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NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

FOCUSED FEASIBILITY STUDY

222 South Ferry Street
Schenectady, New York

NYSDEC Site No. 447047

October 2019

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Prepared for:
New York State Department of Environmental Conservation

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I, Daniel J. Loewenstein, certify that I am currently a NYS registered professional engineer and that this Report was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

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Date:
October 8, 2019

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1 INTRODUCTION

On behalf of the New York State Department of Environmental Conservation (NYSDEC), Arcadis CE, Inc. (Arcadis) has prepared this Focused Feasibility Study (FFS) to evaluate remedial alternatives at the 222 South Ferry Street Site, in the City of Schenectady, Schenectady County, New York (site) (Figures 1-1 and 1-2). The FS was conducted under NYSDEC State Superfund Standby Contract Work Assignment No. D007618-50. The purpose of this report is to evaluate potential remedial alternatives based on the seven evaluation criteria listed in the NYSDEC Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10).

After approval of this FFS, the NYSDEC will issue a Proposed Remedial Action Plan (PRAP) which is open to public comment. Following the public comment period, the NYSDEC will issue a Record of Decision (ROD) for the site.

This FFS was completed in accordance with DER-10, NYSDEC guidance on presumptive remedies as defined in 6 NYCRR Part 375, NYSDEC DER program policy for Green Remediation (DER-31), and other appropriate NYSDEC and United States Environmental Protection Agency (USEPA) guidance.

1.1 Site Location and Background

The 222 South Ferry Street Site is located in the eastern portion of the City of Schenectady (City) (Figure 1-1) and currently consists of a vacant parking lot owned by Maxim Engineering P.C. The site formerly consisted of a crockery warehouse and residential dwellings from at least the 1880s to the 1900s and a trucking repair shop and storage facility with a paint shop during the 1930s to the 1960s. The ground surface over the majority of the site is composed largely of asphalt paved areas with grass portions along the northern and southern edges. The site is relatively flat with no discernable slope. The site is located within a mixed residential-commercial neighborhood. The site is bordered by South Ferry Street and South Church Street to the east and west, respectively. It is bordered to the north by an apartment building and catering company, and to the south by commercial businesses, a vacant lot, and residential buildings. The last buildings on the site were demolished between the 1970s and 1980s.

1.2 Geology/Hydrogeology

The Schenectady Formation of the Upper Ordovician consisting primarily of greywacke with sandstone, siltstone, and shale is present beneath the site and the surrounding area according to regional mapping (Fisher et al., 1970). During the Remedial Investigation (RI), soil borings were advanced up to approximately 18 feet below ground surface (bgs) at the site without encountering bedrock. Based on the 2004 geotechnical investigation, overburden materials extend to at least 90 feet bgs. Natural overburden materials in the area are mapped as commonly calcareous laminated silts and clays that have low permeability and potential land instability (Caldwell et al.,1987). Overburden materials observed during the RI were generally composed of urban fill and coarse to fine sand which overlies silt and clay. Groundwater flow at the site is generally to the north toward the Mohawk River, which is the regional groundwater discharge.

1.3 Previous Investigations

To evaluate the subsurface conditions for a proposed four-story student housing complex, Dente Engineering, P.C. conducted a geotechnical investigation on behalf of BBL construction services (BBL) in 2007 (Dente Engineering, 2007). Six geotechnical soil borings between 22 feet bgs and 92 feet bgs in depth were advanced. Overburden materials observed included mainly fill material to depths of 15 to 20 feet bgs, fine sand and silt from 20 to 35 feet bgs, fine to medium sand from 35 to 55 feet bgs, and interbedded strata of silt and fine sand with some layers of coarse sand and clay from 55 feet bgs extending down to 90 feet bgs. Bedrock was not encountered, and groundwater ranged from five to 12 feet bgs, with some isolated saturated zones at various shallower depths. Samples for laboratory analysis of potential contaminants were not collected during this investigation.

A Phase I Environmental Site Assessment (ESA) was completed by Evergreen Testing & Environmental Services, Inc., on behalf of BBL in October 2007 (Evergreen Testing and Environmental Services Inc., 2007). The Phase I revealed that the site formerly consisted of a crockery warehouse and residential dwellings from at least the 1880s to the 1900s, and was a trucking repair shop/storage facility and paint shop from the early 1930s to the 1960s. The last existing buildings on the site were all demolished between the 1970s and 1980s. The Phase I revealed no evidence of recognized environmental concerns and deemed that a Phase II ESA was not warranted. It was noted by Evergreen that “Other Environmental Concerns” existed at the site because of the truck repair and storage facility and other former buildings on and near the site that would have been heated by fuel oil. This fuel oil would have been stored in tanks located in the basement or underground, and it is unknown whether the tanks were emptied and/or removed.

Evergreen also conducted two subsurface investigations in December 2007 on behalf of BBL (Evergreen Testing and Environmental Services Inc., 2008). These investigations included soil and groundwater sampling. Four soil borings (EB-1 through EB-4) were advanced. One soil sample was collected from each boring and analyzed for volatile organic compounds (VOCs) and STARS semi-volatile organic compounds (SVOCs), Resource Conservation and Recovery Act (RCRA) 8 Metals and polychlorinated biphenyls (PCBs). A grab groundwater sample was also collected from three of the borings and analyzed for volatile organic compounds and semi-volatile organic compounds. An additional nine soil borings were advanced and converted into monitoring wells. Soil and groundwater samples were collected from each of these locations. Laboratory data from these two subsurface investigations conducted by Evergreen revealed that acetone and cis-1,2-dichloroethene exceeded Unrestricted Use Soil Cleanup Objectives (SCOs) from several soil sample locations. Various semi-volatile organic compounds exceeded the Unrestricted Use SCOs. However, Evergreen noted that these analytes are typical in coal tar and could be attributed to the existing fill material. Mercury, lead, and hexavalent chromium also exceeded the Unrestricted Use Soil Cleanup Objectives. Only one analyte (benzo(a)pyrene) was detected above the Commercial Use SCOs. Several chlorinated VOCs in groundwater were detected at concentrations exceeding NYSDEC Class GA Standards, with the highest concentrations existing in the central portion of the site. SVOCs were not detected in soil at concentrations greater than Commercial Use SCOs.

In August 2008, C.T. Male Associates Inc. (C.T. Male) performed a groundwater investigation on behalf of the Schenectady Metroplex Development Authority (C.T. Male Associates Inc., 2008). Groundwater samples were collected from the nine monitoring wells on site. Laboratory results indicated that

groundwater samples from monitoring wells MW-2, MW-5, and MW-8, which are in the approximate central area of the site, contained chlorinated VOCs (CVOCs) at elevated concentrations.

In January 2014, Arcadis performed a site characterization (SC) of the site on behalf of the NYSDEC (Arcadis, 2014). The site characterization included the excavation of three test pits, drilling of four soil borings, installation and sampling of four groundwater monitoring wells, and the installation and sampling of eight soil vapor points. A subsurface soil sample was collected from each soil boring and test pit and was submitted for analysis of Target Compound List (TCL) volatile organic compounds (VOCs) by United States Environmental Protection Agency (USEPA) Method 8260, TCL SVOCs by USEPA Method 8270, RCRA 8 Metals by USEPA Methods 6010 and 7471, and PCBs by USEPA Method 8082. Soil vapor samples were collected from the eight newly installed vapor points at the site and analyzed for VOCs by USEPA Method TO-15. Two rounds of groundwater sampling were conducted; during the first round samples were collected from the nine previously existing monitoring wells, and during the second round samples were collected from all thirteen monitoring wells on site. All groundwater samples were analyzed for TCL VOCs by USEPA Method 8260, TCL SVOCs by USEPA Method 8270, RCRA 8 Metals by USEPA Methods 6010 and 7470, and PCBs by USEPA Method 8082, with the exception of the second round of sampling of wells MW-1 through MW-9, which were only analyzed for TCL VOCs by USEPA Method 8260. The findings of the 2014 site characterization sampling are summarized below.

Unsaturated subsurface soil at, and in the vicinity of, the site did not appear to be significantly impacted by site-related CVOCs. CVOC-impacted soil at and below the water table was mainly isolated to the central area of the site. Vinyl chloride and cis-1,2-dichloroethene (DCE) were present at concentrations greater than corresponding 6 NYCRR Part 375 Unrestricted Use SCOs in this area. Vinyl chloride also exceeded the corresponding 6 NYCRR Part 375 Residential SCO in one soil sample collected from this area. CVOCs were detected in groundwater samples collected from 11 of the 13 overburden wells during the SC.

Trichloroethene (TCE), cis-1,2-DCE, and vinyl chloride were the most frequently detected compounds that exceeded the corresponding NYSDEC Class GA standards. CVOC-impacted groundwater generally extends the entire north to south width of the site and is present at the down-gradient property boundary at MW-10. However, these impacts did not extend to the eastern portion of the site. The soil vapor point sample from SV-8 adjacent to the residence at 226 South Ferry Street did not have detections of CVOCs.

Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene, benzo(k)fluoranthene, and chrysene were detected at concentrations greater than either the corresponding Commercial or Residential SCOs in one SC soil sample. Lead and mercury were the most frequently detected metals in SC soil samples; however, the majority of these detections were below corresponding Commercial and Residential SCOs. Arsenic, barium, chromium, and cadmium were also detected in one of two SC soil samples at concentrations greater than corresponding Commercial or Residential SCOs. Selenium was detected in samples from three monitoring wells and arsenic was detected in samples from two monitoring wells at concentrations greater than corresponding NYSDEC Class GA Groundwater Standards. The SVOCs and metals detected at the site, while not likely associated with the CVOC impacts, are likely attributable to past commercial and industrial activity at the site. PCBs were not detected in any of the SC soil or groundwater samples.

During the excavation of Test Pit 3 in the northern part of the site, two inactive underground storage tanks (USTs) were uncovered. NYSDEC personnel onsite at the time directed that these USTs would be

addressed at a later date. Based on sampling and field observations, these USTs do not appear to be a source of CVOCs in soil or groundwater.

2 REMEDIAL INVESTIGATION SUMMARY

2.1 Remedial Investigation

The RI expanded on the data collection during the 2014 Site Characterization (Arcadis CE, Inc., 2018). and CVOCs in groundwater and soil vapor. During the RI, on-site surface soil samples, on-site and off-site groundwater, and on-site and off-site soil vapor samples were collected (Figures 2-1 through 2-7).

Surface soil samples in the south-eastern portion of the site exceeded unrestricted SCOs for lead, zinc, mercury and the pesticide 4-4' DDT, but were below residential SCOs. One sample slightly exceeded the residential SCO for mercury. The SVOCs benzo(a)anthracene, benzo(a)pyrene, benzo(b) fluoranthene, benzo(k)fluoranthene, chrysene and indeno (1,2,3-cd) pyrene, were detected at concentrations that exceeded the residential SCOs, and the commercial SCOs in some cases. These exceedances are likely attributable to past industrial activities at the site, but are not related to the chlorinated compounds found in groundwater and soil vapor at the site. Neither CVOCs, nor PCBs were detected in the surface soil samples. The Site Characterization report previously identified elevated metals concentrations in soil at depth in the northern portion of the site exceeding commercial SCOs, SVOCs in soil near MW-13, and minimal detections of CVOCs in sub-surface soil. Metals in soils are not believed to have been associated with site operations.

CVOCs were not detected in the three newly installed off-site wells north of the site. CVOCs were detected in groundwater samples collected from 9 of the 10 on-site wells during the RI. Cis-1,2-DCE, vinyl chloride, and TCE were the most frequently detected compounds that exceeded the NYSDEC Class GA standards. On the western half of the site, CVOC-impacted groundwater generally extends across the width of the site from north to south and is present at the down-gradient (northern) property boundary at MW-10. However, these impacts do not appear to extend off-site to the north and are very limited on the eastern half of the site. This is consistent with the groundwater results from site characterization report.

As part of a state-wide initiative, groundwater samples were collected and analyzed for PFCs and 1,4 dioxane at the site. Groundwater concentrations of these compounds did not exceed screening levels or the USEPA health advisory limit for PFCs or 1,4 dioxane.

Concentrations of CVOCs in off-site soil vapor samples were very low and did not represent a concern for soil vapor intrusion. Elevated CVOC concentrations were present at soil vapor points SV-1 and SV-4 in the south and central portions of the site. The soil vapor at SV-8 adjacent to the residence at 226 South Ferry Street had detections of CVOCs in 2017, which is an increase from 2014 site characterization data.

2.2 Conceptual Site Model

With the conclusion of RI sampling and corresponding activities, the current Conceptual Site Model is as follows:

Previous investigations indicated that the source of the groundwater contamination was located in the central portion of the site. Additional contaminant delineation and sampling efforts during the RI confirm

that CVOC concentrations are highest in the central portion of the site, with lower concentrations in soil and groundwater to the east and west. SVOC and metals impacts at the site are likely attributable to past commercial and industrial activity at the site.

CVOC-impacted groundwater and soil remain at the site. The concurrent decreases in TCE concentrations and increases in cis-1,2-DCE and vinyl chloride concentrations in groundwater samples and reducing conditions observed during groundwater purging suggest that anaerobic degradation is likely occurring at the site. Groundwater flow in the vicinity of the site is generally to the north-northeast with a relatively flat hydraulic gradient over much of the site. While CVOCs are present at elevated concentrations in the suspected source area, it doesn't appear that CVOC-impacted groundwater has migrated down-gradient or off-site to the north. Soil vapor sampling results indicate that there is a potential for soil vapor intrusion for newly constructed buildings at the site. Any future construction at the site should be evaluated for soil vapor intrusion.

While there is conflicting information as to how many USTs remain at the site, it is assumed for remedial planning purposes that two USTs remain on-site based on ground penetrating radar (GPR) and observations from test pits conducted during the SC.

The site land surface is generally flat and covered with asphalt pavement. The nearest residential area is adjacent to the southeast corner of the site, likely hydraulically up-gradient of the site. The area is serviced by municipal water. Overburden materials are generally composed of urban fill and sand which overlie silt and clay.

Unsaturated soil, fill materials, and building debris at the site do not appear to be significantly impacted by site-related contaminants. CVOC-impacted groundwater remains at the site in the suspected source area in the central portion of the site near MW-8, which contains groundwater with the highest concentrations of CVOCs. Groundwater with CVOC concentrations greater than the corresponding NYSDEC GA Standards is present over much of the central portion of the site.

3 QUALITATIVE EXPOSURE/RISK ASSESSMENT

A qualitative human health exposure pathway assessment was performed using the data collected during the RI. The qualitative exposure assessment consists of characterizing the exposure setting, identifying potential exposure pathways, and evaluating contaminant fate and transport. An exposure pathway describes the means by which an individual may be exposed to contaminants originating from the site. An exposure pathway has five elements: (1) a contaminant source; (2) contaminant release and transport mechanism; (3) a point of exposure; (4) a route of exposure; and (5) a receptor population. The plausible exposure pathways are discussed below by medium.

3.1 Soil

Based on the results of the RI, surface soils contained at least one SVOC at concentrations exceeding the applicable 6NYCRR Part 375 SCOs. While the majority of the site is paved with asphalt, some areas of exposed soil/vegetation are present. Because some human receptors (e.g., pedestrians) have access to the site, there is the potential for human exposure to soil.

The most likely soil exposure pathway is construction/utility worker contact with subsurface soil via incidental ingestion, dermal contact, and inhalation of volatilized chemicals during construction activities (i.e., trenches or excavations to repair or maintain underground utilities). While prolonged contact or ingestion of site soil is unlikely, contact with affected soil by construction and/or utility workers represents a possible future exposure pathway.

3.2 Groundwater

CVOCs are present in site groundwater at concentrations greater than applicable NYSDEC Class GA Standards. The impacts to groundwater appear limited and restricted to the site itself, as the new down-gradient off-site wells to the north did not contain CVOCs. Groundwater presently has no exposure point or route, as groundwater in the vicinity of the site is not used as a drinking water source, nor is it anticipated to be used as a drinking water source in the future. Utility workers are not expected to come into contact with groundwater containing CVOCs because the depth to groundwater at the site is greater than the depth of a typical utility or building excavation.

3.3 Soil Vapor

The basic model for soil vapor intrusion into a building is migration from a subsurface source (in this instance from volatilization of CVOCs from the dissolved-phase CVOC plume present beneath the site) through cracks, foundation joints, or other openings in the floor. Since there are no buildings currently on site, the human exposure pathway related to soil vapor is not complete. Based on data collected during the RI, soil vapor intrusion mitigation would be warranted if any building plans develop for the site.

4 REMEDIAL ACTION OBJECTIVES AND EVALUATION CRITERIA

The remedial goals for the 222 South Ferry Street Site will be the restoration of the site to pre-release conditions, to the extent feasible, given the existing and potential future land use and the location of the site in an area of historic fill. At this time the end use of the property is not known, but it expected to be consistent with restricted residential land use.

4.1 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the affected media are listed below. Generally, these RAOs may be achieved by minimizing the:

- Magnitude and extent of contamination in the affected media;
- Migratory potential of the contaminants; and
- Potential for human exposure to in-situ contaminated media.

4.1.1 Soil

The RAOs for soil are listed below.

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation exposure to contaminants volatilizing from soil.
- Prevent migration of contaminants that would result in groundwater contamination.

4.1.2 Groundwater

The RAOs for groundwater are listed below.

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater.
- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Remove the source of groundwater contamination.

4.1.3 Soil Vapor

The RAOs for soil vapor are listed below.

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into future buildings at the site.

4.2 Evaluation Criteria

In accordance with DER-10 Technical Guidance for Site Investigation and Remediation (DER-10) (NYSDEC, 2010), the remedial measure alternatives developed in this Feasibility Study will be screened based on an evaluation of the following criteria:

- Overall Protection of Human Health and the Environment;
- Compliance with Standards, Criteria, and Guidance (SCGs);
- Long-term Effectiveness and Permanence;
- Reduction of Toxicity, Mobility, and Volume;
- Short-term Effectiveness;
- Implementability;
- Cost;
- Community Acceptance.

4.2.1 Overall Protection of Human Health and the Environment

This criterion serves as a final check to assess whether each alternative meets the requirements that are protective of human health and the environment. The overall assessment of protection is based on a composite of factors assessed under the other evaluation criteria. The evaluation focuses on how a specific alternative achieves protection over time and how site risks are reduced. The analysis includes how each source of contamination is to be eliminated, reduced, or controlled for each alternative.

4.2.2 Compliance with SCGs

This evaluation criterion assesses how each alternative complies with 6 NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives, 6 NYCRR Part 375 Restricted Residential Soil Cleanup Objectives, 6 NYCRR Part 375 Protection of Groundwater Soil Cleanup Objective, NYSDEC Class GA Standards, and the guidelines set forth in the NYSDOH October 2006 Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York.

4.2.3 Long-Term Effectiveness and Permanence

This evaluation criterion addresses the results of a remedial action in terms of its permanence and quantity/nature of waste or residual remaining at the site after response objectives have been met. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the waste or residual remaining at the site and operating system necessary for the remedy to remain effective. The factors being evaluated include the permanence of the remedial alternative, magnitude of the remaining risk, adequacy of controls used to manage residual waste, and reliability of controls used to manage residual waste.

4.2.4 Reduction of Toxicity, Mobility, and Volume

This evaluation criterion assesses the remedial alternative's use of the technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous wastes as their principal element. The NYSDEC's policy is to give preference to alternatives that eliminate any significant threats at the site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in the contaminants mobility, or reduction of the total volume of contaminated media. This evaluation includes: the amount of the hazardous materials that would be destroyed or treated, the degree of expected reduction in toxicity, mobility, or volume measured as a percentage, the degree in which the treatment would be irreversible, and the type and quantity of treatment residuals that would remain following treatment.

4.2.5 Short-Term Effectiveness

This evaluation criterion assesses the effects of the alternative during the construction and implementation phase. Alternatives are evaluated with respect to the effects on human health and the environment during implementation of the remedial action. The aspects evaluated include: protection of the community during remedial actions, environmental impacts as a result of remedial actions, time until the remedial response objectives are achieved, and protection of workers during the remedial action.

4.2.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. The evaluation includes: feasibility of construction and operation; the reliability of the technology; the ease of undertaking additional remedial action; monitoring considerations; activities needed to coordinate with other offices or agencies; availability of adequate off-site treatment, storage, and disposal services; availability of equipment; and the availability of services and materials.

4.2.7 Cost

Cost estimates are prepared and evaluated for each alternative. The cost estimates include capital costs, operation and maintenance (O&M) costs, and future capital costs. A cost sensitivity analysis is performed which includes the following factors: the effective life of the remedial action, the O&M costs, the duration of the cleanup, the volume of contaminated material, other design parameters, and the discount rate. Cost estimates developed at the detailed analysis of alternatives phase of a feasibility study generally have an expected accuracy range of -30 to +50 percent (USEPA, 2000).

