REPORT

Focused Feasibility Study
Mid-Town Laundry Site

New York State Department of Environmental Conservation

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Focused Feasibility Study
Mid-Town Laundry Site

Prepared for:

New York State Department of Environmental Conservation

I, Douglas M. Crawford, certify that I am currently a NYS registered professional engineer and that this Feasibility Study 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) and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

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LIST OF ACRONYMS

bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-Dichloroethene
COCs	Contaminants of Concern
COPC	Constituents of Potential Concern
DNAPL	dense non-aqueous phase liquid
DER	Division of Environmental Remediation
EISB	Enhanced *In Situ* Bioremediation
FFS	Focused Feasibility Study
ft	feet or foot
GRA	General Response Action
ISCO	*In Situ* Chemical Oxidation
NCP	National Oil and Hazardous Substances Contingency Plan
NYCRR	New York Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OBG	O'Brien & Gere Engineers, Inc.
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
PCE	Tetrachloroethene
QHHEA	Qualitative Human Health Exposure Assessment
RAOs	Remedial Action Objectives
RI	Remedial Investigation
SARA	Superfund Amendments and Reauthorization Act
SCGs	Standards, Criteria, and Guidance
SCOs	Soil Cleanup Objectives
SGVs	Standards and Guidance Values
SMP	Site Management Plan
SVE	Soil Vapor Extraction
TCE	Trichloroethene

µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter
USEPA	United States Environmental Protection Agency
VC	Vinyl Chloride
VI	Vapor Intrusion
VOCs	Volatile Organic Compounds
WA	Work Assignment

1. INTRODUCTION

The purpose of this report is to present the Focused Feasibility Study (FFS) for the Mid-Town Laundry site (referred herein as "the Site") located at 1122-1124 State Street, Schenectady, New York (New York State Department of Environmental Conservation [NYSDEC] Site #447048). A site location map is provided as **Figure 1-1**. This *FFS Report* has been developed by O'Brien & Gere Engineers, Inc. (OBG) under contract by Parsons Engineering of NY, Inc. and on behalf of the NYSDEC under Engineering Services Standby Contract Work Assignment (WA) #D007623-16.

The FFS was performed in accordance with the following regulations and guidance documents:

- NYSDEC Division of Environmental Remediation (DER) *Technical Guidance for Site Investigation and Remediation (DER-10)* (NYSDEC 2010b).
- New York State's regulations and Environmental Remedial Programs (6 New York Codes, Rules and Regulation (NYCRR) Part 375).
- NYSDEC *CP-51 Soil Cleanup Guidance. Division of Environmental Remediation* (NYSDEC 2010a).
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA).
- National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (United States Environmental Protection Agency (USEPA) 1990).

This *FFS Report* contains six sections. **Section 2** presents a brief description of the Site and its history. **Section 3** presents a summary of the Remedial Investigation (RI) activities, description of geologic and hydrogeologic conditions and the nature and extent of Site-related constituents in soil, groundwater and air/sub-slab vapor. The human health exposure assessment is also documented in **Section 3**. The development and screening of remedial alternatives and the detailed analysis of alternatives are documented in **Sections 4** and **5**, respectively. The alternative that represents the best balance with respect to the evaluation criteria is presented in **Section 6.**

2. SITE DESCRIPTION AND HISTORY

2.1 SITE DESCRIPTION

The Site is located at 1122-1124 State Street in Schenectady, New York (**Figure 1-2**). The Site is bound by State Street to the north, Albany Street to the south, off-Site commercial properties to the west and off-Site residential properties to the east and southwest. The Site is approximately 0.227 acres and is currently occupied by two abutting buildings. The western building is currently being used as a restaurant and the eastern building as a laundromat. The combined Site and off-Site residential properties to the southwest are discussed as the "RI Study Area."

The on-Site topography is relatively flat with little surface relief. The entire site is paved, with parking in the front and back of two abutting buildings that occupy approximately 70% of the Site. Local land use consists of mixed residential and commercial use. Existing above ground structures include a concrete block and brick commercial building and brick or wooden residential, single and multi-unit dwellings. Structures within the RI Study Area are serviced by natural gas and municipally-supplied water and sewer systems.

2.2 SITE HISTORY

The Site operated as a dry-cleaning facility from approximately 1969 to 1987. The Site is listed on New York State's inactive hazardous-waste disposal registry and assigned Site ID #447048.

NYSDEC initiated an investigation in the vicinity of the Site in 2009. The investigation work was conducted by Precision Environmental Services, Inc. (PES) for the NYSDEC as part of the Brandywine Avenue Plume Trackdown (NYSDEC Spill No. 9706794) and consisted of sampling and analysis of Site media in an attempt to evaluate the extent of VOC impacts in groundwater.

3. SUMMARY OF REMEDIAL INVESTIGATION AND EXPOSURE ASSESSMENT

3.1 PREVIOUS INVESTIGATIONS

As described in **Section 2.2**, NYSDEC initiated an investigation in the vicinity of the Site in 2009. The following three reports, prepared by PES, document the results of the investigations conducted between 2009 and 2011:

- *Supplemental Subsurface Investigation Report Findings; Brandywine Avenue Plume Track Down, NYSDEC Spill No: 9706794* (PES, 2010a)
- *Supplemental Subsurface Investigation Report Findings; Brandywine Avenue Plume Track Down, NYSDEC Spill No: 9706794* (PES, 2010b)
- *Supplemental Subsurface Investigation Report Findings; Brandywine Avenue Plume Track Down, NYSDEC Spill No: 9706794* (PES, 2011).

3.2 REMEDIAL INVESTIGATION

A RI was performed by OBG in accordance with the Engineering Services Standby Contract WA #D007623-16 and the Schedule 1 Scope of Work (NYSDEC 2014). The *RI Report* was developed by OBG and submitted to NYSDEC in November of 2017. The objectives of the RI activities conducted in the RI study were to:

- Collect data necessary to evaluate:
  - Possible presence of a residual source of Site-related contaminants of concern (COCs) in the vicinity of the Site.
  - Nature and horizontal extent of Site-related COCs in groundwater with respect to previous investigation results.
- Evaluate potential vapor intrusion (VI) in nearby residential and commercial buildings.
- Evaluate linkages between the contaminant source(s) and potentially exposed human receptor population through a Qualitative Human Health Exposure Assessment (QHHEA).
- Identify preliminary remedial action objectives (RAOs).
- Gather data to support the FFS.

3.3 GEOLOGIC AND HYDROGEOLOGIC CONDITIONS

The Site is located within the Hudson Mohawk Lowland Physiographic Province. The overburden soils in the surrounding area have been characterized as lacustrine deltaic deposits, composed predominantly of well sorted, stratified coarse to fine gravel and sand (Cadwell *et al*, 1987). These deposits make up a portion of the Albany-Schenectady sand plain, which ranges in thickness from 10 to 100 feet and overlies beds of silt, clay, and till (Halberg, H.N., Hunt, O.P., and Pauszek, F.H., 1964). The bedrock geology underlying the Site is the Austin Glen Formation, which consists of graywacke and shale that is of Middle to Upper Ordovician origin (Fisher *et al*, 1970). The Albany-Schenectady sand plain extends from southern Schenectady southeastward toward Albany and covers part of the buried Mohawk, Alplaus, and Colonie channels. The sands are not highly permeable, yielding water sufficient for household supplies, and in some places the sand is sufficiently thick to sustain small industrial supplies (Halberg, H.N., Hunt, O.P., and Pauszek, F.H., 1964).

Shallow soils encountered at the Site were generally composed of fine to coarse brown sand with varying amounts of silt and traces of gravel at depths ranging from approximately 22-feet below ground surface (ft bgs) to 26-ft bgs. These soils are underlain by gray, silty clay/clayey silt with relatively thin fine to medium sand seams from approximately 26 to 45-ft bgs. The deepest borings/wells within the RI Study Area were advanced to approximately 45-ft bgs. Bedrock was not encountered during the RI.

Regional groundwater flow through the shallow overburden is to the south to southwest. The shallow overburden water table occurs within the sand unit between 12 to 15 ft bgs. The deep overburden water table

occurs within the silty clay/clayey silt units between 15 to 18 ft bgs. The nearest public water supply wells are located approximately 3.3 miles to the west-northwest of the RI Study Area. This well field supplies water to the City of Schenectady, New York.

3.4 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination in overburden soils, shallow and deep overburden groundwater, air and sub-slab soil vapor to be addressed in the FFS is summarized below and in the following subsections. For the purpose of identifying areas to be addressed in this FFS, and to support the development and evaluation of remedial alternatives, reasonably anticipated land use has been considered. Analytical results presented in the *RI Report* were compared to the respective soil cleanup objectives (SCOs) in 6 NYCRR 375 for residential and commercial land use in consideration of anticipated future land use. In addition, for the purposes of developing an alternative to evaluate pre-disposal conditions, analytical results were compared to the 6 NYCRR 375 SCOs for unrestricted land use. Site-related COCs detected in soil that are also detected in groundwater at concentrations above the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (SGVs) for Class GA groundwater have been compared to the Protection of Groundwater SCOs.

Historic and RI groundwater analytical results were compared to the Class GA SGVs. Sub-slab soil vapor and indoor air analytical results have been compared to the Soil Vapor/Indoor Air Matrices A, B and C, provided in the New York State Department of Health's (NYSDOH's) *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (NYSDOH, 2017), as appropriate.

Based on these considerations, the nature and extent of contamination is presented below.

3.4.1 Surface Soil

Based on the current Site use and conditions, exposed surface soil is not currently present or expected in the future; therefore, the collection of surface soil samples was not included in the RI scope of work.

3.4.2 Subsurface Soil

Site-related COCs [tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE)] were detected in subsurface soil samples collected on-Site. Of the nine samples analyzed, four contained PCE concentrations above Part 375 SCOs, at depths ranging from 9 to 32-ft bgs. PCE concentrations exceeded the Part 375 Unrestricted Use and Protection of Groundwater SCOs in a sample collected immediately beneath the basement slab of the Mid-Town Laundry building, and in three samples along the northern side of the Mid-Town Laundry building. The highest concentration of PCE (110 mg/kg) detected in subsurface soil, which exceeded the Part 375 Residential Use SCO but did not exceed Commercial Use SCOs, was along this side of the building at a depth of 12 ft below grade. (Additional subsurface soil samples were collected in 2018 at depths ranging from 10 to 15-ft bgs to evaluate concentrations of PCE at this location.) TCE and cis-1,2-DCE were also detected in on-Site subsurface soil, but at concentrations below Part 375 Residential Use SCOs.

3.4.3 Groundwater

Site-related COCs including PCE and associated degradation products (including TCE, cis-1,2-DCE and vinyl chloride (VC)) were detected in RI Study Area groundwater samples at concentrations above Class GA SGVs. In the shallow overburden, Site-related COCs in groundwater are highest beneath the building on-Site and directly downgradient of the Site, with consistent concentrations downgradient and decreasing concentrations laterally. VC was not detected in on-Site shallow groundwater.

In the deep overburden, concentrations of PCE and its degradation products in groundwater decrease hydraulically downgradient. PCE concentrations in the deep overburden are consistent with concentrations observed in the shallow overburden directly downgradient of the Site.

Dense non-aqueous phase liquid (DNAPL), that has entered the subsurface in the past, can act as a residual source of constituents to groundwater. DNAPL was not observed during the installation of soil borings and DNAPL has not been documented in monitoring wells. However, the highest groundwater PCE concentration documented in a groundwater sample was 2,900 micrograms per liter (µg/L) collected 19 feet beneath the

basement slab of the Mid-Town building. This concentration is greater than 1% of the PCE solubility of 200,000 µg/L (2,000 µg/L), which may suggest that residual DNAPL had been present near this sample location. Groundwater sample results from nearby sample locations indicate that the potential presence of residual DNAPL is isolated horizontally and vertically.

3.4.4 Sub-Slab Soil Vapor/Indoor Air

Site-related COCs including PCE, TCE and cis-1,2-DCE were observed in on-Site indoor air and sub-slab soil vapor samples on-Site (of the restaurant basement, restaurant, and laundromat) and at the adjacent commercial building. VC was also observed at the adjacent commercial building.

The NYSDOH Soil Vapor/Indoor Air Matrix A values for PCE recommended mitigation based on the results from the restaurant basement, restaurant, and laundromat. In 2017, after installation of a VI mitigation system over the existing basement slab, indoor air samples were collected from the laundry, restaurant, and restaurant basement. PCE was detected in the indoor air samples at concentrations of 5,300 micrograms per cubic meter (µg/m^3) in the restaurant basement, 18 µg/m^3 in the restaurant, and 15 µg/m^3 in the laundromat.

Sub-slab and indoor air samples were also collected in the adjacent commercial building. PCE and TCE were detected in the indoor air and sub-slab samples at concentrations above the NYSDOH Soil Vapor/Indoor Air Matrices A and B. The NYSDOH Soil Vapor/Indoor Air Matrix B for PCE indicates mitigation is recommended to minimize exposure. A partial SSDS was installed in 2016. Indoor air data collected subsequent to the installation of the partial SSDS indicated that the system had reduced the concentrations of PCE, TCE, cis-1,2-DCE, and VC.

Sub-slab vapor, indoor air, and ambient air samples were also collected at three other neighboring properties within the RI Study Area. Comparison of this sub-slab and indoor air data to the NYSDOH Soil Vapor/Indoor Air Matrices A, B, and C indicated that no further action was necessary.

3.5. SUMMARY OF QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

A QHHEA was completed to evaluate potential human exposure to Site-related constituents under current and reasonably anticipated future use scenarios. Based upon the results of the RI, the QHHEA identified constituents of potential concern (COPCs) for human health. COPCs were designated for detected constituents in each medium if they exceeded screening criteria corresponding with current and reasonably anticipated future land use. The *QHHEA Report* is included in **Appendix L** of the *RI Report*, and a summary of the exposure assessment is provided below.

Based on current zoning (mixed use commercial land use), it is reasonable to anticipate that the Site and nearby off-Site areas will continue to be used for commercial and residential purposes in the future. The most likely future exposure scenario assumes that the buildings, building slabs, and pavement/groundcover will remain in place for the foreseeable future. Potential receptors and potentially complete exposure pathways under current and reasonably foreseeable future scenarios include:

- Current/future commercial workers that work within RI Study Area commercial buildings or, under a hypothetical future use scenario, another building in its place. Commercial workers may be exposed indirectly to groundwater-derived and/or soil-derived vapors via inhalation in the interior spaces of the commercial building;
- Current/future off-Site residents (child and adult) within the RI Study Area, potentially exposed to COCs from groundwater-derived and/or soil-derived vapors via inhalation in the interior spaces;
- Current/future utility workers that could be involved with future utility-related activities, potentially exposed to COCs via dermal contact with affected groundwater and indirectly to groundwater-derived and/or soil-derived vapors via inhalation; and

- Future construction workers that could be involved with hypothetical construction-related activities, potentially exposed to COCs via dermal contact with affected groundwater and indirectly to groundwater-derived and/or soil-derived vapors via inhalation.

4. DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section documents the development of remedial alternatives for Site media, which was performed consistent with *DER-10*. As part of the development of remedial alternatives, RAOs and general response actions (GRAs) were identified for the FFS. In addition, the areas and volumes of media to be addressed by the remedial alternatives evaluated are documented. The FFS was completed in accordance with *NYSDEC's DER-15 - Presumptive/Proven Remedial Technologies* (February 2007), which was considered during the development of the range of remedial alternatives evaluated. Consistent with NYSDEC's *DER-31 – Green Remediation* (NYSDEC 2011) and USEPA's *Superfund Green Remediation Strategy* (September 2010), green remediation concepts were considered during the development of alternatives in this FFS.

4.1 DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

RAOs are medium-specific goals for protecting human health and the environment. RAOs form the basis for the FFS by providing overall goals for site remediation. The RAOs are considered during the identification of appropriate remedial technologies and development of remedial alternatives for the Site, and later during the evaluation of remedial alternatives.

RAOs are based on engineering judgment, potential exposure pathways identified in the QHHEA presented in **Appendix L** of the *RI Report*, potential Standards, Criteria and Guidance (SCGs), and migration potential. Additionally, the current, intended and reasonably anticipated future land use of the Site and its surroundings (residential and/or commercial use) and the nature and extent of Site-related contaminants exceeding chemical-specific SCGs were considered during the development of the RAOs. Documentation of the rationale employed in the development of RAOs for Site media is presented below.

4.1.1 Identification and Potential Standards, Criteria and Guidance (SCGs)

There are three types of SCGs: chemical-specific, location-specific, and action-specific. Chemical-specific SCGs are health- or risk-based numerical values, or methodologies which when applied to site-specific conditions result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. Location-specific SCGs set restrictions on activities based on the characteristics of the site and immediate environment on which the activity is to be performed. Action-specific SCGs set controls or restrictions on particular types of remedial actions once the remedial actions have been identified as part of a remedial alternative. The identification of potential SCGs is documented in **Table 4-1**. The rationale for the selection of chemical-specific SCGs related to New York State's 6 NYCRR 375 SCOs and land use is further described below.

4.1.2 Land Use and Selection of Soil Cleanup Objectives

Consistent with 6 NYCRR Part 375-1.8(f) and *DER-10* 4.2(i), the current, intended and reasonably anticipated future land use of the Site are considered when selecting SCOs. The property is located in an area surrounded by properties of mixed commercial and residential uses.

