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August 4, 2020

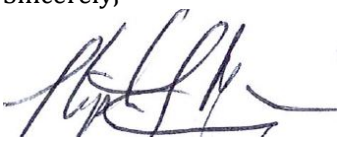
Mr. Tracy A. Smith
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, New York 12233-7016

RE: Ballfield Site Feasibility Study Report
Geddes and Syracuse, Onondaga County, NY (Site No. 734072)

Dear Mr. Smith:

Enclosed is the Ballfield Site Feasibility Study Report and comment responses to the March 19, 2020 comment letter from New York State Department of Environmental Conservation. The Feasibility Study Report was prepared by Ramboll on behalf of Honeywell for your review. Please contact Clare Leary of Ramboll (315-956-6472 and Clare.Leary@Ramboll.com) or me if you have any questions regarding this report.

Sincerely,



Stephen J. Miller, P.E.
Syracuse Remediation Program Manager

Attachment (electronic copy [ec])

Cc:	Harry Warner	NYSDEC Region 7 (ec)
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	Hazel Powless	HETF (ec)
	Alma Lowry	(ec)
	Travis Glazier	O.C. Office of the Environment (ec)
	Shane Blauvelt	Honeywell (ec)
	Clare Leary	Ramboll (ec)
	Christopher Calkins	Ramboll (ec)

On March 19, 2020 the New York State Department of Environmental Conservation (NYSDEC) sent comments regarding the Willis Avenue Ballfield Site Feasibility Study dated February 10, 2020. Below are the responses to those comments.

Comment 1: Page 5, paragraph 5, Executive Summary. This paragraph states that the "historical use of Wastebed C was for the deposition of Solvay Waste" but there is no information in the Executive Summary discussing the origin of the numerous contaminants of concern present on the site or that exceed unrestricted use or commercial soil standards. Please revise to include additional information here.

Response: The text in the Executive Summary (Page 5, Paragraph 5 and Page 6, Paragraphs 3 and 4) has been updated to discuss the placement of historic fill material on the Site and its presence as the source for Site constituents. Based on the Remedial Investigation, the chemical parameters of interest were clarified. Additionally, for the purpose of identifying areas and volumes of media to be addressed in this FS, the primary constituents of concern exceeding Part 375 Commercial Use and Unrestricted Use soil cleanup objectives in surface and subsurface soil/fill material were also identified.

Comment 2: Page 26, paragraph 2, Section 4.2 and page 36, paragraph 2, Section 5.2.3. In these paragraphs add "on-site" before "source areas". Other areas (e.g., tables) of the FS should also be revised accordingly.

Response: The text was updated in Sections 2.2, 2.3, 2.3.1.1, 2.3.1.2, and 4.5 and Table 4-2 to clarify the absence of discrete "on-Site source areas". The text discussing "source areas" in Section 5.2.3 was removed as a result of text edits addressing Comment 8.

Comment 3: Page 25, Section 4.5. The discussion of the technology screening and evaluation requires additional discussion. For example, the decision to exclude containment technologies (e.g., low permeability cap) from the range of remedial options is not discussed in the text although Table 4.2 discusses inconsistencies with future site redevelopment. The text in this section should also discuss the effectiveness of the technology and/or why they may be incompatible with future uses of the site.

Response: Section 4.5 was revised to include additional details related to the evaluation of remedial technologies. Remedial technologies retained as representative process options are identified in Section 4.5.1, including a description of the effectiveness of the technology.

Comment 4: Page 30, Section 4.6.3. A demarcation layer below the cover system or a discussion why it may not be necessary should be included. Please revise.

Response: The text was updated in Section 4.6.3 to indicate that a demarcation layer will be installed prior to placement of the engineered cover system. The demarcation layer would serve as a boundary and warning layer between impacted Site soil/fill material and the engineered cover system. The Alternative 3 cost estimate (Table 5-4) was also updated to include the cost to procure and install a demarcation layer.

Comment 5: Page 31, paragraph 4, Section 4.6.4. In the first sentence 3.7 acres should be revised to be 9.2 acres to be consistent with text in the following paragraph and figure 4-2. Please revise.

Response: The text was revised in Section 4.6.4 to reflect a total of 9.2 acres of historic fill material proposed for removal under Alternative 4.

Comment 6: Page 31, Section 4.6.4. Text from Alternative 5 (page 32, paragraph 7) regarding removal of approximately 21,000 square feet of existing building foundations/slabs, resulting in approximately 3,900 tons of construction and debris (C&D) material should also be included in Alternative 4. Please revise.

Response: Consistent with the text from Alternative 5 (Section 4.6.5, Paragraph 6), the following text was added to Alternative 4 (Section 4.6.4): "Alternative 4 also would include removal of approximately 21,000 sq ft of existing building foundations/slabs, resulting in approximately 3,900 tons of construction and debris (C&D) material."

Comment 7: Pages 34, last paragraph, Section 5.2.1. This section includes the remedial alternative evaluation criteria for "Overall Protection of Human Health and the Environment." However, this paragraph discusses future uses of the site. This text should be moved to Section 5.2.8, "Land Use." Please revise.

Response: The Remedial Alternative Evaluation Criteria for Overall Protection of Human Health and the Environment and Land Use were revised to be consistent with 6 NYCRR Part 375-1.8(f) and NYSDEC DER-10 Section 4.2 (see revisions to Table 2). The text in Section 5.2.1 (Overall Protection of Human Health and the Environment) was revised to remove discussion of current, intended, and reasonably anticipated future use of the Site. The text in Section 5.2.8 (Land Use) was revised to incorporate relevant text removed from Section 5.2.1.

Comment 8: Page 36, paragraph 2, Section 5.2.3. In this paragraph it states "While historic fill material and Site-wide soil/fill material would be addressed in Alternatives 4 and 5, through removal, limited added long-term effectiveness is afforded since discrete source areas were not identified at the Site." Although discrete source areas were not identified, the removal of the historic fill material would provide more long-term effectiveness. Please revise.

Response: The text in Section 5.2.3 was revised to read as follows: "Historic fill material and Site-wide soil/fill material would be addressed in Alternatives 4 and 5 through removal, providing added long-term effectiveness."

Comment 9: Table 4-1, page 5. The first two rows (Institutional Controls and Cover Systems) and the last row (Green Remediation) should be considered potential SCGs. Please revise.

Response: Table 4-1 was revised to document the New York State Department of Environmental Conservation, Division of Environmental Remediation guidance documents addressing Institutional

Controls (DER-33), Cover Systems (DER-10), and Green Remediation (DER-31), as potential Standards, Criteria, and Guidance (SCGs).

Comment 10: Figures 3-1 to 4-3. In these figures the Lakeshore Collection Trench should extend to the east along the West Wall IRM. Please revise.

Response: Figures 3-1, 4-1, 4-2, and 4-3 were revised to include the West Wall Collection Trench.

Comment 11: Figure 4-2. Is there information to determine that contaminated fill is not present in the "Swale Area" along State Fair Boulevard? If not, the figures should be revised as necessary (e.g., material should be excavated up to 20 feet in this area). Please revise accordingly.

Response: As documented in the July 20, 2011 letter to NYSDEC regarding the "Ballfield/Willis Avenue/Semet Ponds Landscape Restoration Berm Surface Soil Sampling Results and Recommendations", berm surface soil sampling was performed at the request of NYSDEC prior to initiation of landscaping and restoration work along the I-690 and State Fair Boulevard corridor. Test pits were also advanced in the berm area along the Ballfield Site. C&D debris and a mixture of boiler slag and fly ash was identified in the subsurface. "Industrial-type" debris (*e.g.,* 55-gallon drums, diaphragm cells, and Allen-Moore cells) typically seen in the center of the Site during previous investigations was not seen in the berm area.

The July 2011 letter recommended installation of a 1-ft soil cover, consistent with the cover proposed under Alternative 3. Installation of a 2-ft soil cover within the swale area was also proposed under Alternative 4 for added protectiveness. A below grade gas line and above grade electrical utilities exist within the swale area, limiting the ability to complete deep excavations. Based on the July 2011 cover recommendations and presence of utilities, Alternative 4 excavation assumptions within the swale area will remain as-is. Excavation to remove Site-wide historic fill materials and Solvay Waste, including within the swale area, is evaluated under Alternative 5.

Intended for
Honeywell

Document type
Report

Date
August 2020

BALLFIELD SITE FEASIBILITY STUDY

RAMBOLL Bright ideas. Sustainable change.

Ballfield Site Feasibility Study

Project name	**Ballfield Site**
Project no.	**1163.72875**
Recipient	**Honeywell**
Document type	**Report**
Version	**[2]**
Date	**August 4, 2020**
Prepared by	**Melanie Marshall**
Checked by	**Clare Leary**
Approved by	**Doug Crawford**
Description	**Feasibility Study for Ballfield Site**

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LIST OF ACRONYMS

ACO	Administrative Consent Order
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
B&B	Blasland & Bouck
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Cm/sec	centimeter per second
COC	Constituent of Concern
COPC	Constituents of potential concern
CPOI	Chemical Parameter of Interest
cy	cubic yards
C&D	construction and debris
DER	Division of Environmental Remediation
EPAR	Exposure Pathway Analysis Report
ERA	Ecological Risk Assessment
FS	Feasibility Study
ft	feet or foot
GAC	granular activated carbon
GRA	General Response Action
GWTP	Groundwater Treatment Plant
HDPE	high density polyethylene
Honeywell	Honeywell International, Inc.
IRM	Interim Remedial Measure
LDR	Land Disposal Restriction
LHCS	Lakeshore Hydraulic Containment System
Metro	Metropolitan Wastewater Treatment Plant
MPE	multi-phase extraction
MtCO2e	million metric tons of carbon dioxide equivalent
MWH	Montgomery Watson Harza
NAPL	non-aqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NYCRR	New York Codes, Rules and Regulation
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.
OCDWEP	Onondaga County Department of Water Environmental Protection
O&M	Operation and Maintenance
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCDD/Fs	Polychlorinated Dibenzo-p-Dioxins and Dibenzofurans
PSA	Preliminary Site Assessment
RAO	Remedial Action Objective
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SCG	Standards, Criteria, and Guidance

SCO	Soil Cleanup Objective
SGV	Standards or Guidance Values
Site	Ballfield Site
SMP	Site Management Plan
SVOC	Semi-volatile Organic Compound
USEPA	United States Environmental Protection Agency
ULSD	Ultra Low Sulfur Diesel
VOC	Volatile Organic Compound
WBB/HB	Wastebed B/Harbor Brook Site
Willis/Semet	Willis Avenue/Semet Tar Beds

EXECUTIVE SUMMARY

This Feasibility Study (FS) Report was prepared to document the development and evaluation of remedial alternatives to address Ballfield Site (Site) soil/fill material and shallow and intermediate groundwater and provide long-lasting protection to the local community and environment (Figure ES-1).

This FS was conducted in accordance with NYSDEC's *Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10)* (NYSDEC 2010).

Development of this FS follows the completion of the Remedial Investigation (RI) for the Site, in which the nature and extent of the contamination at the Site, and the potential human health and ecological exposure pathways were evaluated. The RI was completed pursuant to an earlier Administrative Consent Order (ACO) (D-7-0002-00-02) between the New York State Department of Environmental Conservation (NYSDEC) and Honeywell International Inc. (Honeywell) dated April 26, 2000 (NYSDEC 2000).

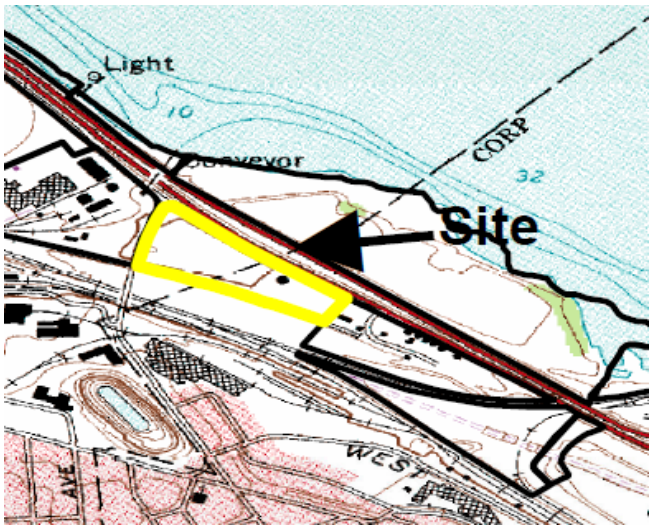

Figure ES-1: Ballfield Site Location

The focus of this FS is to address potential risks to human health and the environment associated with Site-wide soil/fill material and shallow and intermediate groundwater. Deep groundwater will be addressed regionally in a separate FS Report.