4.2.8 Community Acceptance

Following submission of this report and the generation of the PRAP by the NYSDEC, a summary of the proposed remedial action will be sent to the project's contact list. The summary will include the date, time, and location of the public meeting, and announcement of the 30-day period for submission of written comments from the public. A Responsiveness Summary will be prepared to address public comments on the PRAP. After the submission of Responsiveness Summary, a final remedy will be selected and publicized. If the final remedy differs significantly from the proposed remedy, public notices will include descriptions of the differences and the reason for the changes.

5 REMEDIAL ALTERNATIVES ANALYSIS

Based upon the site characteristics and in consultation with the NYSDEC, the following remedial alternatives were considered to be potentially applicable to the soil, groundwater, and soil vapor contamination at the site:

Alternative 1: No Further Action

Alternative 2: Excavation to Unrestricted Use SCOs (7,000 cubic yards (CY)) and Monitored Natural Attenuation (MNA) (with Tank Removal and Institutional Controls)

Alternative 3: Excavation to Unrestricted Use SCOs (7,000 CY) and In-Situ Chemical Oxidation (ISCO) (with Tank Removal and Institutional Controls)

Alternative 4: Excavation to Restricted Residential SCOs (3,000 CY) and MNA (with Tank Removal and Institutional Controls)

Alternative 5: Excavation to Restricted Residential SCOs (3,000 CY) and ISCO (with Tank Removal and Institutional Controls)

Alternative 6: Excavation to Protection of GW SCOs (10,600 CY) and MNA (with Tank Removal and Institutional Controls)

Alternative 7: Excavation to Protection of GW SCOs (10,600 CY) and ISCO (with Tank Removal and Institutional Controls)

Alternative 8: Source Area Excavation (2,500 CY) and Passive ISCO

This section presents an analysis of the potential remedial alternatives for remediation of the 222 South Ferry St Site in accordance with the criteria described in Section 4.2. Except for Alternative 1, each alternative will require institutional controls in the form of a site management plan and an environmental easement that will be used to address monitoring requirements and future use of the site.

5.1 Remedial Alternatives Evaluation

5.1.1 Alternative 1: No Further Action

5.1.1.1 Description

The no further action alternative, by definition, involves no further institutional controls, environmental monitoring, or remedial action, and therefore, includes no technological barriers. In accordance with DER-10, this alternative serves as a baseline, defining the minimum steps that would be taken at the site in the absence of any type of action directed at the existing contamination.

Alternative 1 would include abandoning of all monitoring wells, and soil vapor monitoring points, which are depicted on Figure 5-1.

Wells to Abandon

- MW-1
- MW-2
- MW-3
- MW-4
- MW-5
- MW-6
- MW-7
- MW-8
- MW-9
- MW-10
- MW-11
- MW-12
- MW-13
- SV-1
- SV-2
- SV-3
- SV-4
- SV-5
- SV-6
- SV-7
- SV-8

5.1.1.2 Overall Protection of Human Health and the Environment

The No Further Action alternative would not be protective of public health and the environment as soil and groundwater containing CVOCs at concentrations greater than applicable soil and groundwater standards would remain at the site. Although the nearest receptors are supplied with public drinking water; the potential for future exposure to contaminated soil and groundwater via construction/excavation activities at the site would also remain.

5.1.1.3 Compliance with SCGs

The No Further Action alternative would not meet the SCGs as contamination would persist at concentrations greater than standards/guidelines in soil, groundwater, and soil vapor.

5.1.1.4 Long-Term Effectiveness and Permanence

The No Further Action alternative would not meet the SCGs over the long term as contamination would persist at concentrations greater than standards/guidelines in soil, groundwater, and soil vapor.

5.1.1.5 Reduction of Toxicity, Mobility, and Volume with Treatment

The No Further Action alternative would not reduce the toxicity or mobility of the contaminants. The volume of the contamination may be reduced through natural attenuation.

5.1.1.6 Short-Term Impact and Effectiveness

Community Protection

Standard protection measures for mitigation of environmental impacts and nuisance conditions would be implemented during system dismantling and well abandoning.

Worker Protection

Implementation of this alternative would be undertaken using standard procedures for worker protection including the establishment of a health and safety plan which would outline the appropriate protective measures which should be undertaken during any subsurface activities in the affected area.

Environmental Impacts

Implementation of this alternative would not be expected to create adverse environmental impacts; however, the source of the vapor intrusion impacts would remain.

Time Required to Implement

This alternative would likely require less than one year to implement.

5.1.1.7 Implementability

The No Further Action alternative can be easily implemented.

5.1.1.8 Cost

The capital and present worth costs for Alternative 1 are presented in Table 5-1. There are no O&M costs.

- Capital Costs: The probable capital cost to construct and implement Alternative 1 is approximately $41,300.
- Present Worth Cost: The probable net present worth for this alternative is approximately $41,000. This was calculated using a 5% annual discount rate.

5.1.2 Alternative 2: Excavation to Unrestricted Use SCOs (7,000 cubic yards (CY)) and MNA (with Tank Removal and Institutional Controls)

5.1.2.1 Description

Alternative 2 would include the following elements, which are depicted on Figure 5-2:

- Removal, cleaning, and disposal of the USTs and abandoning of monitoring wells, and soil vapor monitoring points within the remediation area;

Wells to Abandon

  - MW-1
  - MW-2
  - MW-3
  - MW-8
  - MW-10
  - MW-12
  - MW-13
  - SV-3
  - SV-4
  - SV-6
  - SV-8

- Excavation of approximately 7,000 CY of on-site soil within the remediation area to a maximum depth of 10 feet bgs (based on observations from soil borings and monitoring wells). The remediation area is generally based on the following information:
  - Site soil borings/monitoring wells with exceedances of Unrestricted Use SCOs.

  The excavation horizontal limits are based on points approximately half the distance from the nearest soil sample location with contaminants less than SCGs.

- Sloping and/or shoring as necessary;
- Short-term groundwater recovery and treatment is anticipated to be necessary to dewater the target interval;
- Off-site disposal of excavated soil as non-hazardous waste in accordance with applicable federal, state, and local regulations;
- Backfilling of excavation with clean off-site fill following confirmation sampling that indicates that impacted soil has been removed;
- Installation of replacement monitoring wells; and
- Annual groundwater monitoring for two years.

This alternative assumes that the on-site electrical lines in the vicinity of the excavation area would be protected or relocated.

5.1.2.2 Overall Protection of Human Health and the Environment

Alternative 2 would be protective of public health and the environment as soil contamination acting as a source for groundwater impacts and potential soil vapor impacts would be removed, with subsequent natural attenuation.

5.1.2.3 Compliance with SCGs

Alternative 2 would meet soil SCGs over the short-term and should meet groundwater and soil vapor SCGs over the long-term by removing the sources of contamination.

5.1.2.4 Long-Term Effectiveness and Permanence

Alternative 2 would be effective in the long-term through removal of remaining sources of contamination.

5.1.2.5 Reduction of Toxicity, Mobility, and Volume with Treatment

Alternative 2 would reduce the toxicity and volume of the contaminants, but would not reduce their mobility.

5.1.2.6 Short-Term Impact and Effectiveness

Community Protection

Standard protection measures for mitigation of environmental impacts and nuisance conditions would be implemented during excavation activities, well installation, and during routine groundwater sampling.

Worker Protection

Implementation of this alternative would be undertaken using standard procedures for worker protection including the establishment of a health and safety plan which would outline the appropriate protective measures which should be undertaken during any subsurface activities in the affected area.

Environmental Impacts

Implementation of this alternative would not be expected to create adverse environmental impacts.

Time Required to Implement

This alternative would likely require approximately three years to implement.

5.1.2.7 Implementability

Alternative 2 can be easily implemented using readily available technologies.

5.1.2.8 Cost

The capital, O&M, and present worth costs for Alternative 2 are presented in Table 5-2. A three-year implementation period was chosen for this alternative.

- Capital Costs: The probable capital cost to construct and implement this alternative is approximately $2,057,600.
- O&M Costs: The probable annual operations, monitoring, and maintenance cost for this alternative is $12,500. The final year's operations, monitoring, and maintenance cost for this alternative is $12,100.
- Present Worth Cost: Over a three-year implementation period, the probable net present worth for this alternative is approximately $2,105,000. This was calculated using a 5% annual discount rate.

5.1.3 Alternative 3: Excavation to Unrestricted Use SCOs (7,000 CY) and ISCO (with Tank Removal and Institutional Controls)

5.1.3.1 Description

Alternative 3 would include the following elements, which are depicted on Figure 5-3:

- Removal, cleaning, and disposal of the USTs and abandoning of monitoring wells, and soil vapor monitoring points within the remediation area;

Wells to Abandon

- MW-1
- MW-2
- MW-3
- MW-8
- MW-10
- MW-12
- MW-13
- SV-3
- SV-4
- SV-6
- SV-8

- Excavation of approximately 7,000 CY of on-site soil within the remediation area to a maximum depth of 10 feet bgs (based on observations from soil borings and monitoring wells). The remediation area is generally based on the following information:
  - Site soil borings/monitoring wells with exceedances of Unrestricted Use SCOs.

  The excavation horizontal limits are based on points approximately half the distance from the nearest soil sample location with contaminants less than SCGs.

- Sloping and/or shoring as necessary;
- Short-term groundwater recovery and treatment is anticipated to be necessary to dewater the target interval;
- Off-site disposal of excavated soil as non-hazardous waste in accordance with applicable federal, state, and local regulations;
- Backfilling of excavation with clean off-site fill following confirmation sampling that indicates that impacted soil has been removed;
- Installation of injection wells;
- Installation of replacement monitoring wells;
- Up to two injections of sodium permanganate within the area of impacted groundwater using direct-push technology; and
- Annual groundwater monitoring for one year.

This alternative assumes that the on-site electrical lines in the vicinity of the excavation area would be protected or relocated.

5.1.3.2 Overall Protection of Human Health and the Environment

Alternative 3 would be protective of public health and the environment as soil contamination acting as a source for groundwater impacts and potential soil vapor impacts would be removed, with subsequent ISCO.

5.1.3.3 Compliance with SCGs

Alternative 3 would meet soil SCGs over the short-term and should meet groundwater and soil vapor SCGs over the long-term by removing the sources of contamination.

5.1.3.4 Long-Term Effectiveness and Permanence

Alternative 3 would be effective in the long-term through removal of remaining sources of contamination.

5.1.3.5 Reduction of Toxicity, Mobility, and Volume with Treatment

Alternative 3 would reduce the toxicity, mobility, and volume of the contaminants.

5.1.3.6 Short-Term Impact and Effectiveness

Community Protection

Standard protection measures for mitigation of environmental impacts and nuisance conditions would be implemented during excavation activities, well installation, and during routine groundwater sampling.

Worker Protection

Implementation of this alternative would be undertaken using standard procedures for worker protection including the establishment of a health and safety plan which would outline the appropriate protective measures which should be undertaken during any subsurface activities in the affected area.

Environmental Impacts

Implementation of this alternative would not be expected to create adverse environmental impacts.

Time Required to Implement

This alternative would likely require approximately two years to implement.

5.1.3.7 Implementability

Alternative 3 can be easily implemented using readily available technologies.

5.1.3.8 Cost

The capital, O&M, and present worth costs for Alternative 3 are presented in Table 5-3. A two-year implementation period was chosen for this alternative.

- Capital Costs: The probable capital cost to construct and implement this alternative is approximately $2,690,100.

- O&M Costs: The probable annual operations, monitoring, and maintenance cost for this alternative is $12,500. The final year's operations, monitoring, and maintenance cost for this alternative is $12,100.
- Present Worth Cost: Over a two-year implementation period, the probable net present worth for this alternative is approximately $2,726,000. This was calculated using a 5% annual discount rate.

5.1.4 Alternative 4: Excavation to Restricted Residential SCOs (3,000 CY) and MNA (with Tank Removal and Institutional Controls)

5.1.4.1 Description

Alternative 4 would include the following elements, which are depicted on Figure 5-4:

- Removal, cleaning, and disposal of the UST's and abandoning of monitoring wells, and soil vapor monitoring points within the remediation area;

Wells to Abandon

  - MW-3
  - MW-8
  - SV-4
  - SV-8

- Excavation of approximately 3,000 CY of on-site soil within the remediation area to a maximum depth of 10 feet bgs (based on observations from soil borings and monitoring wells). The remediation area is generally based on the following information:
  - Site soil borings/monitoring wells with exceedances of Restricted Residential SCOs.

  The excavation horizontal limits are based on points approximately half the distance from the nearest soil sample location with contaminants less than SCGs.

- Sloping and/or shoring as necessary;
- Short-term groundwater recovery and treatment is anticipated to be necessary to dewater the target interval;
- Off-site disposal of excavated soil as non-hazardous waste in accordance with applicable federal, state, and local regulations;
- Backfilling of excavation with clean off-site fill following confirmation sampling that indicates that impacted soil has been removed;
- Installation of replacement monitoring wells; and
- Annual groundwater monitoring for three years.

This alternative assumes that the on-site electrical lines in the vicinity of the excavation area would be protected or relocated.

5.1.4.2 Overall Protection of Human Health and the Environment

Alternative 4 would be protective of public health and the environment as soil contamination acting as a source for groundwater impacts and potential soil vapor impacts would be removed, with subsequent natural attenuation.

5.1.4.3 Compliance with SCGs

Alternative 4 would meet soil SCGs over the short-term and should meet groundwater and soil vapor SCGs over the long-term by removing the sources of contamination.

5.1.4.4 Long-Term Effectiveness and Permanence

Alternative 4 would be effective in the long-term through removal of remaining sources of contamination.

5.1.4.5 Reduction of Toxicity, Mobility, and Volume with Treatment

Alternative 4 would reduce the toxicity and volume of the contaminants, but would not reduce their mobility.

5.1.4.6 Short-Term Impact and Effectiveness

Community Protection

Standard protection measures for mitigation of environmental impacts and nuisance conditions would be implemented during excavation activities, well installation, and during routine groundwater sampling.

Worker Protection

Implementation of this alternative would be undertaken using standard procedures for worker protection including the establishment of a health and safety plan which would outline the appropriate protective measures which should be undertaken during any subsurface activities in the affected area.

Environmental Impacts

Implementation of this alternative would not be expected to create adverse environmental impacts.

Time Required to Implement

This alternative would likely require approximately four years to implement.

5.1.4.7 Implementability

Alternative 4 can be easily implemented using readily available technologies.

5.1.4.8 Cost

The capital, O&M, and present worth costs for Alternative 4 are presented in Table 5-4. A four-year implementation period was chosen for this alternative.

- Capital Costs: The probable capital cost to construct and implement this alternative is approximately $1,223,400.
- O&M Costs: The probable annual operations, monitoring, and maintenance cost for this alternative is $12,500. The final year's operations, monitoring, and maintenance cost for this alternative is $20,570.

- Present Worth Cost: Over a four-year implementation period, the probable net present worth for this alternative is approximately $1,290,000. This was calculated using a 5% annual discount rate.

5.1.5 Alternative 5: Excavation to Restricted Residential SCOs (3,000 CY) and ISCO (with Tank Removal and Institutional Controls)

5.1.5.1 Description

Alternative 5 would include the following elements, which are depicted on Figure 5-5:

- Cleaning, removal, and disposal of the UST's and abandoning of monitoring wells, and soil vapor monitoring points within the remediation area;

Wells to Abandon

  - MW-3
  - MW-8
  - SV-4
  - SV-8

- Excavation of approximately 3,000 CY of on-site soil within the remediation area to a maximum depth of 10 feet bgs (based on observations from soil borings and monitoring wells). The remediation area is generally based on the following information:
  - Site soil borings/monitoring wells with exceedances of Restricted Residential SCOs.

    The excavation horizontal limits are based on points approximately half the distance from the nearest soil sample location with contaminants less than SCGs.

- Sloping and/or shoring as necessary;
- Short-term groundwater recovery and treatment is anticipated to be necessary to dewater the target interval;
- Off-site disposal of excavated soil as non-hazardous waste in accordance with applicable federal, state, and local regulations;
- Backfilling of excavation with clean off-site fill following confirmation sampling that indicates that impacted soil has been removed;
- Installation of replacement monitoring wells;
- Up to two injections of sodium permanganate within the groundwater plume area using direct-push technology; and
- Annual groundwater monitoring for two years.

This alternative assumes that the on-site electrical lines in the vicinity of the excavation area would be protected or relocated.

5.1.5.2 Overall Protection of Human Health and the Environment

Alternative 5 would be protective of public health and the environment as soil contamination acting as a source for groundwater impacts and potential soil vapor impacts would be removed, with subsequent ISCO.

5.1.5.3 Compliance with SCGs

Alternative 5 would meet soil SCGs over the short-term and should meet groundwater and soil vapor SCGs over the long-term by removing the sources of contamination.

5.1.5.4 Long-Term Effectiveness and Permanence

Alternative 5 would be effective in the long-term through removal of remaining sources of contamination.

5.1.5.5 Reduction of Toxicity, Mobility, and Volume with Treatment

Alternative 5 would reduce the toxicity, mobility, and volume of the contaminants.

5.1.5.6 Short-Term Impact and Effectiveness

Community Protection

Standard protection measures for mitigation of environmental impacts and nuisance conditions would be implemented during excavation activities, well installation, and during routine groundwater sampling.

Worker Protection

Implementation of this alternative would be undertaken using standard procedures for worker protection including the establishment of a health and safety plan which would outline the appropriate protective measures which should be undertaken during any subsurface activities in the affected area.

Environmental Impacts

Implementation of this alternative would not be expected to create adverse environmental impacts.

Time Required to Implement

This alternative would likely require approximately three years to implement.

5.1.5.7 Implementability

Alternative 5 can be easily implemented using readily available technologies.

5.1.5.8 Cost

The capital, O&M, and present worth costs for A three-year implementation period was chosen for this alternative.

- Capital Costs: The probable capital cost to construct and implement this alternative is approximately $2,014,200.
- O&M Costs: The probable annual operations, monitoring, and maintenance cost for this alternative is $12,500. The final year's operations, monitoring, and maintenance cost for this alternative is $20,570.

- Present Worth Cost: Over a three-year implementation period, the probable net present worth for this alternative is approximately $2,070,000. This was calculated using a 5% annual discount rate.

5.1.6 Alternative 6: Excavation to Protection of GW Standard SCOs (10,600 CY) and MNA (with Tank Removal and Institutional Controls)

5.1.6.1 Description

Alternative 6 would include the following elements, which are depicted on Figure 5-6:

- Removal, cleaning, and disposal of the UST's and abandoning of monitoring wells, and soil vapor monitoring points within the remediation area;

Wells to Abandon

  - MW-1
  - MW-2
  - MW-3
  - MW-4
  - MW-5
  - MW-6
  - MW-8
  - MW-10
  - MW-12
  - MW-13
  - SV-1
  - SV-3
  - SV-4
  - SV-5
  - SV-6
  - SV-8

- Excavation of approximately 10,600 CY of on-site soil within the remediation area to a maximum depth of 10 feet bgs (based on observations from soil borings and monitoring wells). The remediation area is generally based on the following information:
  - Site soil borings/monitoring wells with exceedances of Protection of Groundwater SCOs.

    The excavation horizontal limits are based on points approximately half the distance from the nearest soil sample location with contaminants less than SCGs.

- Sloping and/or shoring as necessary;
- Short-term groundwater recovery and treatment is anticipated to be necessary to dewater the target interval;
- Off-site disposal of excavated soil as non-hazardous waste in accordance with applicable federal, state, and local regulations;
- Backfilling of excavation with clean off-site fill following confirmation sampling that indicates that impacted soil has been removed;
- Installation of replacement monitoring wells; and
- Annual groundwater monitoring for two years.

This alternative assumes that the on-site electrical lines in the vicinity of the excavation area would be protected or relocated.

5.1.6.2 Overall Protection of Human Health and the Environment

Alternative 6 would be protective of public health and the environment as soil contamination acting as a source for groundwater impacts and potential soil vapor impacts would be removed, with subsequent natural attenuation.

5.1.6.3 Compliance with SCGs

Alternative 6 would meet soil SCGs over the short-term and should meet groundwater and soil vapor SCGs over the long-term by removing the sources of contamination.

5.1.6.4 Long-Term Effectiveness and Permanence

Alternative 6 would be effective in the long-term through removal of remaining sources of contamination.

5.1.6.5 Reduction of Toxicity, Mobility, and Volume with Treatment

Alternative 6 would reduce the toxicity and volume of the contaminants, but would not reduce their mobility.

5.1.6.6 Short-Term Impact and Effectiveness

Community Protection

Standard protection measures for mitigation of environmental impacts and nuisance conditions would be implemented during excavation activities, well installation, and during routine groundwater sampling.

Worker Protection

Implementation of this alternative would be undertaken using standard procedures for worker protection including the establishment of a health and safety plan which would outline the appropriate protective measures which should be undertaken during any subsurface activities in the affected area.

Environmental Impacts

Implementation of this alternative would not be expected to create adverse environmental impacts.