Based on the nature of the community, it is reasonable to anticipate that the Site and nearby off-Site areas will continue to be used for commercial and residential purposes in the future. While current zoning is for mixed use commercial land use (which includes residential use) the most likely future exposure scenario assumes that the on-Site buildings, building slabs, and pavement/groundcover will remain in place for the foreseeable future and be utilized for commercial purposes. Therefore, the following 6 NYCRR Part 375 Commercial Use SCO is identified as appropriate for the Site, and further described below:

- 6 NYCRR Part 375 SCOs for Commerical Use: Commercial use, as defined in 6 NYCRR Part 375-1.8(g)(2)(iii) allows for the primary purpose of buying, selling or trading of merchandise or services. Commercial use includes passive recreational uses, which are public uses with limited potential for soil contact. The Commercial use category as defined in DER-10:

- i. restricts the use to commercial activities including the buying and/or selling of goods or services, or other uses identified in subparagraph iii below;
- ii. requires a SMP to manage remaining soil contamination and institutional/ engineering controls at the site;
- iii. is the appropriate use category for the following site uses: (1) health care facilities, including hospitals, clinics etc.; or (2) college academic and administrative facilities; and

iv. allows for passive recreational, which includes recreational uses with limited potential for soil contact, such as: (1) artificial surface fields; (2) outdoor tennis or basketball courts; (3) other paved recreational facilities used for roller hockey, roller skating, shuffle board, etc.; (4) outdoor pools; (5) indoor sports or recreational facilities; (6) golf courses; and (7) paved (raised) bike or walking paths. Consistent with *DER-10,* for purposes of evaluating a pre-disposal conditions alternative, analytical results for subsurface soil were also compared to SCOs for Unrestricted Use.

4.1.3 Remedial Action Objectives for Soil, Groundwater and Soil Vapor/Indoor Air

Potential chemical-specific SCGs and potential exposure pathways identified in the QHHEA for soil, groundwater and soil vapor/indoor air at the Site were considered during the development of RAOs and remedial alternatives. As described in **Section 3.4**, soil, groundwater and soil vapor/indoor air samples exhibit concentrations above chemical-specific SCGs in certain locations within the RI Study Area. Though groundwater within the RI Study Area is not used as a drinking or industrial water supply and is highly unlikely to be used as a drinking or industrial supply in the future, groundwater exceedances of SCGs were considered. Accordingly, the following RAOs were developed.

RAOs for Public Health Protection

Based on consideration of potential chemical-specific SCGs, nature and extent of contamination, potential exposure pathways identified in the QHHEA, and the current, intended and reasonably anticipated future use of the Site and its surroundings, the following *DER-10* generic RAOs were identified for the protection of human health:

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater
- Prevent ingestion/direct contact with contaminated soil
- Prevent inhalation of, or exposure to, contaminants volatilizing from contaminants in soil
- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at the site.

RAOs for Environmental Protection

Based on consideration of potential chemical-specific SCGs, nature and extent of contamination, and the current, intended and reasonably anticipated future use of the Site and its surroundings, the following *DER-10* generic RAOs were identified for protection of the environment:

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable
- Remove the source of ground or surface water contamination
- Prevent migration of contaminants that would result in groundwater or surface water contamination.

4.2 DEVELOPMENT OF GENERAL RESPONSE ACTIONS (GRAS)

GRAs are medium-specific actions which may, either alone or in combination, form alternatives to satisfy the RAOs. GRAs identified for soil and groundwater are summarized as follows:

Soil

The following GRAs were identified for soil:

- ***No further action.*** No action is considered in the FFS, as required by the NCP (40 Code of Federal Regulations (CFR) Part 300.430) and *DER-10* Sections 4.1(d) and (b), as a baseline against which other actions are evaluated.
- ***Institutional controls.*** Actions that provide site access and use restrictions and provisions for continued operation of the remedy.
- ***Containment actions.*** Actions that minimize the potential for direct contact with and erosion of soil.
- ***In situ treatment actions.*** Actions that treat soil in place to reduce mobility or toxicity.
- ***Removal actions.*** Actions to excavate soil.
- ***Disposal actions.*** Actions that dispose of soil on-Site or off-Site.

Groundwater

The following GRAs were identified for groundwater:

- ***No further action.*** No action is considered in the FFS, as required by the NCP (40 CFR Part 300.430) and DER-10 Sections 4.1(d) and (b), as a baseline against which other actions are evaluated.
- ***Institutional controls.*** Actions that provide site access and use restrictions and provisions for continued operation of the remedy.
- ***In situ treatment actions.*** Actions that treat groundwater in place to reduce mobility or toxicity.

Sub-Slab Soil Vapor/Indoor Air

The following GRAs were identified for sub-slab soil vapor/indoor air:

- ***No further action.*** No action is considered in the FFS, as required by the NCP (40 CFR Part 300.430) and DER-10 Sections 4.1(d) and (b), as a baseline against which other actions are evaluated.
- ***Institutional controls.*** Actions that provide for evaluation and mitigation of VI for future new structures on-Site, at adjacent commercial property and within the RI Study Area; and, actions that provide provisions for continued operation of the VI mitigation systems (on-Site and adjacent off-Site commercial building), and monitoring of effectiveness of mitigation systems.

4.3 IDENTIFICATION OF VOLUMES OR AREAS OF MEDIA

Volumes and areas of media to be addressed in this FFS were estimated based on Site conditions, the nature and extent of contamination, RAOs, and potential chemical-specific SCGs. The areal extents of these media are described below.

As described in **Section 3.4**, impacted groundwater is observed throughout both the defined on-Site and off-Site areas of the RI Study Area. For purposes of the FFS, it is assumed that approximately 0.22 acres of on-Site and 1.5 acres of off-Site areas demonstrate impacted groundwater occurring from approximately 15-ft to 35-ft below grade, comprising both shallow and deeper groundwater.

Soil exceeding SCOs is limited to the northwestern portion of the site and immediately below the existing building. Based on the results of the RI, impacted soil generally coincides with possible residual source area location and groundwater data in this area. Approximately 5,200 cubic yards of impacted soil may exist in this possible residual source area at depths ranging between approximately 9-ft below grade to 32-ft below grade. For purposes of evaluating a pre-disposal condition and to account for potential unknown on-Site impacted soil, an estimated volume of 9,200 cubic yards of Site soil has been assumed.

4.4 ASSEMBLY OF REMEDIAL ALTERNATIVES

Five remedial alternatives were developed by assembling GRAs, as described above in **Section 4.2**, into combinations that address RAOs for soil, ground water and sub-slab soil vapor/indoor air. For this *FFS*, *DER-10*, *DER-15*, *DER-31* and input from NYSDEC representatives were considered in the selection of technologies included and in the development of the range of remedial alternatives. A summary of the alternatives and their components is presented in **Tables 1 and 2**, below.

Table 1: Mid-Town Laundry Site – FFS Remedial Alternatives

Alternative 1	Alternative 2	Alternative 3	Alternative 4A/4B	Alternative 5
No Action	*In Situ* Chemical Treatment and Targeted Soil Removal	*In Situ* Biological Treatment and Targeted Soil Removal	Soil Vapor Extraction (SVE)/SVE with Air Sparging Extraction	Restoration to Pre-Disposal/Pre-Release Conditions

Table 2: Components of Remedial Alternatives

Remedial Component	Remedial Alternative 1	2	3	4A/B	5
No action	●				
Institutional controls ■ Institutional controls, SMP, periodic Site reviews		●	●	●	
■ Periodic Site reviews					●
Engineering controls ■ Continued operation of VI mitigation systems (on-Site and adjacent off-Site commercial building)		●	●	●	
Engineering controls ■ Cover systems	●	●	●	●	
In situ chemical oxidation (ISCO) in source area and on-Site downgradient plume		●			
Enhanced *in situ* bioremediation (EISB) in source area and on-Site downgradient plume			●		
Soil Vapor Extraction (4A)/ Soil Vapor Extraction with Air Sparging (4A and 4B)				●	
Targeted excavation/amendment addition		●	●		
Full building demolition on-Site					●
Full soil excavation on-Site					●
Removal and off-site treatment/disposal of excavated soil		●	●		●
Continued VI investigation/monitoring, groundwater and soil vapor monitoring in RI Study Area		●	●	●	●
Site restoration		●	●	●	●

Common elements of the remedial alternatives include remedial action components common to the active alternatives that are not currently in place and need to be implemented. Common elements include; institutional controls, continued operation of VI mitigation systems (on-Site and adjacent off-Site commercial building), continued VI investigation/monitoring, groundwater and soil vapor monitoring in RI Study Area, a SMP, periodic Site reviews and Site restoration. A description of each alternative is included in the following subsections.

4.4.1 Alternative 1 – No Further Action

Alternative 1 is the no further action alternative. A no action alternative is required to be considered by the *NCP* and *DER-10* Section 4.4(b)3 and serves as a benchmark for the evaluation of action alternatives. This alternative

provides for an assessment of the environmental conditions if no remedial actions are implemented. Because this alternative would result in contaminants remaining above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the Site be reviewed at least once every five years. If justified by the review, remedial actions may be implemented to remove, treat, or contain contaminated media.

4.4.2 Alternative 2 – *In Situ* Chemical Treatment and Targeted Soil Removal

Alternative 2 includes *in situ* chemical treatment of the possible residual source area below the existing building and within the on-Site downgradient groundwater plume and targeted excavation of soil exceeding Protection of Groundwater SCOs, as illustrated on **Figure 4-1**. This alternative would also include institutional controls and engineering controls, including continued operation and maintenance of VI mitigation systems (on-Site and adjacent off-Site commercial building) and cover systems, continued VI investigation/monitoring and groundwater monitoring in RI Study Area, a SMP and periodic Site reviews.

In Situ Chemical Treatment

In situ chemical oxidation (ISCO) would treat groundwater using oxidants injected within the affected saturated areas. Oxidation reactions chemically convert constituents to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. Following installation of injection wells, ISCO reagents would be applied via injection to the saturated zone in two distinct areas of the site; beneath the existing building and within the parking area downgradient of the building, comprising a total of approximately 4,000 and 5,000 square feet, respectively.

The effectiveness of ISCO is limited by subsurface hydrogeologic and geochemical conditions and ability to effectively deliver oxidants to the treatment zone. Implementation of ISCO would necessitate treatability testing for oxidant selection and dosage and to assess natural oxidant demand (NOD) of the subsurface.

For purposes of estimating cost, a permanganate-based oxidant has been assumed to be applied to the saturated zone, between 10-ft and up to 32-ft below grade, by low-pressure direct push injection wells. A total of four injection events are assumed for the area below the building (approximately 3,900 square feet) and two injection events are assumed over the remainder of the site (approximately 5,000 square feet). Installation of wells to access below the building has assumed horizontal/directional drilling techniques originating outside the building footprint. Vertical injection wells installed through the basement slab may be considered during design, as a potentially more cost-effective option provided physical access for installation and reagent injection is feasible. Similarly, direct injection geoprobes may be utilized in place of vertical wells however, each injection event would necessitate mobilization of equipment.

Targeted Soil Removal with Off-Site Disposal

Soil in the northwest corner exhibiting maximum concentrations above Protection of Groundwater SCOs would be excavated and disposed off-Site in an appropriate facility. The excavation would require removal and restoration of existing pavement and temporary shoring, as the removal area is constrained both by the existing building and the property boundary. Amendment may be added at the excavation bottom, to allow for residual treatment, prior to backfilling. The excavation would be backfilled and restored to match surrounding grade. For purposes of estimating cost, it is assumed that approximately 225 cubic yards of soil would be removed from this area at a depth of approximately 15-ft below grade.

Cover Systems

On-Site surfaces are currently covered by the building and asphalt pavement. These cover surfaces will be maintained to provide a physical barrier to direct contact with soils below, prevent surface water infiltration to groundwater and contain soil vapors.

Vapor Intrusion Investigation/Monitoring, Groundwater and Soil Vapor Monitoring in RI Study Area

Long term monitoring at the Site includes soil vapor and ground water monitoring in the RI Study Area. Additional evaluation of VI downgradient of the Site in the RI Study Area for vapor intrusion potential would also be conducted. Subsequent VI mitigation at properties where vapor intrusion (or unacceptable risk for intrusion) is demonstrated, would be also performed. For purposes of estimating cost, it was assumed that VI evaluation would comprise bi-annual sub-slab soil vapor and first floor indoor air samples at a total of 23

residences. Additionally, it was assumed that five residences would require installation of vapor mitigation systems.

Groundwater monitoring would comprise bi-annual sampling of existing wells both on-Site and off-Site within the RI study area for volatile organic compounds (VOCs). For purposes of estimating cost, it was assumed that a sampling event would occur once annually with half of the existing wells (approximately eight per year) being sampled; the remaining wells would be sampled in the following year.

Institutional Controls

Administrative control(s) such as an IC (*e.g.*, environmental easements, deed restrictions, and environmental notices) would be recorded for the Site to require the continued management of engineering controls to maintain protectiveness of human health and the environment. The institutional controls would also restrict the use of groundwater as a source of potable or process water, require groundwater monitoring, and provide for control of indoor air quality.

Continuing and effective operation of VI mitigation systems would be required to mitigate VI exposures and would be specified in the institutional controls. System effectiveness would need to be demonstrated. Repair, modification or replacement of VI mitigation systems may be required, as necessary. Where necessary, preventative measures may be included in the design and construction of new buildings at the Site to mitigate the potential for exposure to constituents that may be present in soil vapor. Such measures may include the use of a vapor barrier or the installation of a venting system. Restrictions would preclude activities that would potentially expose soil and soil vapor that might cause vapor intrusion, without prior review and approval by NYSDEC. In addition, institutional controls would include provision for maintenance of cover systems. As described above in **Section 4.1.2**, the reasonably anticipated future land use for the Site is residential. The institutional controls would reflect this Site use.

Site Management Plan

A SMP would guide future activities at the Site by documenting institutional controls and engineering controls and by developing requirements for periodic Site reviews, the implementation of required operation and maintenance (O&M) activities, and future development on the Site. In addition, consistent with 6 NYCRR Part 375-1.8(h)(3), annual certification of institutional controls and engineering controls would be required in the SMP.

Periodic Site Reviews

Periodic site reviews would be conducted in accordance with the SMP to evaluate the Site with regard to continuing protection of human health and the environment as evidenced by information such as documentation of field inspections. 6 NYCRR Part 375-1.8(h)(3) specifies that the frequency of periodic site reviews should be annual, unless a different frequency is approved by NYSDEC; it is assumed that annual reviews would be conducted at the Site. Because this alternative would result in contaminants remaining above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the Site be reviewed at least once every five years. If justified by the review, remedial actions may be implemented to remove, treat, or contain the contaminated soils.

4.4.3 Alternative 3 – *In Situ* Biological Treatment and Targeted Soil Removal

Alternative 3 includes enhanced *in situ* bioremediation (EISB) of the possible residual source area below the existing building and within the on-Site downgradient groundwater plume and targeted excavation of soil exceeding Residential SCOs, as illustrated on **Figure 4-2**. In addition to EISB, described below, this alternative would also include the common remedial alternative elements, targeted soil removal and cover systems that are described in Alternative 2.

Enhanced *In Situ* Biological Treatment

Enhanced *in situ* biological treatment would be accomplished by amending the saturated subsurface to enhance anaerobic conditions and accelerate contaminant biodegradation. EISB may be conducted through biostimulation (providing donors or nutrients to existing microbial populations), bioaugmentation (purposeful addition of beneficial microbial population cultures), or both. The electron donor creates and sustains anaerobic

conditions by consuming oxygen and other electron acceptors during its biodegradation. It also promotes the reduction of oxidized contaminants, such as chlorinated solvents, by generating hydrogen through fermentation reactions.

The effectiveness of EISB is dependent upon subsurface hydrogeologic, geochemical, and microbial conditions and effective delivery of bioremediation amendments to the treatment zone. Implementation of EISB would require pre-design investigation and testing to assess the existing subsurface environment and existing microbial populations as well as bench-scale studies to assess effectiveness.

EISB would be applied in a similar manner as ISCO, using injection to target the possible residual source area (approximately 3,900 square feet) below the existing building, for the purpose of source treatment. It would also be applied as a treatment zone along the southwestern and portions of the southeastern property boundary (approximately a 40-ft wide and 100-ft long along the property boundary) as a means of providing contaminant degradation and minimizing horizontal and vertical migration. Application of EISB in this manner would provide an added benefit of increased biodegradation/natural attenuation in downgradient groundwater in the RI Study Area, since the added amendments "drift" downgradient with groundwater movement. For purposes of estimating cost, it is assumed that the two injection events would occur within the saturated zone of the subsurface by amendment with emulsified vegetable oil and electron donor (such as zero valent iron) to stimulate biological anaerobic dechlorination and one event would occur to generate the treatment zone for the remainder of the Site. Bioaugmentation, the purposeful addition of appropriate microbial communities, has not been assumed for this Alternative; the need for augmentation would be evaluated based on treatability studies performed as part of a remedial design phase.