Introduction

The Ballfield Site is situated to the south and east of the intersection of Willis Avenue and State Fair Boulevard and is approximately 600 feet (ft) (north-south) along Willis Avenue and 1,400 ft (east-west) along State Fair Boulevard, covering approximately 12.9 acres. The southern portion of the Site borders CSX railroad property. The Site is situated on top of Wastebed C. Historical use of Wastebed C was for the deposition of Solvay waste, a non-hazardous waste consisting primarily of calcium carbonate, calcium silicate, and magnesium hydroxide with lesser amounts of carbonates, sulfates, salts, and metal oxides. The bed covers approximately 21.8 acres. The Site was also used as a landfill for miscellaneous debris, including diaphragm cells, laboratory equipment, construction and demolition debris, miscellaneous metal debris, and boiler slag (herein referred to as historic fill material) between 1938 and 1959.

In accordance with the requirements of the ACO, a Preliminary Site Assessment (PSA) was performed in the winter and spring of 2001. A summary of the analytical data collected during the PSA was submitted to the NYSDEC by O'Brien & Gere Engineers, Inc. (OBG) in September 2001 (OBG 2001). Based on review of the data, indicating the presence of hazardous substances, the Department determined that a Remedial Investigation/Feasibility Study (RI/FS) should be implemented at the Site. An RI was performed in accordance with the NYSDEC-approved *RI/FS Work Plan* (OBG 2002) between

the fall of 2002 and the fall of 2003, and the *Draft Final RI Report* was submitted in January 2004 (Montgomery Watson Harza 2004). The NYSDEC provided comments on the Draft Final RI Report in a letter dated August 4, 2005.

A Supplemental RI was performed in accordance with the NYSDEC-approved letter work plan (Honeywell 2005) between October 2005 and May 2006. A *Revised RI Report* was submitted to the NYSDEC in December 2007 (OBG 2007).

Based on the RI, chemical parameters of interest (CPOIs) identified for the Site include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/Fs), and inorganics. Data collected during the RI suggests that the source for the Site constituents is the fill historically placed on the Site. Due to the heterogenous nature of the historic fill material, and likely random placement within the landfill, there is no clear distribution or focused source of contaminants within the Site soils either vertically or horizontally within the fill zone.

The current, intended and reasonably anticipated future land use for the Site was considered when selecting soil cleanup objectives (SCOs) and to support the development and evaluation of potential remedial alternatives. The reasonably anticipated future use of the Site is commercial; therefore, soil/fill material analytical results were compared to the 6 New York Codes, Rules, and Regulation (6 NYCRR) Part 375 SCOs for Commercial Use. For the purposes of evaluating a pre-disposal conditions alternative, analytical results for soil/fill material were also compared to SCOs for Unrestricted Use. The predominant constituents of concern (COCs) in Site surface soil/fill material exceeding the Part 375 Commercial Use and Unrestricted Use SCOs were polycyclic aromatic hydrocarbons (PAHs) and inorganics. The predominant COCs in Site subsurface soil/fill material exceeding the Part 375 Commercial Use SCOs were PAHs, PCBs, and inorganics. VOCs, in addition to those compounds exceeding Commercial Use SCOs, were found to exceed the SCOs for Unrestricted Use.

Interim Remedial Measures

Interim Remedial Measures (IRMs) have been implemented that mitigate potential impacts from the migration of constituents of concern in groundwater to Onondaga Lake from the Willis Avenue and Wastebed B/Harbor Brook (WBB/HB) Sites, both located hydraulically downgradient from the Ballfield Site. Documentation pertaining to the control of sources to Onondaga Lake demonstrates that these IRMs have mitigated potential impacts to the lake (Parsons and OBG 2017, 2014, 2013). IRMs performed to address groundwater migration to Onondaga Lake have included:

- The Willis-Semet Hydraulic Containment System IRM, installed in 2006 and 2007 to prevent the migration of impacted shallow and intermediate groundwater to Onondaga Lake. The Willis Avenue portion of this IRM consists of approximately 1,300 ft of barrier wall and groundwater collection system along the Onondaga Lake shoreline. Groundwater collected from this system is treated at the Willis Avenue Groundwater Treatment Plant (GWTP). The Willis Avenue GWTP, constructed in 2006 and upgraded three times since then, treats groundwater collected portfolio-wide.
- The WBB/HB West Wall IRM was installed to address impacted shallow and intermediate groundwater to Onondaga Lake. This barrier wall and collection system extends from the eastern end of the Willis-Semet Hydraulic Containment System IRM. Groundwater collected from the WBB/HB Site by this system is treated at the Willis Avenue GWTP.

These IRMs have been included in the final remedies documented in the RODs for these sites, respectively (NYSDEC and USEPA 2019, NYSDEC and USEPA 2018).

Feasibility Study Remedial Action Objectives

Remedial action objectives (RAOs) for soil/fill material and shallow and intermediate groundwater at the Site were developed to be protective of human health and the environment. The RAOs were based on consideration of potential Standards, Criteria, and Guidance (SCGs), the nature and extent of contamination, potentially unacceptable risks, and the current, intended and reasonably anticipated future use of the Site and its surroundings. The RAOs are as follows:

RAOs for Public Health Protection

- Prevent, or reduce to the extent practicable, ingestion/direct contact with contaminated soil/fill material
- Prevent, or reduce to the extent practicable, inhalation of or exposure to contaminants volatilizing from contaminated soil/fill material and unacceptable inhalation exposure associated with soil vapor. In the event that buildings are constructed at the Site, mitigate impacts to public health resulting from known, or potential, soil vapor intrusion into buildings at the Site.
- Prevent, or reduce to the extent practicable, potential unacceptable risks to human health associated with ingestion of shallow and intermediate groundwater with contaminant levels exceeding drinking water standard
- Prevent, or reduce to the extent practicable, potential unacceptable risks to human health associated with contact with, or inhalation of volatiles from contaminated shallow and intermediate groundwater

RAOs for Environmental Protection

- Prevent, or reduce to the extent practicable, the migration of contaminants that would result in shallow and intermediate groundwater, sediment, or surface water contamination

Development of Remedial Alternatives

The following steps were followed in developing five remedial alternatives:

- Developed general response actions (GRAs), which are medium-specific actions which may, either alone or in combination, form alternatives to satisfy the RAOs
- Identified areas and volumes of media, which describe the material(s) to be addressed
- Identified and screened remedial technologies and process options, which resulted in a series of potential remediation technologies that address Site soil/fill material and shallow and intermediate groundwater
- Evaluated technologies and process options for effectiveness, implementability, and cost

SUMMARY OF REMEDIAL ALTERNATIVES

Alternative 1
No Further Action

Alternative 2
Limited Action

Alternative 3
Engineered Cover System in Anticipation of Commercial Development

Alternative 4
Targeted Excavation of Historic Fill Material

Alternative 5
Site-Wide Excavation and Off-Site Disposal

Detailed Analysis of Remedial Alternatives

The assembled alternatives were analyzed in detail using the evaluation criteria as required by state regulations and guidance. The detailed analysis of alternatives indicates:

Alternative 1 does not protect human health and the environment, as there are no actions being taken to address the contaminated media. Alternative 2, the limited action alternative, would be protective of human health and the environmental relative to shallow and intermediate groundwater discharge and potential exposures; however, protection of the environment relative to erosion and migration of soil/fill material would not be provided. Alternatives 3 through 5 would satisfy the threshold criteria by providing overall protection to human health and the environment, and by complying with the identified SGCs. Therefore, with the exception of Alternatives 1 and 2, 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; and cost) concludes that Alternatives 4 and 5 are significantly more difficult to implement, present significant short-term impacts, and are the most costly means of achieving the objectives. Alternative 3 satisfies the threshold criteria of overall protection to human health and the environment, and best addresses the primary balancing criteria.

This FS Report documents the development and evaluation of remedial alternatives in sufficient detail such that risk management decision makers may select a remedy for the Site. Following review of the evaluations documented in this FS Report, NYSDEC will document the preferred remedial action in a Proposed Remedial Action Plan. Following receipt of public comments on the Proposed Remedial Action Plan, the selected remedial alternative will be documented in a Record of Decision (ROD).

1. INTRODUCTION

This report documents the Feasibility Study (FS) that was conducted to develop and evaluate potential remedial alternatives to address soil/fill material and shallow and intermediate groundwater at the Ballfield Site (Site). Site deep groundwater will be addressed regionally in a separate FS Report.

The Site is located in Geddes and Syracuse, New York; a Site Location map is included as attached Figure 1-1 and below as Figure 1. This FS Report documents the evaluation of alternatives that provide long-lasting protection to the local community and environment and allow the Site to return to productive use.

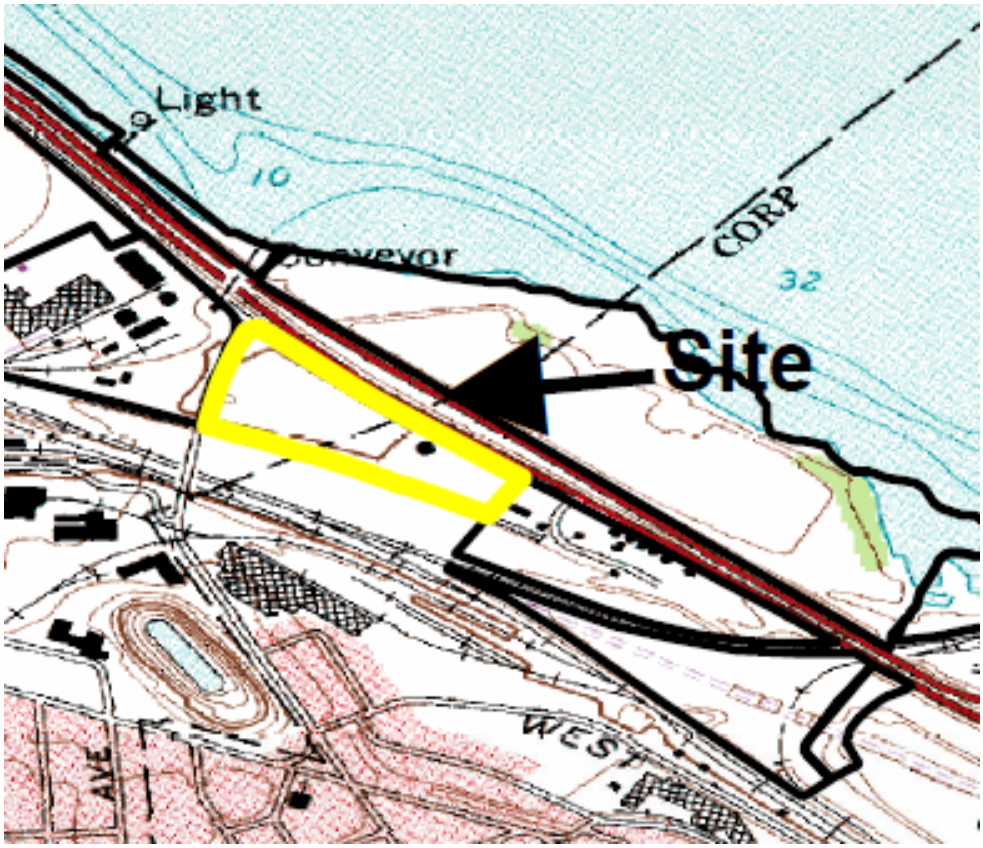

Figure 1: Ballfield Site Location

This report documents the development and evaluation of remedial alternatives such that a final remedy may be selected to address Site soil/fill material and shallow and intermediate groundwater. Potential impacts from the Site shallow and intermediate groundwater to Onondaga Lake have been addressed by interim remedial measures (IRMs) implemented as part of the neighboring Willis Avenue and Wastebed B/Harbor Brook Sites, including the construction of a series of barrier walls and collection systems along the lakeshore. These IRMs have been included in the final remedies documented in the RODs for these sites, respectively (NYSDEC and USEPA 2019, NYSDEC and USEPA 2018). The completed IRMs and evaluations of performance are also summarized in this FS Report.

This FS Report contains six sections. The remainder of this section (Section 1) presents a brief description of the Site and its history. Section 2 presents a summary of previous environmental investigations and studies, including a summary of the Remedial Investigation (RI), and human health

and ecological risk evaluations. Existing IRMs are described 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 report conclusions are presented in Section 6.

1.1 Site Description and History

The Ballfield Site is situated to the south and east of the intersection of Willis Avenue and State Fair Boulevard and extends approximately 600 feet (ft) (north-south) along Willis Avenue and approximately 1,400 ft (east-west) along State Fair Boulevard, covering approximately 12.9 acres. The southern portion of the Site borders CSX railroad property. The Site is situated on top of Wastebed C. Historical use of Wastebed C was for the deposition of Solvay waste, a non-hazardous waste consisting primarily of calcium carbonate, calcium silicate and magnesium hydroxide with lesser amounts of carbonates, sulfates, salts and metal oxides. The bed covers approximately 21.8 acres. Wastebed C received Solvay waste from approximately 1908 to 1926 (Blasland & Bouck 1989). The succession of Wastebed C is illustrated by the historical aerial photographs included in the *RI Report* (OBG 2007). A Site Plan is included as Figure 1-2. An aerial view of the Site is included below as Figure 2.