Time Required to Implement

This alternative would likely require approximately three years to implement.

5.1.6.7 Implementability

Alternative 6 can be easily implemented using readily available technologies.

5.1.6.8 Cost

The capital, O&M, and present worth costs for Alternative 6 are presented in Table 5-6. A three-year implementation period was chosen for this alternative.

- Capital Costs: The probable capital cost to construct and implement this alternative is approximately $3,352,700.
- O&M Costs: The probable annual operations, monitoring, and maintenance cost for this alternative is $12,500. The final year's operations, monitoring, and maintenance cost for this alternative is $6,050.
- Present Worth Cost: Over a three-year implementation period, the probable net present worth for this alternative is approximately $3,394,000. This was calculated using a 5% annual discount rate.

5.1.7 Alternative 7: Excavation to Protection of GW Standard SCOs (10,600 CY) and ISCO (with Tank Removal and Institutional Controls)

5.1.7.1 Description

Alternative 7 would include the following elements, which are depicted on Figure 5-7:

- Removing, cleaning, and disposal of the UST's and abandoning of monitoring wells, and soil vapor monitoring points within the remediation area;

Wells to Abandon

o MW-1	o MW-12
o MW-2	o MW-13
o MW-3	o SV-1
o MW-4	o SV-3
o MW-5	o SV-4
o MW-6	o SV-5
o MW-8	o SV-6
o MW-10	o SV-8

- Excavation of approximately 10,600 CY of on-site soil within the remediation area to a maximum depth of 10 feet bgs (based on observations from soil borings and monitoring wells). The remediation area is generally based on the following information:
    - Site soil borings/monitoring wells with exceedances of Protection of Groundwater SCOs.

    The excavation horizontal limits are based on points approximately half the distance from the nearest soil sample location with contaminants less than SCGs.

- Sloping and/or shoring as necessary;
- Short-term groundwater recovery and treatment is anticipated to be necessary to dewater the target interval;
- Off-site disposal of excavated soil as non-hazardous waste in accordance with applicable federal, state, and local regulations;
- Backfilling of excavation with clean off-site fill following confirmation sampling that indicates that impacted soil has been removed;
- Installation of replacement monitoring wells;

- Up to two injections of sodium permanganate within the groundwater plume area using direct-push technology; and
- Groundwater monitoring for one year.

This alternative assumes that the on-site electrical lines in the vicinity of the excavation area would be protected or relocated.

5.1.7.2 Overall Protection of Human Health and the Environment

Alternative 7 would be protective of public health and the environment as soil contamination acting as a source for groundwater impacts and potential soil vapor impacts would be removed, with subsequent ISCO.

5.1.7.3 Compliance with SCGs

Alternative 7 would meet soil SCGs over the short-term and should meet groundwater and soil vapor SCGs over the long-term by removing the sources of contamination.

5.1.7.4 Long-Term Effectiveness and Permanence

Alternative 7 would be effective in the long-term through removal of remaining sources of contamination.

5.1.7.5 Reduction of Toxicity, Mobility, and Volume with Treatment

Alternative 7 would reduce the toxicity, mobility, and volume of the contaminants.

5.1.7.6 Short-Term Impact and Effectiveness

Community Protection

Standard protection measures for mitigation of environmental impacts and nuisance conditions would be implemented during excavation activities, well installation, and during routine groundwater sampling.

Worker Protection

Implementation of this alternative would be undertaken using standard procedures for worker protection including the establishment of a health and safety plan which would outline the appropriate protective measures which should be undertaken during any subsurface activities in the affected area.

Environmental Impacts

Implementation of this alternative would not be expected to create adverse environmental impacts.

Time Required to Implement

This alternative would likely require approximately two years to implement.

5.1.7.7 Implementability

Alternative 7 can be easily implemented using readily available technologies.

5.1.7.8 Cost

The capital, O&M, and present worth costs for Alternative 7 are presented in Table 5-7. A two-year implementation period was chosen for this alternative.

- Capital Costs: The probable capital cost to construct and implement this alternative is approximately $4,099,600.
- O&M Costs: The probable annual operations, monitoring, and maintenance cost for this alternative is $12,500. The final year's operations, monitoring, and maintenance cost for this alternative is $6,050.
- Present Worth Cost: Over a two-year implementation period, the probable net present worth for this alternative is approximately $4,130,000. This was calculated using a 5% annual discount rate.

5.1.8 Alternative 8: Source Area Excavation (2,500 CY) and Passive ISCO

5.1.8.1 Description

Alternative 8 would include the following elements, which are depicted on Figure 5-8:

- Cleaning, removal, and disposal of the UST's and abandoning of monitoring wells and soil vapor monitoring points within the remediation area;

  Wells to Abandon

  - MW-3
  - MW-8
  - SV-4
- Excavation of approximately 2,500 CY of on-site soil within the remediation area to a maximum depth of 10 feet bgs (based on observations from soil borings and monitoring wells). The remediation "source area" is generally defined based on the following information:
  - Data from site soil borings and monitoring wells within the source area to establish the horizontal and vertical locations of contaminants and depths to groundwater; and
  - Data from site soil borings and monitoring wells outside the source area (The horizontal limits of the excavation are based on points approximately one-half the distance from the nearest soil sample location with contaminants less than Restricted Residential SCOs).
- Sloping and/or shoring as necessary;
- Short-term groundwater recovery and treatment is anticipated to be necessary to dewater the target interval;
- Off-site disposal of excavated soil as non-hazardous waste in accordance with applicable federal, state, and local regulations;
- Application of crystalline potassium permanganate mixed with the backfill material in the lower approximately three feet of the excavation area (that which is below the water table) as a treatment using an excavator to mix and add directly to the excavated areas;
- Backfilling of excavation with off-site fill following confirmation sampling that indicates that impacted soil has been removed;
- Installation of replacement monitoring wells; and
- Annual groundwater monitoring for two years.

This alternative assumes that the on-site electrical lines in the vicinity of the excavation area would be protected or relocated.

5.1.8.2 Overall Protection of Human Health and the Environment

Alternative 8 would be protective of public health and the environment as soil contamination acting as a source for groundwater impacts and potential soil vapor impacts would be removed, and subsequent ISCO would occur to enhance the remediation of site groundwater in the source area.

5.1.8.3 Compliance with SCGs

Alternative 8 would meet soil SCGs over the short-term and should meet groundwater and soil vapor SCGs over the long-term by removing the major sources of contamination.

5.1.8.4 Long-Term Effectiveness and Permanence

Alternative 8 would be effective in the long-term through removal of some remaining sources of contamination.

5.1.8.5 Reduction of Toxicity, Mobility, and Volume with Treatment

Alternative 8 would reduce the toxicity, mobility, and volume of the contaminants.

5.1.8.6 Short-Term Impact and Effectiveness

Community Protection

Standard protection measures for mitigation of environmental impacts and nuisance conditions would be implemented during excavation, backfilling, ISCO mixing and placement, well installation, and routine groundwater sampling.

Worker Protection

Implementation of this alternative would be undertaken using standard procedures for worker protection, including the establishment of a health and safety plan which would outline the appropriate protective measures which should be undertaken during any subsurface activities in the affected area.

Environmental Impacts

Implementation of this alternative would not be expected to create adverse environmental impacts.

Time Required to Implement

This alternative would likely require approximately two years to implement.

5.1.8.7 Implementability

Alternative 8 can be easily implemented using readily available technologies.

5.1.8.8 Cost

The capital, O&M, and present worth costs for a two-year implementation period were estimated for this alternative.

- Capital Costs: The probable capital cost to construct and implement this alternative is approximately $1,055,800.
- O&M Costs: The probable annual operations, monitoring, and maintenance cost for this alternative is $12,500. The operations, monitoring, and maintenance closeout cost for this alternative is $21,780.
- Present Worth Cost: Over a two-year implementation period, the probable net present worth for this alternative is approximately $1,112,000. This was calculated using a 5% annual discount rate.

5.2 Comparative Analysis

5.2.1 Overview

The RAOs for the site are concerned with the prevention of contact with contaminated soil, groundwater, and soil vapor and the remediation of the affected media to pre-release conditions, Restricted Residential SCOs, Unrestricted Use SCOs, or Protection of GW Standard SCOs, and NYSDEC Class GA Standards for soil and groundwater, to the extent practicable. The alternatives presented for the site provide varying levels of remedial actions and are summarized in the table below.

Alternative	Name	Description	Likelihood of Meeting RAOs
1	No Further Action	Minimum steps for remediation	Will not meet
2	Excavation to Unrestricted Use SCOs (7,000 CY) and MNA (with Tank Removal and Institutional Controls)	Groundwater monitoring to document contaminant distribution and degradation over time.	May meet
3	Excavation to Unrestricted Use SCOs (7,000 CY) and ISCO (with Tank Removal and Institutional Controls)	Active groundwater remediation.	Likely meet
4	Excavation to Restricted Residential SCOs (3,000 CY) and MNA (with Tank Removal and Institutional Controls)	Groundwater monitoring to document contaminant distribution and degradation over time.	May meet
5	Excavation to Restricted Residential SCOs (3,000 CY) and ISCO (with Tank Removal and Institutional Controls)	Active groundwater remediation.	Likely meet

6	Excavation to Protection of GW Standard SCOs (10,600 CY) and MNA (with Tank Removal and Institutional Controls)	Groundwater monitoring to document contaminant distribution and degradation over time.	May meet
7	Excavation to Protection of GW Standard SCOs (10,600 CY) and ISCO (with Tank Removal and Institutional Controls)	Active groundwater remediation.	Likely meet
8	Source Area Excavation (2,500 CY) and Passive ISCO	Active groundwater remediation.	Likely meet

5.2.2 Overall Protection of Public Health

Alternative 1 would not be protective of human health and the environment. CVOCs would remain in soil, groundwater, soil vapor, and indoor air, while active mitigation of indoor air, the only completed exposure pathway, would be discontinued.

Alternatives 2, 4, and 6 provide more protection than Alternative 1 in that direct contact with residual soil and groundwater contamination would be eliminated through excavation. Residual groundwater contamination would be addressed over time by monitored natural attenuation.

Alternatives 3, 5, 7, and 8 provide more protection than Alternatives 2, 4, and 6 in that direct contact with residual soil and groundwater contamination would be eliminated through active groundwater treatment in addition to excavation.

5.2.3 Compliance with SCGs

Alternatives 1 will likely not meet the SCGs over time. Alternatives 2, 4, and 6 will meet the SCGs with time. Alternatives 3, 5, 7, and 8 are capable of meeting SCGs in less time than Alternatives 2, 4, and 6.

5.2.4 Long-Term Effectiveness and Permanence

Alternative 1 will likely not be effective in the long term. Alternatives 2, 4, and 6 may be effective in the long-term. Alternatives 3, 5, 7, and 8 would be effective in the long-term.

5.2.5 Reduction of Toxicity, Mobility, and Volume with Treatment

Alternative 1 would not reduce the toxicity or mobility of the contaminants. Alternative 1 may reduce the contaminant volume over time. Alternatives 2, 4, and 6 would reduce the contaminant volume over time. Alternatives 3, 5, 7, and 8 would reduce the toxicity, mobility, and volume of the contaminants.

5.2.6 Short-Term Impact and Effectiveness

The ranking of each of the alternatives, in order of short-term impact and effectiveness (from least to greatest) is shown below:

1. Alternative 1 – No Further Action.
2. Alternative 4 – Excavation to Restricted Residential SCOs (3,000 CY) and MNA (with Tank Removal and Institutional Controls).

3. Alternative 2 – Excavation to Unrestricted Use SCOs (7,000 CY) and MNA (with Tank Removal and Institutional Controls).
4. Alternative 6 – Excavation to Protection of GW Standard SCOs (10,600 CY) and MNA (with Tank Removal and Institutional Controls).
5. Alternative 8 – Source Area Excavation (2,500 CY) and Passive ISCO
6. Alternative 5 – Excavation to Restricted Residential SCOs (3,000 CY) and ISCO (with Tank Removal and Institutional Controls).
7. Alternative 3 – Excavation to Unrestricted Use SCOs (7,000 CY) and ISCO (with Tank Removal and Institutional Controls).
8. Alternative 7 – Excavation to Protection of GW Standard SCOs (10,600 CY) and ISCO (with Tank Removal and Institutional Controls).

5.2.7 Implementability

Each of the alternatives could be readily implemented using regionally available resources.

5.2.8 Cost

A comparison of the costs for each alternative is provided in Table 5-8. The ranking of each of the alternatives, in order of the cost (from lowest to highest) required to meet the RAOs is shown below:

1. Alternative 1 – No Further Action.
2. Alternative 8 – Source Area Excavation (2,500 CY) and Passive ISCO
3. Alternative 4 – Excavation to Restricted Residential SCOs (3,000 CY) and MNA (with Tank Removal and Institutional Controls).
4. Alternative 5 – Excavation to Restricted Residential SCOs (3,000 CY) and ISCO (with Tank Removal and Institutional Controls).
5. Alternative 2 – Excavation to Unrestricted Use SCOs and MNA (with Tank Removal and Institutional Controls for SVI).
6. Alternative 3 – Excavation to Unrestricted Use SCOs (7,000 CY) and ISCO (with Tank Removal and Institutional Controls).
7. Alternative 6 – Excavation to Protection of GW Standard SCOs (10,600 CY) and MNA (with Tank Removal and Institutional Controls).
8. Alternative 7 – Excavation to Protection of GW Standard SCOs (10,600 CY) and ISCO (with Tank Removal and Institutional Controls).

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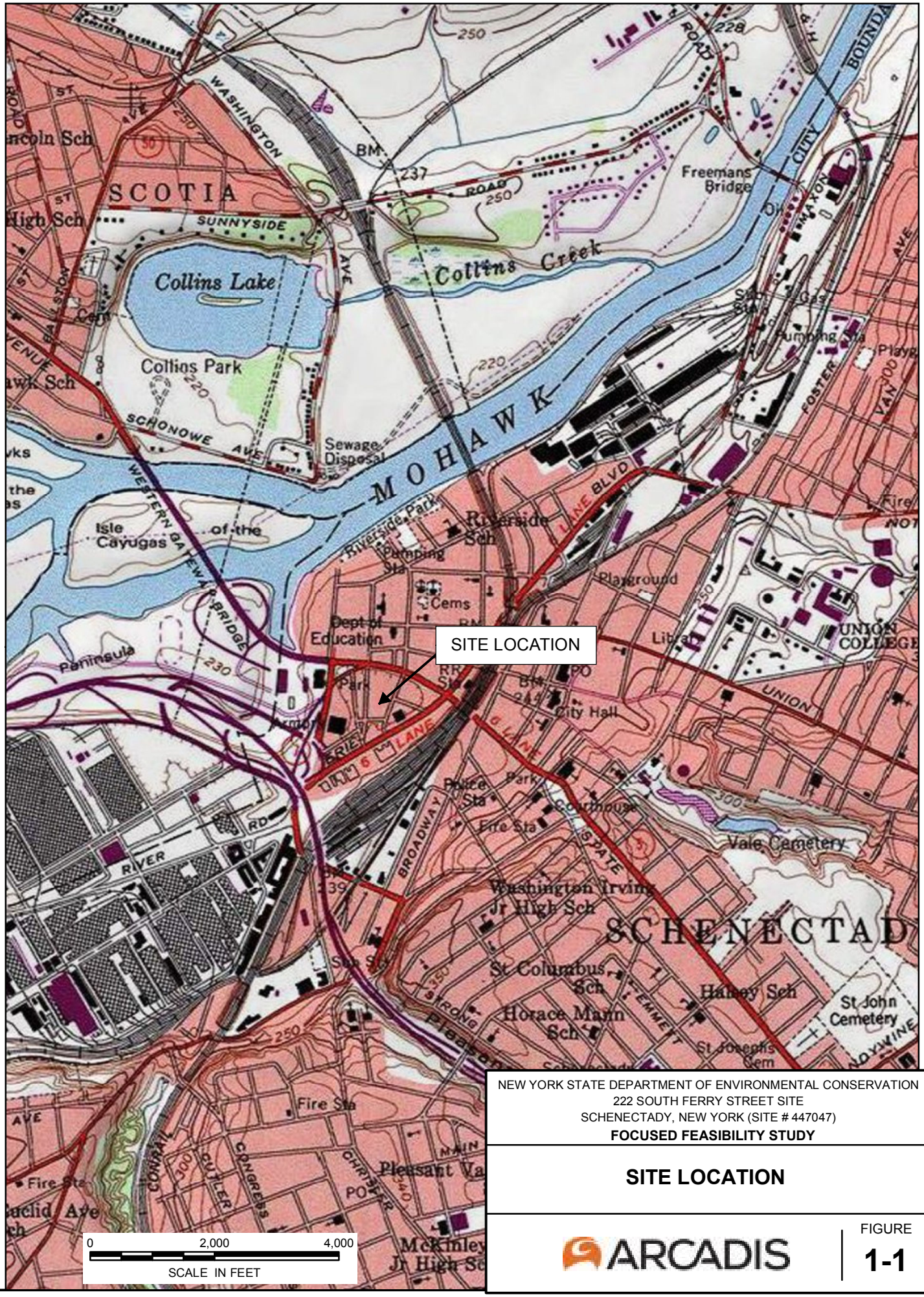
FIGURES



NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
222 SOUTH FERRY STREET SITE
SCHENECTADY, NEW YORK (SITE # 447047)
FOCUSED FEASIBILITY STUDY

SITE LOCATION

ARCADIS

FIGURE
1-1

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NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL
CONSERVATION 222 SOUTH FERRY STREET
SITE (#447047) SCHENECTADY, NEW YORK
FOCUSED FEASIBILITY STUDY

AERIAL PHOTOGRAPH

ARCADIS Design & Consultancy for natural and built assets

FIGURE
1-2

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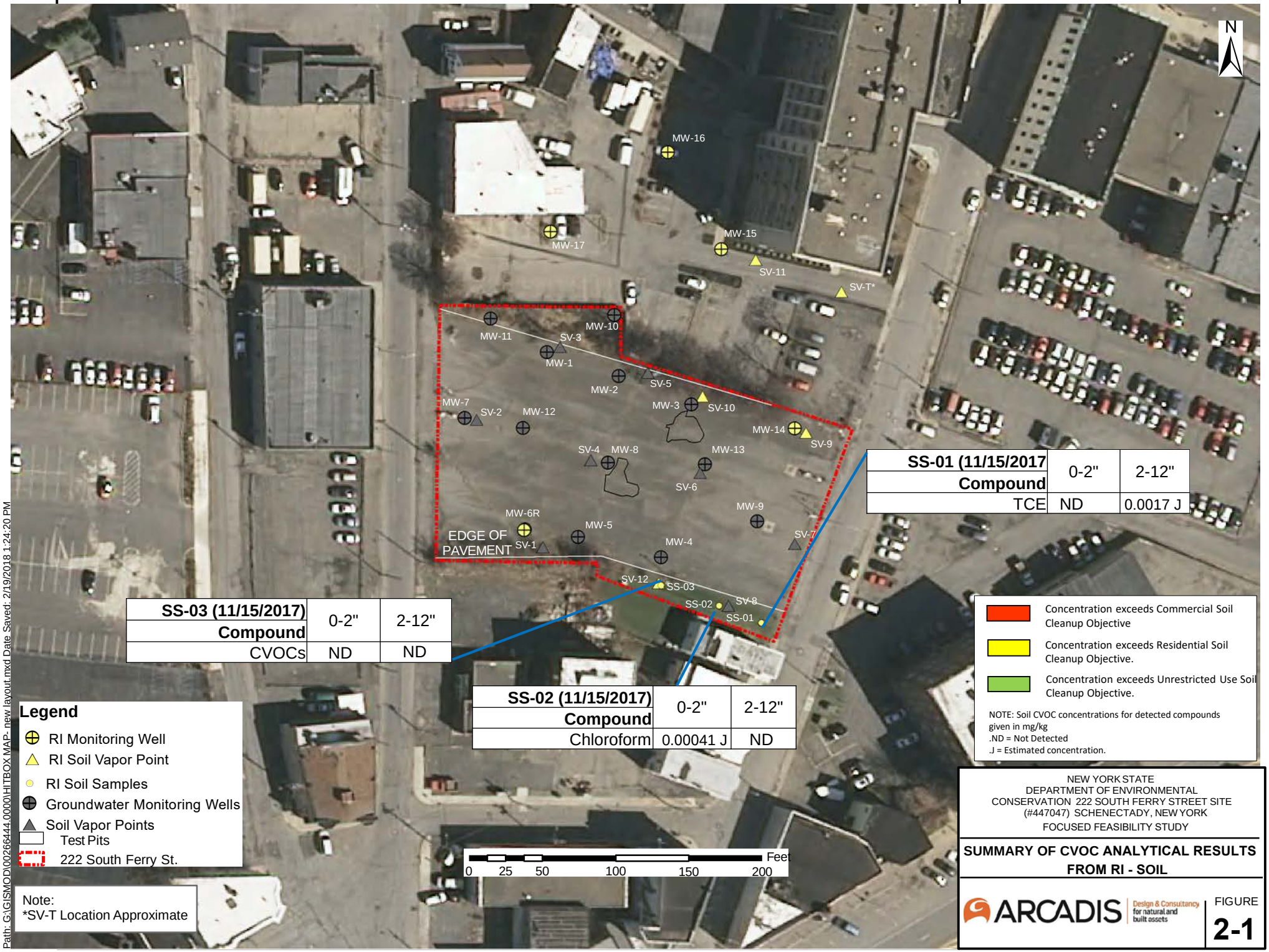


