protecting the primary exposure pathway because, although it is possible for bioremediation to be effectively implemented at the Site, the intrinsic site conditions are not favorable for bioremediation to be effectively implemented. ZVI received a moderate score for protecting primary exposure pathways because the delivery method required for implementation of ZVI at this site, pressurized injection, frequently results in incomplete distribution of ZVI and creates pockets of untreated containment mass. Hydraulic containment also received a moderate score for protection of site specific exposure pathways because although hydraulic containment will limit the migration of the contaminant plume, it is unlikely to result in long-term decrease in source area contaminant concentration. No action and MNA received the lowest ranking for overall protection of human health and the environment because contaminant mass is not removed or destroyed and the risk for exposure is not mitigated.

10.2 Compliance with State and Federal Regulations

This evaluation criterion evaluates whether an alternative meets federal and state environmental statutes and regulations that pertain to the Site. Each alternative is evaluated with respect to its ability to comply with such requirements.

All of the alternatives listed would require a period of natural attenuation for the groundwater downgradient of the treatment area to reach regulatory limits, and consequently, all of the alternatives received the same score for meeting the chemical specific ARARs, with the exception of No Action and MNA. The No Action and MNA alternative received the lowest score because regulatory limits would not be achieved in any portion of the plume during implementation. All of the technologies would comply with the action and location-specific Applicable or Relevant and Appropriate Requirements (ARARs).

10.3 Long-term Effectiveness and Permanence

The magnitude of residual risk remaining from untreated impacted media or treatment residuals and the adequacy and reliability of containment systems and institutional controls are evaluated under this criterion.

ISCO received the highest score for long-term effectiveness and permanence because the pilot test demonstrated that ISCO will result in a sustained decrease in contaminant concentrations. ZVI received a moderate score because injection is inconsistent and results in pockets of untreated contaminant mass. Hydraulic containment also received a moderate score because although groundwater extraction removes some contaminant mass, contaminate concentrations frequently rebound following discontinuation. Bioremediation received a moderate score for potential residual risk because the naturally occurring aerobic aquifer would need to be flipped to anaerobic conditions for anaerobic bioremediation to successfully be implemented. The No Action and MNA alternatives received the lowest score because the source mass is not removed or destroyed and consequently the long-term risks remain.

10.4 Reduction of Toxicity, Mobility, and Volume through Treatment

The degree to which an alternative employs treatment to reduce the harmful effects of contaminants, their ability to move in the environment, and the amount of contamination present is evaluated by this criterion.

ISCO received the highest score for reduction in toxicity, mobility or volume of contamination because it has been demonstrated to effectively treat contaminant mass at the Site and during the oxidation process contaminants are converted to non-regulated byproducts. Bioremediation received a lower score because of the potential for incomplete conversion of parent products to non-regulated daughter products. ZVI also received a lower score due to the potential for pockets of untreated contaminant mass to remain in the subsurface as a result of non-uniform amendment delivery during pressurized injection. ISCO, ZVI, and bioremediation received the same score for irreversibility. When effective, the process for mass reduction for all three technologies is irreversible. Hydraulic containment received a lower score because contaminant concentrations frequently rebound or remain constant following system shutdown. The no action and MNA alternatives received a lower ranking than the other technologies because contaminant source mass is allowed to remain intact within the subsurface.

10.5 Short-Term Effectiveness

The short-term effectiveness evaluation takes into consideration any risk the alternative poses to on-Site workers, the surrounding community, or the environment during implementation, as well as the length of time needed to implement the alternative.

No action and MNA received a higher score for short-term effectiveness because neither technology requires disturbance of the subsurface, handling of chemicals, use of machinery, or construction activities. ISCO, ZVI, bioremediation, and hydraulic containment do not create a short term increase in risk to the community, workers, or the environment during implementation. ISCO received the highest score for time until remedial response objectives are achieved because it has the shortest active remediation implementation period. ZVI and bioremediation followed in the scoring just behind. No action, MNA, and hydraulic containment received the lowest scores for time until remedial response objectives are achieved because none of the technologies result in treatment of the contaminant mass in the source area.

10.6 Implementability

The analysis of implementability considers the technical and administrative feasibility of remedy implementation, as well as the availability of required materials and services.

ISCO and bioremediation received the same score for implementability because they both require a similar in-situ injection infrastructure and neither require any specialty subcontractors or vendors to implement. Hydraulic containment received a lower score for implementability because it involves construction of an above ground treatment system in addition to subsurface infrastructure. ZVI received a lower score for implementability because it would require specialized injection equipment to open the pore space in the subsurface to accept the injection slurry. The no action and MNA alternatives received the highest rating for each category because implementation does not require any construction activity or use of vendors/subcontractors.

10.7 Cost

The following table presents the probable range of costs for each alternative:

Alternative	Most Likely Cost
1. No Action	$0
2. Monitored Natural Attenuation	$500,000
3. Zero Valent Iron	$6,300,000
4. Hydraulic Containment	$2,200,000
5. In Situ Chemical Oxidation	$1,100,000
6. Anaerobic Bioremediation	$1,700,000

10.8 Community Acceptance

This criterion considers whether the local community agrees with the Department's preferred alternative. Comments received on the Proposed Plan are important indicators of community acceptance.

The Department presented its Proposed Plan on September 1, 2021 through the use of a presentation on DHEC's website. The Department sent out postcards to the local area and allowed comments to be submitted until October 15, 2021. During the public comment period, no written comments were received.

11.0 Selected Remedy

The Department has selected Alternative 5: In Situ Chemical Oxidation as the selected remedy for remediation at the Site.

This Alternative would involve the injection of sodium permanganate solution into the aquifer via a direct push rig or in permanent wells. The oxidant solution will react with any organic compounds encountered and destroy or chemically transform the contaminants to a higher valence state. Typically, contaminants are converted to carbon dioxide and water. It is expected that there will be 5 injection events over a 5-6 year period.

An onsite pilot test was conducted with In-Situ Chemical Oxidation that successfully demonstrated that it can be implemented under the site-specific conditions at the site. A reduction of over 90 percent of the contaminant mass was achieved with very limited rebound over a five-year period.

This Alternative will substantially reduce contaminant concentrations in the source area. It is expected that the contaminant concentrations will be reduced by 90 percent by the end of active remediation. Long-term groundwater monitoring would be required and institutional controls would be established to restrict the use of groundwater at the site. It is expected that it will take greater than 10 years for contaminants in groundwater to be below EPA Maximum Contaminant Levels (MCLs).

This Alternative is the best solution in terms of the overall protection of human health and the environment; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and has the shortest active remediation implementation period.

The estimated cost for implementation for this Alternative is $1.1 million.