Figure 2: Aerial of Ballfield Site

Fill materials were placed above the Solvay waste. The NYSDEC has reported notification by a former employee of Allied Chemical Corporation (predecessor to AlliedSignal, Inc. and Honeywell), indicating that the western portion of the Site was used as a landfill for miscellaneous debris during the 1940s. Aerial photographs indicate that fill materials were placed on the Site between 1938 and 1959.

During the Preliminary Site Assessment (PSA) and RI investigations, fill materials were found in the eastern and western portions of the Site confirming that the Site was used as a landfill. The fill materials consisted of Allen-Moore diaphragm cell bodies and related graphite, laboratory vials and flasks, construction and demolition debris, miscellaneous metal debris, and boiler slag (this material is referred to as historic fill material). The area south of the Ballfield Site is owned by the CSX Corporation. Aerial photos indicate that the area has not received fill material in the past. The area is classified as successional northern hardwoods.

A portion of the Ballfield Site is currently owned and operated by Clark Equipment Rental & Sales (Clark Equipment). Clark Equipment primarily operates on the eastern portion of the Site.

The eastern portion of the Site was formerly owned and operated by the Butler Fence Company, and is currently owned by Clark Equipment. This portion of the Site contains a building, a gravel parking lot, and a large aboveground storage tank that is used as a storage area. The eastern portion of the

property is surrounded by a 6-foot (ft) high fence with a locking gate. Based on the cover type mapping performed as a component of the Willis Avenue Site Ecological Risk Assessment (ERA), the eastern portion of the Site is classified as urban industrial exterior.

The western portion of the Ballfield Site owned by Honeywell, purchased in 2008 from Quality Distribution (formerly Chemical Leaman), which owned the Site from 1979 through 2008. This portion of the Site was not used for any active purpose after 1979. During the 1960s and 1970s, the area was used as a baseball field for employees of Allied Chemical, predecessor to Honeywell. This area is currently being used to stage clean imported fill being used for remediation projects at adjacent Honeywell sites. Based on the cover type mapping performed as a component of the Willis Avenue Site ERA, the western portion of the Site is classified as successional old field and the central portion is classified as successional northern hardwoods.

A former pump station was located off the southwestern corner of the Site, adjacent to Willis Avenue. This pump station was active around 1900, although the exact years of operation are unknown. Three intake pipes traversed the Site in a north-south direction. The locations of the former pump house and associated intake pipes are presented on Figure 1-2.

2. SITE CHARACTERIZATION

This section presents the Site conditions as they relate to the FS. As described in Section 1, this FS addresses soil/fill material and shallow/intermediate groundwater. Site conditions have been evaluated during PSA and RI investigations which were summarized in the RI Report (OBG 2007).

2.1 Previous Investigations and Studies

Together with historical usage of the Site, previous geologic and hydrogeologic studies provided the framework for the selection of sampling locations and the initial analytical parameters for samples collected during the RI. These studies, which are described in the RI Report (OBG 2007) include:

- *Site History Report* (Honeywell 2000)
- *PSA Data Summary* Report (OBG 2001)

Subsequent to the RI, a vapor intrusion investigation was conducted at the then existing on-Site Butler Fence garage. The results of the vapor intrusion investigation were summarized in a letter report dated June 19, 2009 (OBG 2009).

2.2 Remedial Investigation

Based on the data collected during the PSA (OBG 2001) and previous study data, the NYSDEC determined that a Remedial Investigation/Feasibility Study (RI/FS) should be implemented at the Site (NYSDEC 2002). The RI was performed in accordance with a NYSDEC-approved RI/FS Work Plan (OBG 2002) and in accordance with the United States Environmental Protection Agency's (USEPA's) *Guidance for Conducting Remedial Investigations and Feasibility Studies under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)* (USEPA 1988) and Part 300.68 of the National Contingency Plan (NCP), CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986. The *RI Report* was submitted in September 2004 to the NYSDEC and resubmitted following revisions based on NYSDEC comments in December 2007 (OBG 2007).

The following conclusions were developed based on previous study data, the RI, and subsequent investigations:

- The nature and extent of historic fill material is well defined
  - The fill material covers an area of approximately 8 acres, with a thickness ranging from 3 to 20 ft
  - The fill material included diaphragm cells, laboratory equipment, construction and demolition debris, miscellaneous metal debris, and boiler slag
- The local geology consists of seven distinct layers including fill material, Solvay waste, marl, silt and clay, silt and fine-grained sand/basal sand and gravel, till, and bedrock
- The Site has three distinct groundwater zones including:
  - A shallow zone that includes the heterogeneous fill layer and underlying Solvay waste
  - An intermediate zone that consists of the fine-grained marl layer
  - A deep zone, which encompasses the silt and fine-grained sand deposits and basal sand and gravel deposits
  - The elevation of the shallow zone ranges from a minimum elevation of approximately 355 ft mean sea level (msl) along the northwest corner of the site (BFMW-01) to 363 ft msl along the southwest corner of the site (BFMW-06). The maximum thickness of this unit is approximately 45 ft with an average thickness around 35 ft. The marl unit ranges from approximately 345 ft

msl to 362 ft msl. The maximum thickness of the marl is approximately 20 ft and the average thickness is around 10 ft. The deep sand and gravel is not present on the Ballfield Site. The marl is directly underlain by silt and clay (northeast portion of site), silt and sand (northwest portion of the site), or till (center of site forwards the east).

- Shallow and intermediate groundwater generally flow towards the north towards Onondaga Lake
- A small component shallow groundwater may flow radially to surface water bodies, the Penn-Can Property, and or the Willis Avenue Site
- Groundwater elevations and equivalent fresh water head values suggest limited deep groundwater flow towards the Willis Avenue Site (the Plant Area and the Lakeshore Area) and towards the Wastebed B/Harbor Brook Site (Penn-Can Property and the Lakeshore Area)
- Hydraulic conductivities for the three groundwater zones are
  - Shallow zone ranges from 4.6×10^{-5} cm/sec to 6×10^{-3} cm/sec
  - Intermediate zone ranges from 3×10^{-5} cm/sec to 4.7×10^{-4} cm/sec
  - Deep zone which ranges from 2.1×10^{-4} cm/sec to 1.2×10^{-3} cm/sec
- Chemical parameters of interest (CPOIs) at the Site include carbon disulfide, bromodichloromethane, chlorodibromomethane, cyclohexane, methylcyclohexane, benzene, toluene, ethylbenzene and xylene (BTEX), methylated benzenes, chlorobenzenes, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs), and inorganics
- CPOIs in soil/fill material and groundwater are randomly distributed throughout the fill, and the underlying groundwater, no on-Site source areas are readily apparent, and concentrations of various organic and inorganic CPOIs exceed applicable standards and guidance
- CPOIs in Site soils are well-defined by the extent of the fill
- CPOIs were detected in Site groundwater; however, no defined groundwater plume is present at the Site
- Benzene and phenol concentrations in groundwater tend to increase with depth
- Mercury concentrations tend to be greatest in shallow groundwater and decrease with depth. Mercury typically has a low solubility in groundwater and likely has not traveled far from the shallow fill material believed to be the source
- The results of the vapor intrusion investigation indicated that the Butler Fence garage indoor air is not impacted by constituents detected below the building slab

2.3 Nature and Extent of Contamination

This section presents a summary of the nature and extent of contamination of soil/fill material and shallow and intermediate groundwater to be addressed in the FS. Review of the data collected during the PSA and RI suggests that the on-Site source area for constituents is the fill historically placed on the Site. This fill material is heterogeneous in nature and was likely placed at random within the landfill. There is no clear distribution of contaminants within the Site soils either vertically or horizontally within the fill zone. The lack of a clear distribution suggests the lack of a focused source of the contaminants at the Site. Based on the RI, CPOIs were identified in the RI Report and include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), PCBs, dioxins/furans, and inorganics. A brief description of the nature and extent of the contamination in media as it relates to the FS is presented below. Additional details related to nature and extent of contamination are provided in the RI Report (OBG 2007).

The reasonably anticipated future land use for the Site is commercial. Therefore, for the purpose of identifying areas to be addressed in this FS and to support the development and evaluation of potential remedial alternatives, analytical results for soil/fill material presented in the *RI Report* (OBG

2007) were compared to NYS's 6 New York Codes, Rules, and Regulation (6 NYCRR) Part 375 soil cleanup objectives (SCOs) for commercial use. For the purposes of evaluating a pre-disposal conditions alternative, analytical results for soil/fill material were also compared to SCOs for Unrestricted Use. Consistent with applicable classifications, Class GA groundwater standards or guidance values (SGVs) were compared to groundwater analytical results.

2.3.1 Soil/Fill Material

CPOIs in the soils appear to be leaching into groundwater, and the leached CPOIs may be transported downgradient of the Site within groundwater. Surface soils may be eroded via surface water run-off and CPOIs could potentially be carried to the north towards State Fair Boulevard or to the south towards the CSX railroad. This migration is unlikely due to the dense vegetation generally found within the areas of the Site that have the potential for surface run-off areas stated above. Surface soils may be eroded via wind and CPOIs could potentially be carried off-site. This migration of CPOIs is unlikely due to the dense vegetation generally found on the Site. The Butler Fence area is not vegetated and is covered by crushed stone.

2.3.1.1 Surface Soil/Fill Material

Surface soil/fill samples were collected as part of the PSA and RI field programs and are considered any sample collected between 0 and 2 ft below ground surface (bgs). The analytical results were compared to the Part 375 SCOs for Commercial and Unrestricted Uses.

Based on Site data, VOCs, SVOCs, pesticides, PCBs, PCDD/Fs, and inorganics were detected in surface soil/fill material on-Site. The predominant constituents of concern (COCs) exceeding the Part 375 Commercial Use SCOs were PAHs, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo[a,h]anthracene, and indeno(1,2,3-CD)pyrene, and inorganics (including mercury, arsenic, and barium).

The predominant COCs exceeding the Part 375 Unrestricted Use SCOs in surface soil/fill material PAHs, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo[a,h]anthracene, indeno(1,2,3-CD)pyrene, chrysene, and inorganics.

There is no clear distribution of chemical parameters in Site surface soils and no apparent on-Site source area. These results are consistent with the Site being used as a landfill in the past. The VOC CPOIs concentrations were variable across the Site and did not show a distinct distribution pattern. Chloroform and methylene chloride had their highest concentrations in surface soils located on the western portion of the Site. Tetrachloroethene was detected in the central portion of the Site at its highest concentration. PAHs were detected consistently across the Site with the exception of the north-central portion of the Site (BFGP-09C). Concentrations of PAHs in this area were approximately two orders of magnitude greater than the other surface soil locations at the Site. The highest PCB concentrations were detected within the south-central portion of the Site (BFGP-11). Mercury, arsenic, nickel, and chromium were detected within surface soils throughout the Site. The concentrations of inorganics in general varied between locations and presented no specific distribution pattern.

The estimated total area of surface soil/fill material exceeding either the SCOs for commercial or Unrestricted Use extends over approximately 12.9 acres of the Ballfield Site.

2.3.1.2 Subsurface Soil/Fill Material

Subsurface soils are considered soil samples collected from a depth greater than 2 ft. During the PSA, subsurface soil samples were collected from test pits, geoprobe borings, and soil borings. During the RI and supplemental RI, subsurface soil samples were collected from soil borings.
Based on Site data, VOCs, SVOCs, pesticides, PCBs, PCDD/Fs, and inorganics were detected in subsurface soil/fill material on the Site. The predominant COCs exceeding the Part 375 Commercial SCOs were PAHs (including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo[a,h]anthracene, and indeno(1,2,3-cd)pyrene, hexachlorobenzene, PCBs (Aroclor 1254), and inorganics (including mercury, arsenic, manganese, cyanide, and barium).

The COCs that exceeded the SCOs for Unrestricted Use SCOs predominantly included tetrachloroethene, benzene, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo[a,h]anthracene, chrysene, indeno(1,2,3-CD)pyrene, and inorganics.

No apparent on-Site source area was identified. This is consistent with the Site previously being used as a landfill and the fill materials being heterogeneous in nature. Acetone, tetrachloroethene, and benzene were the most widely distributed VOCs in subsurface soils. PAHs were also distributed throughout subsurface soils at the Site. In general, the highest concentrations of VOCs and SVOCs were detected in samples collected between 2 and 18 ft in the central and western portions of the Site which corresponds to the area of heterogeneous fill at the Site. The highest PCB concentrations were detected at the highest concentrations and greatest frequency in subsurface soils between 2 and 10 ft bgs. This interval consists mainly of assorted fill that was placed on the Site historically. The lack of a clear distribution pattern of analytical results is consistent with the Site being used as a landfill in the past.