4.4.4 Alternative 4A/B – Soil Vapor Extraction (SVE)/SVE with Air Sparging Extraction

Alternative 4 includes soil vapor extraction (SVE) to address both the possible residual source below the building as well as vapor intrusion potential to indoor air within the existing building. Alternative 4 assesses SVE on its own (4A) and SVE paired with air sparging wells (4B). In addition to SVE/SVE-Air Sparging, described below, this alternative would also include the common remedial alternative elements and cover systems that are described in Alternative 2. Soils targeted for removal under previous alternatives would be addressed by SVE/SVE-AS in Alternative 4 A/B.

Soil Vapor Extraction/Air Sparging.

Soil vapor extraction (SVE) employs vacuum applied to wells within the unsaturated zone of soils to induce control and capture of VOCs in soil vapor and initiate volatilization of VOCs from the soil to vapor phase as a means of remediating contaminated unsaturated soils. The recovered gas may be treated prior to exhausting to the atmosphere as necessary. SVE may be combined with air sparging (AS) to extend VOC extraction to saturated soils.

The effectiveness of SVE/SVE-AS is dependent upon subsurface conditions that allow for vapor communication through the soils. Existing communication testing indicated that subsurface obstructions may be present. Implementation of SVE/SVE-AS would require additional pre-design investigation and testing to assess the existing subsurface environment below the building and evaluate the need for vapor treatment prior to discharge.

SVE/SVE-AS would be implemented at the building perimeter and operated in conjunction with a vapor intrusion system to provide vapor extraction below the building footprint. For purposes of estimating cost, it is assumed that five SVE wells would be installed to a depth of 12-ft bgs along the southwestern and northwestern building side. The existing VI mitigation system would be replaced with a new floor over the existing basement floor and full floor and wall sealing. Both the SVE wells and replaced VI mitigation system would be connected by buried exterior piping to a vacuum system housed in a temporary building located in the rear parking lot of the building. Granular activated carbon would be included for vapor-phase treatment prior to discharge. Alternative 4B would also include the installation of seven air sparging wells to approximately 20-ft bgs.

4.4.5 Alternative 5 – Restoration of Pre-Disposal/Pre-Release Conditions

Alternative 5 includes removal of soil above Unrestricted Use SCOs by excavation and includes full demolition of the existing building, as illustrated on **Figure 4-3**. The conceptual extent of excavation includes the potential residual source area below the building and on-Site areas downgradient of the existing building. The entirety of the existing building would require demolition to access soil under the building footprint. For purposes of developing cost, it is assumed that the area of excavation would be defined by the property boundary and that the excavation would progress to a depth of 25-ft bgs across the property, with a deeper area under the existing building (northwestern side) to a depth of 35-ft, resulting in a total volume of 9,200 cubic yards removed and managed off-Site. The Site would be backfilled with clean material in accordance with DER-10 Section 5.4(e)4 to match adjacent grade and paved.

Due to the depth of excavation and challenges of working within a developed multi-use area, full excavation would necessitate use of off-Site areas for support, soil staging, dewatering, water treatment, etc., as well as sheeting for excavation support of off-site areas. Additionally, significant dewatering and water treatment would be required. Recovered water would require both pre-treatment and discharge to municipal facilities. Transportation considerations would include; significantly increased traffic, fuel usage, and adverse effects on both air quality and community safety (based on the full demolition of the existing building, export of excavated material, import of clean fill and other materials).

Administrative controls are not required for the on-Site property under this alternative, however, VI investigation/monitoring and mitigation as necessary, groundwater and soil vapor monitoring, and periodic Site reviews in the RI Study Area would continue as described in the other alternatives.

5. DETAILED ANALYSIS OF ALTERNATIVES

This section documents the detailed analysis of four remedial alternatives developed during the assembly of remedial alternatives. The detailed analysis of the remedial alternatives was conducted consistent with *DER-10* and the *Guidance for Developing Remedial Investigation and Feasibility Studies under CERCLA* (USEPA 1988). This section describes the individual and comparative analysis of the remedial alternatives with respect to evaluation criteria that embody the specific statutory requirements.

5.1 INDIVIDUAL ANALYSIS OF ALTERNATIVES

DER-10 Section 4.2 indicates that, during remedy selection, ten evaluation criteria should be categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The threshold criteria must be satisfied in order for an alternative to be eligible for selection. The primary balancing criteria are used to balance the differences between the alternatives. The modifying criteria are formally considered by NYSDEC after public comment is received on the Proposed Plan. The criteria are described in **Table 3** below:

Table 3: Remedial Alternative Evaluation Criteria

Criterion	Considerations
Threshold Criteria	
Overall protectiveness of human health and the environment	■ Achievement and maintenance of adequate protection ■ Elimination, reduction, or control of site risks through treatment, engineering, or institutional controls ■ Assessment relative to the current, intended, and reasonably anticipated future use of the Site and its surroundings.
Compliance with SCGs	■ Attainment of chemical-, location-, and action-specific SCGs
Primary Balancing Criteria	
Long-term effectiveness and permanence	■ Magnitude of potential residual risk from materials remaining at the conclusion of the remedial activities. ■ Adequacy and reliability of controls necessary to manage materials left on Site
Reduction of toxicity, mobility, or volume through treatment	■ Treatment or recycling processes employed and materials treated ■ Amount of hazardous substances, pollutants, or contaminants treated or recycled ■ Degree of expected reduction of mobility, toxicity, or volume of the waste due to treatment or recycling ■ Degree to which treatment would be irreversible ■ Type and quantity of residuals that would remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate ■ Degree to which treatment would reduce the inherent hazards posed by the Site.
Short-term effectiveness	■ Short-term potential risks to the community during implementation ■ Potential impacts to workers and effectiveness/reliability of protective measures ■ Potential environmental impacts and the effectiveness/reliability of mitigative measures ■ Time until protection would be achieved.
Implementability	■ Technical difficulties and unknowns ■ Reliability of the technology

Table 3: Remedial Alternative Evaluation Criteria Criterion	Considerations
	■ Ease of undertaking additional remedial actions ■ Ability to monitor the effectiveness of the remedy ■ Activities needed to coordinate with other offices and agencies ■ Ability and time required to obtain any necessary agency approvals and permits ■ Availability of adequate off-Site treatment, storage, and disposal capacity/services ■ Availability of necessary equipment and specialists ■ Provisions to obtain necessary additional resources ■ Availability of prospective technologies.
Cost	■ Capital costs ■ Annual O&M costs ■ Periodic O&M costs ■ Present worth cost.
Land Use[1]	■ Consistency with land use
Modifying Criteria	
State acceptance	■ Indicates whether, based on its review of the RI/FS reports and the Proposed Plan, the state supports, opposes, and/or has identified any reservations with the preferred response measure.
Community acceptance	■ Summarizes the public's general response to the response measures described in the Proposed Plan and the RI/FS reports. This assessment includes determining which of the response measures the community supports, opposes, and/or has reservations about.

The objective of the detailed analysis of alternatives was to analyze and present sufficient information to allow the alternatives to be compared and a remedy selected. The analysis consisted of an individual assessment of each alternative with respect to the evaluation criteria that encompass statutory requirements and overall feasibility and acceptability. The summary of this analysis is presented in **Table 4-2.**

5.2 COMPARATIVE ANALYSIS OF ALTERNATIVES

5.2.1 Overall Protection of Human Health and the Environment

Alternative 1, the no action alternative, is not expected to provide protection of human health due to potential hypothetical exposure to soil, groundwater and sub-slab soil vapor/indoor air. Protection of human health from risks associated with ingestion of groundwater exceeding SCGs is provided through public water supply connections for the Site and surrounding properties. Alternatives 2 and 3offer additional protection of human health to risks associated with VI through active treatment of groundwater via ISCO or EISB, respectively, and targeted soil removal. Alternatives 4A and 4B offer additional protection of human health to the risks associated with VI through the SVE/SVE-AS. Protection of human health relative to soil vapor exposures would be

[1] Land use is not a criterion under the NCP; however, it is a primary balancing criterion under *DER-10* and is included as such in the detailed analysis of alternatives at this Site.

provided through VI mitigation systems or floor sealing in combination with SVE. Alternative 5 would provide protectiveness through full soil removal.

Alternative 3 would provide for greater protection of the environment (versus Alternatives 2 and 4A/B) through EISB treatment that, in addition to on-Site treatment, would also facilitate biodegradation/natural attenuation in downgradient groundwater. Alternative 5 would be protective of the environment through extensive removal of soil and would meet RAOs while allowing for unrestricted use of the Site by addressing soil exceeding Unrestricted Use SCOs.

In summary, Alternatives 2, 3, 4A/B, and 5 would satisfy the threshold criterion by providing long-term protection of human health and the environment and by addressing RAOs. Alternatives 2, 3, 4A/B, and 5 are consistent with current, intended, and reasonably anticipated future use of the Site. While Alternatives 2, 3 and 4A/B would provide protectiveness of human health and the environment and are consistent with current, intended and reasonably anticipated future use of the Site, the added soil excavation in Alternative 5 would allow for unrestricted use of the Site.

5.2.2 Compliance with SCGs

Chemical-, location-, and action-specific SCGs identified for consideration in the FFS are summarized in Table 4-1. Alternatives 2, 3 and 4A/B would address chemical-specific SCGs through *in situ* treatment and targeted soil removal, a SMP, and institutional and engineering controls and periodic Site reviews. Alternative 5 would address chemical-specific SCGs through removal of soil. Alternative 1 would rely on the existing cover, VI mitigation systems and public water supply to address SCGs, however, maintenance of these engineering controls is not included as part of Alternative 1.

No action- or location-specific SCGs were identified for Alternative 1, the no further action alternative. Construction methods and safety procedures, compliance with Occupational Safety and Health Administration (OSHA) requirements, and transportation and disposal requirements would be implemented to adhere to the location- and action-specific SCGs identified for Alternatives 2, 3, 4A/B and 5. Implementation of institutional controls associated with Alternatives 2 and 3 would be in general conformance with NYSDEC's *Institutional Controls: A Guide to Drafting and Recording Institutional Controls - DER-33* (NYSDEC 2010c). Procedures would be implemented to adhere to the location-specific SCGs related to federal and state requirements for cultural, archeological, and historical resources. With respect to action-specific SCGs, proposed excavation activities would be conducted consistent with applicable standards; earth moving/excavation activities would be conducted consistent with air quality standards; transportation and disposal activities would be conducted in accordance with applicable State and Federal requirements, by licensed and permitted haulers; and Site construction activities would be conducted in accordance with OSHA safety requirements. The subsurface injections associated with Alternatives 2 and 3 would need to comply with the federal underground injection control regulations. Discharge of collected soil vapor would need to comply with applicable air regulations.

5.2.3 Long-Term Effectiveness and Permanence

Alternative 1 would not provide long-term effectiveness and permanence in a reasonable time frame, whereas long-term effectiveness and permanence for Alternatives 2, 3 and 4A/B would be provided over time. Long-term effectiveness and permanence for Alternative 5 would be provided upon completion of construction. No additional controls are included in Alternative 1, while controls are included in Alternative 2, 3 and 4A/B, including institutional and engineering controls (including covers and VI mitigation systems), SMP, and periodic Site reviews. Alternatives 2 and 4A/B, would minimize residual risk and contaminant migration in groundwater from the source area using targeted soil excavation and *in situ* treatment using ISCO (Alternative 2) or *in situ* treatment using SVE/SVE-AS (Alternatives 4A/B); Alternative 4B would provide greater control over residual risk than Alternative 4A due to the inclusion of air sparging. In Alternative 3, targeted soil excavation and *in situ* biological treatment using EISB would minimize residual risk and contaminant migration in groundwater from the source area, and would further reduce residual risk by enhancing and facilitating biodegradation/natural attenuation in downgradient groundwater in the RI Study Area. Additional soil excavation in Alternative 5 would minimize residual risk and contaminant migration in shallow and deep groundwater from the source area.

Institutional and engineering controls, including continued operation of the existing VI mitigation systems, SMP, and periodic Site reviews included in Alternatives 2, 3 and 4A/B would be adequate and reliable controls of potential risks associated with exposure to constituents in soil, groundwater and sub-slab soil vapor/indoor air. Alternative 5 would provide a high degree of adequacy and reliability, afforded by extensive soil removal. Monitoring and periodic reviews included in Alternative 5 would provide reliable means of evaluating groundwater and potential VI conditions within the RI Study Area.

Alternatives 2, 3 and 4A/B would meet RAOs over time, at completion of their respective remedies. Alternative 5 would meet RAOs at completion of construction, estimated at one construction season.

Each alternative offers long-term sustainability, though implementation of Alternative 5, specifically due to additional soil excavation, would result in nominally greater impacts to greenhouse gas emissions during construction than Alternatives 2, 3 and 4A/B. Long-term O&M requirements in Alternatives 2, 3 and 4A/B would result in minimal impact to the environment. Alternative 1 would result in no additional greenhouse gas emissions associated with long-term maintenance.

In summary, Alternatives 2, 3, 4A/B and 5 would provide long-term effectiveness and permanence, while Alternative 1 would not. Residual risks associated with Alternatives 2, 3 and 4A/B would be adequately and reliably addressed through institutional and engineering controls. Alternative 2, 3 and 4A/B would result in minimal long-term fuel/energy consumption, greenhouse gas emissions, and impacts to water, ecology, workers or the community associated with long-term maintenance of the remedies, while there would be no long-term maintenance associated with Alternative 5.

5.2.4 Reduction of Toxicity, Mobility or Volume through Treatment

There would be no reduction in toxicity, mobility, or volume in soil through treatment under Alternative 1, the no action alternative. Alternatives 2, 3 and 4A/B would result in reduction in toxicity, mobility and volume of Site-related contaminants through *in situ* treatment (Alternatives 2, 3 and 4A/B)and targeted excavation and off-Site disposal (Alternatives 2 and 3), however Alternative 3 would also promote biological degradation/natural attenuation in downgradient groundwater in the RI Study Area. Additional soil removal in Alternative 5 would result in a greater reduction in toxicity, mobility and volume of Site-related contaminants on-Site as compared to Alternatives 2, 3 and 4A/B.

5.2.5 Short-Term Effectiveness

Alternative 1 does not include additional physical measures in areas of contamination. Alternatives 2, 3, 4A/B and 5 would be constructed using proper protective equipment to manage potential risks to on-Site workers, and proper precautions and monitoring to be protective of the general public and the environment. Alternatives 2, 3 and 4A/B would meet RAOs over time, at completion of their respective remedies. Alternative 5 would meet RAOs upon completion of soil excavation activities, expected to be within one construction season.

Impacts to the community resulting from implementation of *in situ* treatment (Alternatives 2, 3 and 4A/B) and targeted soil removal and off-Site disposal (Alternatives 2 and 3) would be minimal. The implementation of the excavation and off-Site disposal included in Alternative 5 would result in greater impacts to the community, given the current commercial use of on- and off-site areas as it requires relocation of the on-Site business and demolition of the building. Impacts include increased traffic, as well as increased noise for the duration of construction.

As it relates to traffic, transportation of excavated materials and backfill in Alternative 5 is anticipated to result in approximately 1,200 truck trips to and from the Site as compared Alternatives 2 and 3 where the truck trips necessary for transportation of excavated materials would be minimal.

With respect to sustainability, there is an environmental footprint inherent in the implementation of Alternatives 2, 3, 4A/B and 5 as it relates to construction and operation as well as impacts to the community (as described above). The implementation of *in situ* treatment (Alternatives 2, 3 and 4A/B) and targeted soil removal and off-Site disposal (Alternatives 2 and 3) would result in direct emissions and fuel consumption; vapor phase treatment would mitigate emissions from the vapor extraction process. The implementation of excavation and off-Site disposal included in Alternative 5 would result in greater direct emissions and fuel

consumption. It is estimated that greenhouse gas emissions associated with construction and transportation needs would be *de minimis* for Alternatives 2, 3 and 4A/B, and would be approximately 230 metric tons of carbon dioxide equivalent (MtCO2e) for Alternative 5.

Green remediation techniques, as detailed in NYSDEC's *Green Remediation Program Policy - DER-31* (NYSDEC 2011) and the EPA Region 2's *Clean and Green Policy* (USEPA 2010), would be considered for each alternative to reduce short-term environmental impacts. Green remediation best practices such as the following may be considered:

- Use of renewable energy (*e.g.,* biofuels) and/or purchase of renewable energy credits to power energy needs during construction and/or O&M of the remedy
- Reduction in vehicle idling, including both on and off-road vehicles and construction equipment during construction and/or O&M of the remedy
- Beneficial reuse of material that would otherwise be considered a waste
- Use of Ultra Low Sulfur Diesel.

In summary, Alternatives 2, 3, 4A/B and 5 would provide short-term effectiveness. Worker and community risks during remedy implementation are similar for Alternatives 2, 3 and 4A/B, and greater for Alternative 5.

5.2.6 Implementability

Alternatives 1 through 5 are implementable. Alternatives 2, 3, 4A/B and 5 are constructible and operable; the materials necessary for the construction of these alternatives are reasonably available.

Excavation and disposal in Alternatives 2 and 3 would be readily constructible and reliable options requiring only conventional excavation and over-the-road hauling equipment; no proprietary equipment or specialists would be needed to implement. *In situ* amendments in Alternative 2 and 3 would require specialized products and well drilling services; however, subcontractors would be readily available to provide these products and services. Similarly, SVE and SVE-AS systems (Alternatives 4A/B) require specialized equipment and services, however, subcontractors would be readily available to provide these products and services.