SS-03 (11/15/2017)	0-2"	2-12"
Compound		
CVOCs	ND	ND

SS-02 (11/15/2017)	0-2"	2-12"
Compound		
Chloroform	0.00041 J	ND

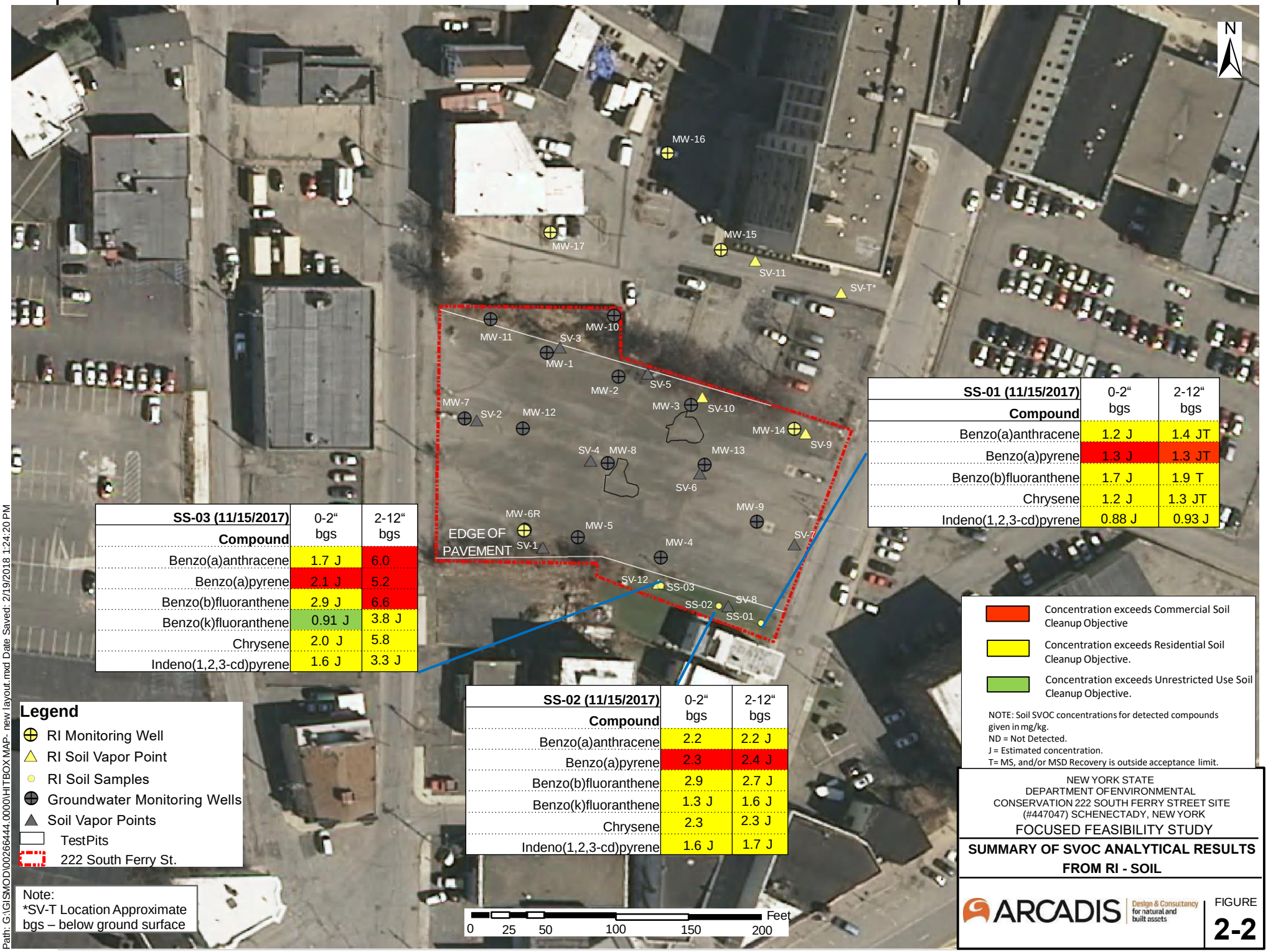
SS-01 (11/15/2017	0-2"	2-12"
Compound		
TCE	ND	0.0017 J

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL
CONSERVATION 222 SOUTH FERRY STREET SITE
(#447047) SCHENECTADY, NEW YORK
FOCUSED FEASIBILITY STUDY

SUMMARY OF CVOC ANALYTICAL RESULTS FROM RI - SOIL

ARCADIS Design & Consultancy for natural and built assets

FIGURE
2-1



SS-03 (11/15/2017)	0-2" bgs	2-12" bgs
Compound		
Benzo(a)anthracene	1.7 J	6.0
Benzo(a)pyrene	2.1 J	5.2
Benzo(b)fluoranthene	2.9 J	6.6
Benzo(k)fluoranthene	0.91 J	3.8 J
Chrysene	2.0 J	5.8
Indeno(1,2,3-cd)pyrene	1.6 J	3.3 J

SS-01 (11/15/2017)	0-2" bgs	2-12" bgs
Compound		
Benzo(a)anthracene	1.2 J	1.4 JT
Benzo(a)pyrene	1.3 J	1.3 JT
Benzo(b)fluoranthene	1.7 J	1.9 T
Chrysene	1.2 J	1.3 JT
Indeno(1,2,3-cd)pyrene	0.88 J	0.93 J

SS-02 (11/15/2017)	0-2" bgs	2-12" bgs
Compound		
Benzo(a)anthracene	2.2	2.2 J
Benzo(a)pyrene	2.3	2.4 J
Benzo(b)fluoranthene	2.9	2.7 J
Benzo(k)fluoranthene	1.3 J	1.6 J
Chrysene	2.3	2.3 J
Indeno(1,2,3-cd)pyrene	1.6 J	1.7 J

Concentration exceeds Commercial Soil Cleanup Objective

Concentration exceeds Residential Soil Cleanup Objective.

Concentration exceeds Unrestricted Use Soil Cleanup Objective.

NOTE: Soil SVOC concentrations for detected compounds given in mg/kg.
ND = Not Detected.
J = Estimated concentration.
T= MS, and/or MSD Recovery is outside acceptance limit.

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL
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(#447047) SCHENECTADY, NEW YORK

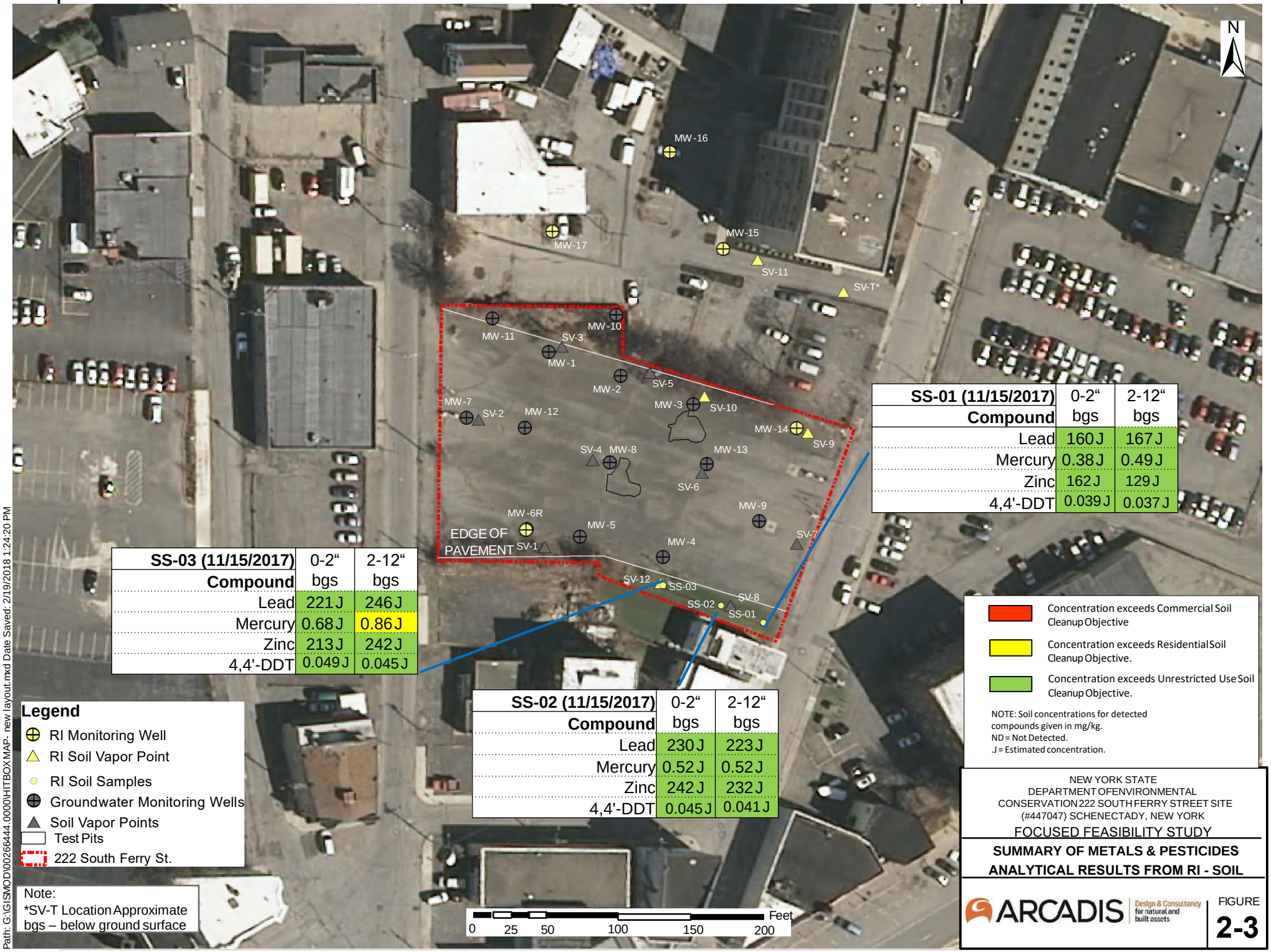
FOCUSED FEASIBILITY STUDY

SUMMARY OF SVOC ANALYTICAL RESULTS FROM RI - SOIL

ARCADIS Design & Consultancy for natural and built assets

FIGURE **2-2**

Path: G:\GIS\MOD\00266444.0000\HITBOX MAP- new layout.mxd Date Saved: 2/19/2018 1:24:20 PM



SS-01 (11/15/2017)	0-2" bgs	2-12" bgs
Compound		
Lead	160 J	167 J
Mercury	0.38 J	0.49 J
Zinc	162 J	129 J
4,4'-DDT	0.039 J	0.037 J

SS-03 (11/15/2017)	0-2" bgs	2-12" bgs
Compound		
Lead	221 J	246 J
Mercury	0.68 J	0.86 J
Zinc	213 J	242 J
4,4'-DDT	0.049 J	0.045 J

SS-02 (11/15/2017)	0-2" bgs	2-12" bgs
Compound		
Lead	230 J	223 J
Mercury	0.52 J	0.52 J
Zinc	242 J	232 J
4,4'-DDT	0.045 J	0.041 J

Legend

- RI Monitoring Well
- RI Soil Vapor Point
- RI Soil Samples
- Groundwater Monitoring Wells
- Soil Vapor Points
- Test Pits
- 222 South Ferry St.

Note:
*SV-T Location Approximate
bgs – below ground surface

- Concentration exceeds Commercial Soil Cleanup Objective
- Concentration exceeds Residential Soil Cleanup Objective.
- Concentration exceeds Unrestricted Use Soil Cleanup Objective.

NOTE: Soil concentrations for detected compounds given in mg/kg.
ND = Not Detected.
J = Estimated concentration.

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL
CONSERVATION 222 SOUTH FERRY STREET SITE
(#447047) SCHENECTADY, NEW YORK

FOCUSED FEASIBILITY STUDY

SUMMARY OF METALS & PESTICIDES ANALYTICAL RESULTS FROM RI - SOIL

ARCADIS Design & Consultancy for natural and built assets

FIGURE
2-3

Path: G:\GIS\MOD\00266444.0000\HITBOXMAP- new layout.mxd Date Saved: 2/19/2018 1:24:20 PM

MW-17 Compound	11/28/2017
CVOCs	ND

MW-16 Compound	11/28/2017
CVOCs	ND

MW-15 Compound	11/28/2017
CVOCs	ND

MW-1 Compound	12/10/2007	8/22/2008	10/3/2013	1/24/2014	11/28/2017
cis-1,2-DCE	72.1	38	ND	1.3	1.2
Vinyl Chloride	101	160	5.6	67	17

MW-10 Compound	1/24/2014	11/28/2017
TCE	0.89 J	ND
1,1-DCE	1	4.7 J
cis-1,2-DCE	430 D	250 D
trans-1,2-DCE	3.3	ND
Vinyl Chloride	420 D	280 D

MW-2 Compound	12/10/2007	8/22/2008	10/2/2013	1/22/2014	11/27/2017
TCE	8.4	120	4.6	1.4	ND
cis-1,2-DCE	273	350	67	21	16
Vinyl Chloride	68	43	120	36	35

MW-14 Compound	11/28/2017
CVOCs	ND

MW-12 Compound	1/24/2014	11/27/2017
TCE	3.6	ND
cis-1,2-DCE	40	12
trans-1,2-DCE	0.77 J	ND
Vinyl Chloride	40	24

MW-13 Compound	1/24/2014	11/28/2017
TCE	7.3	ND
cis-1,2-DCE	130	12
trans-1,2-DCE	0.91 J	ND
Vinyl Chloride	310 D	37

MW-8 Compound	12/10/2007	8/22/2008	10/3/2013	1/23/2014	11/28/2017
TCE	2,150	800	280	100	ND
1,1-DCE	104	7.9	ND	14	ND
cis-1,2-DCE	71,100	5,300	42,000 D	19,000 D	24,000 D
trans-1,2-DCE	1,860	98	ND	83	ND
Vinyl Chloride	6,680	600	18,000	13,000 D	19,000 D

MW-4 Compound	12/10/2007	8/22/2008	10/2/2013	1/23/2014	11/27/2017
TCE	ND	ND	1.6	0.82 J	0.99 J
cis-1,2-DCE	14.6	ND	ND	0.69 J	ND
trans-1,2-DCE	1.65	ND	ND	ND	ND
Vinyl Chloride	2.99	ND	ND	1	35

MW-6R Compound	12/10/2007	8/22/2008	10/3/2013	1/23/2014	11/27/2017
cis-1,2-DCE	8.99	24	33	32	160 T
Vinyl Chloride	ND	ND	69	32	42

MW-5 Compound	12/10/2007	8/22/2008	10/2/2013	1/22/2014	11/28/2017
TCE	73.2	230	170	52	53
1,1-DCE	ND	ND	ND	1.4	6.5 J
cis-1,2-DCE	832	410	810	1,000 D	530
trans-1,2-DCE	23.3	7.5	16	22	15
Vinyl Chloride	ND	ND	18	28	68

MW-16 MW-17 MW-15 AMW-2 AMW-1 MW-10 MW-11 SV-3 MW-1 MW-2 SV-5 SV-11 SV-T* MW-7 SV-2 MW-12 MW-3 SV-10 MW-14 SV-9 SV-4 MW-8 MW-13 SV-6 MW-9 MW-6R MW-5 SV-1 MW-4 SV-7 EDGE OF PAVEMENT SV-12 SS-03 SS-02 SV-8 SS-01

216 215 214 215 216 217

N

0 37.5 75 150 225 300 Feet

Esri, HERE

Legend

- Soil Vapor Points
- RI Soil Samples
- Groundwater Monitoring Wells
- RI Monitoring Well
- RI Soil Vapor Point
- Outdoor Air Sample (11/30/2017)
- Test Pits
- 222 South Ferry St.
- Groundwater Elevation

Note:
*SV-T Location Approximate

Concentration exceeds corresponding NYSDEC Class GA Standard

NOTE: Groundwater CVOC concentrations for detected compounds given in µg/L
.ND = Not Detected
.J = Estimated concentration
T = MS, and/or MSD Recovery is outside acceptance limit
D = Dilution