2.3.2 Groundwater

Groundwater quality was evaluated for the Site during one round of PSA groundwater samples, two rounds of RI groundwater samples, and two rounds of Supplemental RI groundwater sampling. Based on Site data, VOCs, SVOCs, and inorganics were detected in Site shallow and intermediate groundwater. Groundwater discharges towards the Willis Avenue and WBB/HB Sites. As described in Section 3, shallow and intermediate groundwater discharging from the Willis Avenue and WBB/HB Sites is addressed by IRMs that are elements of the final remedies as documented in the Record of Decisions (RODs), respectively (NYSDEC and USEPA 2019, NYSDEC and USEPA 2018). As indicated above, deep groundwater will be addressed regionally in a separate FS report.

The COCs detected and exceeding the Class GA SGVs for shallow and intermediate groundwater included:

- VOCs: BTEX, chloroform, tetrachloroethene, acetone, 2-butanone, vinyl chloride, and chloroethane
- SVOCs: benzo(b)fluoranthene, phenols, bis(2-ethylhexyl)phthalate, chlorobenzenes, benzo(a)anthracene, chrysene, indeno[1,2,3-cd]pyrene, benzo(k)fluoranthene, fluoranthene, pyrene, phenanthrene
- Inorganics: sodium, iron, chromium, magnesium, sulfate, lead, mercury, manganese, antimony, chloride, copper, selenium, arsenic, cyanide, barium, and thallium

The majority of shallow and intermediate groundwater appears to flow north towards the Willis Avenue Site and WBB/HB Site towards Onondaga Lake. It should be noted that this groundwater is collected within the collection systems installed as part of the Willis Avenue/Semet Tar Beds (Willis/Semet) and Wastebed B/Harbor Brook (WBB/HB) IRMs (described in Section 3). As stated in the Ballfield Site Groundwater Flux and Site Loading Evaluation Memo, following installation of the barrier wall and

associated collection systems, shallow and intermediate groundwater no longer discharge to the lake (OBG 2019). However, some component of the shallow groundwater moves to the south from the mounded Site. It may discharge to surface water (on the WBB/HB Site (Penn-Can Property)) or move laterally towards the west (to the Willis Avenue Site) or the east (to the Penn-Can Property). Surface water on the Penn-Can property was addressed by the Upper Harbor Brook IRM (OBG 2018) or will be addressed as part of the WBB/HB remedy.

2.4 Human Health and Ecological Risk Evaluations

Potential human and ecological receptors and exposure pathways have been identified for the Site. In addition, Site constituents in various Site media have been screened against risk-based values. These evaluations were presented in the RI and are summarized below.

2.4.1 Human Health Risk Evaluation

An *Exposure Pathway Analysis Report* (EPAR) was prepared by Montgomery Watson Harza (MWH) and submitted to the NYSDEC on December 23, 2003 (MWH 2003). The receptors identified in the EPAR included:

- Industrial Worker
- Construction worker
- Trespasser

As part of the EPAR, constituents in surface soil, subsurface soil, shallow groundwater, deep soil gas, and shallow soil gas were included in a screening assessment. Potential exposure pathways evaluated included direct exposure to impacted media via inhalation, ingestion, and/or dermal contact. The screening results presented in the EPAR suggest that CPOIs for the Site include inorganics, carbon disulfide, bromodichloromethane, chlorodibromomethane, cyclohexane, methylcyclohexane, BTEX, methylated benzenes, chlorinated benzenes, PAHs, PCBs, and PCDD/Fs.

The screening assessment was revisited in 2007 subsequent to completion of the Supplemental RI and documented in a September 2007 letter presenting the Ballfield Site Revised Remedial Investigation Report – Risk Assessment Screening Results (Honeywell 2007). Based on this document, constituents of potential concern (COPCs) were identified for surface soil, subsurface soil, shallow groundwater and shallow soil gas. The assessment indicated that COPCs included inorganics, various VOCs, PAHs, PCBs and PCDD/F.

2.4.2 Ecological Risk Evaluation

The following assessments have been completed to evaluate ecological risk at the Site:

- *Combined Fish and Wildlife Impact Analysis (Step 1) and Screening Level Ecological Assessment* (MWH 2003)
- *Baseline Ecological Risk Assessment Problem Formulation* (ERAGs Step 3) (MWH 2004a)
- *Risk Assessment Screening* (Honeywell 2007)

There are no unique habitats within the boundaries of the Site. Potential environmental receptors include terrestrial wildlife utilizing the upland areas of the Site. The upland area habitats are classified as successional old growth field, successional northern hardwoods, and urban industrial exterior as discussed in Section 1.1. There are no aquatic habitats on the Site based on the elimination of the ponded area following repair to the potable water pipeline.

Likely ecological receptors for the Site include the white-footed mouse, rabbit, American robin, white-tailed deer, red-tailed hawk, and the red fox. CPOIs identified in the risk assessment screening include inorganics, carbon disulfide, bromodichloromethane, chlorodibromomethane, cyclohexane, methylcyclohexane, BTEX, methylated benzenes, chlorobenzenes, PAHs, PCBs, PCDD/Fs, and pesticides.

The screening assessment was revisited in 2007 subsequent to completion of the Supplemental RI and documented in a September 2007 letter presenting the Ballfield Site Revised Remedial Investigation Report – Risk Assessment Screening Results (Honeywell 2007). Based on this document, COPCs were identified for surface soil. The assessment indicated that COPCs included inorganics, various VOCs, PAHs, PCBs, PCDD/F and pesticides.

3. INTERIM REMEDIAL MEASURES

Remedial activities have been conducted in alignment with the schedules for remediation of Onondaga Lake. As a result, Site shallow and intermediate groundwater was addressed by IRMs implemented for the Willis Avenue and WBB/HB Sites, located hydraulically downgradient from the Ballfield Site. These IRMs have been included in the final remedies documented in the RODs for these sites, respectively (NYSDEC and USEPA 2019, NYSDEC and USEPA 2018).

IRM objectives with respect to groundwater discharge to Onondaga Lake were (NYSDEC and USEPA 2012, 2011; OBG 2014, 2014a; Parsons and OBG 2014, 2014a):

- Eliminate, to the extent practicable, within the scope of the IRM, the discharge of contaminated groundwater Onondaga Lake
- Eliminate, to the extent practicable, within the scope of the IRM, the potential human health and ecological impacts associated with site constituents of concern
- Eliminate, to the extent practicable, within the scope of the IRM, potential impacts to fish and wildlife resources associated with on-going discharges of contaminants of concern from the Site

The IRMs are discussed below and depicted on Figure 3-1. Following is a brief summary of the elements included in these IRMs:

- The Willis portion of the Willis-Semet Hydraulic Containment System
- The West Wall portion of the Wastebed B/Harbor Brook IRM

3.1 Willis-Semet Hydraulic Containment System IRM

The Willis-Semet Hydraulic Containment System IRM barrier wall and associated groundwater collection system were installed as part of the lakeshore hydraulic containment system (LHCS) to collect shallow and intermediate groundwater prior to discharge to Onondaga Lake; see Figure 3 below.

Figure 3: Installation of Willis-Semet Hydraulic Containment System IRM

The Willis Avenue portion of the LHCS was installed to eliminate, to the extent practicable, the migration of contaminated groundwater containing process residuals and non-aqueous phase liquid (NAPL) into Onondaga Lake. This portion of the IRM was completed in 2007, and consisted of the installation of 1,288 linear ft of barrier wall and groundwater collection system. The locations of the barrier walls and collection systems are presented on Figure 3-1.

The Willis-Semet Hydraulic Containment System IRM included the design and construction of a groundwater treatment plant (GWTP), see Figure 4 below and Figure 3-1 attached. The GWTP provides treatment of the groundwater prior to discharge to the Onondaga County Department of Water Environment Protection (OCDWEP) Metropolitan Wastewater Treatment Plant (Metro). The Willis-Semet Hydraulic Containment System IRM is further described in the Willis Avenue Feasibility Study (OBG 2019a).

Figure 4: Willis-Semet Groundwater Treatment Plant

3.2 West Wall IRM

The West Wall IRM consists of a subsurface sheet pile barrier wall and groundwater collection trench from the eastern end of the Willis/Semet IRM Barrier Wall to the western bank of Lower Harbor Brook. It was designed and constructed to eliminate, to the extent practicable, the discharge of contaminated groundwater and NAPL (and collect NAPLs, as feasible) into Onondaga Lake and Harbor Brook. This IRM is also part of a larger hydraulic control system consisting of the Willis/Semet IRM (Parsons 2012) and the Wastebed B/Harbor Brook IRM (Parsons 2014) to address area groundwater. The locations of the barrier walls and collection systems are presented on Figure 3-1.

Figure 5: Installation of West Wall IRM

The West Wall IRM is further described in the WBB/HB FS Report (OBG 2018).

4. DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section documents the development of remedial alternatives for soil/fill and shallow and intermediate groundwater at the Site, consistent with NYSDEC's DER-10 (NYSDEC 2010), and the *RI/FS Work Plan* (OBG 2002). As part of the development of remedial alternatives, remedial action objectives (RAOs) and general response actions (GRAs) were identified for the FS. In addition, the areas and volumes of media to be addressed by the remedial alternatives and specific remedial technologies that, following screening, were used to develop the range of remedial alternatives evaluated in this FS are documented. In addition, consistent with NYSDEC's *DER-31 – Green Remediation* (NYSDEC 2011), green remediation concepts were considered during the development of alternatives in this FS.

4.1 Development of RAOs

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

RAOs are developed based on professional and engineering judgment, receptors identified in the Human Health and Ecological Risk Evaluations (Sections 2.4.1 and 2.4.2, respectively), 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; the nature and extent of COCs exceeding chemical-specific SCGs and potential impact(s) to nearby Sites were considered during the development of the RAOs.

As described in Section 3, remedial objectives were developed with respect to shallow and intermediate groundwater discharge to Onondaga Lake as part of the IRMs. Also, as described in Section 3, the IRMs and remedial action have been demonstrated to address these IRM objectives. Documentation of the rationale employed in the development of RAOs for Site media is presented below.

4.1.1 Identification of 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 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 land 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 NYS's 6 NYCRR 375 SCOs and land use is further described below.

4.1.2 Land Use and the Selection of SCOs

Consistent with 6 NYCRR 375-1.8 (f) and DER-10 4.2 (i), the current, intended, and reasonably anticipated future uses of the Site are considered when selecting SCOs. As described in Section 1.1, the eastern portion of the Site is owned and operated by Clark Equipment, while the western portion of the Site is owned by Honeywell and currently used to stage clean imported fill being used for remediation projects at nearby Honeywell sites.

The Site is currently zoned for industrial use within the Town of Geddes and City of Syracuse. It is reasonably anticipated that the Site will continue to be used for commercial and industrial uses for the foreseeable future.

Given that the reasonably anticipated future use for the Site will be for industrial or commercial purposes, the following 6 NYCRR Part 375 Restricted Use SCOs are identified as appropriate SCOs for the Site:

- 6 NYCRR Part 375 SCOs for Commercial Use
  - Commercial use, as defined in 6 NYCRR Part 375-1.8(g)(2)(iii) includes land which shall only be considered for the primary purpose of buying, selling or trading of merchandise or services
  - SCOs for Commercial Use are proposed for areas where current or anticipated commercial use may occur
- 6 NYCRR Part 375 SCOs for Industrial Use
  - Industrial use, as defined in 6 NYCRR Part 375-1.8(g)(2)(iv) includes land which shall only be considered for the primary purpose of manufacturing, production, fabrication, or assembly process and ancillary services
  - SCOs for Industrial Use are proposed for areas where current or anticipated industrial use may occur

For purposes of evaluating a required pre-disposal conditions alternative, analytical results for soil/fill material were also compared to SCOs for Unrestricted Use.

4.1.3 RAOs for Soil/Fill Material and Shallow and Intermediate Groundwater

Potential chemical-specific SCGs and human and ecological receptors identified for soil/fill material and shallow and intermediate groundwater at the Site were considered during the development of RAOs and remedial alternatives. As described in Section 2.3, soil/fill material samples exhibit concentrations above SCOs in certain areas at the Site. Though shallow and intermediate groundwater at the Ballfield Site 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.

Potential exposure pathways were identified related to ecological receptor exposures to soil/fill material. However, given the anticipated future commercial use of the property, it is not anticipated to represent habitat for ecological receptors.

As described in Section 3, shallow and intermediate groundwater discharges to Onondaga Lake have been addressed through IRMs. IRM objectives with respect to groundwater discharge to Onondaga Lake have been achieved as a result of IRM implementation and are presented in Section 3. Accordingly, the following RAOs were developed.