Excavation proposed in Alternative 5 would require similar conventional over-the-road and excavation equipment as Alternatives 2 and 3 however, the scope of excavation and Site constraints complicate implementability due to the depth of excavation and challenges of working within a developed multi-use area. Full excavation, as proposed, would necessitate use of off-Site areas for support, soil staging, dewatering, water treatment, etc., as well as sheeting for excavation support of off-site areas. Additionally, Alternative 5 would require significant dewatering and water treatment, generally not required in Alternatives 2 and 3 Recovered water would require both pre-treatment and discharge to municipal facilities. Transportation considerations related to the implementation of Alternative 5 include; significantly increased traffic, fuel usage, and adverse effects on both air quality and community safety (based on the full demolition of the existing building, export of excavated material, import of clean fill and other materials), as compared to Alternatives 2 and 3.

Institutional controls and the SMP would be readily implementable to achieve effectiveness for Alternatives 2, 3 and 4A/B. Alternatives 2, 3 and 4A/B would require coordination with other agencies, including NYSDEC, New York State Department of Transportation (NYSDOT), New York State Department of Health (NYSDOH), the City of Schenectady, and Schenectady County, as well as property owners.

5.2.7 Cost

Detailed cost estimates have been developed for the purpose of comparison of alternatives and are included as **Tables 4-3 through 4-8**. The estimated costs associated with Alternatives 1 through 5 are summarized in **Table 4** as follows:

Table 4: Summary of Remedial Alternative Cost Estimates			
Alternative	Total estimated capital present worth cost	Total estimated present worth of O&M (30 years)	Total estimated net present worth cost
1 – No Further Action	$0	$0	$0
2 – *In situ* Chemical Treatment and Targeted Soil Removal	$1,254,000	$375,000	$1,629,000
3 - *In Situ* Biological Treatment and Targeted Soil Removal	$938,000	$375,000	$1,313,000
4A – SVE	$869,000	$450,000	$1,320,000
4B – SVE/Air Sparge	$950,000	$408,000	$1,358,000
5– Restoration to Pre-Disposal/Pre-Release Conditions	$5,109,000	$325,000	$5,434,000

5.2.8 Land Use

Alternatives 2 through 5 can be implemented consistent with current, intended and reasonably anticipated future use of the property, though implementation of Alternative 5 would be significantly disruptive to users of the property and neighboring residences. Alternative 1 does not provide the required level of long-term protectiveness for current and reasonably anticipated future use of the property.

6. CONCLUSIONS

Five remedial alternatives were developed and evaluated for the Site in this FFS Report. Specifically, this FFS Report documents the development of RAOs for the protection of human health and the environment to address contaminants identified in soil, groundwater and sub-slab soil vapor/indoor air, for the Site. Consistent with *DER-10* and the *NCP*, the five remedial alternatives developed to address these RAOs were subjected to a detailed evaluation based on required evaluation criteria and in sufficient detail such that risk management decision makers may select a remedy for the Site.

Alternative 1 would not satisfy the threshold criteria in the long-term, while Alternatives 2, 3, 4A/B and 5 would satisfy the threshold criteria by providing protection to human health and the environment, and by addressing the identified alternative-specific SCGs. Therefore, with the exception of Alternative 1, each alternative would be eligible for selection as the final remedy. The relative comparison based on the primary balancing criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; land use; and cost) concludes that Alternatives 2, 3 and 4A/B would be protective of human health and the environment through *in situ* treatment and targeted soil removal and implementation of institutional and engineering controls. Direct exposure to soil, groundwater and sub-slab soil vapor/indoor air is addressed through implementation of *in situ* treatment (Alternatives 2, 3 and 4A/B) and targeted soil removal and off-Site disposal (Alternatives 2 and 3). Monitoring and institutional controls in Alternatives 2, 3 and 4A/B would provide a means for monitoring effectiveness of the remedy, while restricting property usage. As described in **Section 5**, Alternatives 2, 3 and 4B would actively address groundwater in portions of the Site. Alternative 3 would also be expected to promote biological degradation/natural attenuation in downgradient groundwater in the RI Study Area. Alternative 5 would provide added protectiveness compared to the other alternatives given the additional building demolition and soil excavation to meet more stringent SCOs and allow unrestricted future site use. However the alternative is the most costly.

As part of the remedial decision-making process and following review of the evaluations documented in this FFS Report, NYSDEC will identify an alternative to propose as the preferred remedy to be documented in a Proposed Plan for the Site. Following receipt of public comments on the Proposed Plan, the selected remedial alternative will be documented in a Record of Decision (ROD) for the Site.

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Tables

TABLE 4-1. POTENTIAL STANDARDS, CRITERIA, AND GUIDANCE

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
Potential Chemical-Specific SCGs				
Soil	6 NYCRR Part 375-6 Remedial Program Soil Cleanup Objectives (SCOs)	Promulgated state regulation that provides SCOs for various restricted property uses (industrial, commercial, restricted residential, and residential), for the protection of groundwater and ecological resources, and for unrestricted property use. A site designated for unrestricted use is a site subject to no imposed institutional or engineering controls, such as an environmental easement or deed restriction. [Division of Environmental Remediation (DER)-10 (NYSDEC 2010)].	SCOs for restricted use (residential, commercial) are potentially applicable to site soil/fill material given the current and reasonably anticipated future land to include both residential occupancy and commercial use. SCOs for the protection of groundwater may be applicable. SCOs for unrestricted use may not be applicable given the current and reasonably anticipated future land use of the Site; however, were considered for the purpose of evaluating pre-disposal conditions.	Yes
	NYSDEC CP-51 Soil Cleanup Guidance	Guidance that provides framework and procedures for the selection of soil cleanup levels appropriate for each of the remedial programs in the NYSDEC DER.	SCOs for restricted use (residential, commercial) are potentially applicable to site soil/fill material given the current and reasonably anticipated future land to include both residential occupancy and commercial use. SCOs for the protection of groundwater may be applicable. SCOs for unrestricted use may not be applicable given the current and reasonably anticipated future land use of the Site; however, were considered for the purpose of evaluating pre-disposal conditions.	Yes
Groundwater	6 NYCRR Part 703 – Class GA groundwater quality standards	Promulgated water quality standards for fresh groundwater, including narrative and constituent-specific standards.	Potentially applicable for groundwater on-Site and within the RI Study Area.	Yes
	NYS TOGS 1.1.1 – Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations	Guidance that summarizes groundwater standards and guidance values.	Potentially applicable for groundwater on-Site and within the RI Study Area.	Yes
Air/Sub-slab Vapor	NYSDOH's October 2006 Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York and May 2017 Updates to Soil Vapor/ Indoor Air Decision Matrices	Guidance document that provides thresholds for indoor air and sub-slab soil vapor above which vapor mitigation is required.	Potentially applicable, occupied commercial buildings present on-Site and at adjacent off-Site locations and residential buildings present within the RI Study Area.	Yes
	OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, OSWER Publication 9200.2-154, June 2015	Technical guidance that provides recommendations on assessment of vapor intrusion pathways that pose an unacceptable risk to human health.	Potentially applicable, occupied commercial buildings present on-Site and at adjacent off-Site locations and residential buildings present within the RI Study Area.	Yes
Potential Location-Specific SCGs				
Water Bodies	33 CFR 320 - 330 - Navigation and Navigable Waters	Regulatory policies and permit requirements for work affecting waters of the United States and navigable waterways.	Not applicable.	No
	16 USC 661 - Fish and Wildlife Coordination Act	Requires protection of fish and wildlife in a stream or other water body when performing activities that modify a stream or river.		
Wetlands	6 NYCRR 663 - Freshwater wetland permit requirements	Actions occurring in a designated freshwater wetland (within 100 feet) must be approved by NYSDEC or its designee. Activities occurring adjacent to freshwater wetlands must: be compatible with preservation, protection, and conservation of wetlands and benefits; result in no more than insubstantial degradation to or loss of any part of the wetland; and be compatible with public health and welfare.	Not applicable. The Site is not within 100 feet of a designated freshwater wetland.	No
	Clean Water Act Section 404 33 CFR Parts 320 - 330	Regulatory policies and permit requirements for work affecting waters of the United States, including wetlands.	Not applicable. There are no delineated wetlands on-Site.	No
	Clean Water Act Section 404 40 CFR Parts 230-231	Provides for restoration and maintenance of integrity of waters of the United States, including wetlands, through the control of dredged or fill material discharge.		

TABLE 4-1. POTENTIAL STANDARDS, CRITERIA, AND GUIDANCE

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
	Executive Order 11990 - Protection of Wetlands	Executive order requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or loss of wetlands if a practical alternative exists.		
Wetlands & Floodplains	Policy on Floodplains and Wetland Assessments for CERCLA Actions (OSWER Directive 9280.0-2; 1985)	Policy and guidance requiring Superfund actions to meet substantive requirements of Executive Orders 11988 and 11990. Describes requirements for floodplain assessment during remedial action planning.	Not applicable. There are no delineated wetlands on-Site and the Site is not within a 100-year floodplain.	No
	40 CFR Part 6, Appendix A - Statement of Procedures on Floodplains Management and Wetlands Protection (January 5, 1979, https://www.epa.gov/nepa/floodplain-management-and-wetland-guidance-national-environmental-policy-act-reviews)	Policy and guidance for implementing Executive Orders 11988 and 11990. Requires federal agencies to evaluate the potential effects of action proposed in wetlands and floodplains to avoid, to the extent possible, adverse effects. Federal agencies are required to evaluate alternatives to actions in wetlands or floodplains and to avoid or minimize adverse impacts if not practical alternatives exist.		
Floodplains	6 NYCRR 373-2.2 - Location standards for hazardous waste treatment, storage, and disposal facilities -100-yr floodplain	Hazardous waste treatment, storage, or disposal facilities located in a 100-yr floodplain must be designed, constructed, operated and maintained to prevent washout of hazardous waste during a 100-year flood.	Not applicable. The Site is not within the 100-year floodplain.	No
	40 CFR Part 264.18(b) - Location Standards - Floodplains	Hazardous waste treatment, storage, or disposal facilities located in a 100-yr floodplain must be designed, constructed, operated and maintained to prevent washout of hazardous waste during a 100-year flood.		
	Executive Order 11988 - Floodplain Management	USEPA is required to conduct activities to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupation or modification of floodplains. The procedures also require USEPA to avoid direct or indirect support of floodplain development wherever there are practicable alternatives and minimize potential harm to floodplains when there are no practicable alternatives.		
	Executive Order 13690 - Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input	Executive order establishes a Federal Flood Risk Management Standard (FFRMS), a Process for Further Soliciting and Considering Stakeholder Input, and amends Executive Order 11988. The FFRMS establishes a construction standard and framework for Federally funded projects constructed in, and affecting, floodplains, to reduce the risks and cost of floods. Under the FFRMS, federal agency management is expanded from the current base flood level to a higher vertical elevation and corresponding horizontal floodplain to address current and future flood risk to increase resiliency of projects funded with federal funds. The Executive Order also sets forth a process for solicitation and consideration of public input, prior to implementation of the FFRMS.		
	6 NYCRR 500 - Floodplain Management Regulations Development Permits	Promulgated state regulations providing permit requirements for development in areas of special flood hazard (floodplain within a community subject to a one percent or greater chance of flooding in any given year).		
Within 61 meters (200 feet) of a fault displaced in Holocene time	40 CFR Part 264.18(a) - Location Standards - Seismic considerations	New treatment, storage, or disposal of hazardous waste is not allowed.	Not applicable. Site is not located within 200 feet of a fault displaced in Holocene time, as listed in 40 CFR 264 Appendix VI. None listed in New York State.	No

TABLE 4-1. POTENTIAL STANDARDS, CRITERIA, AND GUIDANCE

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
Within salt dome or bed formation, underground mine, or cave	40 CFR Part 264.18 (c) - Location standards; salt dome formations, salt bed formations, underground mines and caves.	Placement of non-containerized or bulk liquid hazardous waste is not allowed.	Not applicable. No salt dome formations, salt bed formations, underground mines, or caves present at Site.	No
Habitat of an endangered or threatened species	6 NYCRR 182	Promulgated state regulation that provides requirements to minimize damage to habitat of an endangered species.	Not applicable. No endangered or threatened wildlife species, rare plants, or significant habitats were identified at the Site.	No
	Endangered Species Act	Provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction.		
	50 CFR Part 17 - Endangered and Threatened Wildlife and Plants and 50 CFR Part 402 - Interagency Cooperation	Promulgated federal regulation that requires that federal agencies ensure authorized, funded, or executed actions will not destroy or have adverse modification of critical habitat.		
Historical property or district	National Historic Preservation Act 36 CFR 800- Preservation of Historic Properties Owned by a Federal Agency	Remedial actions are required to account for the effects of remedial activities on any historic properties included on or eligible for inclusion on the National Register of Historic Places.	Not applicable. Site not owned by a Federal Agency.	No
	National Historic Preservation Act 36 CFR Part 65 - National Historic Landmarks Program	Promulgated federal regulation requiring that actions must be taken to preserve and recover historical/archeological artifacts found.	Potentially applicable. Historic, architectural, archeological and/or cultural resources present at or near the Site would be evaluated, as necessary, during the design phase.	Yes
	New York State Historic Preservation Act of 1980 9 NYCRR Parts 426 - 428	State law and regulations requiring the protection of historic, architectural, archeological, and cultural property.		
Wildlife refuge	National Wildlife Refuge System Administration Act 50 CFR Part 27 – Prohibited Acts	Provides for protection of areas designated as part of National Wildlife Refuge System.	Not applicable. Site not located in wildlife refuge.	No
Wilderness area	Wilderness Act 50 CFR Part 35 - Wilderness Preservation and Management	Provides for protection of federally-owned designated wilderness areas.	Not applicable. Site not located in wilderness area.	No
Wild, scenic, or recreational river	Wild and Scenic Rivers Act	Provides for protection of areas specified as wild, scenic, or recreational.	Not applicable. Site not located near wild, scenic, or recreational river.	No
Coastal zone	Coastal Zone Management Act	Requires activities be conducted consistent with approved State management programs.	Not applicable. Site not located in coastal zone.	No
Coastal barrier	Coastal Barrier Resources Act	Prohibits any new Federal expenditure within the Coastal Barrier Resource System.	Not applicable. Site not located in coastal barrier system or coastal zone.	No
Protection of waters	33 U.S.C. 1341 – Clean Water Act Section 401, State Water Quality Certification Program	States have the authority to veto or place conditions on federally permitted activities that may result in water pollution.	Potentially applicable to Site.	No

Potential Action-Specific SCGs				
Institutional controls	NYSDEC DER-33 Institutional Controls: A Guide to Drafting and Recording Institutional Controls, December 2010	Technical guidance document that provides guidelines for proper development and recording of institutional controls as part of a site remedial program.	Potentially applicable when institutional controls are implemented as a component of the selected remedy.	Yes
Cover systems	NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, May 2010	Technical guidance document that provides guidelines for cover thicknesses as they relate to property use in areas where exposed surface soil exceeds NYCRR Part 375 SCOs. Specifically, where the exposed surface soil at the site exceeds the applicable soil cleanup objective for protection of human health and/or ecological resources, the soil cover for restricted residential use, is to be two feet; for commercial or industrial use, is to be one foot; or when an ecological resource has been identified is to be a minimum of two feet; and when such a concern is identified by NYSDEC, consideration should be given to supplementing the demarcation layer to serve as an impediment to burrowing.	Potentially applicable for cover components of alternatives.	Yes
Landfill	40 CFR Part 257 – Criteria for Classification of Solid Waste Disposal Facilities and Practices	Promulgated federal regulation that provides criteria for solid waste disposal facilities to protect health and the environment.	Landfilling of wastes may be applicable for the Site.	Yes
	40 CFR Parts 264 and 265, Subpart N – Landfills	Promulgated federal regulation that provides requirements for hazardous waste landfill units.		
Generation and management of solid waste	6 NYCRR 360 - Solid Waste Management Facilities	Promulgated state regulation that provides requirements for management of solid wastes, including disposal and closure of disposal facilities.	Potentially applicable to alternatives including disposal of residuals generated by treatment processes.	Yes
Land disposal	6 NYCRR 376 - Land Disposal Restrictions	Promulgated federal and state regulations that provide treatment standards to be met prior to land disposal of hazardous wastes.	Potentially applicable to residuals generated by treatment process if found to be hazardous wastes and disposed at a landfill. Applicable for off-site treatment and disposal of soil/fill material.	Yes
	40 CFR Part 268 - Land Disposal Restrictions			
	62 CFR 25997 - Phase IV Supplemental Proposal on Land Disposal of Mineral Processing Wastes			
Green remediation	NYSDEC DER-31 Green Remediation Program Policy, January 2011	State and federal technical guidance documents that provide guidelines for the development of site remediation strategies in a manner that minimizes environmental impacts and applies green remediation concepts (e.*g.*, reduction in greenhouse gas emissions, energy consumption and resource use, promotion of recycling of materials and conservations of water, land and habitat).	Potentially applicable.	Yes
	Superfund Green Remediation Strategy, September 2010			
General excavation	6 NYCRR 200-203, 211-212 - Prevention and Control of Air Contamination and Air Pollution	Provides requirements for air emission sources.	Portions potentially applicable to volatile emissions during excavation.	Yes
	6 NYCRR 257 - Air Quality Standards	Promulgated state regulation that provides specific limits on generation of SO_2, particulates, CO_2, photochemical oxidants, hydrocarbons (non-methane), NO_2, fluorides, beryllium and H_2S from point sources.	Not applicable. Dust emissions would not be generated from a point source.	No
	40 CFR Part 50.1 - 50.12 - National Ambient Air Quality Standards	Promulgated federal regulation that provides air quality standards for pollutants considered harmful to public health and the environment. The six principle pollutants are carbon monoxide, lead, nitrogen dioxide, particulates, ozone, and sulfur oxides.	Potentially applicable to alternatives during which dust generation may result, such as during earth moving, grading, and excavation.	Yes
	NYS TAGM 4031 - Dust Suppressing and Particle Monitoring at Inactive Hazardous Waste Disposal Sites	State guidance document that provides limitations on dust emissions.		