12.0 Statutory Determinations

Based on information currently available, the Department believes the selected remedy meets the mandatory threshold criteria required by the NCP, and provides the best balance of trade-offs among the other alternatives. The Department expects the selected remedy to satisfy the following statutory requirements: be protective of human health and the environment; comply with applicable or relevant and appropriate requirements; be cost-effective; utilize permanent solutions to the maximum extent practicable; and satisfy the preference for treatment as a principle element of the remedy.

PART III - RESPONSIVENESS SUMMARY

Public participation activities prior to the issuance of this ROD included an online presentation of the Proposed Plan, maintenance of a website which included site-specific information, and the publication of notices to the surrounding community. All reports and documents that formed the basis for the selection of the response action are contained in the Administrative Record. The Administrative Record is available for review at the Lancaster County Public Library and at the Department's website, www.scdhec.gov/JoslynClarkControls. The notice of the availability of these documents was published in the Lancaster News on September 4, 2021.

On September 1, 2021, a presentation of the Proposed Plan was made available for public viewing on the Department's website. Representatives of the Department presented the results of recent investigation work, explained the remedial alternatives evaluated in the Focused Feasibility Study, and presented the Department's preferred alternative (the Proposed Plan). This meeting initiated the official public comment period, which concluded on October 15, 2021. There were no formal comments during the comment period.

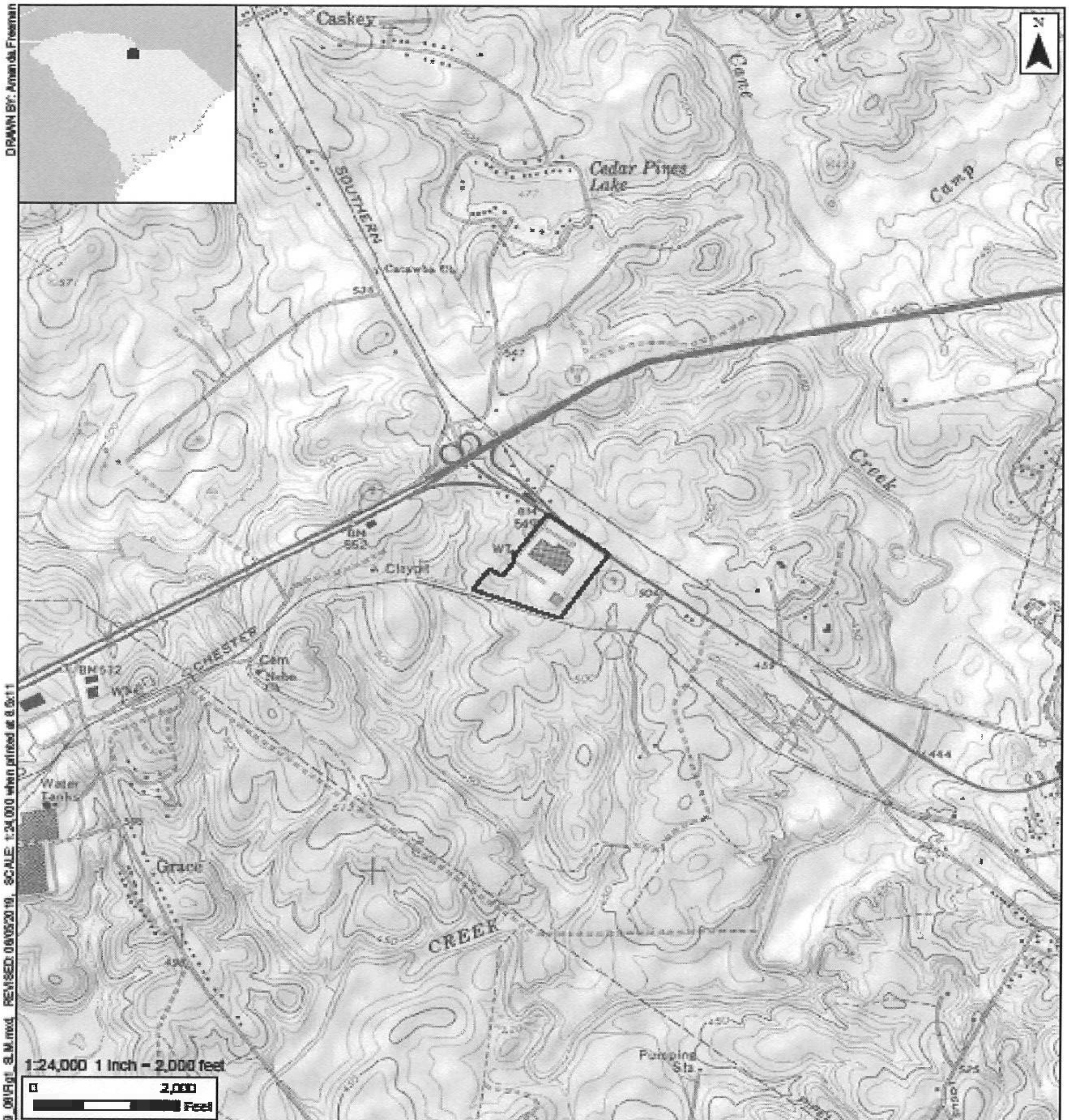
Figure 1

EPA PERFORMANCE CRITERIA SCORING

EPA Performance Criteria	No Action	ZVI	MNA	Hydraulic Containment	Bioremediation	ISCO
Overall protection of human health and the environment						
The treatment technology protects the Site specific primary exposure pathways	1	2	1	2	2	3
The treatment technology limits or eliminates short term or cross-media impacts	1	3	1	2	3	3
Compliance with Applicable or Relevant and Appropriate Requirements						
The alternative is capable of meeting the chemical specific ARARs (surface water, groundwater, and air emission standards)	1	3	1	3	3	3
The alternative is capable of meeting the action and location specific ARARs (protection of wetlands, historic preservation act, UIC permit, OSHA)	3	3	3	3	3	3
Long Term Effectiveness and Permanence						
Potential residual risk for untreated contamination	1	2	1	2	2	4
Adequacy and reliability of required controls required following remediation	1	3	1	2	3	3
Reduction of Toxicity, Mobility, or Volume Through Treatment						
Does the treatment technology reduce the toxicity, mobility or volume of the contamination?	1	2	1	2	2	4
Is the treatment technology irreversible?	1	3	1	2	3	3
Short Term Effectiveness						
Will there be significant additional risks to the community, workers, or the environment as a result of implementing this technology?	4	3	4	3	3	3
Time until remedial response objectives are achieved	2	3	2	2	3	4
Implementability						
Ability to construct and operate technology	5	2	5	2	3	3
Availability of vendors and specialists	5	3	5	3	3	3
Cost						
Capital costs	5	2	5	2	3	4
Operation and maintenance costs	5	3	4	2	3	3
TOTAL	36	37	35	32	39	46

Figure 2

Site Location Map



Legend

Site

Environmental Resources Management
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Figure 1
Site Location Map
Former Joslyn Clark Facility
2013 W, Meeting Street
Lancaster, Lancaster County, SC