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
222 SOUTH FERRY STREET SITE (#447047)
SCHENECTADY, NEW YORK

FOCUSED FEASIBILITY STUDY

SUMMARY OF CVOC ANALYTICAL RESULTS FROM RI - OVERBURDEN GROUNDWATER

ARCADIS Design & Consultancy for natural and built assets

FIGURE 2-4

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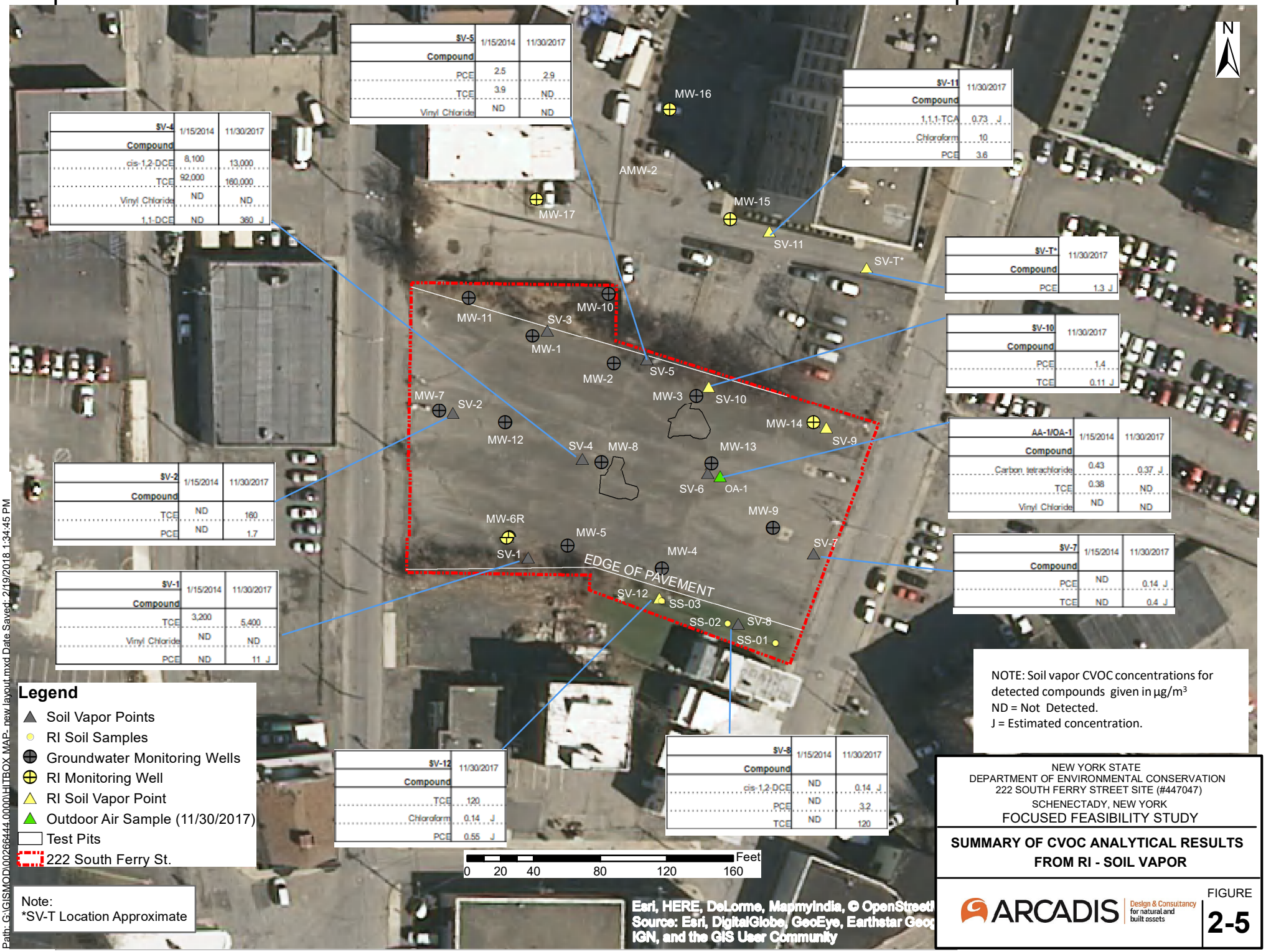
SV-5 | 1/15/2014 | 11/30/2017
Compound
PCE | 2.5 | 2.9
TCE | 3.9 | ND
Vinyl Chloride | ND | ND
SV-4 | 1/15/2014 | 11/30/2017
Compound
cis-1,2-DCE | 8,100 | 13,000
TCE | 92,000 | 160,000
Vinyl Chloride | ND | ND
1,1-DCE | ND | 380 J
SV-11 | 11/30/2017
Compound
1,1,1-TCA | 0.73 J
Chloroform | 10
PCE | 3.6
SV-T* | 11/30/2017
Compound
PCE | 1.3 J
SV-10 | 11/30/2017
Compound
PCE | 1.4
TCE | 0.11 J
AA-1/OA-1 | 1/15/2014 | 11/30/2017
Compound
Carbon tetrachloride | 0.43 | 0.37 J
TCE | 0.38 | ND
Vinyl Chloride | ND | ND
SV-2 | 1/15/2014 | 11/30/2017
Compound
TCE | ND | 160
PCE | ND | 1.7
SV-7 | 1/15/2014 | 11/30/2017
Compound
PCE | ND | 0.14 J
TCE | ND | 0.4 J
SV-1 | 1/15/2014 | 11/30/2017
Compound
TCE | 3,200 | 5,400
Vinyl Chloride | ND | ND
PCE | ND | 11 J
SV-12 | 11/30/2017
Compound
TCE | 120
Chloroform | 0.14 J
PCE | 0.55 J
SV-8 | 1/15/2014 | 11/30/2017
Compound
cis-1,2-DCE | ND | 0.14 J
PCE | ND | 3.2
TCE | ND | 120
MW-16
AMW-2
MW-17
MW-15
SV-11
SV-T*
MW-11
MW-10
SV-3
MW-1
MW-2
SV-5
MW-7
SV-2
MW-3
SV-10
MW-14
SV-9
MW-12
SV-4
MW-8
MW-13
SV-6
OA-1
MW-9
MW-6R
MW-5
SV-1
MW-4
SV-7
EDGE OF PAVEMENT
SV-12
SS-03
SS-02
SV-8
SS-01
N
Legend
Soil Vapor Points
RI Soil Samples
Groundwater Monitoring Wells
RI Monitoring Well
RI Soil Vapor Point
Outdoor Air Sample (11/30/2017)
Test Pits
222 South Ferry St.
Note:
*SV-T Location Approximate
0 20 40 80 120 160 Feet
NOTE: Soil vapor CVOC concentrations for detected compounds given in µg/m³
ND = Not Detected.
J = Estimated concentration.
Esri, HERE, DeLorme, MapmyIndia, © OpenStreet
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geo
IGN, and the GIS User Community
NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
222 SOUTH FERRY STREET SITE (#447047)
SCHENECTADY, NEW YORK
FOCUSED FEASIBILITY STUDY
SUMMARY OF CVOC ANALYTICAL RESULTS FROM RI - SOIL VAPOR
ARCADIS Design & Consultancy for natural and built assets
FIGURE
2-5
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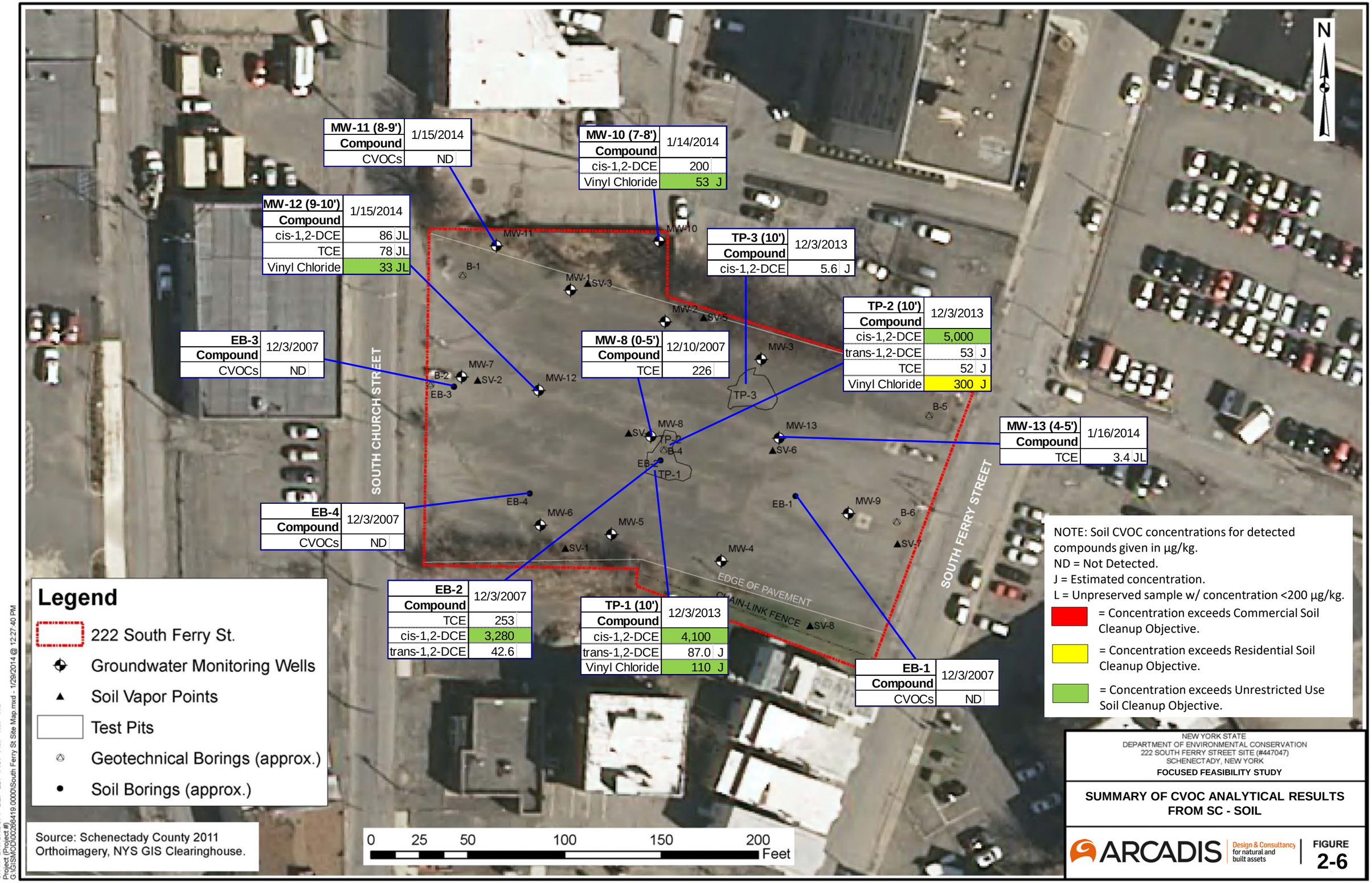

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: TR:
Project (Project #)
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NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
222 SOUTH FERRY STREET SITE (#447047)
SCHENECTADY, NEW YORK
FOCUSED FEASIBILITY STUDY

SUMMARY OF CVOC ANALYTICAL RESULTS FROM SC - SOIL

ARCADIS Design & Consultancy for natural and built assets

FIGURE 2-6

MW-10 (7-8')	1/14/2014
Compound	
Arsenic	130
Barium	588
Cadmium	5.5
Chromium	57.6 J
Lead	5,680 J
Mercury	3.3

MW-12 (9-10')	1/15/2014
Compound	
Lead	77.7 J

TP-3 (10')	12/3/2013
Compound	
Lead	146 J
Mercury	0.29 J

MW-13 (4-5')	1/16/2014
Compound	
Benzo(a)anthracene	35 D
Benzo(a)pyrene	36 D
Benzo(b)fluoranthene	46 D
Benzo(k)fluoranthene	5.2
Chrysene	35 D
Dibenzo(a,h)anthracene	5.5
Indeno(1,2,3-cd)pyrene	27 D
Lead	104 J
Mercury	0.74

TP-1 (10')	12/3/2013
Compound	
Mercury	0.19

TP-2 (10')	12/3/2013
Compound	
Chromium	40.3
Lead	125 J
Mercury	2.5

MW-10, MW-11, B-1, MW-1, SV-3, MW-2, SV-5, B-3, MW-3, MW-7, B-2, EB-3, SV-2, MW-12, TP-3, B-5, MW-8, SV-4, TP-2, B-4, EB-2, TP-1, MW-13, SV-6, EB-4, MW-6, MW-5, SV-1, EB-1, MW-9, B-6, SV-7, MW-4, EDGE OF PAVEMENT, CHAIN-LINK FENCE, SV-8

SOUTH CHURCH STREET

SOUTH FERRY STREET

N

NOTE: Soil SVOC and metals concentrations for detected compounds given in mg/kg.
ND = Not Detected.
J = Estimated concentration.

= Concentration exceeds Commercial Soil Cleanup Objective.

= Concentration exceeds Residential Soil Cleanup Objective.

= Concentration exceeds Unrestricted Use Soil Cleanup Objective.

Legend

- 222 South Ferry St.
- Groundwater Monitoring Wells
- Soil Vapor Points
- Test Pits
- Geotechnical Borings (approx.)
- Soil Borings (approx.)

Source: Schenectady County 2011 Orthoimagery, NYS GIS Clearinghouse.

0 30 60 120 180 240 Feet

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
222 SOUTH FERRY STREET SITE (#447047)
SCHENECTADY, NEW YORK
FOCUSED FEASIBILITY STUDY

SUMMARY OF SVOC AND METALS RESULTS FROM SC-SOIL

ARCADIS Design & Consultancy for natural and built assets

FIGURE 2-7

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: TR:
Project (Project #)
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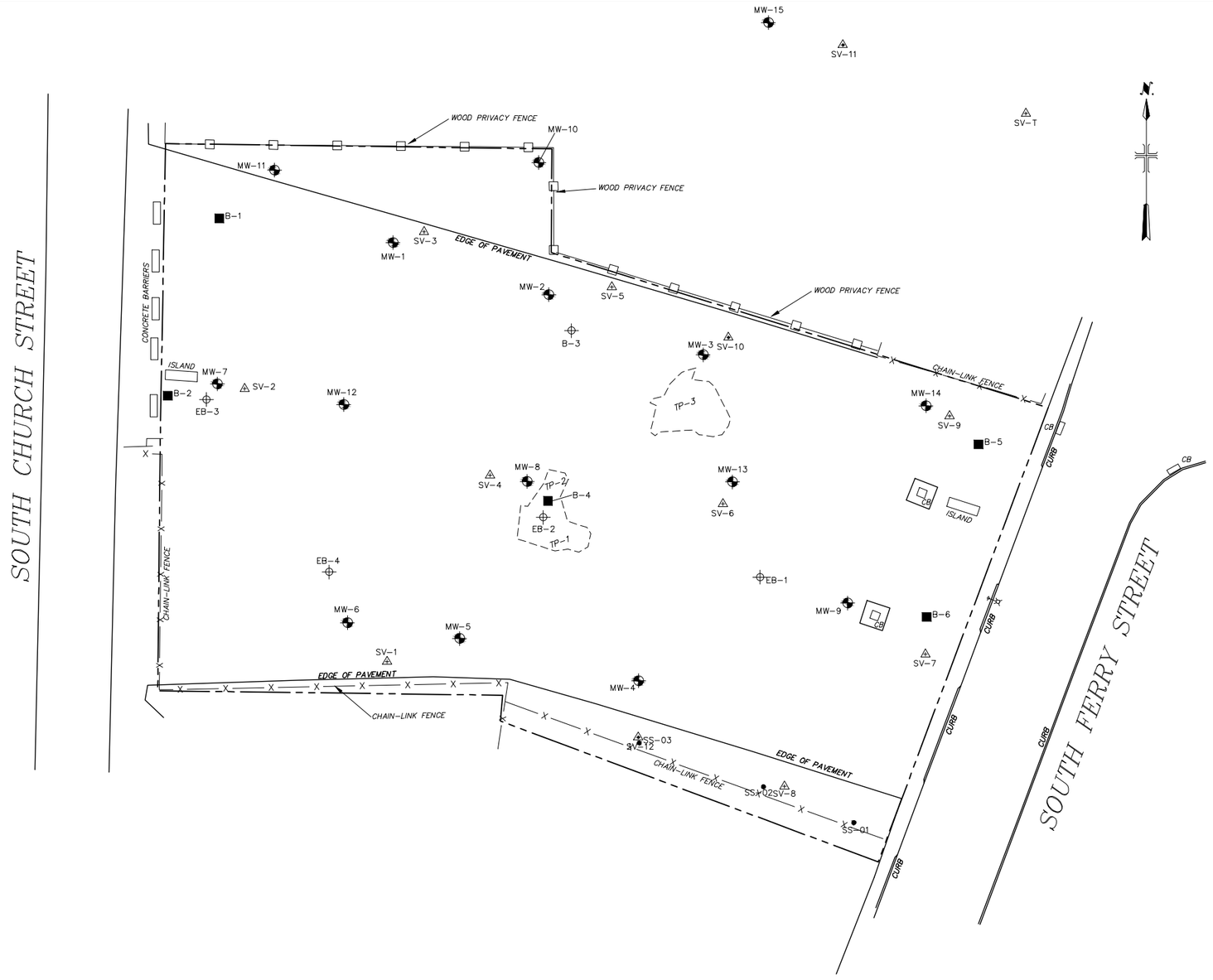


LEGEND

- GROUNDWATER MONITORING WELLS
- GEOTECHNICAL BORINGS (APPROX.)
- SOIL BORINGS (APPROX.)
- SOIL VAPOR POINTS
- TEST PITS
- 222 SOUTH FERRY STREET
- CHAIN LINK FENCE
- WOOD PRIVACY FENCE

0 20' 40' 80'

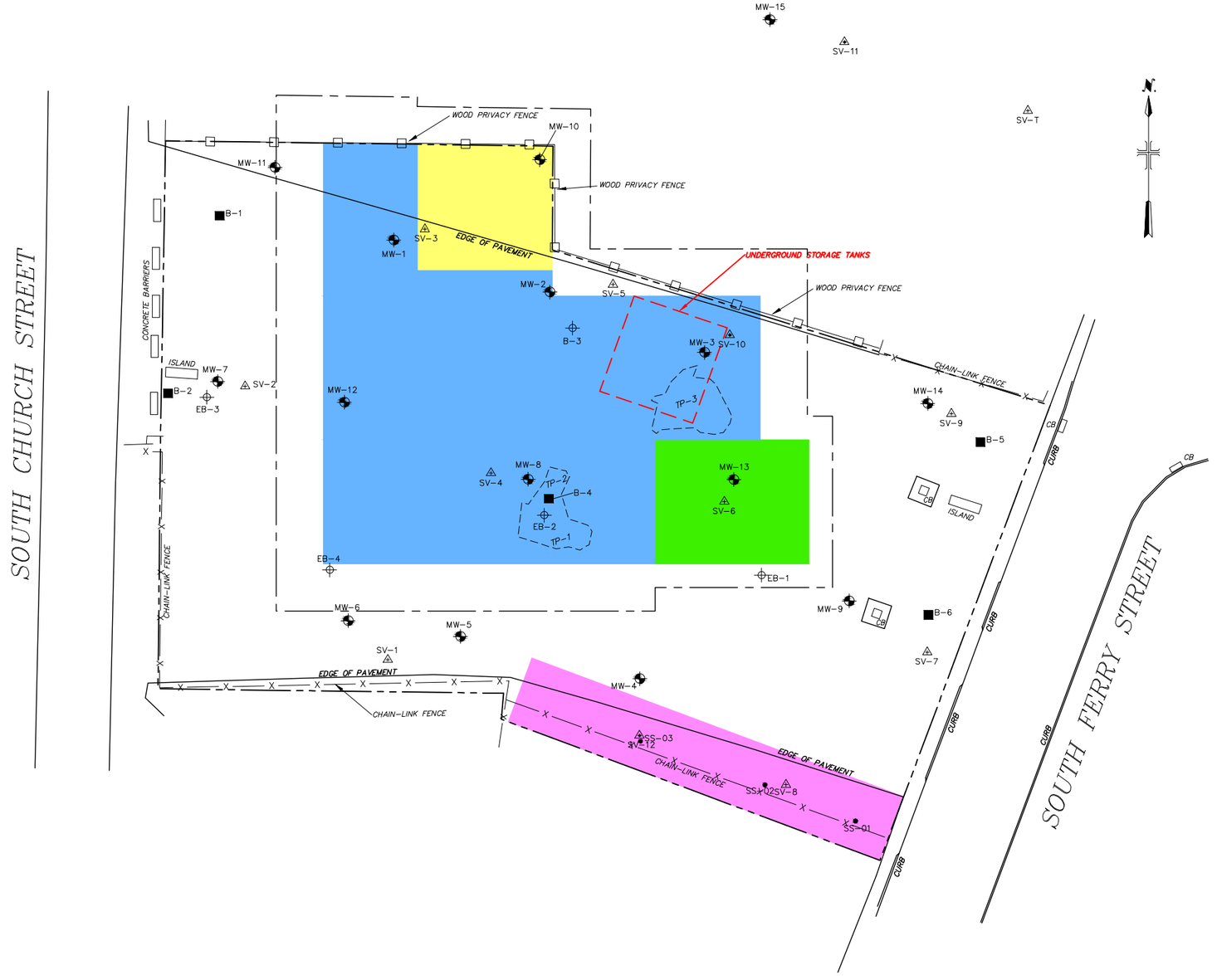
BASE MAP SOURCE: SURVEY PERFORMED BY YEC, INC, SEPTEMBER 2013 & JANUARY 2014,
DATUM – HORZ. NAD83, VERT. NAVD88 FROM GPS OBSERVATIONS, NY STATE PLANE COORDINATES.

NYSDEC
222 SOUTH FERRY STREET SITE (#447047)
SCHENECTADY, NEW YORK
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 1
NO FURTHER ACTION

ARCADIS Design & Consultancy for natural and built assets

FIGURE
5-1



LEGEND

- GROUNDWATER MONITORING WELLS
- GEOTECHNICAL BORINGS (APPROX.)
- SOIL BORINGS (APPROX.)
- SOIL VAPOR POINTS
- TEST PITS
- 222 SOUTH FERRY STREET
- CHAIN LINK FENCE
- WOOD PRIVACY FENCE
- BUFFER AREA FOR EXCAVATION SLOPING
- APPROXIMATE LOCATION OF UNDERGROUND STORAGE TANKS. EXCAVATION DEPTHS 10 FEET BELOW GRADE

- PROPOSED INITIAL EXCAVATION DEPTH 1 FOOT BELOW GRADE TO TARGET SVOCS
- PROPOSED INITIAL EXCAVATION DEPTH 4–5 FEET BELOW GRADE TO TARGET SVOCS
- PROPOSED INITIAL EXCAVATION DEPTH 7–8 FEET BELOW GRADE TO TARGET METALS
- PROPOSED INITIAL EXCAVATION DEPTH 10 FEET BELOW GRADE TO TARGET VOCS

0 20' 40' 80'

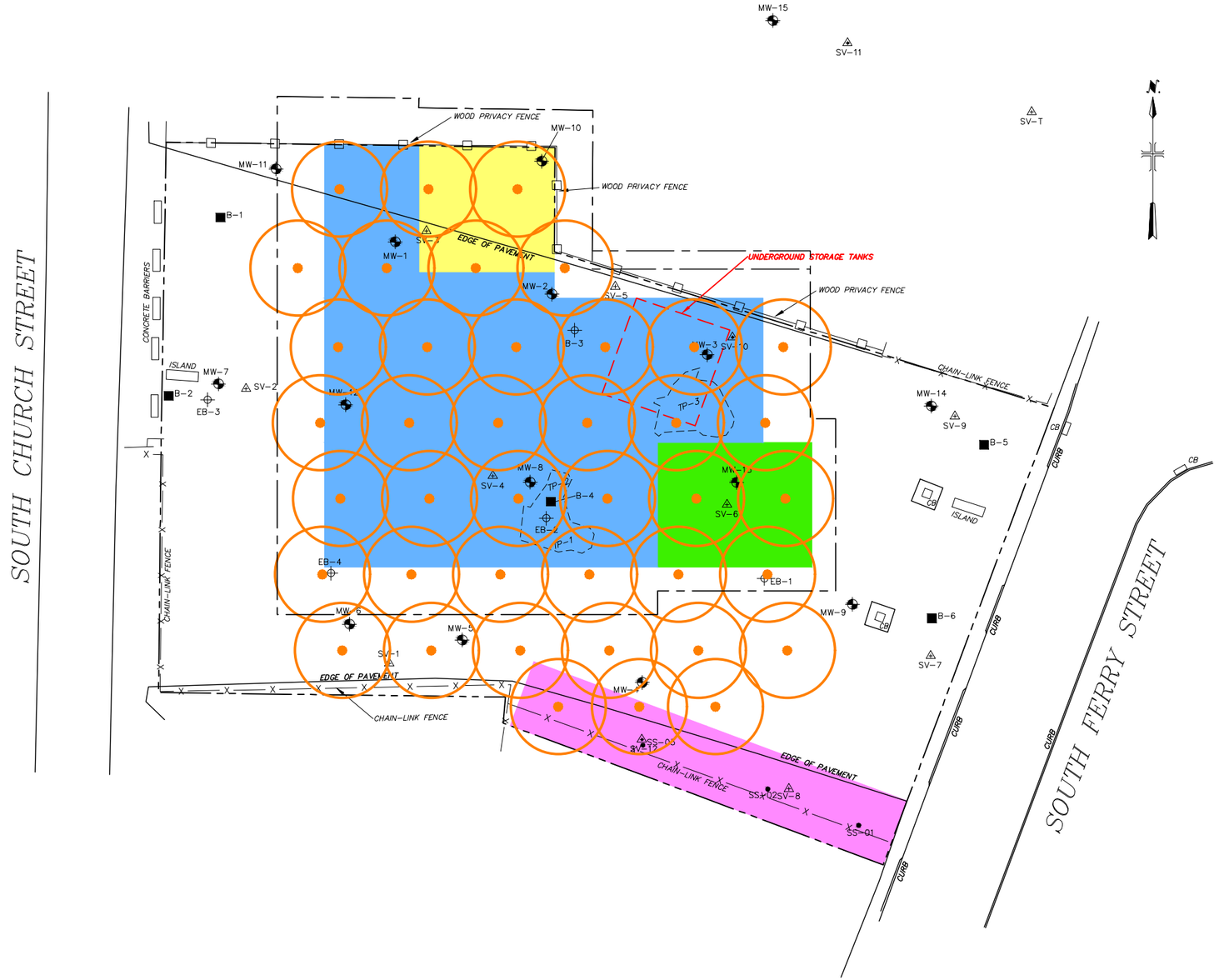
BASE MAP SOURCE: SURVEY PERFORMED BY YEC, INC, SEPTEMBER 2013 & JANUARY 2014,
DATUM – HORZ. NAD83, VERT. NAVD88 FROM GPS OBSERVATIONS, NY STATE PLANE COORDINATES.