Construction	29 CFR Part 1910.120 - Occupational Safety and Health Standards - Hazardous Waste Operations and Emergency Response	Promulgated federal regulation requiring that remedial activities must be in accordance with applicable OSHA requirements.	Potentially applicable for construction activities.	Yes
	29 CFR Part 1926 - Safety and Health Regulations for Construction	Promulgated federal regulation requiring that remedial construction activities must be in accordance with applicable OSHA requirements.	Potentially applicable for construction activities.	Yes
Injection to groundwater	40 CFR 144 – Underground Injection Control (UIC) Program	Permit not required for Class V wells, which are approved by rule under federal UIC program. Substantial compliance with Class V permit requirements must be demonstrated.	Potentially applicable. Injection of *in situ* treatment amendments included as part of alternatives.	Yes
Discharge to publicly owned treatment works (POTW)	Clean Water Act Pretreatment Regulations (40 CFR Part 403)	Pretreatment requirements for discharges to POTWs.	Potentially applicable for construction water discharged to POTW.	Yes
Construction storm water management	NYSDEC General permit for storm water discharges associated with construction activities. Pursuant to Article 17 Titles 7 and 8 and Article 70 of the Environmental Conservation Law.	The regulation prohibits discharge of materials other than storm water and all discharges that contain a hazardous substance in excess of reportable quantities established by 40 CFR 117.3 or 40 CFR 302.4, unless a separate NPDES permit has been issued to regulate those discharges. A permit must be acquired if activities involve disturbance of 5 acres or more. If the project is covered under the general permit, the following are required: development and implementation of a storm water pollution prevention plan; development and implementation of a monitoring program; all records must be retained for a period of at least 3 years after construction is complete.	Not applicable. Construction would not result in clearing/disturbance of more than 5 acres.	No
Transportation	6 NYCRR 364 - Waste Transporter Permits	Promulgated state regulation requiring that hazardous waste transport must be conducted by a hauler permitted under 6 NYCRR 364.	Potentially applicable for off-site transport of hazardous waste to off-site treatment/disposal facilities.	Yes
	49 CFR 107, 171-174 and 177-179 - Department of Transportation Regulations	Promulgated federal regulation requiring that hazardous waste transport to off-site disposal facilities must be conducted in accordance with applicable Department of Transportation requirements	Potentially applicable for off-site transport of hazardous waste to off-site treatment/disposal facilities.	Yes

Notes:

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
CFR – Code of Federal Regulations
DER – Division of Environmental Remediation
FFRMS – Federal Flood Risk Management Standard
NYCRR – New York Code of Rules and Regulations
NYS – New York State
NYSDEC – New York State Department of Environmental Conservation
OSWER – Office of Solid Waste and Emergency Response
SCOs – Soil Cleanup Objectives
SCGs – Standards, Criteria, and Guidance
TAGM – Technical and Administrative Guidance Memorandum (NYSDEC)
TOGS – Technical and Operational Guidance Series
USC – United States Code
USEPA or EPA – United States Environmental Protection Agency
VI – Vapor Intrusion
Shaded cells - not identified as Potential SCGs

TABLE 4-2. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Further Action	Alternative 2 *In Situ* Chemical Treatment and Targeted Soil Removal	Alternative 3 *In Situ* Biological Treatment and Targeted Soil Removal	Alternative 4A/B Soil Vapor Extraction (without/with Air Sparging)	Alternative 5 Restoration to Pre-Disposal/Pre-Release Conditions
	• No Further Action	• Institutional Controls (ICs), Site Management Plan (SMP) and periodic Site reviews • Engineering Controls (ECs), continued operation of vapor intrusion (VI) mitigation systems (on-Site and adjacent off-Site Residential building) and cover systems • *In situ* chemical oxidation (ISCO) in source area and on-Site downgradient plume • Targeted soil excavation/amendment addition • Off-Site disposal • Continued VI investigation/monitoring and groundwater monitoring in Remedial Investigation (RI) Study Area • Site restoration	• ICs, SMP and periodic Site reviews • ECs, continued operation of VI mitigation systems (on-Site and adjacent off-Site Residential building) and cover systems • Enhanced *in situ* bioremediation (EISB) in source area and on-Site downgradient plume • Targeted soil excavation/amendment addition • Off-Site disposal • Continued VI investigation/monitoring and groundwater monitoring in RI Study Area • Site restoration	• ICs, SMP and periodic Site reviews • ECs, operation of VI mitigation systems (on-Site and adjacent off-Site Residential building) and cover systems • Soil Vapor Extraction (SVE; 4A) or SVE with Air Sparging (SVE-AS; 4B) in source area; including replacement/integration of existing VI System. • Site restoration	• SMP and periodic Site reviews • Full building demolition • Soil excavation • Off-Site disposal • Continued VI investigation/monitoring and groundwater monitoring in RI Study Area Site restoration
Overall Protection of Human Health and the Environment					
Overall protection of human health	Not protective of human health other than existing covers, VI mitigation systems and public water supply. The Site buildings and paved areas act as a physical cap and limit exposure to contaminants in soil beneath the buildings and paved areas. Protection of health relative to soil vapor exposures would be provided through VI mitigation systems, that were installed as Interim Remedial Measures (IRMs). Protection of human health from risks associated with ingestion of groundwater exceeding SCGs is provided through public water supply connections for the Site and surrounding properties. Alternative would not provide for mitigation of potentially unacceptable risks to human health associated with exposure to contaminated soil, groundwater and sub-slab soil vapor/indoor air. Alternative would not provide a means of limiting site use, restricting groundwater use, or monitoring constituent concentrations and the progress of natural attenuation.	Protection of human health would be provided. The Site buildings and paved areas act as a physical cap and limit exposure to contaminants in soil beneath the buildings and paved areas. Additional protection of human health would be afforded through targeted excavation of soil. Protection of health relative to soil vapor exposures would be provided through VI mitigation systems, that were installed as IRMs. Protection of human health from risks associated with ingestion of groundwater exceeding SCGs is provided through public water supply connections for the Site and surrounding properties. Additional protection of human health to risks associated with VI would be provided through active treatment of groundwater on-Site via *in situ* chemical oxidation (ISCO). Groundwater use restrictions would minimize potentially unacceptable risks to human health associated with groundwater exceeding Class GA standards. Access/excavation restrictions, Site Management Plan (SMP) and periodic Site reviews would limit Site use and minimize potentially unacceptable risks to human health associated with impacted soil and groundwater remaining on-Site. Continued and effective operation and maintenance of VI mitigation systems, groundwater use restrictions and maintenance of covers, provided for in ICs, would provide added protection of human health.	Protection of human health would be provided. The Site buildings and paved areas act as a physical cap and limit exposure to contaminants in soil beneath the buildings and paved areas. Additional protection of human health would be afforded through targeted excavation of soil. Protection of health relative to soil vapor exposures would be provided through VI mitigation systems, that were installed as IRMs. Protection of human health from risks associated with ingestion of groundwater exceeding SCGs is provided through public water supply connections for the Site and surrounding properties. Additional protection of human health to risks associated with VI would be provided through active treatment of groundwater on-Site via enhanced *in situ* bioremediation (EISB). Access/excavation restrictions, SMP, and periodic Site reviews would limit Site use and minimize potentially unacceptable risks to human health associated with impacted soil and groundwater remaining on-Site. Continued and effective operation and maintenance of VI mitigation systems, groundwater use restrictions and maintenance of covers, provided for in ICs, would provide added protection of human health.	Protection of human health would be provided. The Site buildings and paved areas act as a physical cap and limit exposure to contaminants in soil beneath the buildings and paved areas. Protection of health relative to soil vapor exposures would be provided through VI mitigation systems. Protection of human health from risks associated with ingestion of groundwater exceeding SCGs is provided through public water supply connections for the Site and surrounding properties. Additional protection of human health to risks associated with VI would be provided by active soil vapor collection by SVE, and/or soil and groundwater treatment by SVE-AS. Groundwater use restrictions would minimize potentially unacceptable risks to human health associated with groundwater exceeding Class GA standards. Access/excavation restrictions, Site Management Plan (SMP) and periodic Site reviews would limit Site use and minimize potentially unacceptable risks to human health associated with impacted soil and groundwater remaining on-Site. Continued and effective operation and maintenance of VI mitigation systems, groundwater use restrictions and maintenance of covers, provided for in ICs, would provide added protection of human health.	Protection of human health would be provided. Full building demolition and removal of soil would address potentially unacceptable risks to human health associated with exposure to contaminated soil, groundwater and sub-slab soil vapor/indoor air.
Overall protection of the environment	Relies on natural attenuation to address off-Site migration of groundwater contamination, to attain groundwater SCGs, and to mitigate sources of soil and groundwater contamination. Existing Site buildings and pavement provides source area cover, reducing infiltration, and thereby reducing contaminant migration. However, maintenance of these ECs is not included in this Alternative.	Protective for the environment. Existing Site buildings and pavement provides source area cover, reducing infiltration, and thereby reducing contaminant migration. Targeted excavation of soil provides additional protection of the environment through removal of contaminants in soil. Mitigation of groundwater/saturated soil contamination is provided through active treatment of groundwater on-Site via ISCO (source area/downgradient treatment zone injections). Groundwater, VI and soil vapor monitoring in the RI Study Area included in this alternative provides a means for confirming that contaminant migration, in groundwater and to other media, does not result in either an expanded magnitude and/or extent beyond current conditions. Periodic Site reviews would provide for evaluation of continued protectiveness of the environment.	Protective for the environment. Existing Site buildings and pavement provides source area cover, reducing infiltration, and thereby reducing contaminant migration. Targeted excavation of soil provides additional protection of the environment through removal of contaminants in soil. Mitigation of groundwater/saturated soil contamination is provided through active treatment of groundwater on-Site via EISB (source area/downgradient treatment zone injections). Groundwater, VI and soil vapor monitoring in the RI Study Area included in this alternative provides a means for confirming that contaminant migration, in groundwater and to other media, does not result in either an expanded magnitude and/or extent beyond current conditions.	Protective for the environment. Existing Site buildings and pavement provides source area cover, reducing infiltration, and thereby reducing contaminant migration. *In situ* treatment via SVE of unsaturated soil provides additional protection of the environment through removal of contaminants in unsaturated soil. Mitigation of groundwater/saturated soil contamination is provided through active treatment of SVE-AS. Groundwater, VI and soil vapor monitoring in the RI Study Area included in this alternative provides a means for confirming that contaminant migration, in groundwater and to other media, does not result in either an expanded magnitude and/or extent beyond current conditions. Periodic Site reviews would provide for evaluation of continued protectiveness of the environment.	Protection of the environment would be provided. Full building demolition and removal of soil would address potentially unacceptable risks to the environment associated with sources of soil and groundwater contamination. Groundwater, VI and soil vapor monitoring in the RI Study Area included in this alternative provides a means for confirming that contaminant migration, in groundwater and to other media, does not result in either an expanded magnitude and/or extent beyond current conditions.

TABLE 4-2. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Further Action	Alternative 2 *In Situ* Chemical Treatment and Targeted Soil Removal	Alternative 3 *In Situ* Biological Treatment and Targeted Soil Removal	Alternative 4A/B Soil Vapor Extraction (without/with Air Sparging)	Alternative 5 Restoration to Pre-Disposal/Pre-Release Conditions
			Periodic Site reviews would provide for evaluation of continued protectiveness of the environment.		
Attainment of Remedial Action Objectives (RAOs)	Alternative 1 would not address RAOs for the protection of environmental and human health. (While VI mitigation systems, covers and public water supply exist, they are not required to be maintained under this alternative.)	Alternative 2 would address RAOs for the protection of human health and the environment through removal of targeted areas of soil, *in situ* treatment via ISCO on-Site, continued operation of VI mitigation systems, continued VI investigation/monitoring and groundwater monitoring in Remedial Investigation (RI) Study Area, and through IC/ECs (including maintenance of existing covers and public water supply), SMP, and periodic Site reviews.	Alternative 3 would address RAOs for the protection of human health and the environment through removal of targeted areas of soil, *in situ* treatment via EISB on-Site, continued operation of VI mitigation systems, continued VI investigation/monitoring and groundwater monitoring in RI Study Area and through IC/ECs (including maintenance of existing covers and public water supply, SMP, and periodic Site reviews.	Alternative 4 would address RAOs for the protection of human health and the environment through *in situ* treatment via SVE/SVE-AS on-Site, continued operation of VI mitigation systems, and groundwater monitoring in RI Study Area, and through IC/ECs (including maintenance of existing covers and public water supply), SMP, and periodic Site reviews.	Alternative 5 would address RAOs for the protection of human health and protection of the environment through removal of on-Site source area soil.
Compliance with SCGs					
Compliance with chemical-specific SCGs	Alternative 1 does not actively address chemical-specific SCGs, other than through existing covers and VI mitigation systems.	Removal of targeted areas of soil that exhibit exceedances of Residential Use SCOs, in situ treatment via ISCO on-Site, continued operation of VI mitigation systems, continued VI investigation/monitoring and groundwater monitoring in RI Study Area, IC/ECs, SMP, and periodic Site reviews would address soil, groundwater and sub-slab soil vapor/indoor air SCGs.	Removal of targeted areas of soil that exhibit exceedances of Residential Use SCOs, in situ treatment via EISB on-Site, continued operation of VI mitigation systems, continued VI investigation/monitoring and groundwater monitoring in RI Study Area, IC/ECs, SMP, and periodic Site reviews would address soil, groundwater and sub-slab soil vapor/indoor air SCGs.	*In situ* treatment via SVE/SVE-AS on-Site, continued operation of VI mitigation systems, and groundwater monitoring in RI Study Area, IC/ECs, SMP, and periodic Site reviews would address soil, groundwater and sub-slab soil vapor/indoor air SCGs.	Removal of soil that exhibit exceedances of Unrestricted Use SCOs, including the demolition of the existing building, and continued VI investigation/monitoring and groundwater monitoring in RI Study Area would address soil, groundwater and sub-slab soil vapor/indoor air SCGs.
Compliance with location-specific SCGs	No location-specific SCGs triggered for this alternative.	Proposed actions would be conducted in a manner consistent with Federal and State requirements for cultural, archeological, and historical resources.	Proposed actions would be conducted in a manner consistent with Federal and State requirements for cultural, archeological, and historical resources.	Proposed actions would be conducted in a manner consistent with Federal and State requirements for cultural, archeological, and historical resources.	Proposed actions would be conducted in a manner consistent with Federal and State requirements for cultural, archeological, and historical resources.
Compliance with action-specific SCGs	No action-specific SCGs triggered for this alternative.	Excavated soil would be managed in accordance with applicable Federal and State regulations. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed and permitted haulers. Management, transportation, and disposal of waste generated during site remediation activities would be in accordance with applicable State and Federal requirements. Construction activities, system operation and monitoring would be performed in accordance with OSHA requirements. Injections would be performed in accordance with Federal underground injection control regulations. Institutional controls would be implemented in accordance with NYSDEC DER-33.	Excavated soil would be managed in accordance with applicable Federal and State regulations. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed and permitted haulers. Management, transportation, and disposal of waste generated during site remediation activities would be in accordance with applicable State and Federal requirements. Construction activities, system operation and monitoring would be performed in accordance with OSHA requirements. Injections would be performed in accordance with Federal underground injection control regulations. Institutional controls would be implemented in accordance with NYSDEC DER-33.	Management, transportation, and disposal of waste generated during site remediation activities would be in accordance with applicable State and Federal requirements. Construction activities, system operation and monitoring would be performed in accordance with OSHA requirements. Discharge of soil vapor, with treatment as necessary, would be implemented in accordance with 6 NYCRR 200-203, 211-212.	Excavated soil would be managed in accordance with applicable Federal and State regulations. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed and permitted haulers. Management, transportation, and disposal of waste generated during site remediation activities would be in accordance with applicable State and Federal requirements. Demolition/excavation activities and monitoring would be performed in accordance with OSHA requirements
Long-Term Effectiveness and Permanence					
Magnitude of residual risk	Risks associated with soil, groundwater and sub-slab soil vapor/indoor air exceeding chemical-specific SCGs would remain unchanged.	Targeted soil excavation and *in situ* treatment via ISCO would minimize residual risk and contaminant migration in shallow and deep groundwater from the source area. IC/ECs would address exposures.	Targeted soil excavation and *in situ* treatment via EISB would minimize residual risk and contaminant migration in shallow and deep groundwater from the source area, and would further reduce residual risk by enhancing and facilitating biodegradation/natural attenuation in downgradient shallow and deep groundwater in the RI Study Area. IC/ECs would address exposures.	*In situ* treatment via SVE/SVE-AS would minimize residual risk and contaminant migration in shallow and deep groundwater from the source area. IC/ECs would address exposures.	Minimal residual risk.
Adequacy and reliability of controls	The on-Site buildings are an adequate means of controlling direct contact with soil within the building footprint. The paved areas would also provide an adequate means of controlling direct contact with the soil in this area. A public water supply is an adequate	IC/ECs included in Alternative 2, including continued operation and maintenance of the existing VI mitigation systems, are adequate and reliable means of managing exposures to soil, groundwater and sub-slab soil vapor/indoor air. The maintenance of asphalt capped areas provides reliable means of controlling exposures to	IC/ECs included in Alternative 3, including continued operation and maintenance of the existing VI mitigation systems, are adequate and reliable means of managing exposures to soil, groundwater and sub-slab soil vapor/indoor air. The asphalt capped areas provide means of controlling exposures to	IC/ECs included in Alternative 4, including continued operation and maintenance of a VI mitigation system, are adequate and reliable means of managing exposures to soil, groundwater and sub-slab soil vapor/indoor air. The maintenance of asphalt capped areas provides reliable means of controlling exposures to contaminated surface	Alternative 5 provides a high degree of adequacy and reliability, afforded by expansive soil removal. Monitoring and periodic reviews included in Alternative 5 would provide reliable means of evaluating groundwater conditions within the RI Study Area.