Source: Copyright © 2013 National Geographic Society, i-cubed

Coordinate System: NAD 1983 StatePlane South Carolina FIPS 3900 Feet

Figure 3

TCE Isoconcentration Map – Shallow Aquifer

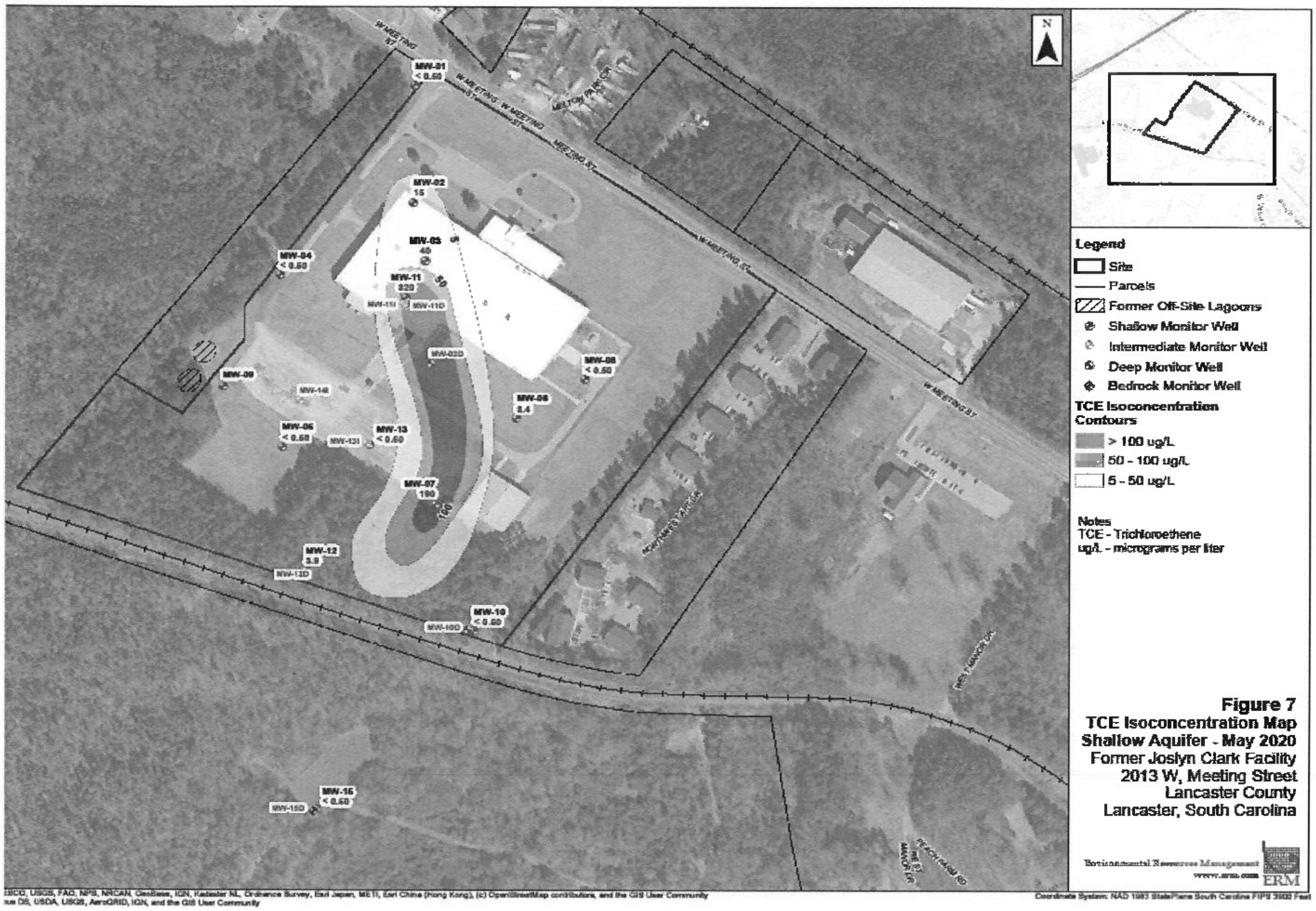
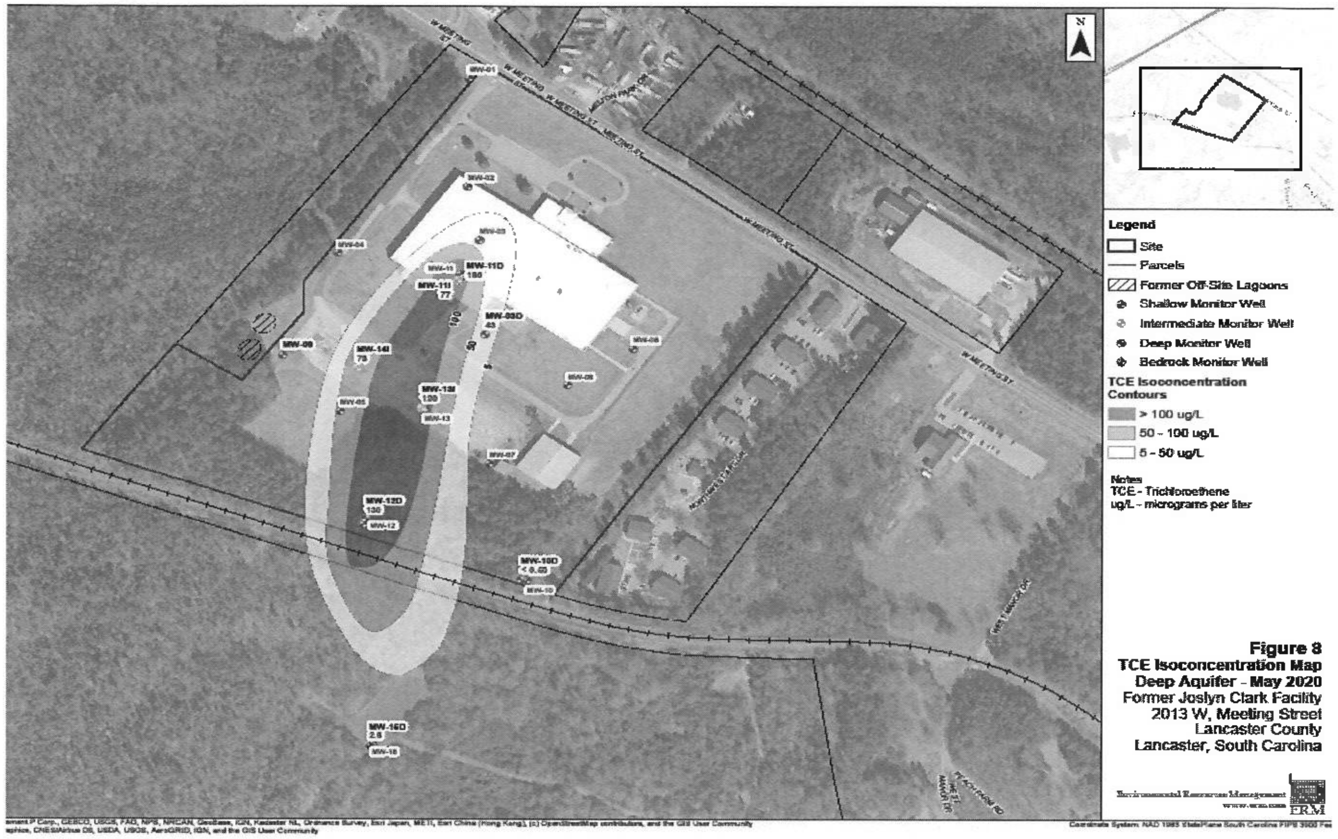