NYSDEC
222 SOUTH FERRY STREET SITE (#447047)
SCHENECTADY, NEW YORK
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 2
EXCAVATION TO UNRESTRICTED USE SOIL CLEANUP OBJECTIVES (7,000 CY) & MNA

ARCADIS Design & Consultancy for natural and built assets

FIGURE 5-2



LEGEND

- GROUNDWATER MONITORING WELLS
- GEOTECHNICAL BORINGS (APPROX.)
- SOIL BORINGS (APPROX.)
- SOIL VAPOR POINTS
- TEST PITS
- 222 SOUTH FERRY STREET
- CHAIN LINK FENCE
- WOOD PRIVACY FENCE
- BUFFER AREA FOR EXCAVATION SLOPING
- APPROXIMATE LOCATION OF UNDERGROUND STORAGE TANKS. EXCAVATION DEPTHS 10 FEET BELOW GRADE
- ISCO INJECTION POINT

- PROPOSED INITIAL EXCAVATION DEPTH 1 FOOT BELOW GRADE TO TARGET SVOCS
- PROPOSED INITIAL EXCAVATION DEPTH 4–5 FEET BELOW GRADE TO TARGET SVOCS
- PROPOSED INITIAL EXCAVATION DEPTH 7–8 FEET BELOW GRADE TO TARGET METALS
- PROPOSED INITIAL EXCAVATION DEPTH 10 FEET BELOW GRADE TO TARGET VOCS

0 20' 40' 80'

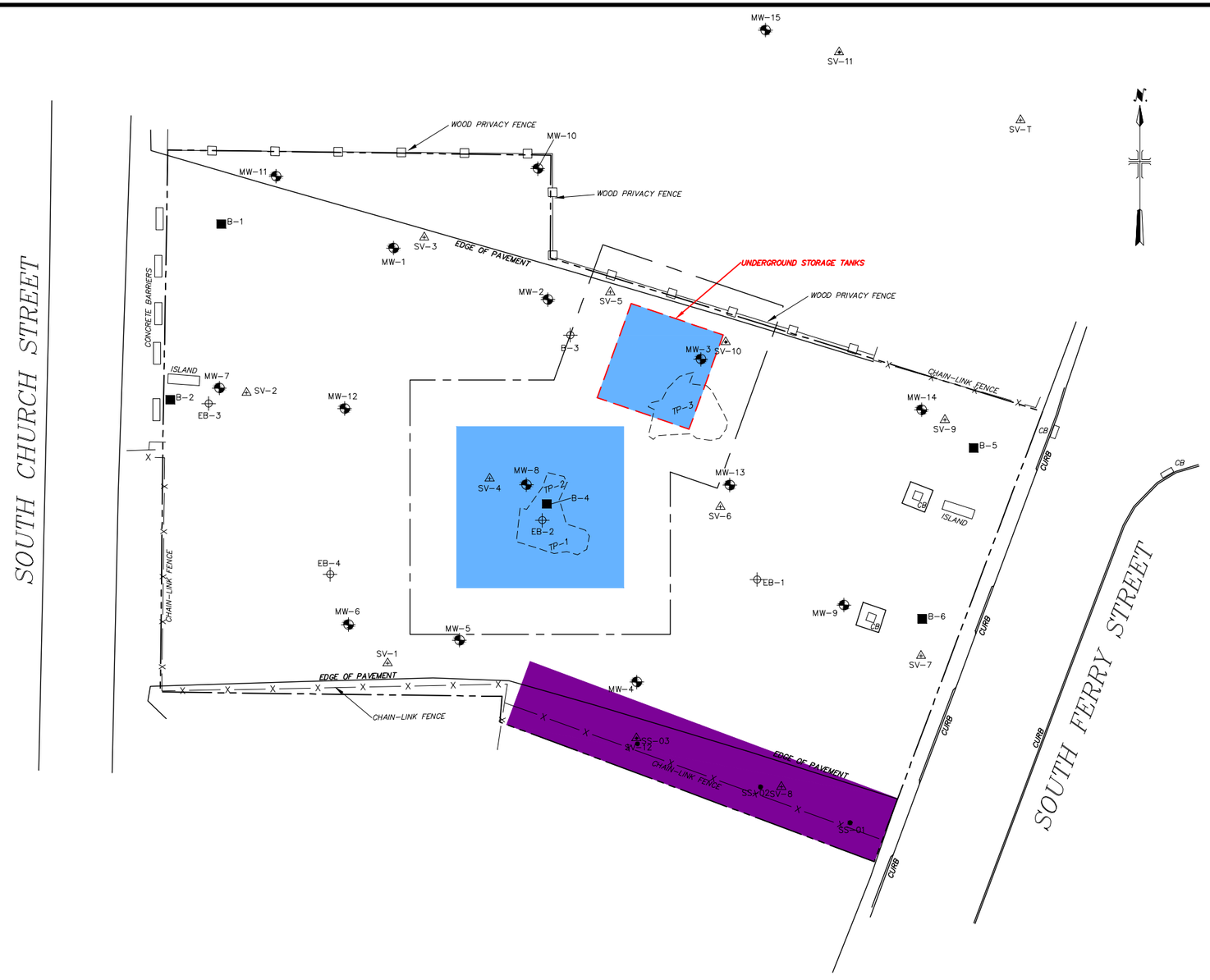
BASE MAP SOURCE: SURVEY PERFORMED BY YEC, INC, SEPTEMBER 2013 & JANUARY 2014,
DATUM – HORZ. NAD83, VERT. NAVD88 FROM GPS OBSERVATIONS, NY STATE PLANE COORDINATES.

NYSDEC
222 SOUTH FERRY STREET SITE (#447047)
SCHENECTADY, NEW YORK
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 3
EXCAVATION TO UNRESTRICTED USE CLEANUP OBJECTIVES (7,000 CY) AND ISCO

ARCADIS Design & Consultancy for natural and built assets

FIGURE 5-3



LEGEND

- GROUNDWATER MONITORING WELLS
- GEOTECHNICAL BORINGS (APPROX.)
- SOIL BORINGS (APPROX.)
- SOIL VAPOR POINTS
- TEST PITS
- 222 SOUTH FERRY STREET
- CHAIN LINK FENCE
- WOOD PRIVACY FENCE
- BUFFER AREA FOR EXCAVATION SLOPING
- APPROXIMATE LOCATION OF UNDERGROUND STORAGE TANKS. EXCAVATION DEPTHS 10 FEET BELOW GRADE

- PROPOSED INITIAL EXCAVATION DEPTH 2 FEET BELOW GRADE TO TARGET SVOCS
- PROPOSED INITIAL EXCAVATION DEPTH 10 FEET BELOW GRADE TO TARGET VOCS

0 20' 40' 80'

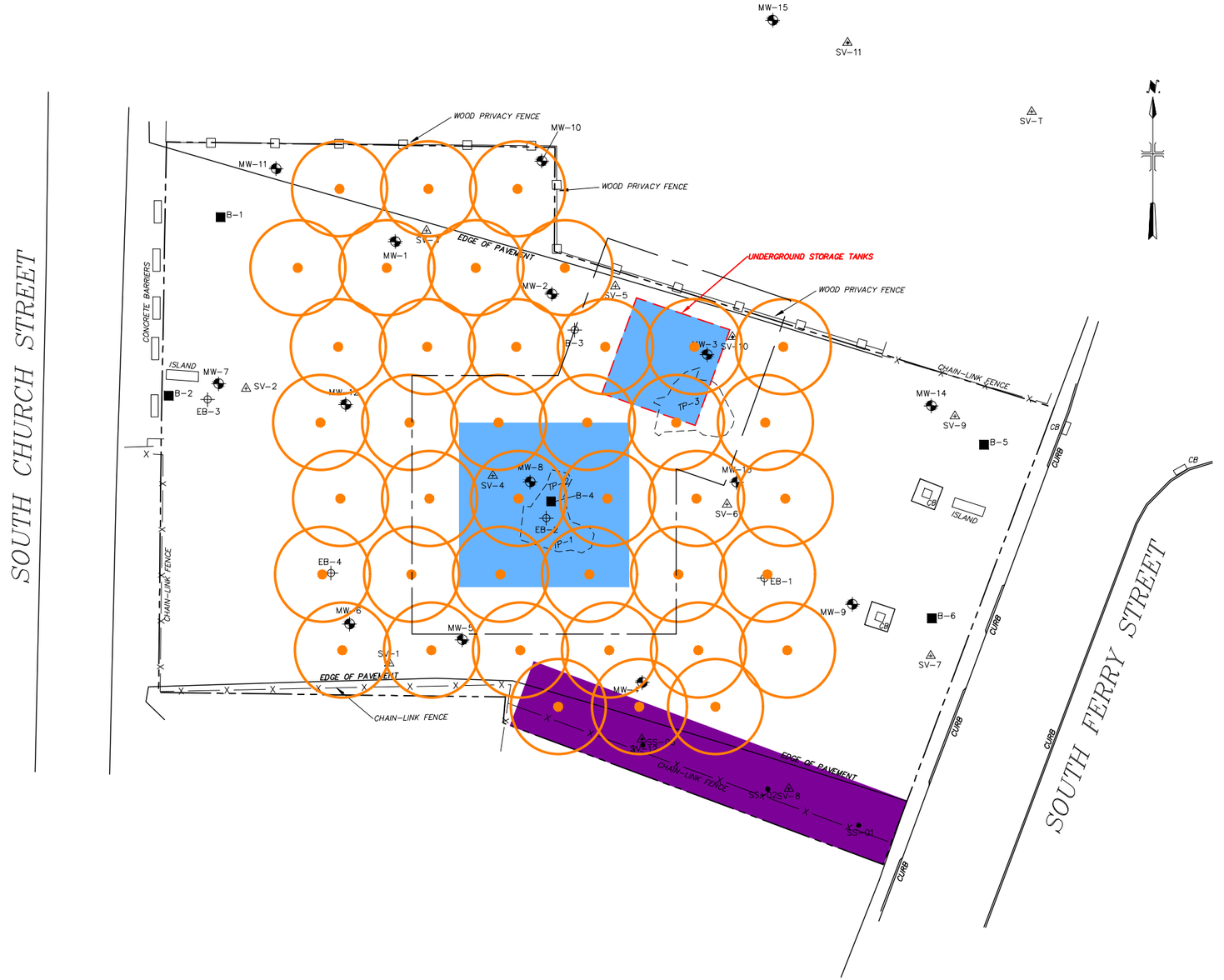
BASE MAP SOURCE: SURVEY PERFORMED BY YEC, INC, SEPTEMBER 2013 & JANUARY 2014,
DATUM – HORZ. NAD83, VERT. NAVD88 FROM GPS OBSERVATIONS, NY STATE PLANE COORDINATES.

NYSDEC
222 SOUTH FERRY STREET SITE (#447047)
SCHENECTADY, NEW YORK
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 4 EXCAVATION TO RESTRICTED RESIDENTIAL SOIL CLEANUP OBJECTIVES (3,000 CY) & MNA

ARCADIS Design & Consultancy for natural and built assets

FIGURE 5-4



LEGEND

- GROUNDWATER MONITORING WELLS
- GEOTECHNICAL BORINGS (APPROX.)
- SOIL BORINGS (APPROX.)
- SOIL VAPOR POINTS
- TEST PITS
- 222 SOUTH FERRY STREET
- CHAIN LINK FENCE
- WOOD PRIVACY FENCE
- BUFFER AREA FOR EXCAVATION SLOPING
- APPROXIMATE LOCATION OF UNDERGROUND STORAGE TANKS. EXCAVATION DEPTHS 10 FEET BELOW GRADE
- ISCO INJECTION POINT

- PROPOSED INITIAL EXCAVATION DEPTH 2 FEET BELOW GRADE TO TARGET SVOCS
- PROPOSED INITIAL EXCAVATION DEPTH 10 FEET BELOW GRADE TO TARGET VOCS

0 20' 40' 80'

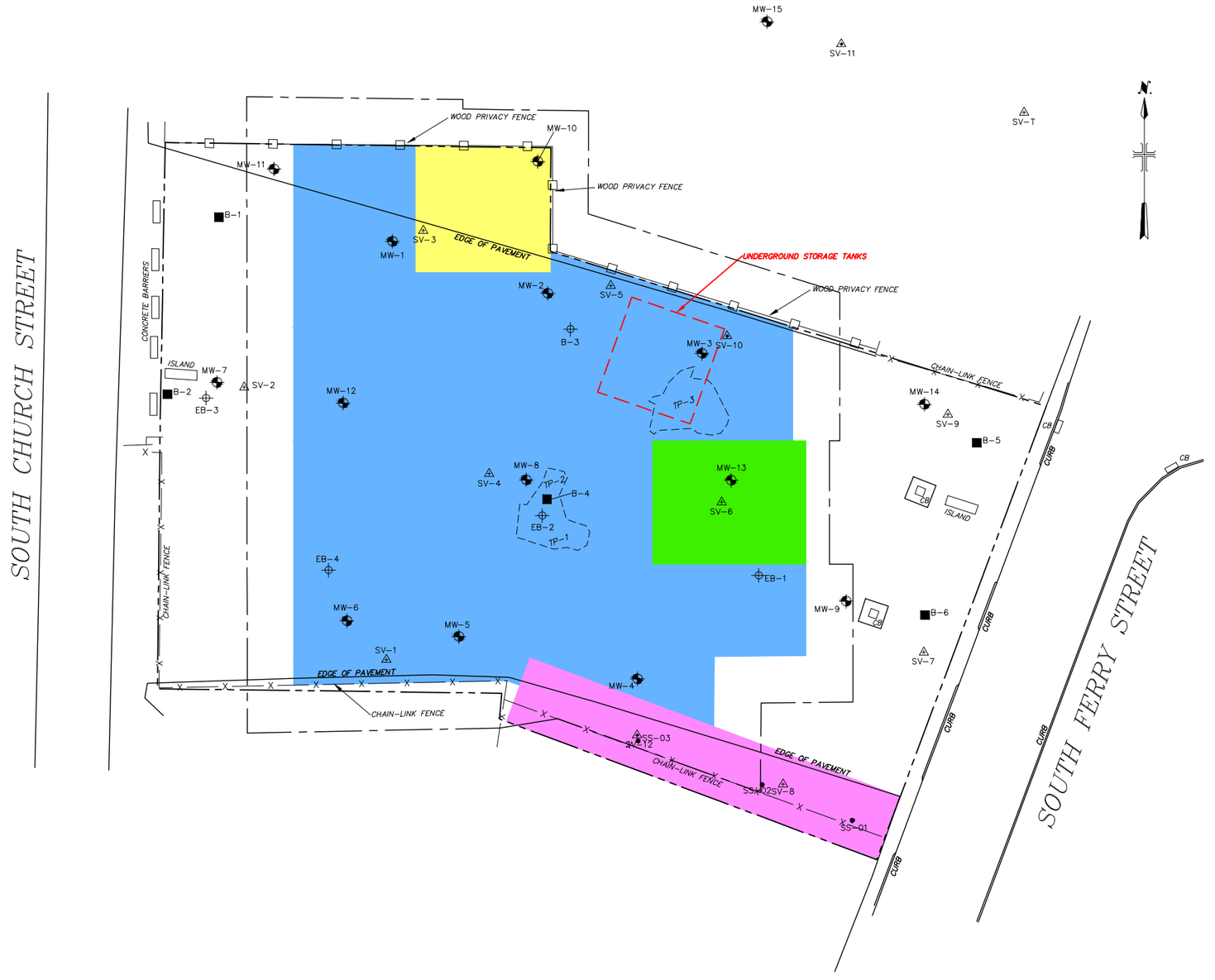
NYSDEC
222 SOUTH FERRY STREET SITE (#447047)
SCHENECTADY, NEW YORK
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 5
EXCAVATION TO RESTRICTED RESIDENTIAL SOIL CLEANUP OBJECTIVES (3,000 CY) AND ISCO

ARCADIS Design & Consultancy for natural and built assets

FIGURE 5-5

BASE MAP SOURCE: SURVEY PERFORMED BY YEC, INC, SEPTEMBER 2013 & JANUARY 2014,
DATUM – HORZ. NAD83, VERT. NAVD88 FROM GPS OBSERVATIONS, NY STATE PLANE COORDINATES.



LEGEND

- GROUNDWATER MONITORING WELLS
- GEOTECHNICAL BORINGS (APPROX.)
- SOIL BORINGS (APPROX.)
- SOIL VAPOR POINTS
- TEST PITS
- 222 SOUTH FERRY STREET
- CHAIN LINK FENCE
- WOOD PRIVACY FENCE
- BUFFER AREA FOR EXCAVATION SLOPING
- APPROXIMATE LOCATION OF UNDERGROUND STORAGE TANKS. EXCAVATION DEPTHS 10 FEET BELOW GRADE

- PROPOSED INITIAL EXCAVATION DEPTH 1 FOOT BELOW GRADE TO TARGET SVOCS
- PROPOSED INITIAL EXCAVATION DEPTH 4–5 FEET BELOW GRADE TO TARGET SVOCS
- PROPOSED INITIAL EXCAVATION DEPTH 7–8 FEET BELOW GRADE TO TARGET METALS
- PROPOSED INITIAL EXCAVATION DEPTH 10 FEET BELOW GRADE TO TARGET VOCS

0 20' 40' 80'

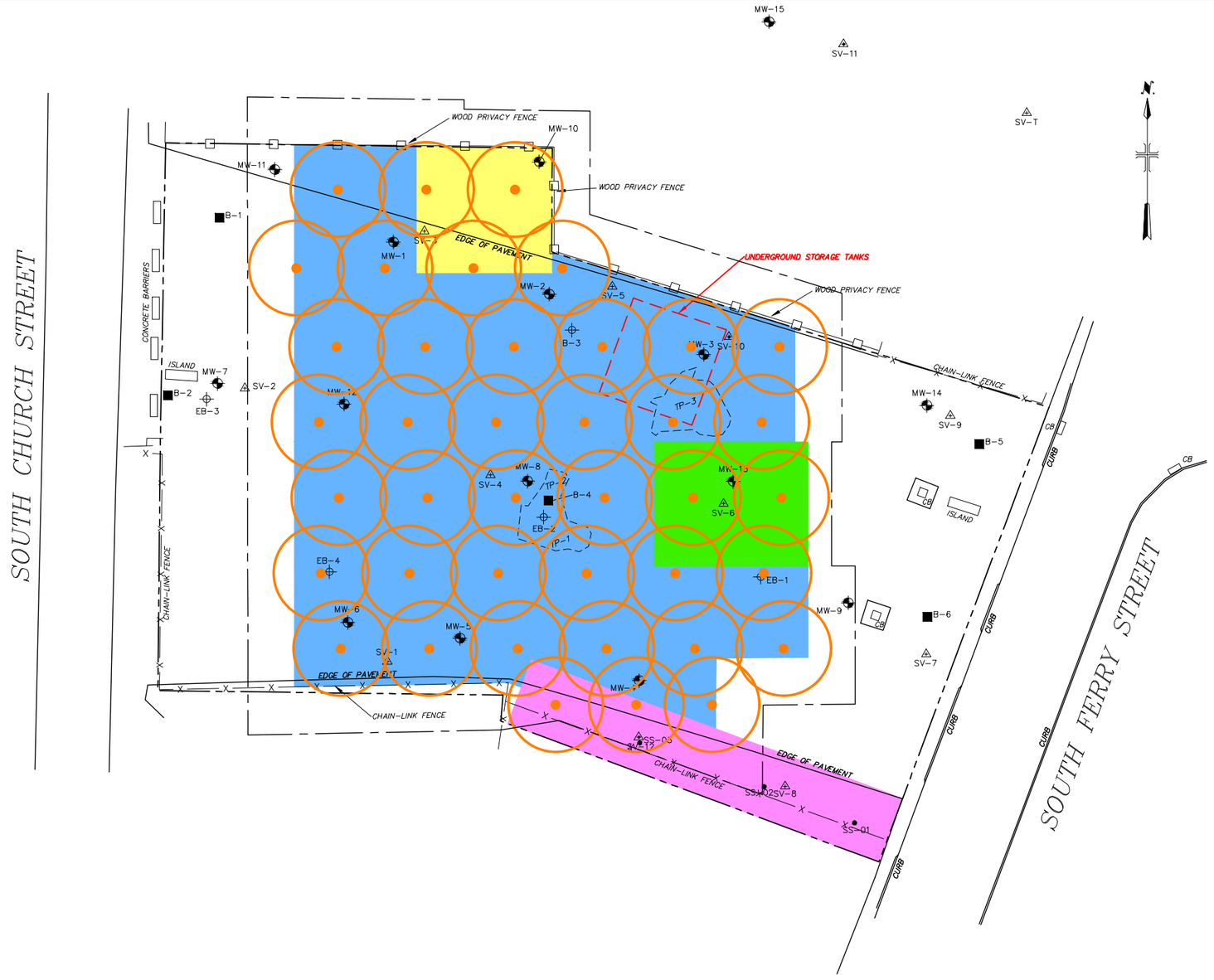
BASE MAP SOURCE: SURVEY PERFORMED BY YEC, INC, SEPTEMBER 2013 & JANUARY 2014,
DATUM – HORZ. NAD83, VERT. NAVD88 FROM GPS OBSERVATIONS, NY STATE PLANE COORDINATES.