TABLE 4-2. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Further Action	Alternative 2 *In Situ* Chemical Treatment and Targeted Soil Removal	Alternative 3 *In Situ* Biological Treatment and Targeted Soil Removal	Alternative 4A/B Soil Vapor Extraction (without/with Air Sparging)	Alternative 5 Restoration to Pre-Disposal/Pre-Release Conditions
	and reliable means of controlling exposures to groundwater (as a potable water source). No future controls are included in this alternative related to VI in on-Site buildings. No provisions are included under Alternative 1 for maintenance of surfaces or restriction of damage/penetration of covers or restriction of groundwater use.	contaminated surface soil. Active groundwater treatment is an adequate and reliable means of minimizing horizontal and vertical migration, and destroying contaminant mass. Removal is an adequate and reliable means of addressing contaminated soil. Continued VI investigation/monitoring and groundwater monitoring in RI Study Area, SMP, and periodic Site reviews included in Alternative 2 would provide reliable means of protecting covers and evaluating groundwater and soil vapor conditions within the RI Study Area.	contaminated surface soil. Active groundwater treatment is an adequate and reliable means of minimizing horizontal and vertical migration, and destroying contaminant mass. Removal is an adequate and reliable means of addressing contaminated soil. Continued VI investigation/monitoring and groundwater monitoring in RI Study Area, SMP, and periodic Site reviews included in Alternative 2 would provide reliable means of protecting covers and evaluating groundwater and soil vapor conditions within the RI Study Area.	soil. SVE/SVE-AS is an adequate and reliable means of collecting and removing soil vapors/contaminant mass. Continued VI investigation/monitoring and groundwater monitoring in RI Study Area, SMP, and periodic Site reviews included in Alternative 4 would provide reliable means of protecting covers and evaluating groundwater and soil vapor conditions within the RI Study Area.	
Long-term sustainability	No maintenance of long-term activities is proposed under this alternative.	Minimal fuel/energy use and greenhouse gas emissions associated with long-term maintenance.	Minimal fuel/energy use and greenhouse gas emissions associated with long-term maintenance.	Minimal fuel/energy use and greenhouse gas emissions associated with long-term maintenance.	Minimal long-term maintenance activities are proposed under this alternative.
Reduction of Toxicity, Mobility, or Volume Through Treatment					
Treatment process used and materials treated	While VI mitigation systems exist, they are not required to be maintained under this alternative. No other active treatment components.	ISCO treatment of Site contaminants in groundwater.	Enhanced *in situ* biological treatment of Site contaminants in groundwater, with likely positive impact to downgradient groundwater due to amendment drift.	Active treatment of recovered soil vapor may require treatment prior to discharge.	No active treatment components.
Amount of hazardous material destroyed or treated	While VI mitigation systems exist, they are not required to be maintained under this alternative. No other hazardous material destroyed or treated.	ISCO to reduce contaminants in groundwater in both source area and in area of downgradient barrier injections.	EISB to reduce contaminants in groundwater in both source area and in area of downgradient barrier injections. It would also be expected to facilitate biodegradation in groundwater within the RI Study Area through amendment drift.	SVE would reduce contaminants in unsaturated soils in the implemented areas below the building. SVE-AS would extend treatment to saturated soils.	Approximately 9,200 cy of soil would be removed from the site.
Degree of expected reduction in toxicity, mobility, or volume	While VI mitigation systems exist, they are not required to be maintained under this alternative. Other than through natural attenuation, no reduction in toxicity, mobility, or volume anticipated.	ISCO would reduce toxicity, mobility and volume of contaminants in groundwater in both source area and in area of downgradient treatment zone injections. Targeted soil removal would also reduce toxicity, mobility and volume of contaminants.	EISB would reduce toxicity, mobility and volume of contaminants in groundwater in both source area and in area of downgradient treatment zone injections. It would also be expected to facilitate biodegradation in groundwater within the RI Study Area through amendment drift. Targeted soil removal would also reduce toxicity, mobility and volume of contaminants.	SVE/SVE-AS would reduce toxicity, mobility and volume of contaminants in groundwater in source area and also reduce toxicity, mobility and volume of contaminants.	Toxicity, mobility, and volume of soil would be reduced through removal.
Degree to which treatment is irreversible	While VI mitigation systems exist, they are not required to be maintained under this alternative. Other than through natural attenuation processes, no treatment would be performed.	Both excavation and ISCO are irreversible.	Both excavation and EISB are irreversible.	Mass removal by SVE/SVE-AS is irreversible.	Demolition and excavation are considered irreversible.
Type and quantity of residuals remaining after treatment	None.	None.	None.	None.	None
Short-Term Effectiveness					
Protection of community during remedial actions	While VI mitigation systems exist, they are not required to be maintained under this alternative. No other active treatment components.	Minimal community impacts expected from ISCO. Monitoring would not affect community. Potential on-Site (and adjacent off-Site Residential building) VI exposure to by-product constituents (i.e. generated during oxidation process) would be addressed by VI mitigation systems.	Minimal community impacts expected from EISB. Monitoring would not affect community. Potential on-Site (and adjacent off-Site Residential building) VI exposure to intermediate constituents (*i.e.* generated during biodegradation process) would be addressed by VI mitigation systems.	Minimal community impacts expected from SVE/SVE-AS. Monitoring would not affect community. Potential on-Site (and adjacent off-Site Residential building) VI exposure to by-product constituents (*i.e.* generated during oxidation process) would be addressed by VI mitigation systems.	Dust and volatile emissions, if any, would be controlled during construction activities. Building demolition, excavation of soil, and off-Site disposal would result in significant impacts to the community relative to truck traffic and noise during the construction.
Protection of workers during remedial actions	While VI mitigation systems exist, they are not required to be maintained under this alternative. No other active components are included in this alternative.	Proper health and safety measures would be established and implemented during remedial activities, and would be effective in protecting workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, and would be effective in protecting workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, and would be effective in protecting workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, and would be effective in protecting workers from exposure to contaminants.
Environmental impacts	While VI mitigation systems exist, they are not required to be maintained under this	ISCO amendments are injected *in situ*, contaminants are not brought to the surface, and therefore, would not present an exposure pathway. Proper protocols would be	EISB amendments are injected *in situ,* contaminants are not brought to the surface, and therefore, would not present an exposure pathway. EISB amendments	SVE/SVE-AS, and operable vapor intrusion systems, are an effective means of controlling the pathways of exposure to contaminants brought to the surface. Proper treatment of	Dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during

TABLE 4-2. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Further Action	Alternative 2 *In Situ* Chemical Treatment and Targeted Soil Removal	Alternative 3 *In Situ* Biological Treatment and Targeted Soil Removal	Alternative 4A/B Soil Vapor Extraction (without/with Air Sparging)	Alternative 5 Restoration to Pre-Disposal/Pre-Release Conditions
	alternative. No other active components are included in this alternative.	followed for the storage and use of the treatment chemicals.	would not require special protocols for storage and use.	impacted soil vapor would be implemented prior to release of recovered soil vapor.	implementation of this alternative. Minimal clearing would be required prior to excavation.
Time until remedial action objectives are achieved	While VI mitigation systems exist, they are not required to be maintained under this alternative. Other than through natural attenuation, RAOs related to public health and environmental protection for soil, groundwater and sub-slab soil vapor/indoor air would not be met with this alternative.	RAOs related to public health and environmental protection for soil, groundwater and sub-slab soil vapor/indoor air would be achieved on-Site upon completion of the remedy. Contaminant concentrations in groundwater within the RI Study Area would be reduced over time through natural attenuation.	RAOs related to public health and environmental protection for soil, groundwater and sub-slab soil vapor/indoor air would be achieved on-Site upon completion of the remedy. EISB would also be expected to facilitate biodegradation in groundwater within the RI Study Area which would enhance natural attenuation of contaminants over time.	RAOs related to public health and environmental protection for soil, groundwater and sub-slab soil vapor/indoor air would be achieved on-Site upon completion of the remedy; implementation of SVE-AS would accelerate the anticipated timeframe to completions as compared to SVE alone. Contaminant concentrations in groundwater within the RI Study Area would be reduced over time through natural attenuation.	RAOs would be achieved upon completion of the remedy. The remedy would be completed in approximately one construction season.
Short-term sustainability	While VI mitigation systems exist, they are not required to be maintained under this alternative. No other active components are included in this alternative.	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on- and off-Site during remedy implementation would be *de minimis.*	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on- and off-Site during remedy implementation would be *de minimis.*	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on- and off-Site during remedy implementation would be *de minimis.*	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on- and off-Site during remedy implementation is estimated at approximately 230 $MTCO_2e$.
Implementability					
Ability to construct and operate the technology	There are no technologies to be constructed or maintained in this alternative.	ISCO injection well network readily constructed and operated. Monitoring and institutional controls readily implemented.	EISB injection well network readily constructed and operated. Monitoring and institutional controls readily implemented.	SVE/SVE-AS injection well network readily constructed and operated. Monitoring and institutional controls readily implemented.	Alternative 5 would require conventional over-the-road and excavation equipment, however, the scope of the Alternative, excavation and off-Site disposal of 9,200 cy of material, and Site constraints complicate implementability due to the depth of excavation and challenges of working within a developed multi-use area. Full excavation, as proposed, would necessitate use of off-Site areas for support, soil staging, dewatering, water treatment, etc., as well as sheeting for excavation support of off-site areas. Additionally, significant dewatering and water treatment would be required. Recovered water would require both pre-treatment and discharge to municipal facilities. Transportation considerations related to the implementation of Alternative 5 include; significantly increased traffic, fuel usage, and adverse effects on both air quality and community safety (based on the full demolition of the existing building, export of excavated material, import of clean fill and other materials).
Reliability of technology	Existing covers and VI mitigation systems are not reliable in the long-term without maintenance.	ISCO is expected to be a reliable method of reducing contaminants and minimizing migration. The reliability would be confirmed during the treatability testing. Excavation and disposal are reliable technologies. Maintained covers are considered reliable.	EISB is expected to be a reliable method of reducing contaminants and minimizing migration. The reliability would be confirmed during the treatability testing. Excavation and disposal are reliable technologies. Maintained covers are considered reliable.	SVE, with and without air sparging, is expected to be a reliable method of reducing contaminants and minimizing migration given suitable subsurface conditions. The reliability would be confirmed during the treatability testing. Maintained covers are considered reliable.	Excavation and disposal are reliable technologies. Maintained covers are considered reliable.
Ease of undertaking additional remedial actions, if necessary	Additional remedial actions, if necessary, would be readily implementable.	Additional remedial actions, if necessary, would be readily implementable.	Additional remedial actions, if necessary, would be readily implementable.	Additional remedial actions, if necessary, would be readily implementable.	Additional remedial actions, if necessary, would be readily implementable.
Ability to monitor effectiveness of remedy	No monitoring is included under this Alternative	Effectiveness of remedy could be monitored through inspection and maintenance of engineering controls, including covers and VI mitigation systems. Groundwater monitoring would indicate changes in groundwater quality in the RI Study Area and effectiveness of ISCO. Soil vapor monitoring would indicate changes in soil vapor in the RI Study Area.	Effectiveness of remedy could be monitored through inspection and maintenance of engineering controls, including covers and VI mitigation systems. Groundwater monitoring would indicate changes in groundwater quality in the RI Study Area and effectiveness of EISB. Soil vapor monitoring would indicate changes in soil vapor in the RI Study Area.	Effectiveness of remedy could be monitored through inspection and maintenance of engineering controls, including covers and VI mitigation systems. Groundwater monitoring would indicate changes in groundwater quality in the RI Study Area and effectiveness of EISB. Soil vapor monitoring would indicate changes in soil vapor in the RI Study Area	Verification of removal would be conducted as part of construction. Groundwater monitoring would indicate changes in groundwater quality in the RI Study Area. Soil vapor monitoring would indicate changes in soil vapor in the RI Study Area.

TABLE 4-2. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Further Action	Alternative 2 *In Situ* Chemical Treatment and Targeted Soil Removal	Alternative 3 *In Situ* Biological Treatment and Targeted Soil Removal	Alternative 4A/B Soil Vapor Extraction (without/with Air Sparging)	Alternative 5 Restoration to Pre-Disposal/Pre-Release Conditions
Coordination with other agencies and property owners	None required.	Coordination with other agencies including NYSDOH, NYSDOT, City of Schenectady, and Schenectady County would be necessary. Coordination with property owners would be necessary.	Coordination with other agencies including NYSDOH, NYSDOT, City of Schenectady, and Schenectady County would be necessary. Coordination with property owners would be necessary.	Coordination with other agencies including NYSDOH, NYSDOT, City of Schenectady, and Schenectady County would be necessary. Coordination with property owners would be necessary.	Coordination with other agencies including NYSDOH, NYSDOT, City of Schenectady, and Schenectady County would be necessary. Coordination with property owners would be necessary.
Availability of off-Site treatment storage and disposal services and capacities	None included in this Alternative.	Capacity for off-Site disposal of approximately 450 tons of material is readily available.	Capacity for off-Site disposal of approximately 450 tons of material is readily available.	Capacity for off-Site disposal/treatment of SVE/SVE-AS media (such as activated carbon) is readily available.	Capacity for off-Site disposal of approximately 11,600 tons of material is available.
Availability of necessary equipment, specialists, and materials	None required.	Equipment, specialists, and materials are readily available.	Equipment, specialists, and materials are readily available.	Equipment, specialists, and materials are readily available.	Equipment, specialists, and materials are readily available.
Costs					
Total estimated capital cost	$0	$1,254,000	$938,000	$869,000 / $950,000	$5,109,000
Present worth of operation and maintenance cost (30 years, 7% discount factor)	$0	$375,000	$375,000	$450,000 / $408,000	$325,000
Total estimated net present worth cost	$0	$1,629,000	$1,313,000	$1,320,000 / $1,358,000	$5,434,000
Land Use					
Consistency with proposed future use	The lack of ICs and maintenance make this Alternative not protective for current, intended, and reasonably anticipated future uses of the Site and RI Study Area.	Excavation/removal and *in situ* treatment may cause disruption to current land use. Following restoration and implementation of IC/ECs, conditions would be consistent with current, intended, and reasonably anticipated future uses of the Site.	Excavation/removal and *in situ* treatment may cause disruption to current land use. Following restoration and implementation of IC/ECs, conditions would be consistent with current, intended, and reasonably anticipated future uses of the Site.	I*n situ* treatment may cause disruption to current land use. Following restoration and implementation of IC/ECs, conditions would be consistent with current, intended, and reasonably anticipated future uses of the Site.	Excavation/removal (including building demolition) may cause significant disruption to current land use. Following restoration, conditions would be consistent with current, intended, and reasonably anticipated future uses of the Site.

Notes:

cy – Cubic Yard
DER – Division of Environmental Remediation
EISB – Enhanced *In Situ* Bioremediation
ECs – Engineering Controls
ICs – Institutional Controls
IRM – Interim Remedial Measure
ISCO – *In Situ* Chemical Oxidation
$MTCO_2e$ – Metric Ton Carbon Dioxide Equivalents
NYSDEC – New York State Department of Environmental Conservation
NYSDOH – New York State Department of Health
NYSDOT – New York State Department of Transportation
OSHA – Occupational Safety and Health Administration
RAOs – Remedial Action Objectives
RI – Remedial Investigation
SCG – Standards, Criteria, and Guidance
SCOs – Soil Cleanup Objectives
SMP – Site Management Plan
SVE – Soil Vapor Extraction
USEPA – United States Environmental Protection Agency
VI – Vapor Intrusion

COST ESTIMATE SUMMARY

TABLE 4-3. ALTERNATIVE 1 COST ESTIMATE

Site: Mid-Town Laundry Site
Location: Schenectady, New York
Phase: Feasibility Phase (+50%/-25%)
Base Year: 2018
Conceptual Basis: No Further Action

ITEM	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
DIRECT CAPITAL CONSTRUCTION COSTS					
TOTAL DIRECT CAPITAL COST				**$0**	
Engineering/Design/Legal			27%	0	10%, 15%, 2% respectively
Construction Management			10%	0	
Contingency			20%	0	Scope contingency
TOTAL ALTERNATIVE CAPITAL COST (rounded)				**$0**	
OPERATION AND MAINTENANCE COSTS					
TOTAL OPERATION AND MAINTENANCE COST				**$0**	

PRESENT WORTH ANALYSIS (YEARS 1-30)		Effective Discount		
Cost Type	**Total Cost**	**Factor (7%)**	**Cost Per Yr**	**Present Value**
Capital Cost - Year 0	$0	1.000	$0	$0
Annual O&M - Years 1-30		0.4136	$0	$0
Periodic Costs - Years 5, 10, 15, 20, 25, 30		0.3596	$0	$0
TOTAL PROJECT PRESENT WORTH (rounded)				**$0**

Notes

1. This cost estimate has been prepared based on information and assumptions available at the time of alternative development and is meant for comparison relative to other remedial alternatives. It is not intended to be representative of actual project costs or for use in establishing project budgets.