4.1.3.1 RAOs for Public Health Protection

Based on consideration of potential chemical-specific SCGs, nature and extent of contamination, potential human health receptors, and the current, intended and reasonably anticipated future use of the Site and its surroundings, the following RAOs for soil/fill material and shallow and intermediate groundwater were developed for the protection of human health:

- Prevent, or reduce to the extent practicable, ingestion/direct contact with contaminated soil/fill material

- Prevent, or reduce to the extent practicable, inhalation of or exposure to contaminants volatilizing from contaminated soil/fill material and unacceptable inhalation exposure associated with soil vapor. Mitigate impacts to public health resulting from existing, or potential for, soil vapor intrusion into existing or future buildings at the Site.
- Prevent, or reduce to the extent practicable, potential unacceptable risks to human health associated with ingestion of shallow and intermediate groundwater with contaminant levels exceeding drinking water standards
- Prevent, or reduce to the extent practicable, potential unacceptable risks to human health associated with contact with, or inhalation of volatiles from contaminated shallow and intermediate groundwater

4.1.3.2 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 RAO for soil/fill material and shallow and intermediate groundwater was developed for protection of the environment:

- Prevent, or reduce to the extent practicable, the migration of contaminants that would result in shallow and intermediate groundwater, sediment or surface water contamination

4.2 Development of GRAs

GRAs are media-specific actions which may, either alone or in combination, form alternatives to satisfy the RAOs and SCOs. GRAs identified for Site soil/fill material, based on the RAOs, are summarized as follows:

Soil/Fill Material

- ***No action.*** No action must be considered in the FS, as specified in DER-10 Sections 4.1 (d) and 4.4 (b), as a baseline against which other actions are evaluated
- ***Institutional controls/limited actions.*** Actions that provide site access and use restrictions and provisions for continued operation of the remedy
- ***Natural recovery.*** Actions that rely on natural processes to attenuate contaminants in soil/fill material
- ***Containment actions.*** Actions that minimize the potential for direct contact with and erosion of surface soil/fill material
- ***In situ treatment actions.*** Actions that treat soil/fill material in place to reduce mobility or toxicity
- ***Removal actions.*** Actions to excavate soil/fill material
- ***Ex situ treatment actions.*** Actions that treat soil/fill material following removal, to reduce mobility, or toxicity
- ***Disposal actions.*** Actions that dispose of soil/fill material on site or off site

GRAs identified for shallow and intermediate groundwater at the Site, based on the RAOs, are summarized as follows:

Shallow and Intermediate Groundwater

- ***No further action.*** No action must be considered in the FS, as required by *DER-10* Sections 4.1 (d) and 4.4 (b), as a baseline against which other actions are evaluated

- ***Institutional controls/limited actions.*** Actions that provide use restrictions, monitoring, and provisions for continued operation of the remedy
- ***Natural recovery.*** Actions that rely on natural processes to attenuate contaminants in groundwater
- ***Hydraulic control (groundwater discharge).*** Actions that collect and/or control groundwater flow, minimizing further migration
- ***Hydraulic control (groundwater infiltration into pipes).*** Actions that collect, control or isolate surface water and/or groundwater flow, preventing migration of Site-related constituents to receiving water bodies
- ***Treatment.*** *In situ* or *ex situ* actions that treat groundwater to reduce mobility or toxicity related to Site COCs

4.3 Identification of Volumes or Areas of Media

Volumes and areas of soil/fill material and Site shallow and intermediate groundwater to be addressed in this FS 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 discussed in Section 3, Site shallow and intermediate groundwater discharges towards the Willis and WBB/HB Sites. Groundwater discharging from the Willis and WBB/HB Sites has been addressed in IRMs completed for these sites that have been incorporated into the final remedies for these sites (NYSDEC and USEPA 2019 and 2018, respectively). Specifically, groundwater discharging to Onondaga Lake has been addressed as follows:

- Shallow and intermediate groundwater discharging to Onondaga Lake has been addressed by the Willis-Semet Hydraulic Containment System IRM, West Wall IRM, and the associated State Fair Boulevard Collection Trench through groundwater collection trenches and barrier walls that have been installed along the lakeshore downgradient of the Willis Plant Site. Collected groundwater is treated at the Willis-Semet GWTP.

4.3.1 Soil/Fill Material

The Ballfield Site includes a total area of approximately 12.9 acres bounded by Willis Avenue to the west, State Fair Boulevard to the north, and the CSX railroad property to the south. As described in Section 2.3, certain surface soils at the Site exhibit concentrations of PAHs and inorganics that are greater than Industrial and Commercial Use SCOs. Site surface soil/fill material concentrations also exceed the Commercial Use SCOs for PCBs. The surface soil/fill material concentrations in samples (between 0- and 2-ft bgs) throughout much of the Site exceed Commercial, Industrial, and/or Unrestricted Use SCOs. Spatially, the surface soil/fill material samples generally exceeded the Commercial and Industrial Use SCOs across the Site, with localized sample locations on the northern portion of the Site exhibiting concentrations below the SCOs. The estimated total area of surface soil/fill material exceeding either the SCOs for Industrial and Commercial Use SCOs extends over approximately 9.2 acres of the Ballfield Site, while Unrestricted Use SCO exceedances extend Site-wide (12.9 acres).

Subsurface soil/fill material samples (greater than 2-ft bgs) also exhibited concentrations exceeding Commercial and Industrial SCOs, with impacts to approximately 45 ft bgs. For the purpose of the FS, the area and volume of historic fill material was also estimated. Based on Site topography and historic fill data collected during the RI, approximately 297,000 cy of historic fill material is present at the Site over approximately 9.2 acres at thicknesses ranging from 19 to 25 ft. Additionally, it is estimated that approximately 1,013,000 cy of soil/fill material exceed Unrestricted Use SCOs is present to depths up to 45 ft over the entire Site.

4.4 Identification and Screening of Remedial Technologies and Process Options

Potentially applicable remedial technologies and process options for each GRA were identified and then screened on the basis of technical implementability. Technical implementability for each identified process option was evaluated with respect to contaminant information, physical characteristics, and areas and volumes of affected media. The screening of remedial technologies and process options was performed for soil/fill material and shallow/intermediate groundwater.

Descriptions for retained technologies and process options identified for the FS are presented in Tables 4-2 and 4-3. Technologies and process options that were viewed as not implementable were not considered further in the FS. The technologies and process options retained for further consideration for Site soil/fill material and shallow and intermediate groundwater are presented below.

Soil/Fill Material

- No action
- Access/use restrictions/administrative control(s) (fencing, institutional controls)
- Site controls (Site Management Plan [SMP])
- Periodic reviews (periodic Site reviews)
- Cover system (engineered cover)
- *In situ* treatment (phytoremediation, soil heating, vitrification)
- Removal (mechanical excavation)
- Off-site disposal (commercial landfill)

Shallow and Intermediate Groundwater

- No further action
- Monitoring
- Access/use restrictions/administrative control(s) (institutional controls)
- Site controls (SMP)
- Periodic reviews (periodic site reviews)
- Natural attenuation
- Vertical wall (slurry wall, sheet piles)
- Groundwater extraction (recovery wells, collection trench, multi-phase extraction [MPE])
- *In situ* treatment wall (permeable reactive barrier)
- *Ex situ* off-site physical/chemical treatment (Willis-Semet GWTP and/or Metro)

4.5 Evaluation of Remedial Technologies and Process Options

The remedial technologies and process options remaining after the initial screening were evaluated further according to the criteria of effectiveness, implementability, and cost. The effectiveness criterion addresses:

- Potential effectiveness of the process option in meeting the RAOs and accommodating the estimated lengths, areas, and/or volumes of media summarized in Section 4.3
- Potential effects on human health and the environment during implementation (including, as appropriate, construction and operation)

- Reliability of the process options for Site COCs and conditions

Technical and institutional aspects of implementing the process options were assessed for the implementability criterion. The capital and operation and maintenance (O&M) costs of each process option were evaluated as to whether they were high, medium, or low relative to the other process options of the same technology type. Based on the evaluation, the more favorable process options of each technology type were chosen as representative process options. The selection of representative process options simplifies the assembly and evaluation of potential alternatives, but does not eliminate other process options for consideration. The representative process option provides a basis for conceptual design during the FS, without limiting flexibility during the remedial design phase. An alternative process option may be selected during the remedial design phase as a result of design evaluations or testing. The screening and evaluation of technologies addressing Site soil/fill material is summarized in Table 4-2. The screening and evaluation of technologies addressing shallow and intermediate groundwater is summarized in Table 4-3.

Soil/Fill Material

Maintained cover systems (i.e., engineering cover, asphalt covers) have been retained for further evaluation in the FS and are effective means of preventing direct contact and erosion of surface materials. Select technologies for soil/fill material containment were not retained because implementation would not support anticipated Site redevelopment plans. Future use of the Site for commercial purposes would be incompatible with installation and long-term maintenance requirements for both low permeability and evapotranspiration cover systems.

In situ treatment technologies for Site-wide treatment were generally not retained because of limited implementability and/or effectiveness due to lack of effectiveness on all contaminants, absence of discrete on-Site source areas, presence of heterogeneous subsurface conditions (*i.e.,* mixed industrial wastes/debris within historic fill material), access limitations (*i.e.,* subsurface utilities, roadways and railroad tracks), and low permeability characteristics of subsurface materials and the depths at which materials requiring treatment are located. A description of the representative process options for retained *in situ* soil/fill material treatment technologies is presented in Section 4.5.1 below.

As a result of the screening and evaluation of technologies, the following *in situ* technologies/process options addressing soil/fill material were not retained:

- Natural degradation via natural attenuation
- Containment via low permeability cap and evapotranspiration cover
- *In situ* physical/chemical treatment via soil vapor extraction, chemical oxidation, solidification/stabilization, and flushing
- *In situ* biological treatment via enhanced bioremediation
- *In situ* thermal via hot air or steam injection and hot water injection

Ex situ technologies for soil/fill material treatment were not retained because of limitations in implementability due to lack of effectiveness on all contaminants, difficulty implementing for heterogeneous mixed industrial wastes/debris within historic fill material, and the potential incompatibility with anticipated Site redevelopment plans. A description of the representative process options for retained *ex situ* soil/fill material treatment technologies is presented in Section 4.5.1 below.

As a result of the screening and evaluation of technologies, the following *ex situ* technologies/process options addressing soil/fill material were not retained:

- *Ex situ* chemical treatment via extraction/washing, chemical oxidation and dehalogenation
- *Ex situ* physical treatment via particle size separation and solidification/stabilization
- *Ex situ* thermal treatment via low temperature thermal desorption, pyrolysis and incineration
- *Ex situ* biological treatment via biopiles, land farming and slurry-phase bioreactor

A description of the representative process options for retained technologies, by GRA and technology for soil/fill material, is presented in Section 4.5.1 below.

Shallow and Intermediate Groundwater

In situ treatment technologies addressing groundwater were generally not retained because of limited implementability and/or effectiveness due heterogeneity of subsurface materials (*i.e.,* mixed industrial wastes/debris within historic fill material), depths at which materials requiring treatment are located, access limitations (*i.e.,* roadways and railroad tracks), utilities, and transportation infrastructure. As a result of the screening and evaluation of technologies for shallow and intermediate groundwater (Table 4-3), the following technologies/process options were evaluated, but not retained:

- *In situ* biological treatment via enhanced bioremediation
- *In situ* chemical treatment via chemical oxidation
- *In situ* physical treatment via in-well air stripping, and air sparging

A description of the representative process options for retained technologies, by GRA and technology for shallow and intermediate groundwater, is presented in Section 4.5.1 below.

4.5.1 Representative Process Options

A description of the representative process options for retained technologies, by GRA and technology for soil/fill material and shallow and intermediate groundwater, is presented in the following sections.

No Further Action

No further action was identified as a representative process option for soil/fill material and shallow and intermediate groundwater. The no action alternative must be considered in the FS, as required by the *DER-10* Section 4.4(b)3 (NYSDEC 2010). Under this alternative, no further remedial actions addressing Site soil/fill material and shallow and intermediate groundwater would be conducted.

Institutional Controls/Limited Actions

Institutional controls, SMP, and periodic reviews were identified as representative process options associated with the institutional controls/limited actions GRA for soil/fill material and shallow and intermediate groundwater.

- ***Fencing.*** Fencing would be installed to restrict access.
- ***Institutional controls.*** Access/use limitations (*e.g.*, institutional controls) would be recorded for the Site documenting land use restrictions, and requiring that activities that would potentially expose contaminated materials (and require health and safety precautions) be performed in accordance with the SMP. The institutional controls would also provide provisions to evaluate and address, if necessary, potential soil vapor intrusion if buildings are constructed at the Site.
- ***Site management plan.*** A SMP would document Site institutional and engineering controls and any physical components of the selected remedy requiring operation, maintenance, and

monitoring to provide for continued effectiveness of the remedy. The SMP would also present provisions for periodic Site reviews.

- ***Periodic Site reviews.*** Periodic review and certification is required by 6 NYCRR Part 375 where institutional and engineering controls, monitoring, and/or O&M activities are required at the Site. The purpose of the periodic reviews is to evaluate the Site with regard to the continuing protection of human health and the environment and to document remedy effectiveness. In accordance with 6 NYCRR Part 375-1.8(h)(3), the frequency of periodic reviews should be annual, unless a different frequency is approved by NYSDEC.

Monitoring was also identified as a representative process option associated with the institutional controls/limited actions GRA for shallow and intermediate groundwater.