Figure 7
TCE Isoconcentration Map
Shallow Aquifer - May 2020
Former Joslyn Clark Facility
2013 W, Meeting Street
Lancaster County
Lancaster, South Carolina

Figure 4

TCE Isoconcentration Map – Deep Aquifer


N
Legend
Site
Parcels
Former Off-Site Lagoons
Shallow Monitor Well
Intermediate Monitor Well
Deep Monitor Well
Bedrock Monitor Well
TCE Isoconcentration Contours
> 100 ug/L
50 - 100 ug/L
5 - 50 ug/L
Notes
TCE - Trichloroethene
ug/L - micrograms per liter
Figure 8
TCE Isoconcentration Map
Deep Aquifer - May 2020
Former Joslyn Clark Facility
2013 W, Meeting Street
Lancaster County
Lancaster, South Carolina
ERM

Appendix A

Proposed Plan

Proposed Plan

Former Joslyn Clark Controls Facility

2013 West Meeting Street, Lancaster, South Carolina 29720

August 2021

S.C. Department of Health and Environmental Control

ANNOUNCEMENT OF PROPOSED PLAN

The South Carolina Department of Health and Environmental Control (DHEC or the Department) has completed an evaluation of cleanup Alternatives to address contamination at the Former Joslyn Clark Controls Facility, 2013 West Meeting Street, Lancaster, South Carolina (the Site). This Proposed Plan identifies DHEC's Preferred Alternative for cleaning up the contamination and provides the reasoning for this preference. In addition, this Plan includes summaries of the other cleanup alternatives evaluated.

The Department is presenting this Proposed Plan to inform the public of our activities, gain public input, and fulfill the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This Proposed Plan summarizes information that can be found in greater detail in the Phase I Environmental Site Assessment Report (January 2009), Phase II Site Assessment Report (December 2009), Phase III Site Assessment Report (February 2012), Passive Soil Gas Survey (November 2012), Human Health Risk Assessment (September 2013), Pre-Remedial Assessment Report (September 2013), Feasibility Study Work Plan (November 2013), Initial Vapor Intrusion Assessment (May 2014), ISCO Pilot Test Work Plan & Addendum (May 2014), ISCO Injection Pilot Test (July 2014), Additional VI Assessment (May 2015), Human Health Risk Assessment (October 2020), Focused Feasibility Study (November 2020), and other documents contained in the Administrative Record. The Department encourages the public to review these documents to gain an understanding of the Site and the activities that have been completed.

The Department will select the final cleanup remedy after reviewing and considering comments submitted during the 30-day public comment period. The Department may modify the Preferred Alternative or select another response action presented in this Proposed Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all the Alternatives presented in this Proposed Plan.

DHEC's Preferred Cleanup Summary
Alternative 5: In Situ Chemical Oxidation (ISCO) with Monitored Natural Attenuation and Land Use Controls

DHEC's preferred remedial option includes:

- Injection of an oxidizing agent into the subsurface which will break down contaminants in groundwater to carbon dioxide and water.
- ISCO pilot test has proven technology effective at the Site.
- Monitored Natural Attenuation and Land Use Controls will be utilized to monitor that remedial goals are met.

MARK YOUR CALENDAR

❑ **PUBLIC MEETING:**

DHEC has provided a presentation of the information evaluated and the proposed cleanup alternatives.

❑ **PUBLIC COMMENT PERIOD:**

September 1, 2021 – October 15, 2021

DHEC will accept written comments on the Proposed Plan during the public comment period. Please submit your written comments to:

Greg Cassidy, Project Manager
DHEC's Bureau of Land & Waste Management
2600 Bull Street
Columbia, SC 29201
cassidga@dhec.sc.gov

❑ **FOR MORE INFORMATION:**

Call: Greg Cassidy, 803-898-0910

See: DHEC's website at:

http://www.scdhec.gov/JoslynClarkControls

View: The Administrative Record at the following locations:

Lancaster County Library
313 S White St, Lancaster SC 29720
(803) 285-1502
Hours: Mon-Thur 9 AM – 7PM, Fri 9 AM – 5 PM, Sat 9 AM – 1 PM

DHEC Freedom of Information Office
2600 Bull Street, Columbia, SC
(803) 898-3817
Hours: Monday - Friday: 8:30 AM - 5:00 PM
Or
http://www.scdhec.gov/JoslynClarkControls

SITE HISTORY

The former Joslyn Clark facility is located at 2013 West Meeting Street in Lancaster, South Carolina, approximately three miles west of downtown Lancaster. The subject property consists of 23 acres of land and is developed with two buildings. The manufacturing building was constructed in 1964 and consists of approximately 180,000 square feet of floor space. An employee/visitor parking lot is located on the north side of the manufacturing building and trailer parking is located on the southwest side of the manufacturing building. A railroad spur is located in the southwest corner of the Site, which is connected to a rail line that runs along the southern property boundary. The southeast portions of the Site are wooded and the northwest portions are grass-covered.

The property was used to manufacture electrical control equipment for fire safety purposes from 1964 until 2009 when operations ceased. The property was vacant from 2009 until 2016 when it was purchased by Makrochem. The Site is currently used to transfer carbon black from bulk quantities (e.g., railcars and tankers) to smaller quantities (e.g., super sacks) for warehousing and subsequent distribution to offsite locations.

Soil investigation activities took place between 2009 and 2011. Eighteen borings were advanced at the Site to evaluate eight potential source areas. The borings were advanced to depths ranging from 4 feet bls to 47 feet bls, depending on the area of concern. Analyses of soil samples collected from the soil borings indicated that trichloroethylene (TCE) was present near the former metal plating area, former degreasing operation, and the former hazardous waste storage shed. TCE concentrations ranged from trace levels to above the EPA Screening Level for the Protection of Groundwater. None of the concentrations exceeded the health-based residential or industrial standards.

Groundwater at the Site is affected by volatile organic compound (VOC) contamination. The VOC-affected groundwater originates in the northwest portion of the manufacturing building and extends southward towards the southern property boundary. The source of this contamination is likely the former paint booth and sump area located in the southwestern portion of the building.