COST ESTIMATE SUMMARY

TABLE 4-4. ALTERNATIVE 2 COST ESTIMATE

Site: Mid-Town Laundry Site
Location: Schenectady, New York
Phase: Feasibility Phase (+50%/-25%)
Base Year: 2018

Conceptual Basis: *In situ* Treatment (Chemical Oxidation)
Targeted Excavation and Backfill
On-Site Covers and Institutional Controls
RI Study Area VI Mitigation, Groundwater and Soil Vapor Monitoring

	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
DIRECT CAPITAL CONSTRUCTION COSTS					
General Conditions	MO	2	$10,000	$20,000	Trailer, electrical, and maintenance; well install and excavation only
Air monitoring and Site Safety	WKS	8	$2,500	$20,000	
Surveys	EA	2	$2,500	$5,000	pre- and post- construction surveys
Workplan and Permitting	LS	1	$25,000	$25,000	
Pre-Design Investigation					
Treatability Study	LS	1	$50,000	$50,000	
Baseline groundwater sampling	EA	6	$750	$4,500	sample collection, VOC analysis and *in situ* treatment parameters
VI Mitigation					
Baseline sampling	EA	23	$1,200	$27,500	one sub-slab and first floor indoor air sample per residence in off-site area and ambient air
SSDS Installation - RI Study Area	EA	5	$15,000	$75,000	residential properties - allotment
Evaluate/Upgrade Existing SSDS	--	--	--	--	Owner Responsible Cost
***In Situ* Treatment**					
Injection well installation - Source Area					
Install injection well via directional drill - 15-ft depth	EA	3	$12,000	$36,000	2-inch dia; 80-ft LF each; 10 injection intervals along horizontal
Install injection well via directional drill - 25-ft depth	EA	3	$15,000	$45,000	2-inch dia; 100-ft LF each; 10 injection intervals along horizontal
Install vertical injection well - 30-ft depth	EA	2	$1,750	$3,500	2-inch diameter; 6 injection intervals
Injection well installation - Downgradient					
Install vertical injection wells - 20-ft depth	EA	15	$1,500	$22,000	2-inch diameter; 5 injection intervals; 20-ft on center
Implementation					
Amendment	LBS	110,080	$2.25	$247,500	persulfate and catalyst; 4 injection events below building, 2 injection events downgradient area
Shipping	EA	4	$3,000	$12,000	per event
Labor	MH	800	$75	$60,000	assume ten 10-hr days per event; 2 persons
Performance Groundwater sampling	EA	48	$750	$36,000	sample collection, VOC analysis and *in situ* treatment parameters; quarterly for 36 months
Soil Excavation and Restoration					
Sawcut and remove pavement	SY	69	$12	$800	25-ft by 25-ft area
Excavation	CY	222	$15	$3,300	to 15-ft with temporary shoring
Transportation and Disposal - Non-Haz	TON	438	$110	$48,100	within 60-miles; assume 1.5 T/cy
Confirmation Sampling	EA	5	$300	$1,500	USEPA Method 8260
Place amendment prior to backfill	LBS	1,500	$2.25	$3,375	assumes oxidant for residual treatment at excavation bottom
Geotextile Demarcation Layer	SY	1,600	$2	$3,200	on-site excavation areas where soils above Unrestricted SCOs remain
Sub-grade Backfill	CY	219	$35	$7,648	to within 3-inches of final grade
Restore pavement	SF	625	$3	$1,875	
Institutional Controls					
Develop Site Management Plan	LS	1	$25,000	$25,000	
Environmental Easement	LS	1	$15,000	$15,000	

COST ESTIMATE SUMMARY

TABLE 4-4. ALTERNATIVE 2 COST ESTIMATE

Site:	Mid-Town Laundry Site	Conceptual Basis:	*In situ* Treatment (Chemical Oxidation)
Location:	Schenectady, New York		Targeted Excavation and Backfill
Phase:	Feasibility Phase (+50%/-25%)		On-Site Covers and Institutional Controls
Base Year:	2018		RI Study Area VI Mitigation, Groundwater and Soil Vapor Monitoring

	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
TOTAL DIRECT CAPITAL COST				**$798,798**	
Management/Design/Legal			27%	$215,676	10%, 15%, 2% respectively
Construction Management			10%	$79,880	
Contingency			20%	$159,760	Scope contingency
TOTAL ALTERNATIVE CAPITAL COST (rounded)				**$1,254,000**	(rounded)
OPERATION AND MAINTENANCE COSTS					
Annual Costs (Years 1-30)					
Site inspection and reporting	LS	1	$7,500	$7,500	Annual
Soil vapor monitoring	EA	14	$500	$7,000	sample collection and VOC analysis; assumes 7 points, 3 ambient air plus QA/QC
Groundwater monitoring	EA	12	$750	$9,000	sample collection and VOC analysis
Asphalt repair and maintenance	--	--	--	--	Owner Responsible Cost
Periodic Costs (Years 2, 4, 6)					
Off-site vapor intrusion monitoring	EA	18	$1,200	$21,600	assumes no monitoring of operational SSDS
RI Study Area SSDS Inspection and maintenance	LS	1	$10,000	$10,000	allotment; does not include electrical power costs borne by building owner for operation
Periodic Costs (Years 5, 10, 15, 20, 25, 30)					
5-yr reviews	LS	1	$5,000	$5,000	

PRESENT WORTH ANALYSIS (YEARS 1-30)		**Effective Discount**		
Cost Type	Total Cost	**Factor (7%)**	**Cost Per Yr**	**Present Value**
Capital Cost - Year 0	**$1,254,000**	1.000	$1,254,000	$1,254,000
Annual O&M - Years 1-30		0.4136	$23,500	$291,590
Periodic Costs - Years 2, 4, 6		0.7674	$31,600	$72,753
Periodic Costs - Years 5, 10, 15, 20, 25, 30		0.3596	$5,000	$10,789
TOTAL PROJECT PRESENT WORTH (rounded)				**$1,629,000**

Notes

1. This cost estimate has been prepared based on information and assumptions available at the time of alternative development and is meant for comparison relative to other remedial alternatives. It is not intended to be representative of actual project costs or for use in establishing project budgets.
2. Portions of this cost estimate have been provided by Regenesis dated 7/16/2018

COST ESTIMATE SUMMARY

TABLE 4-5. ALTERNATIVE 3 COST ESTIMATE

Site: Mid-Town Laundry Site
Location: Schenectady, New York
Phase: Feasibility Phase (+50%/-25%)
Base Year: 2018

Conceptual Basis: *In situ* Treatment (Enhanced Biological)
Targeted Excavation and Backfill
On-Site Covers and Institutional Controls
RI Study Area VI Mitigation, Groundwater and Soil Vapor Monitoring

	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
DIRECT CAPITAL CONSTRUCTION COSTS					
General Conditions	MO	2	$10,000	$20,000	Trailer, electrical, and maintenance; well install and excavation only
Air monitoring and Site Safety	WKS	8	$2,500	$20,000	
Surveys	EA	2	$2,500	$5,000	pre- and post- construction surveys
Workplan and Permitting	LS	1	$25,000	$25,000	
Pre-Design Investigation					
Treatability Study	LS	1	$50,000	$50,000	
Baseline groundwater sampling	EA	6	$750	$4,500	sample collection, VOC analysis and *in situ* treatment parameters
VI Mitigation					
Baseline sampling	EA	23	$1,200	$27,500	one sub-slab and first floor indoor air sample per residence in off-site area and ambient air
SSDS Installation - RI Study Area	EA	5	$15,000	$75,000	residential properties - allotment
Evaluate/Upgrade Existing SSDS	--	--	--	--	Owner Responsible Cost
***In Situ* Treatment**					
Injection well installation - Source Area					
Install injection well via directional drill - 15-ft depth	EA	3	$12,000	$36,000	2-inch dia; 80-ft LF each; 10 injection intervals along horizontal
Install injection well via directional drill - 25-ft depth	EA	3	$15,000	$45,000	2-inch dia; 100-ft LF each; 10 injection intervals along horizontal
Install vertical injection well - 30-ft depth	EA	2	$1,750	$3,500	2-inch diameter; 6 injection intervals
Injection well installation - Downgradient					
Install vertical injection wells - 20-ft depth	EA	10	$1,500	$15,000	2-inch diameter; 5 injection intervals; 20-ft on center along 100-lf downgradient perimeter
Implementation					
Amendment	LBS	15,500	$5.75	$89,000	Assume two injections
Shipping	EA	2	$3,000	$6,000	per event
Labor	MH	400	$75	$30,000	assume ten 10-hr days per event; 2 persons
Performance Groundwater sampling	EA	48	$750	$36,000	sample collection, VOC analysis and *in situ* treatment parameters; quarterly for 36 months
Soil Excavation and Restoration					
Sawcut and remove pavement	SY	69	$12	$800	25-ft by 25-ft area
Excavation	CY	222	$15	$3,300	to 15-ft with temporary shoring
Transportation and Disposal - Non-Haz	TON	438	$110	$48,100	within 60-miles; assume 1.5 T/cy
Confirmation Sampling	E	5	$300	$1,500	USEPA Method 8260
Place amendment prior to backfill	LBS	1,500	$2.25	$3,375	assumes oxidant for residual treatment at excavation bottom
Geotextile Demarcation Layer	SY	1,600	$2	$3,200	on-site excavation areas where soils above Unrestricted SCOs remain
Sub-grade Backfill	CY	219	$35	$7,648	to within 3-inches of final grade
Restore pavement	SF	625	$3	$1,875	
Institutional Controls					
Develop Site Management Plan	LS	1	$25,000	$25,000	
Environmental Easement	LS	1	$15,000	$15,000	

COST ESTIMATE SUMMARY

TABLE 4-5. ALTERNATIVE 3 COST ESTIMATE

Site:	Mid-Town Laundry Site	Conceptual Basis:	*In situ* Treatment (Enhanced Biological)
Location:	Schenectady, New York		Targeted Excavation and Backfill
Phase:	Feasibility Phase (+50%/-25%)		On-Site Covers and Institutional Controls
Base Year:	2018		RI Study Area VI Mitigation, Groundwater and Soil Vapor Monitoring

	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
TOTAL DIRECT CAPITAL COST				**$597,298**	
Management/Design/Legal			27%	$161,271	10%, 15%, 2% respectively
Construction Management			10%	$59,730	
Contingency			20%	$119,460	Scope contingency
TOTAL ALTERNATIVE CAPITAL COST (rounded)				**$938,000**	(rounded)
OPERATION AND MAINTENANCE COSTS					
Annual Costs (Years 1-30)					
Institutional Controls					
Site inspection and reporting	LS	1	$7,500	$7,500	Annual
Soil vapor monitoring	EA	14	$500	$7,000	sample collection and VOC analysis; assumes 7 points, 3 ambient air plus QA/QC
Groundwater monitoring	EA	12	$750	$9,000	sample collection and VOC analysis; assume 8 wells plus QA/QC
Asphalt repair and maintenance	--	--	--	--	Owner Responsible Cost
Periodic Costs (Years 2, 4, 6)					
Off-site vapor intrusion monitoring	EA	18	$1,200	$21,600	assumes no monitoring of operational SSDS
RI Study Area SSDS Inspection and maintenance	LS	1	$10,000	$10,000	allotment; does not include electrical power costs borne by building owner for operation
Periodic Costs (Years 5, 10, 15, 20, 25, 30)					
5-yr reviews	LS	1	$5,000	$5,000	

PRESENT WORTH ANALYSIS (YEARS 1-30)		**Effective Discount**		
Cost Type	Total Cost	**Factor (7%)**	**Cost Per Yr**	**Present Value**
Capital Cost - Year 0	**$938,000**	1.000	$938,000	$938,000
Annual O&M - Years 1-30		0.4136	$23,500	$291,590
Periodic Costs - Years 2, 4, 6		0.7674	$31,600	$72,753
Periodic Costs - Years 5, 10, 15, 20, 25, 30		0.3596	$5,000	$10,789
TOTAL PROJECT PRESENT WORTH (rounded)				**$1,313,000**

Notes

1. This cost estimate has been prepared based on information and assumptions available at the time of alternative development and is meant for comparison relative to other remedial alternatives. It is not intended to be representative of actual project costs or for use in establishing project budgets.
2. Portions of this cost estimate have been provided by Regenesis dated 7/16/2018

COST ESTIMATE SUMMARY

TABLE 4-6. ALTERNATIVE 4A COST ESTIMATE

Site: Mid-Town Laundry Site
Location: Schenectady, New York
Phase: Feasibility Phase (+50%/-25%)
Base Year: 2018

Conceptual Basis: Soil Vapor Extraction
On-Site Covers and Institutional Controls
RI Study Area VI Mitigation, Groundwater and Soil Vapor Monitoring

	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
DIRECT CAPITAL CONSTRUCTION COSTS					
General Conditions	MO	4	$10,000	$40,000	Trailer, electrical, and maintenance; well install and excavation only
Air monitoring and Site Safety	WKS	8	$2,500	$20,000	
Surveys	EA	2	$2,500	$5,000	pre- and post- construction surveys
Workplan and Permitting	LS	1	$25,000	$25,000	
Pre-Design Investigation					
Treatability Study	LS	1	$50,000	$50,000	
Baseline groundwater sampling	EA	6	$750	$4,500	sample collection and VOC analysis
VI Mitigation					
Baseline sampling	EA	23	$1,200	$27,500	one sub-slab and first floor indoor air sample per residence in off-site area and ambient air
SSDS Installation - RI Study Area	EA	5	$15,000	$75,000	residential properties - allotment
Upgrade Existing SSDS	LS	1	$65,000	$65,000	Remove existing. Seal Walls, install granular layer and concrete floor atop existing.
Soil Vapor Extraction					
Install SVE Wells	EA	5	$2,500	$12,500	2-inch dia PVC to 12-ft bgs
Trenching and sub-surface connections	LF	150	$225	$34,000	includes vault installation and asphalt repair
Install SVE System and Electrical	LS	1	$135,000	$135,000	vacuum with GAC assumed, inc. condensate control, monitoring point and controls.
Startup and Commissioning	LS	1	$20,000	$20,000	Assumes 5 days for startup, analytical and flow balancing.
Institutional Controls					
Develop Site Management Plan	LS	1	$25,000	$25,000	
Environmental Easement	LS	1	$15,000	$15,000	
TOTAL DIRECT CAPITAL COST				**$553,500**	
Management/Design/Legal			27%	$149,445	10%, 15%, 2% respectively
Construction Management			10%	$55,350	
Contingency			20%	$110,700	Scope contingency
TOTAL ALTERNATIVE CAPITAL COST (rounded)				**$869,000**	(rounded)

COST ESTIMATE SUMMARY

TABLE 4-6. ALTERNATIVE 4A COST ESTIMATE

Site: Mid-Town Laundry Site
Location: Schenectady, New York
Phase: Feasibility Phase (+50%/-25%)
Base Year: 2018

Conceptual Basis: Soil Vapor Extraction
On-Site Covers and Institutional Controls
RI Study Area VI Mitigation, Groundwater and Soil Vapor Monitoring

	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
OPERATION AND MAINTENANCE COSTS					
Annual Costs (Years 1-30)					
Institutional Controls					
Site inspection and reporting	LS	1	$7,500	$7,500	Annual
Soil vapor monitoring	EA	14	$500	$7,000	sample collection and VOC analysis; assumes 7 points, 3 ambient air plus QA/QC
Groundwater monitoring	EA	12	$750	$9,000	sample collection and VOC analysis; assume 8 wells plus QA/QC
Asphalt repair and maintenance	--	--	--	--	Owner Responsible Cost
Annual Costs (Years 1-10)					
SVE system O&M	Mo.	12	$900	$10,800	twice monthly monitoring, GAC replacement as necessary
Periodic Costs (Years 2, 4, 6)					
Off-site vapor intrusion monitoring	EA	18	$1,200	$21,600	assumes no monitoring of operational SSDS
RI Study Area SSDS Inspection and maintenance	LS	1	$10,000	$10,000	allotment; does not include electrical power costs borne by building owner for operation
Periodic Costs (Years 5, 10, 15, 20, 25, 30)					
5-yr reviews	LS	1	$5,000	$5,000	

PRESENT WORTH ANALYSIS (YEARS 1-30)		**Effective Discount**		
Cost Type	Total Cost	**Factor (7%)**	**Cost Per Yr**	**Present Value**
Capital Cost - Year 0	**$869,000**	1.000	$869,000	$869,000
Annual O&M - Years 1-10		0.702	$34,300	$240,882
Annual O&M - Years 11-30		0.2693	$23,500	$126,555
Periodic Costs - Years 2, 4, 6		0.7674	$31,600	$72,753
Periodic Costs - Years 5, 10, 15, 20, 25, 30		0.3596	$5,000	$10,789
TOTAL PROJECT PRESENT WORTH (rounded)				**$1,320,000**

Notes

1. This cost estimate has been prepared based on information and assumptions available at the time of alternative development and is meant for comparison relative to other remedial alternatives. It is not intended to be representative of actual project costs or for use in establishing project budgets.