- ***Monitoring.*** Monitoring would involve periodic sampling and analysis of media. Monitoring could provide a means of evaluating natural attenuation of shallow and intermediate groundwater and provides a means of evaluating the effectiveness of the selected groundwater remedies.

Natural Recovery

Natural attenuation was identified as the representative process options associated with the natural recovery GRA for shallow and intermediate groundwater.

- ***Natural attenuation.*** Natural attenuation relies on naturally occurring attenuation processes to reduce the mass, mobility, volume, or concentration of organic constituents in groundwater over time. *In situ* processes include biotic and/or abiotic degradation, sorption, dilution, volatilization and/or transformation.

Containment

Engineered cover was identified as a representative process option associated with the containment GRA for soil/fill material, an asphalt cover and evapotranspiration cover were also retained for consideration. Containment systems provide a sustainable means of minimizing erosion of soil/fill material on the Site resultant from surface water flow, minimize the potential for contact with the soil/fill material on the Site, and would also serve to reduce infiltration.

- ***Engineered cover.*** An engineered cover would consist of a soil layer of an appropriate thickness, or other surface such as gravel, pavement or buildings, over existing soil/fill material. Grading and cover installation would be performed such that drainage is promoted, erosion is minimized, and cover integrity is preserved. This cover would be considered for areas where surface soils exhibit concentrations above applicable NYCRR Part 375 SCOs. This cover is effective at preventing erosion of, and contact with exposed surface soil and soil/fill material. Routine cover maintenance, consisting of mowing of vegetation or repairs to paving and inspections for integrity, would be necessary.

Removal

Mechanical excavation was identified as the representative process option associated with the removal GRA for soil/fill material.

- ***Mechanical excavation.*** Mechanical excavation of soil/fill material is generally implemented using construction equipment such as backhoes and front-end loaders. Excavated areas are backfilled, graded, and restored based on restoration requirements. Sloping techniques, benching, and/or engineering controls (*i.e.*, sheet piling) would be necessary during excavation to maintain stability of excavation walls. Geotechnical stability evaluations would need to be conducted to evaluate implementability and safe methods for excavation. Dewatering of excavations and management of water would also be necessary.

Disposal

Disposal at off-site commercial landfill was identified as the representative process option associated with the disposal GRA for soil/fill material.

- ***Commercial landfill.*** Coupled with mechanical removal, excavated soil/fill material would be transported to regulated, commercial off-site landfills for subsequent disposal. Excavated soil/fill material identified as non-hazardous would be disposed at an off-site landfill, while excavated soil/fill material identified as hazardous would require treatment to meet land disposal restrictions (LDRs) prior to disposal (*i.e.*, treatment to meet LDR treatment standards or alternative soil treatment standards). Waste characterization sampling and analysis would be completed, and a Waste Manifest would be submitted to, and approved by the landfills prior to disposal. Due to the exceedingly large volume of soil/fill material, multiple transportation mechanisms and off-site disposal facilities may need to be identified.

4.6 Assembly of Remedial Alternatives

Remedial alternatives were developed by assembling GRAs and representative process options into combinations that address RAOs for soil/fill material and shallow and intermediate groundwater. Five alternatives were developed for the Site, as summarized below. A summary of components of the remedial alternatives is presented below in Table 1.

SUMMARY OF REMEDIAL ALTERNATIVES

Alternative 1
No Further Action

Alternative 2
Limited Action

Alternative 3
Engineered Cover System in Anticipation of Commercial Development

Alternative 4
Targeted Excavation of Historic Fill Material

Alternative 5
Site-Wide Excavation and Off-Site Disposal

Table 1: Components of Remedial Alternatives

Remedial Component	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
No Further Action	•				
Institutional Controls/limited Actions Institutional controls, SMP, periodic reviews, monitoring and natural attenuation		•	•	•	•
Engineered cover System in anticipation of Commercial Development (12.9 Acres)			•		
Targeted soil/fill material excavation and off-site disposal				•	
Site-Wide soil/fill material excavation and off-site disposal					•

A description of each alternative is included in the following subsections.

4.6.1 Alternative 1 – No Further Action

Alternative 1 is the no further action alternative. The no further action alternative is required to be considered by *DER-10* Section 4.4(b)3 (NYSDEC 2010) and serves as a benchmark for the evaluation of action alternatives. The no further action remedial alternative would not include any additional remedial measures that address the soil/fill material and shallow and intermediate groundwater contamination at the Site.

4.6.2 Alternative 2 - Limited Action

Alternative 2 includes institutional controls, SMP, periodic site reviews, monitoring, and natural attenuation. Alternative 2 provides for an assessment of the environmental conditions if no further remedial actions are implemented. These remedial components of Alternative 2 are also common to Alternatives 3 through 5 (Sections 4.6.3 through 4.6.5) and are described in this section.

Institutional Controls

Administrative control(s) such as an institutional control (*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 limit Site and groundwater use and require maintenance of remedial elements such as covers and groundwater collection systems. Where necessary, preventative measures may be included in the design and construction of 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/fill materials and soil vapor that might cause vapor intrusion. As described above in Section 4.1.2, the reasonably anticipated future land use for the Site is industrial and/or commercial. The institutional controls would reflect this Site use.

Site Management Plan

A SMP would guide future activities at the Site by documenting institutional and engineering controls and by developing requirements for periodic site reviews, the implementation of required O&M activities for the selected remedy, and future development on the Site. In addition, consistent with 6 NYCRR Part 375-1.8(h)(3), annual certification of institutional 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 and certification of institutional and engineering controls should be annual, unless a different frequency is approved by NYSDEC; it is assumed that annual reviews would be conducted at the Site.

Monitoring

Monitoring would be included to evaluate natural attenuation in groundwater. The final monitoring program would be established as part of the SMP for the Site.

4.6.3 Alternative 3 - Engineered Cover System in Anticipation of Commercial Development

Alternative 3 includes implementation of an engineered cover system based on potential chemical-specific SCGs and reasonably anticipated future land uses at the Site, and takes into account anticipated future redevelopment. This alternative would also include institutional controls, a SMP, periodic site reviews, natural attenuation, and monitoring of shallow and intermediate groundwater, as described above for Alternative 2.

The cover system takes into account a future commercial redevelopment scenario following Site remediation. As such, a 1-ft thick cover or equivalent would be applied and graded for the purpose of minimizing erosion and potential exposure of human receptors to constituents exceeding SCOs in soil/fill material over approximately 12.9 acres. Existing Site cover (*i.e.*, granular, existing buildings) would be taken into consideration. Shallow excavation (*e.g.,* swale area) and grading activities are assumed to precede cover installation in portions of the Site such that the final cover grade would match existing roadway, building and parking lot grades, or otherwise be compatible with development of the Site. The conceptual extent of the cover system is depicted on Figure 4-1. The engineered cover is described below in this Section.

Engineered Cover System in Anticipation of Commercial Development

Consistent with the current and reasonably anticipated future land uses for the Site, an engineered cover system would be implemented in areas at the Site where surface soil concentrations are above SCOs for industrial or commercial use, as illustrated on Figure 4-1. Consistent with NYSDEC's *DER-10*, the engineered cover system would include a 1-ft thick soil/granular cover (or maintained paved surfaces and buildings) for the purposes of mitigating potentially unacceptable exposure risks and surface erosion in support of the reasonably anticipated future use of the Site and its surroundings, that would be installed following Site grading. To support anticipated future redevelopment and delimit the presence of soil above SCOs, a demarcation layer will be installed below the soil/granular cover to serve as a boundary between impacted Site soil/fill material and the engineered cover system. The need for a demarcation layer will be further considered during the remedial design.

Site grading and cover system installation could be performed in support of future commercial redevelopment. The exact boundaries of the covers and seed application mixes within the anticipated footprint illustrated on Figure 4-1 are unknown; however, for the purposes of cost estimation in this FS, a mix of 1-ft thick vegetated soil cover (9.2 acres) and stone cover (3.7 acres) is assumed based on Site areas. The extent of covers will be revisited during the design phase. The engineered cover system would require routine maintenance and inspection to maintain cover system integrity.

4.6.4 Alternative 4 - Targeted Excavation of Historic Fill Material

Alternative 4 includes excavation of historic fill material, but not underlying Solvay waste. Excavated materials would be managed off-site. Restoration of the excavated area would include the installation of backfill to generally restore the site to surrounding elevations. Final elevations could be up to 10 ft lower than current conditions. This alternative would also include institutional controls, a SMP, periodic site reviews, natural attenuation, and monitoring of shallow and intermediate groundwater, as described above for Alternative 2.

Alternative 4 is intended to remove historic fill materials deposited over Solvay waste for the purpose of minimizing erosion and potential exposure of human receptors to fill materials and constituents exceeding SCOs in soil/fill material over approximately 9.2 acres. Excavation is anticipated to require removal of fill materials as deep as 20 ft bgs. It is assumed that excavation would be conducted to the

top of Solvay Waste. The conceptual extent of the historic fill excavation is depicted on Figure 4-2. The targeted excavation of historic fill material and disposal are described below in this Section.

Targeted Excavation

Mechanical excavation would be conducted to remove historic fill material. As described in Section 2.2, historic fill material included diaphragm cells, laboratory equipment, construction and demolition debris, miscellaneous metal debris, and boiler slag deposited over Solvay Waste. Fill material to be removed ranges in thickness from 3 to 20 ft and covers an area of approximately 9.2 acres. Excavation would be conducted to achieve a minimum temporary slope of 1:2 where possible, with sheet piling installed along select portions. Based on these approximate elevations, the total volume of historical fill material to be removed in Alternative 4 is estimated at approximately 297,000 cy. Due to the required setbacks and sloping from adjacent features (*e.g.*, railways, roadways, existing utilities within the swale area right-of-way) impacted material would remain following excavation. It has been assumed that dewatering a portion of the fill material would be required prior to off-site transportation. For the purpose of the FS, it is anticipated that construction water would be treated at the Willis-Semet GWTP.

Alternative 4 also would include removal of approximately 21,000 sq ft of existing building foundations/slabs, resulting in approximately 3,900 tons of construction and debris (C&D) material.

Off-Site Transportation

For remedial alternative cost estimation purposes, it was assumed a total estimated 515,000 tons of excavated historical fill material and associated Site debris from existing building and foundations would be transported off-site under Alternative 4. It is estimated that the material would be shipped off-site in three construction seasons resulting in approximately 30,000 truck trips.

Site Restoration

Clean backfill would be transported via trucks from an off-site borrow source to the Site, requiring an estimated 152,000 cy (approximately 9,000 truck trips), to restore excavated material over the Solvay waste to near existing grades under Alternative 4. The Site would be restored, as appropriate, in anticipation of future commercial redevelopment

4.6.5 Alternative 5 - Site-Wide Excavation and Off-Site Disposal

Alternative 5 includes mechanical excavation of soil/fill material. This alternative also includes the institutional controls, a SMP, periodic reviews, and also includes monitoring and natural attenuation as described in Alternative 2. Excavated soil/fill material would be transported off-site for management and/or disposal.

Alternative 5 is intended to evaluate restoration to pre-disposal conditions through the full excavation of soil/fill material. As such, Alternative 5 includes removal and replacement of soil/fill material at the Site exhibiting concentrations above Unrestricted SCOs. This is anticipated to require removal of material as deep as 45 ft bgs. Excavated material would be managed off-site. This alternative is depicted on Figure 4-3.

Excavation depths and volumes required to achieve pre-disposal conditions are anticipated to present the following constructability and community concerns:

Geotechnical concerns with Mechanical Excavation and Off-Site Disposal of Soil/Fill

Mechanical excavation would be conducted to remove Site-wide soil/fill material. Material to be removed ranges in thickness up to 45 ft. No soil removal is assumed within 30-ft of rail structures. Excavation would be conducted to achieve a minimum temporary slope of 1:2 where possible, with sheet piling installed along select portions. Based on these approximate elevations, the total volume of soil/fill material in Alternative 5 is estimated at approximately 1,013,000 cy. Due to the required setbacks and sloping from adjacent features (*e.g.*, railways, roadways) some impacted material may remain following excavation. Furthermore, excavation within the swale area would require removal and rerouting of State Fair Boulevard and utilities (*i.e.,* subsurface gas line and above grade electrical) within the swale area right-of-way.

It has been assumed that dewatering a portion of the soil/fill material would be required prior to off-site transportation. For the purpose of the FS, it is anticipated that construction water would be treated at the Willis-Semet GWTP.

Alternative 5 also would include removal of approximately 21,000 sq ft of existing building foundations/slabs, resulting in approximately 3,900 tons of C&D material.

Off-Site Transportation

For remedial alternative cost estimation purposes, it was assumed a total estimated 1,634,000 tons of excavated soil/fill material and associated Site debris from existing foundations and roadways would be transported off-site under Alternative 5. It is estimated that the material would be shipped off-site in nine construction seasons resulting in approximately 90,000 truck trips.

Site Restoration

Clean backfill would be transported via trucks from an off-site borrow source to the Site, requiring an estimated 732,000 cy (40,000 truck trips), to restore excavated areas to near existing grades under Alternative 5.