The highest TCE concentrations in groundwater are in the former paint booth and sump area. The bulk of the VOC contamination is in the shallow aquifer with lower concentrations in the bedrock. The May 2020 groundwater sampling shows TCE in the shallow saprolite aquifer extending almost to the downgradient property boundary. The TCE plume within the fractured bedrock extends approximately 400 feet south of the property boundary and onto an undeveloped parcel.

Soil vapor has been assessed in the former manufacturing building through a passive soil gas survey in 2012, a sub-slab and indoor sampling event in 2014, and then a follow-up sub-slab sampling event in 2015. The passive soil gas investigation included 60 soil gas points that were installed in the northwest portion of the manufacturing building.

Vapor intrusion was evaluated in the building by the collection of six sub-slab soil gas samples along with six co-located indoor air samples, plus a seventh standalone indoor sample in the office area. Indoor air concentrations of TCE were below the screening level for industrial air which indicates that vapor intrusion is not a risk for workers at the Site.

AREAS OF CONCERN

During the course of the remedial investigation activities, three potential sources of TCE groundwater contamination were identified. The first two source areas are suspected to involve a former TCE aboveground storage tank or possible degreaser of unknown capacity.

The first area is in the vicinity of monitoring well MW-3, which is located adjacent to the former metals plating area in the northwest portion of the building.

The second area is also in the northwestern portion of the building where a soil gas sample detected elevated VOCs in soil gas. Soil samples did not detect TCE, but groundwater samples from this area contained elevated concentrations of TCE.

The third area is in the southwestern portion of the building in the former paint boot and cleaning line sump area. Multiple soil gas points installed in this area exhibited the highest soil gas concentrations for TCE and other VOCs. TCE was not detected in this area, but shallow groundwater contained up to 950 parts per billion of TCE.

Based on all the lines of evidence, the former paint booth/sump area and the MW-3 area are the most significant sources of VOC contamination. An in-situ chemical oxidation pilot test was conducted in the MW-3 area. Based on the success of that study, no further remediation is required in this area. Future remediation efforts will focus on the former paint booth and sump area.

SUMMARY OF SITE RISKS

Human health and risk assessments have been prepared in 2013 and 2020 to evaluate potential health impacts for current and future occupants of the former Joslyn Clark facility. Both carcinogenic and non-carcinogenic hazards were evaluated as part of the risk assessment. The primary risk at the Site is exposure of humans to affected groundwater. However, groundwater is not used at the Site and this risk will be administratively mitigated in the future through the use of institutional controls prohibiting the use of groundwater for drinking or irrigation without the approval of DHEC. The potential for human receptors to be in contact with compounds of concern is unlikely based on the depth at which groundwater is present. Therefore, the results of the HHRA indicate that there is no unacceptable risk/hazard to human health receptors at the former Joslyn Clark facility. There is no unacceptable risk for hypothetical site workers who may conduct subsurface excavation/trenching activities or work in buildings constructed offsite under future conditions.

CLEANUP GOALS

Remedial Action Objectives (RAOs) are developed in order to set goals for protecting human health and the environment. The goals should be as specific as possible, but should not unduly limit the range of Alternatives that can be developed. Accordingly, the following RAOs were developed for the Site:

- **RAO 1:** Remediate groundwater to prevent human ingestion of groundwater exceeding federal and state maximum contaminant levels
- **RAO 2:** Reduce the contaminant concentrations below federal and state maximum contaminant levels through active treatment of the contaminate source area.
- **RAO 3:** Monitor groundwater quality until groundwater is restored to drinking water standards.

Groundwater at the Site is impacted primarily by trichloroethylene (TCE). The remedial goal for trichloroethylene is the EPA Maximum Contaminant Level (MCL) of 5 micrograms per liter.

SCOPE AND ROLE OF THE ACTION

The proposed action in this plan will be the final cleanup action for the Site. The remedial action objectives for this proposed action include preventing human ingestion of groundwater, minimizing the time required for groundwater COC concentrations to reduce below MCLs, and restoring groundwater to drinking water standards.

SUMMARY OF REMEDIAL ALTERNATIVES

Based on information collected during site investigations, a Focused Feasibility Study (FFS) was conducted to identify, develop, and evaluate cleanup options and remedial alternatives. The FFS process used the information gathered during the previous investigations and other assessments to develop and evaluate potential remedial alternatives. Each remedial alternative evaluated by the Department is described briefly below. Note: A final Remedial Design will be developed prior to implementation.

SUMMARY OF REMEDIAL ALTERNATIVES

Alternative	Description
1: No Action	• Site is left in its current condition • Discontinuation of groundwater and surface water monitoring • Net present worth: $0
2: Monitored Natural Attenuation (MNA)	• Relies on monitoring the natural degradation processes that reduce contaminant concentrations • Long-term groundwater monitoring program for 50 years • Institutional controls would be implemented to restrict groundwater use • Net present worth: $500,000
3: Zero Valent Iron (ZVI)	• Pressure injection of a ZVI slurry over a vertical depth of 120 feet • Institutional controls would be implemented to restrict groundwater use • Long-term groundwater monitoring for greater than 10 years • Net present worth: $6,300,000
4: Hydraulic Containment	• Groundwater is extracted from the aquifer, treated, and discharged • Institutional controls to restrict groundwater use • Long-term groundwater monitoring for greater than 10 years • Net present worth: $2,200,000
5. In Situ Chemical Oxidation (ISCO)	• Process that reduces the mass of contaminants by injecting an oxidizing agent into the subsurface • Sodium permanganate would be injected using a direct push rig or permanent wells • ISCO pilot test has proven it an effective implementable technology • Institutional Controls would be implemented to restrict groundwater use • Long-term groundwater monitoring for greater than 10 years • Net present worth: $1,100,000
6. Anaerobic Bioremediation	• Process that uses bacteria within the subsurface to reduce contaminants to naturally occurring non-chlorinated organic compounds • Anaerobic bioremediation by the application of a carbon substrate to enhance bacteria mass • Institutional Controls and long-term groundwater monitoring for greater than 10 years • Net present worth: $1,700,000

DESCRIPTION OF ALTERNATIVES

Alternative 1 - No Action

No action is included as a baseline for comparison with other Alternatives. Under this Alternative, no action is taken to treat or prevent potential exposure to contaminated groundwater, or reduce volume, toxicity, or mobility of contaminants. This action would rely on natural attenuation processes to reduce contaminant concentrations over time. This action does not include any institutional controls (e.g., deed restrictions) or monitoring to evaluate natural attenuation or contaminants of concern (COCs) extent and the Site would be uncontrolled. This Alternative would not be protective of human health or the environment and could take more than 100 years to achieve the RAOs.