NYSDEC
222 SOUTH FERRY STREET SITE (#447047)
SCHENECTADY, NEW YORK
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 6
EXCAVATION TO PROTECTION OF GROUNDWATER CLEANUP OBJECTIVES (10,600 CY) & MNA

ARCADIS Design & Consultancy for natural and built assets

FIGURE 5-6



LEGEND

- GROUNDWATER MONITORING WELLS
- GEOTECHNICAL BORINGS (APPROX.)
- SOIL BORINGS (APPROX.)
- SOIL VAPOR POINTS
- TEST PITS
- 222 SOUTH FERRY STREET
- CHAIN LINK FENCE
- WOOD PRIVACY FENCE
- BUFFER AREA FOR EXCAVATION SLOPING
- APPROXIMATE LOCATION OF UNDERGROUND STORAGE TANKS. EXCAVATION DEPTHS 10 FEET BELOW GRADE
- ISCO INJECTION POINT

- PROPOSED INITIAL EXCAVATION DEPTH 1 FOOT BELOW GRADE TO TARGET SVOCS
- PROPOSED INITIAL EXCAVATION DEPTH 4–5 FEET BELOW GRADE TO TARGET SVOCS
- PROPOSED INITIAL EXCAVATION DEPTH 7–8 FEET BELOW GRADE TO TARGET METALS
- PROPOSED INITIAL EXCAVATION DEPTH 10 FEET BELOW GRADE TO TARGET VOCS

0 20’ 40’ 80’

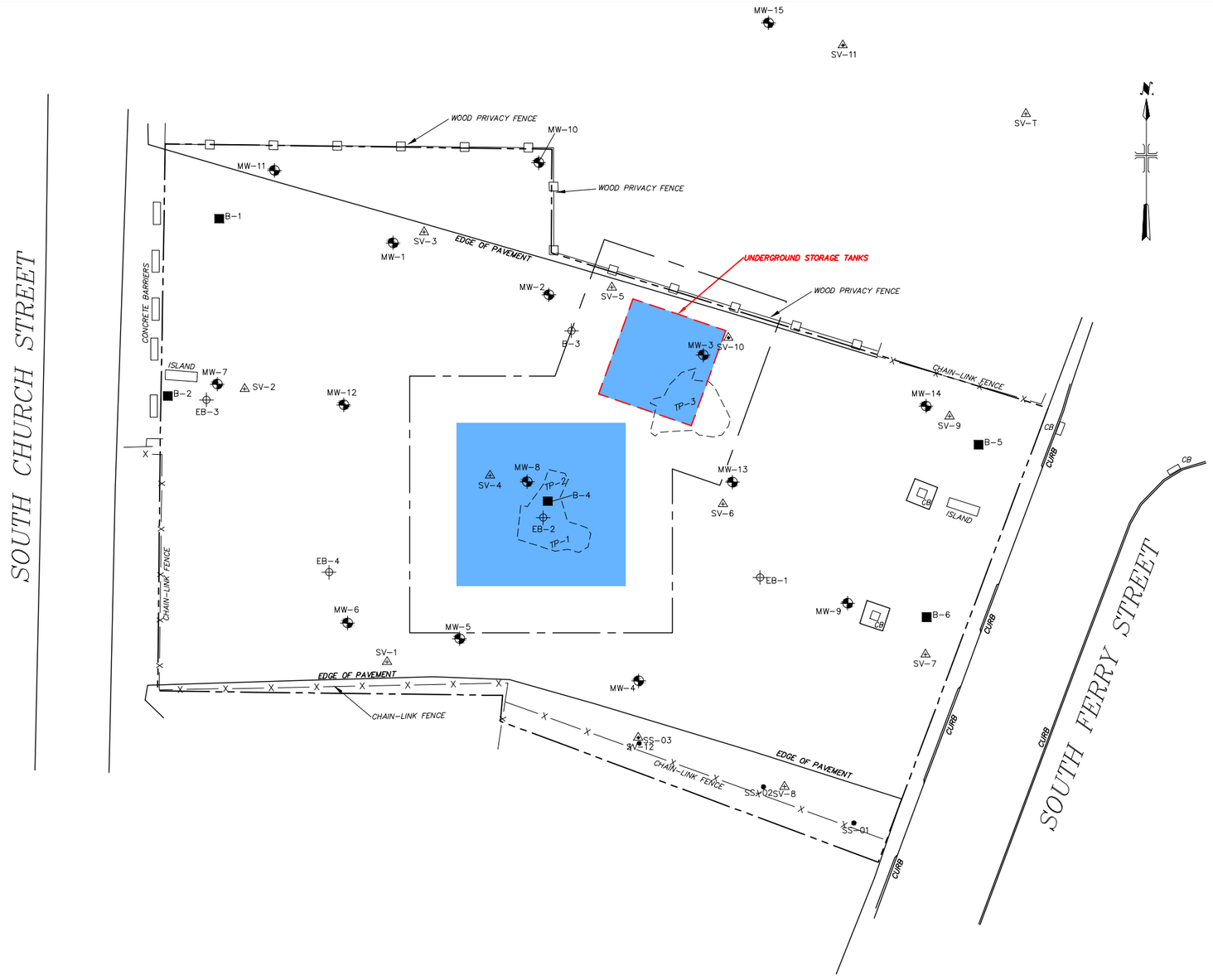
BASE MAP SOURCE: SURVEY PERFORMED BY YEC, INC, SEPTEMBER 2013 & JANUARY 2014,
DATUM – HORZ. NAD83, VERT. NAVD88 FROM GPS OBSERVATIONS, NY STATE PLANE COORDINATES.

NYSDEC
222 SOUTH FERRY STREET SITE (#447047)
SCHENECTADY, NEW YORK
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 7
EXCAVATION TO PROTECTION OF GROUNDWATER CLEANUP OBJECTIVES (10,600 CY) AND ISCO

ARCADIS Design & Consultancy for natural and built assets

FIGURE 5-7



LEGEND

- GROUNDWATER MONITORING WELLS
- GEOTECHNICAL BORINGS (APPROX.)
- SOIL BORINGS (APPROX.)
- SOIL VAPOR POINTS
- TEST PITS
- 222 SOUTH FERRY STREET
- CHAIN LINK FENCE
- WOOD PRIVACY FENCE
- BUFFER AREA FOR EXCAVATION SLOPING
- APPROXIMATE LOCATION OF UNDERGROUND STORAGE TANKS. EXCAVATION DEPTHS 10 FEET BELOW GRADE
- PROPOSED INITIAL EXCAVATION DEPTH 10 FEET BELOW GRADE TO TARGET VOCS

0 20’ 40’ 80’

BASE MAP SOURCE: SURVEY PERFORMED BY YEC, INC, SEPTEMBER 2013 & JANUARY 2014,
DATUM – HORZ. NAD83, VERT. NAVD88 FROM GPS OBSERVATIONS, NY STATE PLANE COORDINATES.

NYSDEC
222 SOUTH FERRY STREET SITE (#447047)
SCHENECTADY, NEW YORK
FOCUSED FEASIBILITY STUDY

ALTERNATIVE 8
SOURCE AREA EXCAVATION (2,500 CY)
AND PASSIVE ISCO

ARCADIS Design & Consultancy for natural and built assets

FIGURE 5-8

TABLES

TABLE 5-1
Remedial Alternative Cost Summary

Alternative 1

NO FURTHER ACTION

OPINION OF PROBABLE COST

Site: 222 South Ferry St
Location: Schenectady, New York
Phase: Alternatives Analysis (-30% to +50%)
Base Year: 2019
Date: September 2019

Description: Alternative 1 consists of abandoning of all site wells and vapor points. Capital costs are incurred in Year 1. There are no O&M costs.

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Well and Vapor Point Abandoning					
Abandonment of Monitoring and Extraction Wells	13	EA	$1,210	$15,730	
Abandonment of Soil Vapor Monitoring Points	8	EA	$1,210	$9,680	
SUBTOTAL				$25,410	
Contingency	30%			$7,623	
SUBTOTAL				$33,033	
Project Management	10%			$3,303	
Remedial Oversight/Reporting	15%			$4,955	
TOTAL CAPITAL COST				**$41,300**	

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (5%)	PRESENT VALUE	NOTES:
Capital	1	$41,300	$41,300	1.00	$41,300	
		$41,300			$41,300	
TOTAL PRESENT VALUE OF ALTERNATIVE - POINT ESTIMATE					**$41,000**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE LOW (-30%)					**$28,700**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE HIGH (+50%)					**$61,500**	

TABLE 5-2
Remedial Alternative Cost Summary

Alternative 2
EXCAVATION TO UNRESTRICTED USE SCOs (7,000 CY) AND MNA (WITH TANK REMOVAL AND INSTITUTIONAL CONTROLS)

OPINION OF PROBABLE COST

Site: 222 South Ferry St
Location: Schenectady, New York
Phase: Alternatives Analysis (-30% to +50%)
Base Year: 2019
Date: September 2019

Description: Alternative 2 consists of excavating contaminated soil, removing the USTs, followed by plume-wide groundwater polishing via monitored natural attenuation. Capital costs are incurred in Year 1. O&M costs are incurred in Years 1-3.

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Institutional Controls Legal/Administrative Costs	1	lump sum	$25,000	$25,000	
Site Management Plan	1	lump sum	$15,000	$15,000	
SUBTOTAL				$40,000	
Excavation					Assume normal business hours
Utility Location	1	lump sum	$1,750	$1,750	
Well and Vapor Point Abandoning					
Abandonment of Monitoring and Extraction Wells	7	EA	$1,210	$8,470	
Abandonment of Soil Vapor Monitoring Points	4	EA	$1,210	$4,840	
Excavation, stock-piling, and loading of contaminated soils	7,000	CY	$13	$91,000	Incl. characterization & permits
Transportation and disposal of contaminated soils	10,500	TON	$65	$682,500	Assumed non-haz
UST cleaning, removal and disposal	1	lump sum	$3,200	$3,200	
Dewatering	1	lump sum	$50,000	$50,000	Incl. treatment
Excavation confirmation sampling and analysis	35	EA	$280	$9,800	
Provide, place, and compact backfill	7,000	CY	$35	$245,000	
Subbase and asphalt	20,000	SF	$5	$100,000	
Topsoil and seed	145	CY	$50	$7,250	
Temporary Facilities	40	DAY	$250	$10,000	
Site Security	40	DAY	$125	$5,000	
Community Air Monitoring Plan (CAMP)	40	DAY	$2,880	$115,200	
Health & Safety	40	DAY	$1,150	$46,000	
SUBTOTAL				$1,380,010	
SUBTOTAL				$1,420,010	
Contingency	15%			$213,002	
SUBTOTAL				$1,633,012	
Design	12%			$195,961	
Project Management	6%			$97,981	
Remedial Oversight/Reporting	8%			$130,641	
TOTAL CAPITAL COST				**$2,057,600**	

OPERATION, MAINTENANCE, AND MONITORING (OM&M) COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Site Monitoring					
Groundwater Sampling & Analysis	1	YR	$7,500	$7,500	Annual sampling - 6 wells
Data Evaluation and Reporting	1	YR	$5,000	$5,000	
SUBTOTAL				$12,500	
TOTAL ANNUAL O&M COST				**$12,500**	
Well and Vapor Point Abandoning					
Abandonment of Monitoring Wells	6	EA	$1,210	$7,260	
Abandonment of Soil Vapor Monitoring Points	4	EA	$1,210	$4,840	
SUBTOTAL				$12,100	
TOTAL CLOSEOUT COST - YEAR 3				**$12,100**	

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (5%)	PRESENT VALUE	NOTES:
Capital	1	$2,070,100	$2,070,100	1.00	$2,070,100	Capital + 1st Year O&M Costs
Annual OM&M	2-3	$25,000	$12,500	1.86	$23,243	GW sampling
Close out	3	$12,100	$12,100	0.95	$11,524	Close out
		$2,107,200			$2,104,866	
TOTAL PRESENT VALUE OF ALTERNATIVE					**$2,105,000**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE LOW (-30%)					**$1,473,500**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE HIGH (+50%)					**$3,157,500**	

TABLE 5-3
Remedial Alternative Cost Summary

Alternative 3
EXCAVATION TO UNRESTRICTED USE SCOs (7,000 CY) AND ISCO (WITH TANK REMOVAL AND INSTITUATIONAL CONTROLS)

OPINION OF PROBABLE COST

Site: 222 South Ferry St
Location: Schenectady, New York
Phase: Alternatives Analysis (-30% to +50%)
Base Year: 2019
Date: September 2019

Description: Alternative 3 consists of excavating the contaminated soil, removing the USTs, followed by plume-wide groundwater polishing via in-situ chemical oxidation using sodium permanganate. Capital costs are incurred in Year 1. O&M costs are incurred in Years 1-2.

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Institutional Controls Legal/Administrative Costs	1	lump sum	$25,000	$25,000	
Site Management Plan	1	lump sum	$15,000	$15,000	
SUBTOTAL				$40,000	
Excavation					Assume normal business hours
Utility Location	1	lump sum	$1,750.00	$1,750	
Well and Vapor Point Abandoning					
Abandonment of Monitoring and Extraction Wells	7	EA	$1,210	$8,470	
Abandonment of Soil Vapor Monitoring Points	4	EA	$1,210	$4,840	
Excavation, stock-piling, and loading of contaminated soils	7,000	CY	$13	$91,000	Incl. characterization & permits
Transportation and disposal of contaminated soils	10,500	TON	$65	$682,500	Assumed non-haz
UST cleaning, removal and disposal	1	lump sum	$3,200	$3,200	
Dewatering	1	lump sum	$50,000	$50,000	Incl. treatment
Excavation confirmation sampling and analysis	35	EA	$280	$9,800	
Provide, place, and compact backfill	7,000	CY	$35	$245,000	
Subbase and asphalt	20,000	SF	$5	$100,000	
Topsoil and seed	145	CY	$50	$7,250	
Temporary Facilities	40	DAY	$250	$10,000	
Site Security	40	DAY	$125	$5,000	
Community Air Monitoring Plan (CAMP)	40	DAY	$2,880	$115,200	
Health & Safety	40	DAY	$1,150	$46,000	
SUBTOTAL				$1,380,010	
ISCO					Assume normal business hours
Mobe/demobe	1	EA	$2,500	$2,500	
Geoprobe Mobe/Demobe	1	EA	$500	$500	
Injection testing	1	lump sum	$15,000	$15,000	
Geoprobe	8	DAY	$1,500	$12,000	
Wellhead assembly	40	EA	$200	$8,000	
Misc valves and fittings	1	LS	$5,000	$5,000	
Distribution hose (1-inch), with cam-lock fittings	110	linear feet	$5	$550	
Remox L (sodium permanganate, delivered)	100,000	LB	$2	$198,000	
Water	150,000	GAL	$0.01	$1,500	
Post-injection monitoring	1	lump sum	$5,000	$5,000	Labor and analytical
Shipping	1	lump sum	$8,800	$8,800	
Tax	1	lump sum	$16,027	$16,027	
SUBTOTAL				$272,877	
Second Injection Event				$272,877	If needed based on monitoring
SUBTOTAL				$545,754	
SUBTOTAL				$1,965,764	
Contingency	15%			$294,865	
SUBTOTAL				$2,260,629	
Design	8%			$180,850	
Project Management	5%			$113,031	
Remedial Oversight/Reporting	6%			$135,638	
TOTAL CAPITAL COST				**$2,690,100**	

OPERATION, MAINTENANCE, AND MONITORING (OM&M) COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Site Monitoring					
Groundwater Sampling & Analysis	1	YR	$7,500	$7,500	Annual sampling - 6 wells
Data Evaluation and Reporting	1	YR	$5,000	$5,000	
SUBTOTAL				$12,500	
TOTAL ANNUAL O&M COST				**$12,500**	
Well and Vapor Point Abandoning					
Abandonment of Monitoring Wells	6	EA	$1,210	$7,260	
Abandonment of Soil Vapor Monitoring Points	4	EA	$1,210	$4,840	
SUBTOTAL				$12,100	
TOTAL CLOSEOUT COST - YEAR 2				**$12,100**	

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (5%)	PRESENT VALUE	NOTES:
Capital	1	$2,702,600	$2,702,600	1.00	$2,702,600	Capital + 1st Year O&M Costs
Annual OM&M	2	$12,500	$12,500	0.95	$11,905	GW sampling
Close out	2	$12,100	$12,100	0.95	$11,524	Close out
		$2,727,200			$2,726,029	
TOTAL PRESENT VALUE OF ALTERNATIVE					**$2,726,000**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE LOW (-30%)					**$1,908,200**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE HIGH (+50%)					**$4,089,000**	

TABLE 5-4
Remedial Alternative Cost Summary

Alternative 4
EXCAVATION TO RESTRICTED RESIDENTIAL SCOs (3,000 CY) AND MNA (WITH TANK REMOVAL AND INSTITUTIONAL CONTROLS)

OPINION OF PROBABLE COST

Site: 222 South Ferry St
Location: Schenectady, New York
Phase: Alternatives Analysis (-30% to +50%)
Base Year: 2019
Date: September 2019

Description: Alternative 4 consists of excavating contaminated soil, removing the USTs, followed by plume-wide groundwater polishing via monitored natural attenuation. Capital costs are incurred in Year 1. O&M costs are incurred in Years 1-4.