5. DETAILED ANALYSIS OF ALTERNATIVES

This section documents the detailed analysis of five remedial alternatives developed during the assembly of remedial alternatives. The detailed analysis of the remedial alternatives was conducted consistent with NYSDEC's *DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2010) and the *RI/FS Work Plan* (OBG 2002). This section describes the individual and comparative analysis of the remedial alternatives with respect to nine evaluation criteria that embody the specific statutory requirements that must be evaluated to satisfy the remedy selection process.

5.1 Individual Analysis of Alternatives

NYSDEC DER-10 Section 4.2 and 6 NYCRR Part 375-1.8(f) indicates that, during remedy selection, nine 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 alternatives. The modifying criteria are formally considered during NYSDEC review of, and public comment on the Proposed Remedial Action Plan. The criteria are described below.

Table 2: 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 removal, treatment, containment, engineering, or institutional controls • Ability to achieve RAOs
Compliance with standards, criteria and guidance (SCGs)	• Attainment of chemical-, location-, and action-specific SCGs • Grounds for invoking a waiver, if necessary
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 • 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

Criterion	Considerations
	• 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	• Consistency with land use • Evaluation of the current, intended and reasonably anticipated future use of the site and its surroundings
Modifying Criteria	
Community acceptance	• Summarizes the public's general response to the remedial alternative described in the Proposed Plan and the RI/FS reports. Community acceptance will be assessed in the Record of Decision (ROD) and includes determining which of the remedial alternative the community supports, opposes, and/or has reservations about.

5.2 Comparative Analysis of Alternatives

The detailed analysis of alternatives also included a comparative evaluation designed to consider the relative performance of the alternatives and identify major trade-offs among them. The comparative evaluation of alternatives is presented in the following subsections. In the comparative analysis of alternatives, the performance of each alternative relative to the others was evaluated for each criterion. As noted in Section 5.1, the detailed evaluation with respect to the FS criteria for each of the alternatives is presented in Table 5-1.

5.2.1 Overall Protection of Human Health and the Environment

Alternative 1, the no further action alternative, does not provide protection of human health due to the absence of controls, resulting in the continued potential for exposure to soil/fill material and shallow and intermediate groundwater. Alternative 1 would not provide protection of the environment or meet the RAOs, as this alternative would not address the potential for discharge of Site-related contaminants in groundwater or the potential for erosion and migration of soil/fill material. Protection of human health and the environment relative to shallow and intermediate groundwater discharge is provided in Alternatives 2 through 5 through the existing groundwater collection system IRMs implemented at Sites located hydraulically downgradient to the Site. Alternative 2, the limited action alternative, would be protective of human health and the environmental relative to shallow and intermediate groundwater discharge and potential exposures; however, protection of the environment relative to erosion and migration of soil/fill material would not be provided. Alternatives 3 through 5 would be protective of human health and the environment following implementation. Alternative 3 provides protectiveness through institutional controls and covers, while Alternatives 4 and 5 provide protectiveness through institutional controls and varying degrees of soil/fill material excavation.

Institutional controls, a SMP, and monitoring would provide for continued protection of the environment and provide a means to evaluate continued protectiveness in Alternatives 2 through 5. Alternative 2 would not provide for protection of human health and the environment relative to the potential for erosion of and exposure to soil/fill material, though institutional controls provide for protection from direct exposure to soil/fill material. Alternative 3 would be protective of human health and the environment through the use of and proper maintenance of the engineered cover system that would control erosion of, and direct contact with, soil/fill material, as well as control the inhalation of

dust. Alternatives 4 and 5 would be protective of human health and the environment through removal and placement of clean backfill that would control erosion of, and direct contact with soil/fill material.

In summary, Alternatives 3 through 5 would be protective of human health and the environment, would address the RAOs, and are consistent with current, intended, and reasonably anticipated future use of the Site. The added risks to workers/community/environment and environmental footprint associated with implementation of Alternatives 4 and 5, and significant challenges associated with the implementability of these alternatives are further described below under the implementability criteria. In addition, implementation of Alternatives 4 and 5 could be disruptive to the timing of current, intended, and reasonably anticipated future use of the Site. Alternative 3 provides adequate and reliable protection of human health and the environment, without the added effort and disruption associated with Alternatives 4 and 5. Under Alternative 4, following disruption associated with excavation of historic fill material, soil/fill material associated with Solvay Wastebed C would still remain at the Site.

5.2.2 Compliance with SCGs

Potential chemical-, location-, and action-specific SCGs identified for consideration in the FS are summarized in Table 4-1. Although shallow and intermediate groundwater is not currently or anticipated to be used, Alternatives 2 through 5 would address shallow and intermediate groundwater exceeding chemical-specific SCGs with natural attenuation processes and institutional controls. It should be noted that, as described in Section 3, potential impacts due to groundwater discharging from the Site to Onondaga Lake are addressed by IRMs conducted at Willis Avenue and WBB/HB Sites, located hydraulically downgradient to the Site. Alternatives 1 and 2 would not actively address chemical-specific SCGs relative to potential releases from or exposure to soil/fill material. For Alternative 3, chemical-specific SCGs are addressed through limiting potential for exposures to and erosion and migration of soil/fill material exceeding chemical-specific SCGs through the use of an engineered cover system, a SMP, and institutional controls. Alternative 4 includes removal of historic fill material overlying soil/fill material associated with Solvay Wastebed C to address a targeted horizon of material exceeding chemical-specific SCGs and containing industrial debris. Alternative 5 would address chemical-specific SCGs through Site-wide removal of historic fill material and underlying soil/fill material associated with Solvay Wastebed C.

No action- or location-specific SCGs were identified for Alternative 1, the no further action alternative. Construction methods and safety procedures would be implemented to adhere to the location- and action-specific SCGs identified for Alternatives 2 through 5. Specifically, institutional controls would be implemented in Alternatives 2 through 5 in general conformance with NYSDEC's guidance DER-33 (NYSDEC 2010a). Additionally, the engineered cover system in Alternative 3 would prevent erosion and exposure to soil/fill material. The engineered cover system would be implemented in general conformance with NYSDEC's guidance *DER-10*. 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 engineered cover system and excavation activities would be conducted consistent with applicable standards; earth moving/excavation activities would be conducted consistent with air quality standards; and transportation and disposal activities would be conducted in accordance with applicable State and Federal requirements, by licensed and permitted haulers.

5.2.3 Long-term Effectiveness and Permanence

Alternative 1 would involve no active remedial measures and, therefore, would not be effective in eliminating the potential exposure to contaminants and would allow the continued migration of

contaminants to groundwater, surface water or sediment. The other alternatives provide an effective means of addressing residual risks associated with soil/fill material and shallow and intermediate groundwater. Potential residual human health risks associated with soil/fill material exceeding SCGs would be addressed in Alternatives 2 through 5 through institutional controls, SMP, and periodic reviews. Additionally, potential exposures to shallow and intermediate groundwater exceeding chemical-specific SCGs would be addressed by institutional controls under Alternatives 2 through 5. Addition of the engineered cover system in Alternative 3 and varying degrees of excavation in Alternatives 4 and 5 would result in added effectiveness relative to addressing potential human and environmental health risks when compared to Alternative 2.

Implementation of an engineered cover system and institutional controls in Alternative 3 would provide adequate and reliable means of controlling erosion of, exposure to, and direct contact with Site soil/fill material. The engineered cover system and institutional controls in Alternative 3 are reliable, adequate, and support Site redevelopment plans. Historic fill material and Site-wide soil/fill material would be addressed in Alternatives 4 and 5, through removal, providing added long-term effectiveness.

Each alternative offers long-term sustainability, though construction of Alternative 3 results in greater greenhouse gas impacts than Alternatives 1 and 2, and construction of Alternatives 4 and 5 results in significantly greater greenhouse gas impacts than the other alternatives. Long-term O&M requirements in Alternatives 2 through 5 would result in minimal impact to the environment. Consistent with NYSDEC policies on green remediation, sustainability considerations alone should not be used to justify implementation of a no further action alternative or a less comprehensive alternative.

In summary, Alternatives 3 through 5 would provide long-term effectiveness and permanence, while Alternatives 1 and 2 would not. Residual risks associated with the potential for exposure to and erosion and migration of soil/fill material would remain in Alternatives 1 and 2. Residual risks associated with Alternatives 3 through 5 are adequately and reliably addressed through institutional controls. Each alternative results 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.

5.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

There would be no reduction in toxicity, mobility, or volume in soil/fill material through treatment provided in Alternatives 1 and 2. Alternative 3 would result in a reduction in mobility (*i.e.*, erosion) of COCs in soil/fill material through an engineered cover system. Alternatives 4 and 5 would result in the reduction in volume of soil/fill material at the Site.

Excavation of historic soil/fill material would result in the removal and off-Site disposal of 297,000 cy under Alternative 4. Alternative 5 would remove approximately 1,013,000 cy of soil/fill material exceeding unrestricted use SCOs for subsequent off-Site disposal. Removal of soil/fill material in Alternatives 4 and 5 is irreversible.

5.2.5 Short-term Effectiveness

Alternatives 1 and 2 do not include physical measures in areas of contamination and, therefore, would not present potential adverse impacts to remediation workers or the community as a result of its implementation. Alternatives 3 through 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. Alternative 3 would address RAOs within one construction season. Alternative 4 would address RAOs within approximately three construction seasons. Alternative 5 would address RAOs within approximately nine construction seasons.

Impacts to the community resulting from the construction of Alternative 3 would primarily be due to increased truck traffic and increased noise for the 1-year duration of cover system construction. Alternatives 4 and 5 would have significantly greater traffic and noise impacts to the community than Alternative 3 with the added concern associated with emissions resulting from disturbance of soils. In addition, Alternatives 4 and 5 would involve temporary disruption and possible rerouting of a portion of State Fair Boulevard, Willis Avenue and/or the CSX rail line for up to 3 to 9 years.

As it relates to traffic, transportation of excavated materials in Alternatives 4 and 5 is anticipated to result in approximately 39,000 to 130,000 trucks trips to and from the Site as compared to 1,100 and 1,800 truck trips necessary for cover construction included in Alternative 3, respectively.

With respect to sustainability, there is an environmental footprint inherent in implementation of each alternative as it relates to construction and operation as well as impacts to the community (as described above). The implementation of the excavation and off-site disposal included in Alternative 5 would result in far greater direct emissions and fuel consumption, as compared to importing construction materials and construction of cover system included in Alternative 3 and targeted excavation in Alternative 4. It is estimated that greenhouse gas emissions associated with construction and transportation needs for Alternative 5 would be approximately 35,000 $MtCO_2e$, as compared to an estimated 70 - 150 $MtCO_2e$ for cover construction included in Alternative 3. Cover construction included in Alternative 3 would represent the equivalent of the annual emissions of approximately 15-30 cars, however, excavation of materials in Alternatives 4 and 5 would represent adding annual emissions of an additional 2,100 cars and 6,900 cars, respectively. Consistent with NYSDEC policies on green remediation, sustainability considerations should not be used to justify implementation of a no action alternative or a less comprehensive alternative.

The engineered cover system included in Alternative 3 would be consistent with current and reasonably anticipated future use. Alternative 1 would not be consistent with current and reasonably anticipated future use since it would not be protective. Alternative 2 relies on institutional controls for protectiveness under current and reasonably anticipated future use. Implementation of Alternatives 4 and 5 could delay implementation of anticipated future redevelopment of the Site.

Green remediation techniques, as detailed in NYSDEC's *Green Remediation Program Policy - DER-31* (NYSDEC 2011), 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 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
- Design of cover systems, to the extent possible, to be usable for alternate uses, require minimal maintenance (*e.g.*, less mowing), allow for infiltration of storm water and/or be integrated with the planned use of the property
- Beneficial reuse of material that would otherwise be considered a waste
- Use of ultra low sulfur diesel (ULSD)

In summary, each active alternative would provide short-term effectiveness. Worker and community risks during remedy implementation would be greater for Alternatives 4 and 5 as compared to Alternative 3. The added risks to workers and the community, the added duration to achieve RAOs, significant traffic impacts to the community and significantly greater environmental footprint make Alternatives 4 and 5 much less effective means of attaining RAOs as compared to the other alternatives.