Alternative 2 – Monitored Natural Attenuation (MNA)

MNA is a passive approach that monitors the natural degradation or reductions of COCs in groundwater. A typical MNA approach centers on monitoring groundwater regularly to evaluate and confirm that site conditions are supportive of COC degradation. Additionally, land use controls would be implemented to protect human health and the environment by restricting development and groundwater use. MNA would be expected to take approximately 50 years with a cost of $500,000.

Alternative 3 – Zero Valent Iron (ZVI)

Zero Valent Iron (ZVI) involves the introduction of iron particles to act as a reducing agent to chemically reduce contaminants. The process involves a contact reaction whereby the chlorinated ethenes dissolved in groundwater come into contact with the iron surface. ZVI can be delivered to the subsurface either through soil blending or via pressurized injection MNA and institutional controls would then be included in this remedy.

This Alternative is expected to reduce site COCs to the RAOs in greater than 10 years. The net present worth is expected to be $6,300,000.

Alternative 4 – Hydraulic Containment

Hydraulic containment involves a series of groundwater extraction wells perpendicular to groundwater flow to capture the contaminant plume and prevent further downgradient migration. The main components of a hydraulic containment system include groundwater extraction, groundwater treatment, and discharge of treated water.

This Alternative is expected to reduce site COCs to the RAOs in greater than 30 years. The net present worth is expected to be $2,200,000.

Alternative 5 – In Situ Chemical Oxidation (ISCO)

Chemical oxidation is a direct chemical reaction involving the injection of oxidants into groundwater to destroy or chemically transform the contaminants. The oxidant is usually injected into the aquifer via a direct push rig or through a permanent well. The oxidant likely to be used is sodium permanganate. An onsite pilot study was conducted that successfully demonstrated that ISCO can be implemented under site-specific conditions. A reduction of over 90 percent of the contaminant mass was achieved with very limited rebound over a five year period.

This Alternative is expected to reduce site COCs to the RAOs in approximately 10 years. The net present worth is expected to be $1,100,000.

Alternative 6 –Anaerobic Bioremediation

Site contaminants can be biologically transformed by bacteria into non-chlorinated organic compounds under anaerobic conditions. Bacteria sequentially replace chlorine atoms in chlorinated ethenes with hydrogen. This process is called reductive dechlorination. The reaction provides energy for growth to the bacteria and reduces chlorinated compounds to naturally occurring non-chlorinated organic compounds such as ethane and ethene. Carbon substrate can be delivered to the subsurface either through permanent injection wells or direct push injection points.

This Alternative is expected to reduce site COCs to the RAOs in greater than 10 years. The net present worth is expected to be $1,700,000.

EVALUATION OF ALTERNATIVES

The National Contingency Plan requires the Department use specific criteria to evaluate and compare the different remediation Alternatives in order to select a remedy. The criteria are:

1. Overall protection of human health and the environment;
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs);
3. Long-term effectiveness and permanence;
4. Reduction of toxicity, mobility, or volume through treatment;
5. Short-term effectiveness;
6. Implementability;
7. Cost; and
8. Community acceptance

The main objectives for the preferred remedial action are to be protective of human health and the environment and to comply with State and Federal regulations. These two objectives are considered *threshold criteria*. For an Alternative to be considered as final, these two threshold criteria must be met.

The following measures are considered *balancing criteria*: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. These criteria are used to weigh the major technical feasibility and cost advantages and disadvantages.

Community response to the preferred Alternative and the other considered Alternatives is a *modifying criterion* that will be carefully considered by the Department prior to final remedy selection.

COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis of each Alternative was performed and can be observed in the EPA Performance Criteria table included. The Alternatives were evaluated in relation to one another for each of the evaluation criteria. The purpose of the analysis is to identify the relative advantages and disadvantages of each Alternative. This evaluation is illustrated in the attached EPA Performance Criteria Table.

Overall Protection of Human Health and the Environment

When evaluating alternatives in terms of overall protection of human health and the environment, consideration is given to the manner in which Site-related risks are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

ISCO received the highest score for protection of site specific exposure pathways because the technology has been successfully pilot tested at the Site and has been shown to result in a sustained decrease of contaminant concentrations. Bioremediation received a moderate score for protecting the primary exposure pathway because, although it is possible for bioremediation to be effectively implemented at the Site, the intrinsic site conditions are not favorable for bioremediation to be effectively implemented. ZVI received a moderate score for protecting primary exposure pathways because the delivery method required for implementation of ZVI at this site, pressurized injection, frequently results in incomplete distribution of ZVI and creates pockets of untreated containment mass. Hydraulic containment also received a moderate score for protection of site specific exposure pathways because although hydraulic containment will limit the migration of the contaminant plume, it is unlikely to result in long-term decrease in source area contaminant concentration. No action and MNA received the lowest ranking for overall protection of human health and the environment because contaminant mass is not removed or destroyed and the risk for exposure is not mitigated.

Compliance with ARARs

This evaluation criterion evaluates whether an alternative meets federal and state environmental statutes and regulations that pertain to the Site. Each alternative is evaluated with respect to its ability to comply with such requirements.

All of the alternatives listed would require a period of natural attenuation for the groundwater downgradient of the treatment area to reach regulatory limits, and consequently, all of the alternatives received the same score for meeting the chemical specific ARARs, with the exception of No Action and MNA. The No Action and MNA alternative received the lowest score because regulatory limits would not be achieved in any portion of the plume during implementation. All of the technologies would comply with the action and location-specific ARARs.

Long-Term Effectiveness and Permanence

The magnitude of residual risk remaining from untreated impacted media or treatment residuals and the adequacy and reliability of containment systems and institutional controls are evaluated under this criterion.

ISCO received the highest score for long-term effectiveness and permanence because the pilot test demonstrated that ISCO will result in a sustained decrease in contaminant concentrations. ZVI received a moderate score because injection is inconsistent and results in pockets of untreated contaminant mass. Hydraulic containment also received a moderate score because although groundwater extraction removes some contaminant mass, contaminate concentrations frequently rebound following discontinuation. Bioremediation received a moderate score for potential residual risk because the naturally occurring aerobic aquifer would need to be flipped to anaerobic conditions for anaerobic bioremediation to successfully be implemented. The No Action and MNA alternatives received the lowest score because the source mass is not removed or destroyed and consequently the long-term risks remain.

Reduction of Toxicity, Mobility, and Volume through Treatment

The degree to which an alternative employs treatment to reduce the harmful effects of contaminants, their ability to move in the environment, and the amount of contamination present is evaluated by this criterion.