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Institutional Controls Legal/Administrative Costs	1	lump sum	$25,000	$25,000	
Site Management Plan	1	lump sum	$15,000	$15,000	
SUBTOTAL				$40,000	
Excavation					Assume normal business hours
Utility Location	1	lump sum	$1,750	$1,750	
Well and Vapor Point Abandoning					
Abandonment of Monitoring and Extraction Wells	2	EA	$1,210	$2,420	
Abandonment of Soil Vapor Monitoring Points	2	EA	$1,210	$2,420	
Excavation, stock-piling, and loading of contaminated soils	3,000	CY	$52	$156,000	Incl. characterization & permits
Transportation and disposal of contaminated soils	4,500	TON	$65	$292,500	Assumed non-haz
UST cleaning, removal and disposal	1	lump sum	$3,200	$3,200	
Dewatering	1	lump sum	$50,000	$50,000	Incl. treatment
Excavation confirmation sampling and analysis	21	EA	$280	$5,880	
Provide, place, and compact backfill	3,000	CY	$35	$105,000	
Subbase and asphalt	10,000	SF	$5	$50,000	
Topsoil and seed	60	CY	$50	$3,000	
Temporary Facilities	30	DAY	$250	$7,500	
Site Security	30	DAY	$125	$3,750	
Community Air Monitoring Plan (CAMP)	30	DAY	$2,880	$86,400	
Health & Safety	30	DAY	$1,150	$34,500	
SUBTOTAL				$804,320	
SUBTOTAL				$844,320	
Contingency	15%			$126,648	
SUBTOTAL				$970,968	
Design	12%			$116,516	
Project Management	6%			$58,258	
Remedial Oversight/Reporting	8%			$77,677	
TOTAL CAPITAL COST				**$1,223,400**	

OPERATION, MAINTENANCE, AND MONITORING (OM&M) COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Site Monitoring					
Groundwater Sampling & Analysis	1	YR	$7,500	$7,500	Annual sampling - 6 wells
Data Evaluation and Reporting	1	YR	$5,000	$5,000	
SUBTOTAL				$12,500	
TOTAL ANNUAL O&M COST				**$12,500**	
Well and Vapor Point Abandoning					
Abandonment of Monitoring Wells	11	EA	$1,210	$13,310	
Abandonment of Soil Vapor Monitoring Points	6	EA	$1,210	$7,260	
SUBTOTAL				$20,570	
TOTAL CLOSEOUT COST - YEAR 4				**$20,570**	

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (5%)	PRESENT VALUE	NOTES:
Capital	1	$1,235,900	$1,235,900	1.00	$1,235,900	Capital + 1st Year O&M Costs
Annual OM&M	2-4	$37,500	$12,500	2.72	$34,041	GW sampling
Close out	4	$20,570	$20,570	0.95	$19,590	Close out
		$1,293,970			$1,289,531	
TOTAL PRESENT VALUE OF ALTERNATIVE					**$1,290,000**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE LOW (-30%)					**$903,000**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE HIGH (+50%)					**$1,935,000**	

TABLE 5-5
Remedial Alternative Cost Summary

Alternative 5
EXCAVATION TO RESTRICTED RESIDENTIAL SCOs (3,000 CY) AND ISCO (WITH TANK REMOVAL AND INSTITUATIONAL CONTROLS)

OPINION OF PROBABLE COST

Site: 222 South Ferry St
Location: Schenectady, New York
Phase: Alternatives Analysis (-30% to +50%)
Base Year: 2019
Date: September 2019

Description: Alternative 5 consists of excavating the contaminated soil, removing the USTs, followed by plume-wide groundwater polishing via in-situ chemical oxidation using sodium permanganate. Capital costs are incurred in Year 1. O&M costs are incurred in Years 1-3.

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Institutional Controls Legal/Administrative Costs	1	lump sum	$25,000	$25,000	
Site Management Plan	1	lump sum	$15,000	$15,000	
SUBTOTAL				$40,000	
Excavation					Assume normal business hours
Utility Location	1	lump sum	$1,750	$1,750	
Well and Vapor Point Abandoning					
Abandonment of Monitoring and Extraction Wells	2	EA	$1,210	$2,420	
Abandonment of Soil Vapor Monitoring Points	2	EA	$1,210	$2,420	
Excavation, stock-piling, and loading of contaminated soils	3,000	CY	$52	$156,000	Incl. characterization & permits
Transportation and disposal of contaminated soils	4,500	TON	$65	$292,500	Assumed non-haz
UST cleaning, removal and disposal	1	lump sum	$3,200	$3,200	
Dewatering	1	lump sum	$50,000	$50,000	Incl. treatment
Excavation confirmation sampling and analysis	21	EA	$280	$5,880	
Provide, place, and compact backfill	3,000	CY	$35	$105,000	
Subbase and asphalt	10,000	SF	$5	$50,000	
Topsoil and seed	60	CY	$50	$3,000	
Temporary Facilities	30	DAY	$250	$7,500	
Site Security	30	DAY	$125	$3,750	
Community Air Monitoring Plan (CAMP)	30	DAY	$2,880	$86,400	
Health & Safety	30	DAY	$1,150	$34,500	
SUBTOTAL				$804,320	
ISCO					Assume normal business hours
Mobe/demobe	1	EA	$2,500	$2,500	
Geoprobe Mobe/Demobe	1	EA	$500	$500	
Injection testing	1	lump sum	$15,000	$15,000	
Geoprobe	8	DAY	$1,500	$12,000	
Wellhead assembly	40	EA	$200	$8,000	
Misc valves and fittings	1	LS	$5,000	$5,000	
Distribution hose (1-inch), with cam-lock fittings	110	linear feet	$5	$550	
Remox L (sodium permanganate, delivered)	100,000	LB	$2	$198,000	
Water	150,000	GAL	$0.01	$1,500	
Post-injection monitoring	1	lump sum	$5,000	$5,000	Labor and analytical
Shipping	1	lump sum	$8,800	$8,800	
Tax	1	lump sum	$16,027	$16,027	
SUBTOTAL				$272,877	
Second Injection Event				$272,877	If needed based on monitoring
SUBTOTAL				$545,754	
SUBTOTAL				$1,390,074	
Contingency	15%			$208,511	
SUBTOTAL				$1,598,585	
Design	12%			$191,830	
Project Management	6%			$95,915	
Remedial Oversight/Reporting	8%			$127,887	
TOTAL CAPITAL COST				**$2,014,200**	

OPERATION, MAINTENANCE, AND MONITORING (OM&M) COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Site Monitoring					
Groundwater Sampling & Analysis	1	YR	$7,500	$7,500	Annual sampling - 6 wells
Data Evaluation and Reporting	1	YR	$5,000	$5,000	
SUBTOTAL				$12,500	
TOTAL ANNUAL O&M COST				**$12,500**	
Well and Vapor Point Abandoning					
Abandonment of Monitoring Wells	11	EA	$1,210	$13,310	
Abandonment of Soil Vapor Monitoring Points	6	EA	$1,210	$7,260	
SUBTOTAL				$20,570	
TOTAL CLOSEOUT COST - YEAR 3				**$20,570**	

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (5%)	PRESENT VALUE	NOTES:
Capital	1	$2,026,700	$2,026,700	1.00	$2,026,700	Capital + 1st Year O&M Costs
Annual OM&M	2-3	$25,000	$12,500	1.86	$23,243	GW sampling
Close out	3	$20,570	$20,570	0.95	$19,590	Close out
		$2,072,270			$2,069,533	
TOTAL PRESENT VALUE OF ALTERNATIVE					**$2,070,000**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE LOW (-30%)					**$1,449,000**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE HIGH (+50%)					**$3,105,000**	

TABLE 5-6
Remedial Alternative Cost Summary

Alternative 6
EXCAVATION TO PROPECTION OF GW STANDARD SCOs (10,600 CY) AND MNA (WITH TANK REMOVAL AND INSTITUTIONAL CONTROLS)

OPINION OF PROBABLE COST

Site: 222 South Ferry St
Location: Schenectady, New York
Phase: Alternatives Analysis (-30% to +50%)
Base Year: 2019
Date: September 2019

Description: Alternative 6 consists of excavating contaminated soil, removing the USTs, followed by plume-wide groundwater polishing via monitored natural attenuation. Capital costs are incurred in Year 1. O&M costs are incurred in Years 1-3.

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Institutional Controls Legal/Administrative Costs	1	lump sum	$25,000	$25,000	
Site Management Plan	1	lump sum	$15,000	$15,000	
SUBTOTAL				$40,000	
Excavation					Assume normal business hours
Utility Location	1	lump sum	$1,750	$1,750	
Well and Vapor Point Abandoning					
Abandonment of Monitoring and Extraction Wells	10	EA	$1,210	$12,100	
Abandonment of Soil Vapor Monitoring Points	6	EA	$1,210	$7,260	
Excavation, stock-piling, and loading of contaminated soils	10,600	CY	$52	$551,200	Incl. characterization & permits
Transportation and disposal of contaminated soils	15,900	TON	$65	$1,033,500	Assumed non-haz
UST cleaning, removal and disposal	1	lump sum	$3,200	$3,200	
Dewatering	1	lump sum	$50,000	$50,000	Incl. treatment
Excavation confirmation sampling and analysis	55	EA	$280	$15,400	
Provide, place, and compact backfill	10,600	CY	$35	$371,000	
Subbase and asphalt	27,000	SF	$5	$135,000	
Topsoil and seed	185	CY	$50	$9,250	
Temporary Facilities	50	DAY	$250	$12,500	
Site Security	50	DAY	$125	$6,250	
Community Air Monitoring Plan (CAMP)	50	DAY	$2,880	$144,000	
Health & Safety	50	DAY	$1,150	$57,500	
SUBTOTAL				$2,409,910	
SUBTOTAL				$2,449,910	
Contingency	15%			$367,487	
SUBTOTAL				$2,817,397	
Design	8%			$225,392	
Project Management	5%			$140,870	
Remedial Oversight/Reporting	6%			$169,044	
TOTAL CAPITAL COST				**$3,352,700**	

OPERATION, MAINTENANCE, AND MONITORING (OM&M) COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Site Monitoring					
Groundwater Sampling & Analysis	1	YR	$7,500	$7,500	Annual sampling - 6 wells
Data Evaluation and Reporting	1	YR	$5,000	$5,000	
SUBTOTAL				$12,500	
TOTAL ANNUAL O&M COST				**$12,500**	
Well and Vapor Point Abandoning					
Abandonment of Monitoring Wells	3	EA	$1,210	$3,630	
Abandonment of Soil Vapor Monitoring Points	2	EA	$1,210	$2,420	
SUBTOTAL				$6,050	
TOTAL CLOSEOUT COST - YEAR 3				**$6,050**	

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (5%)	PRESENT VALUE	NOTES:
Capital	1	$3,365,200	$3,365,200	1.00	$3,365,200	Capital + 1st Year O&M Costs
Annual OM&M	2-3	$25,000	$12,500	1.86	$23,243	GW sampling
Close out	3	$6,050	$6,050	0.95	$5,762	Close out
		$3,396,250			$3,394,205	
TOTAL PRESENT VALUE OF ALTERNATIVE					**$3,394,000**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE LOW (-30%)					**$2,375,800**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE HIGH (+50%)					**$5,091,000**	

TABLE 5-7
Remedial Alternative Cost Summary

Alternative 7
EXCAVATION TO PROTECTION OF GW STANDARD SCOs (10,600 CY) AND ISCO (WITH TANK REMOVAL AND INSTITUATIONAL CONTROLS)

OPINION OF PROBABLE COST

Site: 222 South Ferry St
Location: Schenectady, New York
Phase: Alternatives Analysis (-30% to +50%)
Base Year: 2019
Date: September 2019

Description: Alternative 7 consists of excavating the contaminated soil, removing the USTs, followed by plume-wide groundwater polishing via in-situ chemical oxidation using sodium permanganate. Capital costs are incurred in Year 1. O&M costs are incurred in Years 1-2.

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Institutional Controls Legal/Administrative Costs	1	lump sum	$25,000	$25,000	
Site Management Plan	1	lump sum	$15,000	$15,000	
SUBTOTAL				$40,000	
Excavation					Assume normal business hours
Utility Location	1	lump sum	$1,750	$1,750	
Well and Vapor Point Abandoning					
Abandonment of Monitoring and Extraction Wells	10	EA	$1,210	$12,100	
Abandonment of Soil Vapor Monitoring Points	6	EA	$1,210	$7,260	
Excavation, stock-piling, and loading of contaminated soils	10,600	CY	$52	$551,200	Incl. characterization & permits
Transportation and disposal of contaminated soils	15,900	TON	$65	$1,033,500	Assumed non-haz
UST cleaning, removal and disposal	1	lump sum	$3,200	$3,200	
Dewatering	1	lump sum	$50,000	$50,000	Incl. treatment
Excavation confirmation sampling and analysis	55	EA	$280	$15,400	
Provide, place, and compact backfill	10,600	CY	$35	$371,000	
Subbase and asphalt	27,000	SF	$5	$135,000	
Topsoil and seed	185	CY	$50	$9,250	
Temporary Facilities	50	DAY	$250	$12,500	
Site Security	50	DAY	$125	$6,250	
Community Air Monitoring Plan (CAMP)	50	DAY	$2,880	$144,000	
Health & Safety	50	DAY	$1,150	$57,500	
SUBTOTAL				$2,409,910	
ISCO					Assume normal business hours
Mobe/demobe	1	EA	$2,500	$2,500	
Geoprobe Mobe/Demobe	1	EA	$500	$500	
Injection testing	1	lump sum	$15,000	$15,000	
Geoprobe	8	DAY	$1,500	$12,000	
Wellhead assembly	40	EA	$200	$8,000	
Misc valves and fittings	1	LS	$5,000	$5,000	
Distribution hose (1-inch), with cam-lock fittings	110	linear feet	$5	$550	
Remox L (sodium permanganate, delivered)	100,000	LB	$2	$198,000	
Water	150,000	GAL	$0.01	$1,500	
Post-injection monitoring	1	lump sum	$5,000	$5,000	Labor and analytical
Shipping	1	lump sum	$8,800	$8,800	
Tax	1	lump sum	$16,027	$16,027	
SUBTOTAL				$272,877	
Second Injection Event				$272,877	If needed based on monitoring
SUBTOTAL				$545,754	
SUBTOTAL				$2,995,664	
Contingency	15%			$449,350	
SUBTOTAL				$3,445,014	
Design	8%			$275,601	
Project Management	5%			$172,251	
Remedial Oversight/Reporting	6%			$206,701	
TOTAL CAPITAL COST				**$4,099,600**	

OPERATION, MAINTENANCE, AND MONITORING (OM&M) COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Site Monitoring					
Groundwater Sampling & Analysis	1	YR	$7,500	$7,500	Annual sampling - 6 wells
Data Evaluation and Reporting	1	YR	$5,000	$5,000	
SUBTOTAL				$12,500	
TOTAL ANNUAL O&M COST				**$12,500**	
Well and Vapor Point Abandoning					
Abandonment of Monitoring Wells	3	EA	$1,210	$3,630	
Abandonment of Soil Vapor Monitoring Points	2	EA	$1,210	$2,420	
SUBTOTAL				$6,050	
TOTAL CLOSEOUT COST - YEAR 2				**$6,050**	

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (5%)	PRESENT VALUE	NOTES:
Capital	1	$4,112,100	$4,112,100	1.00	$4,112,100	Capital + 1st Year O&M Costs
Annual OM&M	2	$12,500	$12,500	0.95	$11,905	GW sampling
Close out	2	$6,050	$6,050	0.95	$5,762	Close out
		$4,130,650			$4,129,767	
TOTAL PRESENT VALUE OF ALTERNATIVE					**$4,130,000**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE LOW (-30%)					**$2,891,000**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE HIGH (+50%)					**$6,195,000**	

TABLE 5-8
Remedial Alternative Cost Summary

Alternative 8
SOURCE AREA EXCAVATION (2,500 CY) AND PASSIVE ISCO

OPINION OF PROBABLE COST

Site: 222 South Ferry St
Location: Schenectady, New York
Phase: Alternatives Analysis (-30% to +50%)
Base Year: 2019
Date: September 2019

Description: Alternative 8 consists of excavating the contaminated source area soil, removing the USTs, followed by passive source area groundwater treatment via in-situ chemical oxidation using potassium permanganate mixed with backfill material. Capital costs are incurred in Year 1. O&M costs are incurred in Years 1-2.

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Institutional Controls Legal/Administrative Costs	1	lump sum	$25,000	$25,000	
Site Management Plan	1	lump sum	$15,000	$15,000	
SUBTOTAL				$40,000	
Excavation					Assume normal business hours
Utility Location	1	lump sum	$1,750	$1,750	
Well and Vapor Point Abandoning					
Abandonment of Monitoring and Extraction Wells	2	EA	$1,210	$2,420	
Abandonment of Soil Vapor Monitoring Points	1	EA	$1,210	$1,210	
Excavation, stock-piling, and loading of contaminated soils	2,500	CY	$52	$130,000	Incl. characterization & permits
Milton CAT 320 Hydraulic Excavator Rental	1	MO	$7,000	$7,000	
Mob/demob, labor, fuel, county multiplier	1	lump sum	$17,473	$17,473	
Transportation and disposal of contaminated soils	3,750	TON	$65	$243,750	Assumed non-haz
UST cleaning, removal and disposal	1	lump sum	$3,200	$3,200	
Dewatering	1	lump sum	$50,000	$50,000	Incl. treatment
Excavation confirmation sampling and analysis	21	EA	$280	$5,880	
Provide, place, and compact backfill	2,030	CY	$35	$71,050	general fill
Provide, mix, place, and compact ISCO amendment in stone backfill					bottom approx 3' of excavation
Crushed stone	465	CY	$20	$9,300	
Potassium permanganate	10,000	LB	$2.60	$26,000	
Tax and Shipping for potassium permanganate	1	lump sum	$3,500	$3,500	
Subbase and asphalt	10,000	SF	$5	$50,000	
Temporary Facilities	15	DAY	$250	$3,750	
Site Security	15	DAY	$125	$1,875	
Community Air Monitoring Plan (CAMP)	15	DAY	$2,880	$43,200	
Health & Safety	15	DAY	$1,150	$17,250	
SUBTOTAL				$688,608	
SUBTOTAL				$728,608	
Contingency	15%			$109,291	
SUBTOTAL				$837,899	
Design	12%			$100,548	
Project Management	6%			$50,274	
Remedial Oversight/Reporting	8%			$67,032	
TOTAL CAPITAL COST				**$1,055,800**	

OPERATION, MAINTENANCE, AND MONITORING (OM&M) COSTS

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES:
Site Monitoring					
Groundwater Sampling & Analysis	1	YR	$7,500	$7,500	Annual sampling - 6 wells
Data Evaluation and Reporting	1	YR	$5,000	$5,000	
SUBTOTAL				$12,500	
TOTAL ANNUAL O&M COST				**$12,500**	
Well and Vapor Point Abandoning					
Abandonment of Monitoring Wells	11	EA	$1,210	$13,310	
Abandonment of Soil Vapor Monitoring Points	7	EA	$1,210	$8,470	
SUBTOTAL				$21,780	
TOTAL CLOSEOUT COST - YEAR 2				**$21,780**	

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (5%)	PRESENT VALUE	NOTES:
Capital	1	$1,068,300	$1,068,300	1.00	$1,068,300	Capital + 1st Year O&M Costs
Annual OM&M	1-2	$25,000	$12,500	1.86	$23,243	GW sampling
Close out	2	$21,780	$21,780	0.95	$20,743	Close out
		$1,115,080			$1,112,285	
TOTAL PRESENT VALUE OF ALTERNATIVE					**$1,112,000**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE LOW (-30%)					**$778,400**	
TOTAL PRESENT VALUE OF ALTERNATIVE - RANGE ESTIMATE HIGH (+50%)					**$1,668,000**	

Table 5-9

Remedial Alternative Cost Summary

Site: 222 South Ferry St
Location: Schenectady, New York
Phase: Alternatives Analysis (-30% to +50%)
Base Year: 2019
Date: September 2019

Alternative	Description	Capital Costs and 1st Year O&M	Annual O&M Costs	Close Out O&M Costs	Assumed Remediation Time (years)	Total Present Value
Alternative 1	NO FURTHER ACTION	$41,300	NA	NA	NA	$41,000
Alternative 2	EXCAVATION TO UNRESTRICTED USE SCOs (7,000 CY) AND MNA (WITH TANK REMOVAL AND INSTITUTIONAL CONTROLS)	$2,070,100	$12,500	$12,100	3	$2,105,000
Alternative 3	EXCAVATION TO UNRESTRICTED USE SCOs (7,000 CY) AND ISCO (WITH TANK REMOVAL AND INSTITUATIONAL CONTROLS)	$2,702,600	$12,500	$12,100	2	$2,726,000
Alternative 4	EXCAVATION TO RESTRICTED RESIDENTIAL SCOs (3,000 CY) AND MNA (WITH TANK REMOVAL AND INSTITUTIONAL CONTROLS)	$1,235,900	$12,500	$20,570	4	$1,290,000
Alternative 5	EXCAVATION TO RESTRICTED RESIDENTIAL SCOs (3,000 CY) AND ISCO (WITH TANK REMOVAL AND INSTITUATIONAL CONTROLS)	$2,026,700	$12,500	$20,570	3	$2,070,000
Alternative 6	EXCAVATION TO PROPECTION OF GW STANDARD SCOs (10,600 CY) AND MNA (WITH TANK REMOVAL AND INSTITUTIONAL CONTROLS)	$3,365,200	$12,500	$6,050	3	$3,394,000
Alternative 7	EXCAVATION TO PROTECTION OF GW STANDARD SCOs (10,600 CY) AND ISCO (WITH TANK REMOVAL AND INSTITUATIONAL CONTROLS)	$4,112,100	$12,500	$6,050	2	$4,130,000
Alternative 8	SOURCE AREA EXCAVATION (2,500 CY) AND PASSIVE ISCO	$1,068,300	$12,500	$21,780	2	$1,112,000

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