COST ESTIMATE SUMMARY

TABLE 4-7. ALTERNATIVE 4B COST ESTIMATE

Site: Mid-Town Laundry Site
Location: Schenectady, New York
Phase: Feasibility Phase (+50%/-25%)
Base Year: 2018

Conceptual Basis: Soil Vapor Extraction with Air Sparging
On-Site Covers and Institutional Controls
RI Study Area VI Mitigation, Groundwater and Soil Vapor Monitoring

	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
DIRECT CAPITAL CONSTRUCTION COSTS					
General Conditions	MO	4	$10,000	$40,000	Trailer, electrical, and maintenance; well install and excavation only
Air monitoring and Site Safety	WKS	8	$2,500	$20,000	
Surveys	EA	2	$2,500	$5,000	pre- and post- construction surveys
Workplan and Permitting	LS	1	$25,000	$25,000	
Pre-Design Investigation					
Treatability Study	LS	1	$50,000	$50,000	
Baseline groundwater sampling	EA	6	$750	$4,500	sample collection, VOC analysis and *in situ* treatment parameters
VI Mitigation					
Baseline sampling	EA	23	$1,200	$27,500	one sub-slab and first floor indoor air sample per residence in off-site area and ambient air
SSDS Installation - RI Study Area	EA	5	$15,000	$75,000	residential properties - allotment
Upgrade Existing SSDS	LS	1	$65,000	$65,000	Remove existing. Seal Walls, install granular layer and concrete floor atop existing.
Soil Vapor Extraction/Air Sparging					
Install SVE Wells	EA	5	$2,500	$12,500	2-inch dia PVC to 12-ft bgs
Install Air Sparge Wells	EA	7	$3,000	$21,000	2-inch dia PVC to 20-ft bgs
Trenching and sub-surface connections	LF	175	$225	$39,500	includes vault installation, asphalt repair, and connection to SSDS
Install SVE System and Electrical	LS	1	$160,000	$160,000	vacuum/blower with GAC assumed, inc. condensate control, monitoring point and controls.
Startup and Commissioning	LS	1	$20,000	$20,000	Assumes 5 days for startup, analytical and flow balancing.
Institutional Controls					
Develop Site Management Plan	LS	1	$25,000	$25,000	
Environmental Easement	LS	1	$15,000	$15,000	
TOTAL DIRECT CAPITAL COST				**$605,000**	
Management/Design/Legal			27%	$163,350	10%, 15%, 2% respectively
Construction Management			10%	$60,500	
Contingency			20%	$121,000	Scope contingency
TOTAL ALTERNATIVE CAPITAL COST (rounded)				**$950,000**	(rounded)

COST ESTIMATE SUMMARY

TABLE 4-7. ALTERNATIVE 4B COST ESTIMATE

Site: Mid-Town Laundry Site
Location: Schenectady, New York
Phase: Feasibility Phase (+50%/-25%)
Base Year: 2018

Conceptual Basis: Soil Vapor Extraction with Air Sparging
On-Site Covers and Institutional Controls
RI Study Area VI Mitigation, Groundwater and Soil Vapor Monitoring

	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
OPERATION AND MAINTENANCE COSTS					
Annual Costs (Years 1-30)					
Institutional Controls					
Site inspection and reporting	LS	1	$7,500	$7,500	Annual
Soil vapor monitoring	EA	14	$500	$7,000	sample collection and VOC analysis; assumes 7 points, 3 ambient air plus QA/QC
Groundwater monitoring	EA	12	$750	$9,000	sample collection and VOC analysis; assume 8 wells plus QA/QC
Asphalt repair and maintenance	--	--	--	--	Owner Responsible Cost
Annual Costs (Years 1-6)					
SVE/Air Sparge system O&M	Mo.	12	$1,100	$13,200	twice monthly monitoring, GAC replacement as necessary
Periodic Costs (Years 2, 4, 6)					
Off-site vapor intrusion monitoring	EA	18	$1,200	$21,600	assumes no monitoring of operational SSDS
RI Study Area SSDS Inspection and maintenance	LS	1	$10,000	$10,000	allotment; does not include electrical power costs borne by building owner for operation
Periodic Costs (Years 5, 10, 15, 20, 25, 30)					
5-yr reviews	LS	1	$5,000	$5,000	

PRESENT WORTH ANALYSIS (YEARS 1-30)		**Effective Discount**		
Cost Type	Total Cost	**Factor (7%)**	**Cost Per Yr**	**Present Value**
Capital Cost - Year 0	**$950,000**	1.000	$950,000	$950,000
Annual O&M - Years 1-6		0.794	$36,700	$174,909
Annual O&M - Years 7-30		0.3184	$23,500	$149,660
Periodic Costs - Years 2, 4, 6		0.7674	$31,600	$72,753
Periodic Costs - Years 5, 10, 15, 20, 25, 30		0.3596	$5,000	$10,789
TOTAL PROJECT PRESENT WORTH (rounded)				**$1,358,000**

Notes

1. This cost estimate has been prepared based on information and assumptions available at the time of alternative development and is meant for comparison relative to other remedial alternatives. It is not intended to be representative of actual project costs or for use in establishing project budgets.

COST ESTIMATE SUMMARY

TABLE 4-8. ALTERNATIVE 5 COST ESTIMATE

Site: Mid-Town Laundry Site
Location: Schenectady, New York
Phase: Feasibility Phase (+50%/-25%)
Base Year: 2018

Conceptual Basis: Excavation and disposal to meet Unrestricted SCO
Backfill and restoration
RI Study Area VI Mitigation, Groundwater and Soil Vapor Monitoring

ITEM	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
DIRECT CAPITAL CONSTRUCTION COSTS					
General Conditions	MO	10	$15,000	$150,000	Trailer, electrical, and maintenance
Erosion and Sediment Control	LF	400	$2.50	$1,000	reinforced silt fence; site perimeter, and excavation perimeter
Air monitoring and Site Safety	WKS	40	$2,500	$100,000	
Surveys	EA	4	$2,500	$10,000	pre- and post- construction surveys
Workplan and Permitting	LS	1	$25,000	$25,000	
Building Demolition					
Property acquisition	LS	1	$270,000	$270,000	assumes 25% over current assessment
Building Demolition	CF	40,000	$0.75	$30,000	assumed height 20 feet
Utility disconnnection/termination	LS	1	$10,000	$10,000	allowance for power, water and sewer.
Concrete Slab Removal	SF	2,500	$1.50	$3,800	Slab footprint for demo portion of building, assume 1 foot thick
Footing Removal	LF	200	$14	$2,800	Footing removal for demo portion of building, assume 1 ft thick, 2 ft wide
Transportation and Disposal - C&D	TON	363	$135	$49,000	within 60-miles; 2 T/cy concrete, 1.2 T/cy building materials
Soil Excavation					
Install Sheetpiling	SF	10,050	$40.00	$402,000	along property extents
Excavation - On-site	CY	9,200	$10	$92,000	Material exceeding Residential SCO; average 25-ft bgs
Remove Asphalt	SY	821	$10	$8,210	
Transportation and Disposal - Non-Haz	TON	11,040	$110	$1,214,400	within 120-miles; assume 1.2T/cy
Transportation and Disposal - C&D debris	TON	600	$65	$39,000	asphalt paving and misc subsurface debris
Confirmation Sampling	EA	18	$300	$5,520	USEPA Method 8260; on site only
Groundwater Recovery and Treatment	GAL	1,049,245	$0.250	$262,311	temporary skid plant and discharge to POTW; temporary pumping for excavation dewatering
Backfill and Restoration					
Sub-grade Soil Backfill	CY	9,200	$35	$322,000	to within 6-inches of final grade; compacted lifts
Install gravel surface	CY	183	$45	$8,240	
TOTAL DIRECT CAPITAL COST				**$3,005,281**	
Engineering/Design/Legal			30%	$901,584	10%, 15%, 5% respectively
Construction Management			15%	$450,792	
Contingency			25%	$751,320	Scope contingency
TOTAL ALTERNATIVE CAPITAL COST (rounded)				**$5,109,000**	(rounded)

COST ESTIMATE SUMMARY

TABLE 4-8. ALTERNATIVE 5 COST ESTIMATE

Site: Mid-Town Laundry Site
Location: Schenectady, New York
Phase: Feasibility Phase (+50%/-25%)
Base Year: 2018

Conceptual Basis: Excavation and disposal to meet Unrestricted SCO
Backfill and restoration
RI Study Area VI Mitigation, Groundwater and Soil Vapor Monitoring

ITEM	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
OPERATION AND MAINTENANCE COSTS					
Annual Costs (Years 1-30)					
Institutional Controls					
Reporting	LS	1	$5,000	$5,000	Annual
Soil vapor monitoring	EA	14	$500	$7,000	sample collection and VOC analysis; assumes 7 points, 3 ambient air plus QA/QC
Groundwater monitoring	EA	10	$750	$7,500	sample collection and VOC analysis
Periodic Costs (Years 2, 4, 6)					
Off-site vapor intrusion monitoring	EA	18	$1,200	$21,600	assumes no monitoring of operational SSDS
RI Study Area SSDS Inspection and maintenance	LS	1	$10,000	$10,000	allotment; does not include electrical power costs borne by building owner for operation
Periodic Costs (Years 5, 10, 15, 20, 25, 30)					
5-yr reviews	LS	1	$5,000	$5,000	

PRESENT WORTH ANALYSIS (YEARS 1-30)

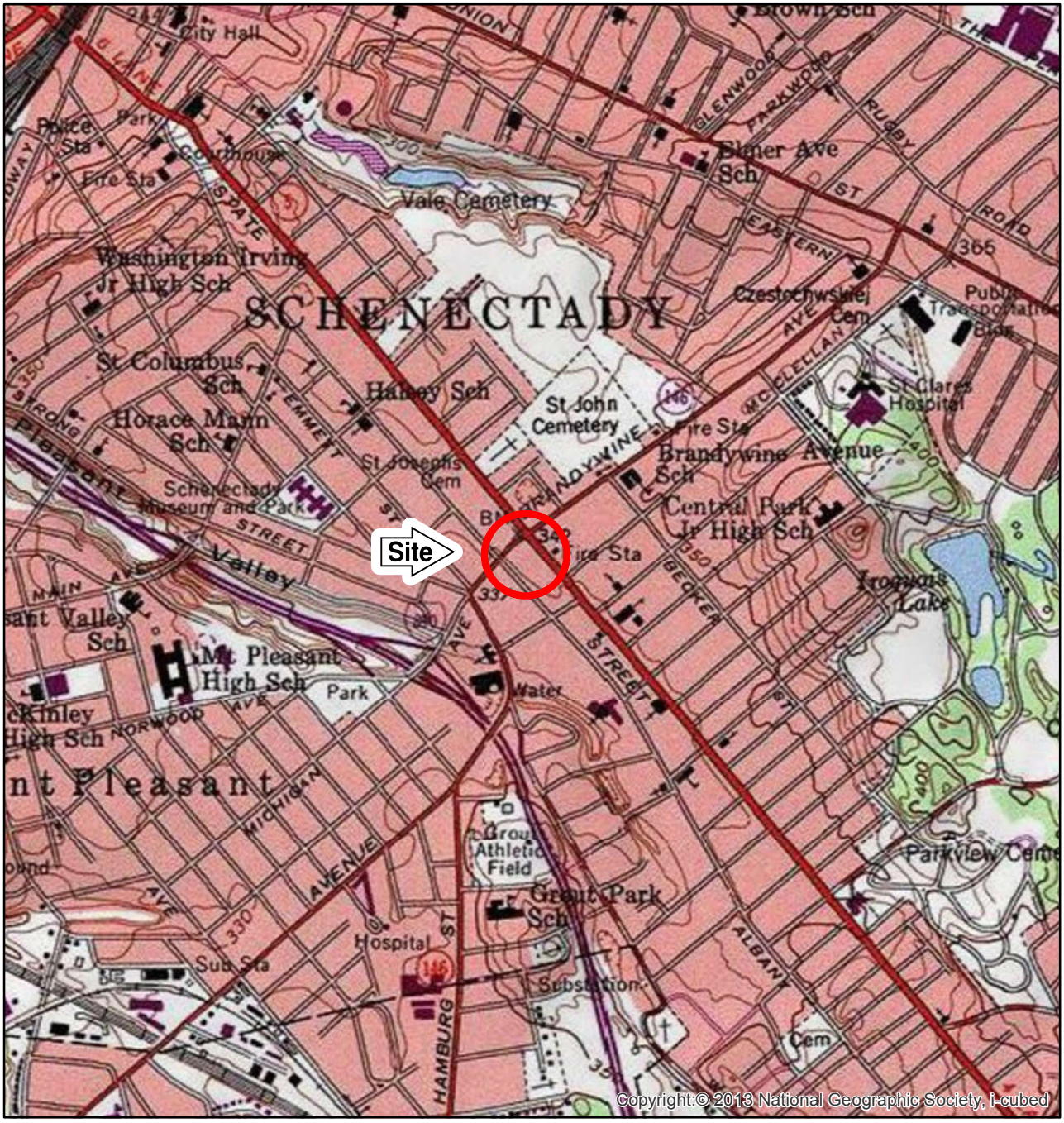
Cost Type	Total Cost	**Effective Discount Factor (7%)**	**Cost Per Yr**	**Present Value**
Capital Cost - Year 0	**$5,109,000**	1.000	$5,109,000	$5,109,000
Annual O&M - Years 1-30		0.4136	$19,500	$241,958
Periodic Costs - Years 2, 4, 6		0.7674	$31,600	$72,753
Periodic Costs - Years 5, 10, 15, 20, 25, 30		0.3596	$5,000	$10,789
TOTAL PROJECT PRESENT WORTH (rounded)				**$5,434,000**

Notes

1. This cost estimate has been prepared based on information and assumptions available at the time of alternative development and is meant for comparison relative to other remedial alternatives. It is not intended to be representative of actual project costs or for use in establishing project budgets.

Figures

FIGURE 1-1



ADAPTED FROM: SCHENECTADY, NY USGS QUADRANGLE

NYSDEC
MID-TOWN LAUNDRY SITE
SITE NO. 447048
SCHENECTADY, NEW YORK

MAP LOCATION

N

SITE LOCATION

0 1,000 2,000 4,000
Feet

1:24,000

JULY 2018
8653.51902

O'BRIEN & GERE ENGINEERS, INC.

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FIGURE 1-2

N

LEGEND

MID-TOWN LAUNDRY PROPERTY - ON SITE

RI STUDY AREA

NYSDEC
MID-TOWN LAUNDRY SITE
SITE NO. 447048
SCHENECTADY, NEW YORK

SITE PLAN

0 50 100 200
Feet

JULY 2018
8653.51902

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LEGEND

- MONITORING WELL
- MID-TOWN LAUNDRY PROPERTY - ON SITE
- RI STUDY AREA
- TARGETED EXCAVATION AREA
- *IN SITU* CHEMICAL OXIDATION AREA

NYSDEC
MID-TOWN LAUNDRY SITE
SITE NO. 447048
SCHENECTADY, NEW YORK

ALTERNATIVE 2

0 50 100 200
Feet

JULY 2018
8653.51902

O'BRIEN & GERE ENGINEERS, INC.

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LEGEND

- MONITORING WELL
- MID-TOWN LAUNDRY PROPERTY - ON SITE
- RI STUDY AREA
- TARGETED EXCAVATION AREA
- ENHANCED *IN SITU* BIOREMEDIATION (EISB)

NYSDEC
MID-TOWN LAUNDRY SITE
SITE NO. 447048
SCHENECTADY, NEW YORK

ALTERNATIVE 3

0 50 100 200
Feet

JULY 2018
8653.51902

O'BRIEN & GERE ENGINEERS, INC.

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LEGEND

- MONITORING WELL
- MID-TOWN LAUNDRY PROPERTY - ON SITE
- RI STUDY
- SOIL VAPOR EXTRACTION (SVE) 4A SVE / AIR SPARGING 4B

NYSDEC
MID-TOWN LAUNDRY SITE
SITE NO. 447048
SCHENECTADY, NEW YORK

ALTERNATIVE 4A / 4B

0 50 100 200
Feet

FEBRUARY 2020
8653.51902

O'BRIEN & GERE ENGINEERS, INC.

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LEGEND

- MONITORING WELL
- RI STUDY AREA
- MID-TOWN LAUNDRY PROPERTY - ON SITE
- EXCAVATION AND BACKFILL

NYSDEC
MID-TOWN LAUNDRY SITE
SITE NO. 447048
SCHENECTADY, NEW YORK

ALTERNATIVE 5

0 50 100 200
Feet

MARCH 2019
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O'BRIEN & GERE ENGINEERS, INC.

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