ISCO received the highest score for reduction in toxicity, mobility or volume of contamination because it has been demonstrated to effectively treat contaminant mass at the Site and during the oxidation process contaminants are converted to non-regulated byproducts. Bioremediation received a lower score because of the potential for incomplete conversion of parent products to non-regulated daughter products. ZVI also received a lower score due to the potential for pockets of untreated contaminant mass to remain in the subsurface as a result of non-uniform amendment delivery during pressurized injection. ISCO, ZVI, and bioremediation received the same score for irreversibility. When effective, the process for mass reduction for all three technologies is irreversible. Hydraulic containment received a lower score because contaminant concentrations frequently rebound or remain constant following system shutdown. The no action and MNA alternatives received a lower ranking than the other technologies because contaminant source mass is allowed to remain intact within the subsurface.

Short-Term Effectiveness

The short-term effectiveness evaluation takes into consideration any risk the alternative poses to on-Site workers, the surrounding community, or the environment during implementation, as well as the length of time needed to implement the alternative.

No action and MNA received a higher score for short-term effectiveness because neither technology requires disturbance of the subsurface, handling of chemicals, use of machinery, or construction activities. ISCO, ZVI, bioremediation, and hydraulic containment do not create a short term increase in risk to the community, workers, or the environment during implementation. ISCO received the highest score for time until remedial response objectives are achieved because it has the shortest active remediation implementation period. ZVI and bioremediation followed in the scoring just behind. No action, MNA, and hydraulic containment received the lowest scores for time until remedial response objectives are achieved because none of the technologies result in treatment of the contaminant mass in the source area.

Implementability

The analysis of implementability considers the technical and administrative feasibility of remedy implementation, as well as the availability of required materials and services.

ISCO and bioremediation received the same score for implementability because they both require a similar in-situ injection infrastructure and neither require any specialty subcontractors or vendors to implement. Hydraulic containment received a lower score for implementability because it involves construction of an above ground treatment system in addition to subsurface infrastructure. ZVI received a lower score for implementability because it would require specialized injection equipment to open the pore space in the subsurface to accept the injection slurry. The no action and MNA alternatives received the highest rating for each category because implementation does not require any construction activity or use of vendors/subcontractors.

Cost

The cost criterion includes estimated active remediation costs and does not include the cost of on-going groundwater monitoring. Cost estimates are expected to be accurate within a range of -30% to +50%.

The following table presents the probable cost for each alternative:

Alternative	Cost
1. No Action	$0
2. Monitored Natural Attenuation	$500,000
3. Zero Valent Iron	$6,300,000
4. Hydraulic Containment	$2,200,000
5. In-situ Chemical Oxidation	$1,100,000
6. Anaerobic Bioremediation	$1,700,000

Community Acceptance

Community acceptance of the preferred remedy will be evaluated after the public comment period. Public comments will be summarized and responses provided in the Responsiveness Summary Section of the Record of Decision document that will present the Department's final Alternative selection. The Department may choose to modify the preferred Alternative or select another remedy based on public comments or new information.

SUMMARY OF THE DEPARTMENT'S PREFERRED ALTERNATIVE

The Department has identified Alternative 5: In-Situ Chemical Oxidation as the preferred remedy for the Site.

This Alternative would involve the injection of sodium permanganate solution into the aquifer via a direct push rig or in permanent wells. The oxidant solution will react with any organic compounds encountered and destroy or chemically transform the contaminants to a higher valence state. Typically, contaminants are converted to carbon dioxide and water. It is expected that there will be 5 injection events over a 5-6 year period.

An onsite pilot test was conducted with In-Situ Chemical Oxidation that successfully demonstrated that it can be implemented under the site-specific conditions at the site. A reduction of over 90 percent of the contaminant mass was achieved with very limited rebound over a five-year period.

This Alternative will substantially reduce contaminant concentrations in the source area. It is expected that the contaminant concentrations will be reduced by 90 percent by the end of active remediation. Long-term groundwater monitoring would be required and institutional controls would be established to restrict the use of groundwater at the site. It is expected that it will take greater than 10 years for contaminants in groundwater to be below EPA Maximum Contaminant Levels (MCLs).

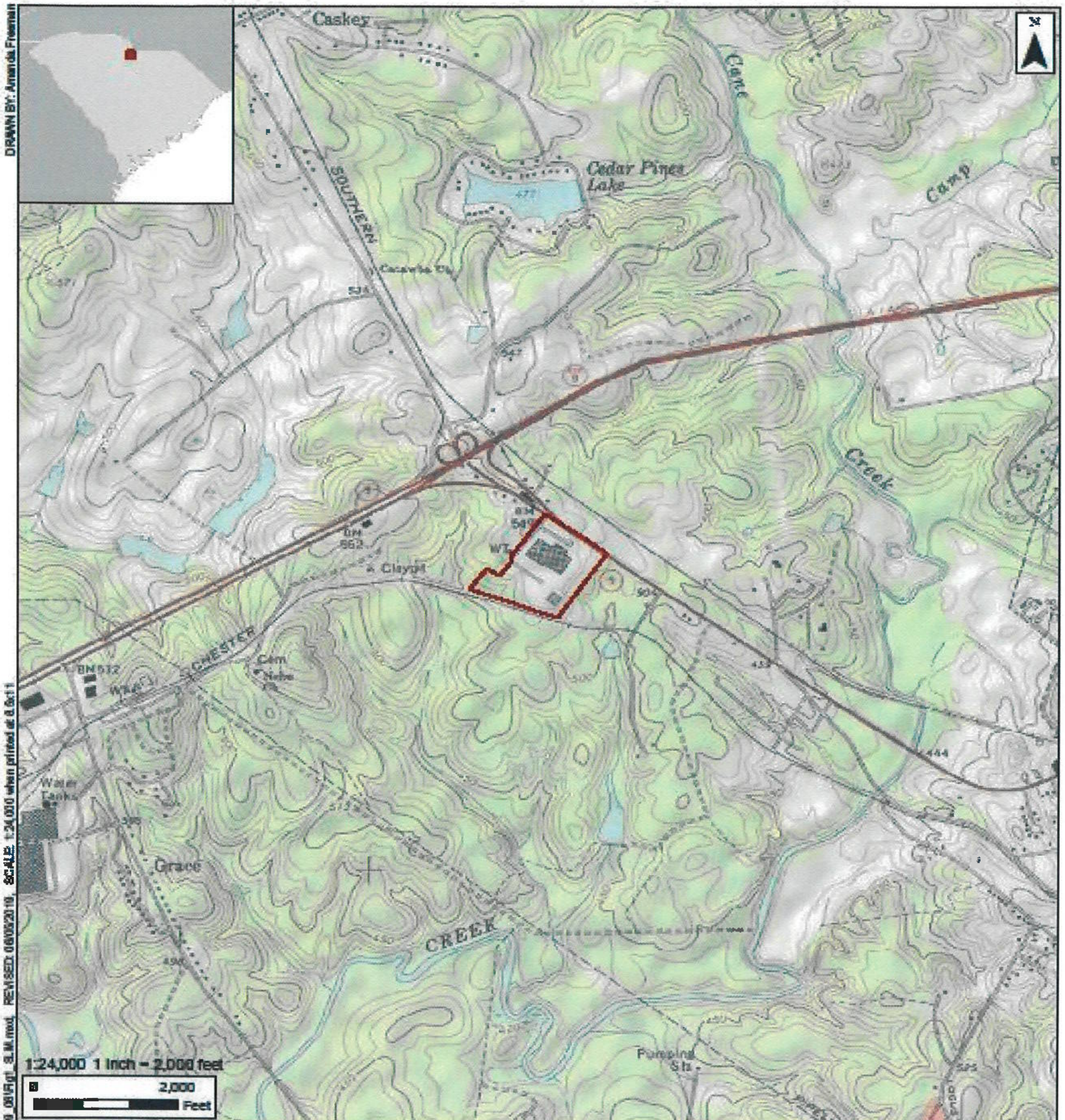
This Alternative is the best solution in terms of the overall protection of human health and the environment; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and has the shortest active remediation implementation period.

The estimated cost for implementation for this Alternative is $1.1 million.

EPA Performance Criteria	No Action	ZVI	MNA	Hydraulic Containment	Bioremediation	ISCO
Overall protection of human health and the environment						
The treatment technology protects the Site specific primary exposure pathways	1	2	1	2	2	3
The treatment technology limits or eliminates short term or cross-media impacts	1	3	1	2	3	3
Compliance with Applicable or Relevant and Appropriate Requirements						
The alternative is capable of meeting the chemical specific ARARs (surface water, groundwater, and air emission standards)	1	3	1	3	3	3
The alternative is capable of meeting the action and location specific ARARs (protection of wetlands, historic preservation act, UIC permit, OSHA)	3	3	3	3	3	3
Long Term Effectiveness and Permanence						
Potential residual risk for untreated contamination	1	2	1	2	2	4
Adequacy and reliability of required controls required following remediation	1	3	1	2	3	3
Reduction of Toxicity, Mobility, or Volume Through Treatment						
Does the treatment technology reduce the toxicity, mobility or volume of the contamination?	1	2	1	2	2	4
Is the treatment technology irreversible?	1	3	1	2	3	3
Short Term Effectiveness						
Will there be significant additional risks to the community, workers, or the environment as a result of implementing this technology?	4	3	4	3	3	3
Time until remedial response objectives are achieved	2	3	2	2	3	4
Implementability						
Ability to construct and operate technology	5	2	5	2	3	3
Availability of vendors and specialists	5	3	5	3	3	3
Cost						
Capital costs	5	2	5	2	3	4
Operation and maintenance costs	5	3	4	2	3	3
TOTAL	36	37	35	32	39	46

Summary of Ranking System

1 = Very poor (or very high cost) relative to other technologies
2 = Poor (or high cost) relative to other technologies
3 = Moderate (or moderate cost) relative to other technologies
4 = Favorable (or low cost) relative to other technologies
5 = Very favorable (or very low cost) relative to other technologies



Legend

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Source: Copyright © 2013 National Geographic Society, i-cubed

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Deep Monitor Well
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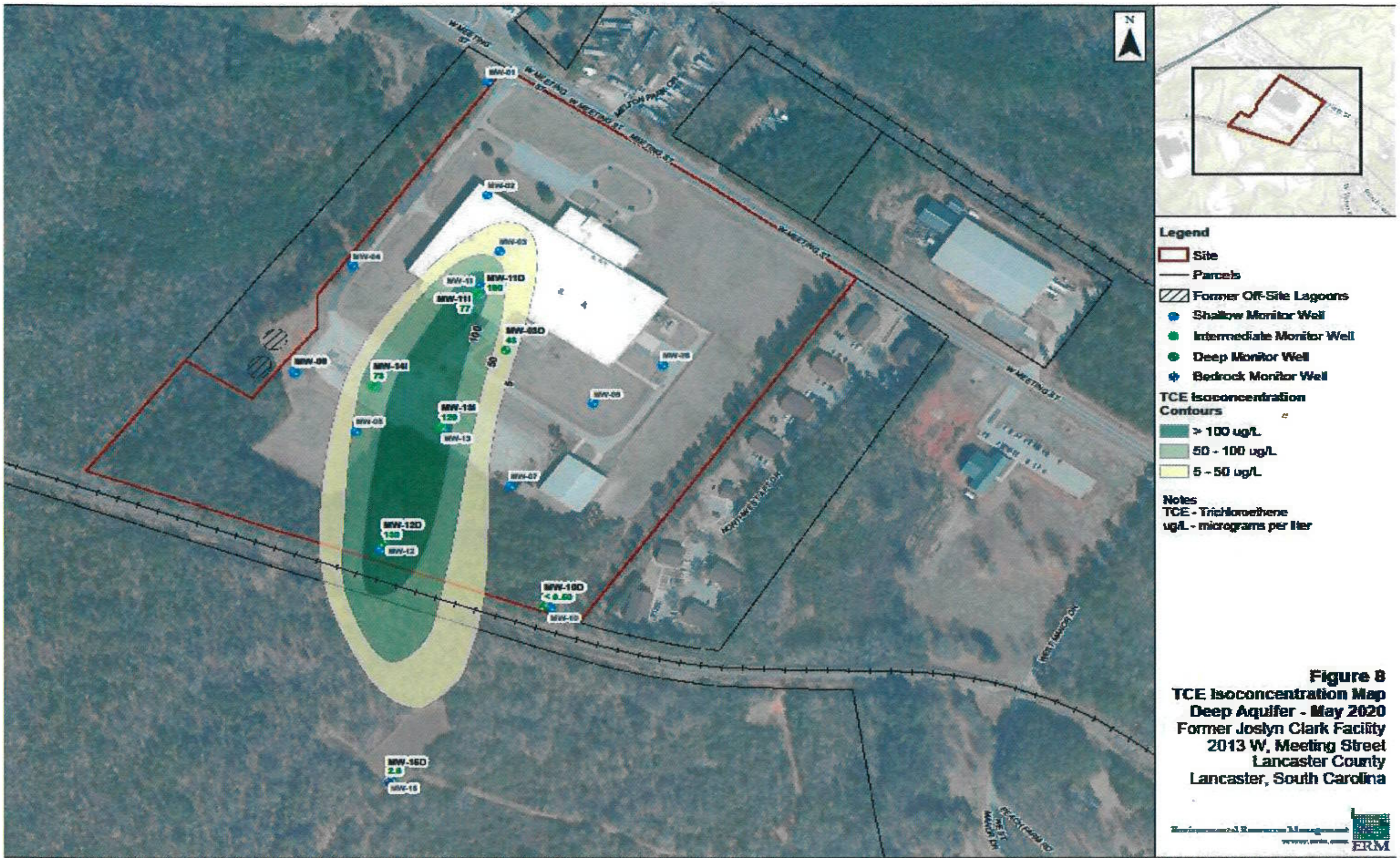

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