5.2.6 Implementability

Alternatives 1 through 3 are readily implementable. Alternatives 1 through 3 can be readily constructed and operated; the materials necessary for the construction of these alternatives are reasonably available. The engineered cover system in Alternative 3 would incorporate constructible and reliable technologies. The necessary equipment and specialists would be available for these alternatives. Monitoring the effectiveness of Alternative 3 would be accomplished through cover system inspections and maintenance to verify continued cover integrity, visual signs of erosion, and condition of the cover system. Alternative 3 would require coordination with other agencies, including NYSDEC, New York State Department of Transportation (NYSDOT), New York State Department of Health (NYSDOH), the Town of Geddes, City of Syracuse, and Onondaga County. Alternatives 4 and 5 are not implementable for the following reasons:

- Excavation and off-site management of 297,000 to 1,013,000 cy of soil/fill material associated with Alternatives 4 and 5, would be substantially more difficult to implement than the cover placement contemplated in Alternative 3. Specifically, there are significant implementability limitations associated with excavation, transportation, and obtaining appropriate disposal capacity for this large volume of material.
- Excavation considerations that limit the implementability of Alternatives 4 and 5 include challenging construction water management and slope stability concerns. Construction water management is anticipated to be significant during excavation since large volumes are anticipated due to the presence of permeable fill. Construction water treatment capacity at the Willis-Semet GWTP would require evaluation. Excavations in the vicinity of active railroads and roadways are anticipated to limit the implementability of excavations in certain areas and require the costly design, procurement and installation of shoring.
- Off-site management of excavated soil/fill material capacity and management options would require further evaluation as disposal capacity may be limited, requiring transport to multiple off-Site facilities. Limitations to implementability would also exist during the excavation, management and disposal of historic fill material due to the heterogeneity and contents of the fill material, including diaphragm cells, laboratory equipment, construction and demolition debris, miscellaneous metal debris, and boiler slag.
- Transportation considerations that severely limit the implementability of Alternatives 4 and 5 include significantly increased traffic, fuel usage and adverse effects on both air quality and community safety. Based on anticipated bulking of the material as a result of excavation, the total estimated volume requiring disposal of between 297,000 and 1,013,000 cy (estimated to be approximately up to 1,720,000 tons). Based on a daily production rate of 400 cy per day for 10 months of the year, it is estimated that up to approximately 88,000 cy of material would be shipped off-site each year in 9,975 truck trips (45 truck trips per day) with an approximately equivalent number of trips being required for restoration. During a 10-hour work day, this would equate to approximately 1 truck entering or leaving the Site every 5 minutes. In addition to the potentially significant adverse effects on local air quality and community traffic patterns, traffic of this magnitude is anticipated to result in significant adverse effects on conditions of roadways.

In summary, Alternatives 1 through 3 are readily implementable. Alternatives 4 and 5 are not practical and are significantly more difficult to implement for the reasons cited above.

5.2.7 Cost

Detailed cost estimates for the alternatives are included as Tables 5-2 through 5-6. The estimated costs associated with Alternatives 1 through 5 are summarized as follows:

Table 3: Summary of Remedial Alternative Cost Estimates

Alternative	Total estimated capital cost	Total estimated present worth of O&M (30 yrs)	Total estimated net present worth cost
1 – No Further Action	$0	$0	$0
2 – Limited Action	$0.08 M	$0.32 M	$0.4 M
3 – Engineered Cover System in Anticipation of Commercial Development	$3.2 M	$0.36 M	$3.6 M
4 – Targeted Excavation of Historic Fill Material with Off-Site Disposal	$104.3 M	$0.34 M	$104.6 M
5 – Site-Wide Excavation with Off-Site Disposal	$379.4 M	$0.30 M	$379.7 M

5.2.8 Land Use

Consistent with 6 NYCRR Part 375-1.8(f) and DER-10 4.2(i), the current, intended, and reasonably anticipated future use of the Site was considered when selecting SCOs. Implementation of Alternative 1 would not be consistent with current, intended, and reasonably anticipated future uses of the Site. Specifically, effects from soil/fill material on human health and the environment would not be controlled under Alternative 1. Alternative 2 would rely on institutional controls for protection from effects from soil/fill material on human health under the current, intended, and reasonably anticipated future uses of the Site. The engineered cover system in Alternative 3 would address soil/fill material exceeding SCOs consistent with current, intended, and reasonably anticipated future use of the property. The engineered cover system in Alternative 3 would also support anticipated future Site redevelopment activities. Alternatives 4 and 5, with temporary disruption and possible rerouting of a portion of State Fair Boulevard, Willis Avenue and the CSX rail line, would significantly disrupt current land use and traffic patterns, and the duration of remedy implementation would delay the anticipated future Site redevelopment plans.

5.2.9 Community Acceptance

Evaluation of the community acceptance criterion summarizes the public's general response to the response measures described in the Proposed Remedial Action Plan and the RI/FS reports. Community acceptance will be assessed in the ROD and includes determining which of the response measures the community supports, opposes, and/or has reservations about.

6. CONCLUSIONS

This FS Report documents the development of remedial alternatives for the protection of human health and the environment to address contaminants identified for the Site. Consistent with DER-10, 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.

As discussed in Section 5, Alternative 1 would not satisfy the threshold criteria, while Alternatives 3 through 5 would satisfy the threshold criteria by providing overall protection to human health and the environment, and by complying with the identified SGCs. While institutional controls included in Alternative 2 are protective of human health, protection of the environment is not provided. Therefore, with the exception of Alternatives 1 and 2, 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; and cost) concludes that Alternatives 4 and 5 are significantly more difficult to implement, present significant short-term impacts, and are the most costly means of achieving the objectives. Alternative 3 is the cost-effective alternative that achieves overall protection to human health and the environment through implementation of an engineered cover system, taking into account anticipated future redevelopment.

Alternative 3 includes implementation of a 1-ft thick soil/granular cover (or maintained paved surfaces or buildings) over approximately 12.9 acres for the purpose of mitigating potentially unacceptable exposure risks and surface soil/fill material erosion. Site grading and cover system installation could be performed in support of future commercial redevelopment. This alternative would also include institutional controls, a SMP, periodic site reviews, natural attenuation, and monitoring of shallow and intermediate groundwater.

As part of the process established for remedial alternatives under the ACO, following review of the evaluations documented in this FS Report, NYSDEC will identify an alternative to propose as the preferred remedy to be documented in a Proposed Remedial Action Plan for the Site. Following receipt of public comments on the Proposed Remedial Action Plan, the selected remedial alternative will be documented in a ROD for the Site.

7. REFERENCES

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TABLES

Table 4-1: Evaluation of Potential Standards, Criteria and Guidance (SCGs)

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
Potential Chemical-Specific SCGs				
Shallow/intermediate groundwater	6 NYCRR 700.1 - Definitions	Promulgated state regulation that provides groundwater definitions.	Fresh groundwater is defined as groundwater with a chloride concentration equal to or less than 250 mg/L or a total dissolved solids concentration (TDS) equal to or less than 1,000 mg/L. Saline groundwater is defined as groundwater with a chloride concentration greater than 250 mg/L or a TDS concentration greater than 1,000 mg/L.	Yes
	6 NYCRR 701 - Classifications - Surface Waters and Groundwaters	Promulgated state regulation that provides groundwater classifications.	6 NYCRR Part 701.15 states that Class GA groundwater is fresh groundwater, and the best use of Class GA groundwater is potable use. 6 NYCRR Part 701.16 states that Class GSA groundwater is saline groundwater, and the best use of Class GSA groundwater is as a source of potable mineral waters, conversion to fresh potable waters, or as raw material for the manufacture of sodium chloride or its derivatives or similar products. 6 NYCRR Part 701.18 states that the groundwater classifications defined in Sections 701.15 (Class GA fresh groundwaters) and 701.16 (Class GSA saline groundwaters) are assigned to all the groundwaters of New York State.	Yes
	6 NYCRR Part 703 - Class GSA groundwater quality standards	Promulgated water quality standards for saline groundwater, consisting of narrative standards for taste-, color-, odor-producing, toxic, and other deleterious substances and thermal discharges.	Potentially applicable for saline groundwater.	Yes
	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 fresh groundwater.	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.	Yes
	40 CFR Part 141 - Drinking Water Standards	Establishes Maximum Contaminant Levels (MCLs) for public water supplies.	Not applicable because Site groundwater not used as drinking water source nor suitable for drinking water source.	No
Soil	6 NYCRR Part 375-6 Remedial Program Soil Cleanup Objectives	Regulation that provides guidance for soil cleanup objectives for various property uses.	Potentially applicable to Site soil. Soil cleanup objectives that are potentially applicable include protection of ecological resources, restricted use - industrial, and restricted use - commercial. Soil cleanup objectives for the protection of groundwater are not applicable as migrating contaminated groundwater will be mitigated by the Semet/Willis and Wastebed B/Harbor Brook IRM barrier wall and collection system.	Yes
Potential Location-Specific SCGs				
Wetlands	6 NYCRR 663 - Freshwater wetland permit requirements	Actions occurring in a designated freshwater wetland (within 100 ft) 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.	Potentially applicable; wetlands have been delineated within 100 ft of Site.	Yes

Table 4-1: Evaluation of Potential Standards, Criteria and Guidance (SCGs)				
Medium Location/Action	**Citation**	**Requirements**	**Comments**	**Potential SCG**
Potential Location-Specific SCGs (Cont'd)				
Wetlands (cont)	Clean Water Act Section 404 33 CFR Parts 320 - 330 - Nationwide permit program	Regulatory policies and permit requirements for work affecting waters of the United States, including wetlands.	Not applicable; no wetlands delineated 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.		
	Executive Order 11990 - Protection of Wetlands	Executive order requires federal agencies to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands if a practicable alternative exists.		
Construction of Buildings	NYSDOH's October 2006 Guidance for Evaluating Soil Vapor Intrusion in the State of New York	Guidance document that provides thresholds for indoor air and subslab soil vapor above which vapor mitigation is required.	Potentially applicable if future buildings are constructed at the Site.	No
	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 if future buildings are constructed at the Site.	No
Floodplains	6 NYCRR 373-2.2 - Location standards for hazardous waste treatment, storage, and disposal facilities -100-year floodplain	Hazardous waste treatment, storage, or disposal facilities located in a 100-year floodplain must be designed, constructed, operated and maintained to prevent washout of hazardous waste during a 100-year flood.	Not applicable; Site is not located in the 100-year or 500-year floodplain.	No
	40 CFR Part 264.18(b) - Location Standards - Floodplains			
	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).		
	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.		

Table 4-1: Evaluation of Potential Standards, Criteria and Guidance (SCGs)				
Medium Location/Action	**Citation**	**Requirements**	**Comments**	**Potential SCG**
Potential Location-Specific SCGs (Cont'd)				
Floodplains (Cont.)	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.	Not applicable; Site is not located in the 100-year or 500-year floodplain.	No
	Town of Geddes Flood Protection Ordinance	Permit requirements for work in areas of special flood hazard.		
	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.		
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 for wetlands as there are no delineated wetlands on Site.	No
	40 CFR Part 6, Appendix A - Statement of Procedures on Floodplains Management and Wetlands Protection (January 5, 1979)	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.		
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 or relevant and appropriate. 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
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 or relevant and appropriate. No salt dome formations, salt bed formations, underground mines or caves present at Site.	No

Table 4-1: Evaluation of Potential Standards, Criteria and Guidance (SCGs)

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
Potential Location-Specific SCGs (Cont'd)				
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.	Potentially applicable or relevant and appropriate. The Indiana bat, a state and federal-listed endangered species has been observed in the Onondaga Lake area. One threatened plant within 2 miles of Site on north shore of Onondaga Lake not anticipated to be impacted by Site activities.	Yes
	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.	Potentially applicable. A draft Phase 1 assessment identified the potential for prehistoric and historic resources in and in the vicinity of the Site.	Yes
	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.		
	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.		
Wilderness Area	Wilderness Act 50 CFR Part 35 - Wilderness Preservation and Management	Provides for protection of federally-owned designated wilderness areas.	Not applicable or relevant and appropriate. 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 or relevant and appropriate. 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 or relevant and appropriate. 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 or relevant and appropriate. Site not located in coastal barrier.	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.	Yes

Table 4-1: Evaluation of Potential Standards, Criteria and Guidance (SCGs)				
Medium Location/Action	**Citation**	**Requirements**	**Comments**	**Potential SCG**
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 guidance 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 guidance for cover 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. Potentially applicable for treatment residuals or soil/fill material consolidated on-Site in a containment unit.	Yes
	40 CFR Parts 264 and 265, Subpart N – Landfills	Promulgated federal regulation that provides requirements for hazardous waste landfill units.		Yes
Principal Threat and Low Level Threat Waste	A Guide to Principal Threat and Low Level Threat Wastes – Quick Reference Fact Sheet (OSWER Superfund Publication 9380.3-06FS, November 1991)	Guidance that outlines federal expectations, definitions, and documentation requirements related to waste considered principal or low level threat waste.	Potentially applicable.	Yes
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 processes 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 technical guidance document that provides guidelines for the development of site remediation strategies in a manner that minimizes environmental impacts and applies	Potentially applicable.	Yes

Table 4-1: Evaluation of Potential Standards, Criteria and Guidance (SCGs)				
Medium Location/Action	**Citation**	**Requirements**	**Comments**	**Potential SCG**
		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).		
Potential Action-Specific SCGs (Cont'd)				
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 H2S from point sources.	Not applicable or relevant and appropriate. Dust emissions would not be generated from a point source. Potential applicable during dust generating activities such as earth moving, grading and excavation.	Yes
	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.	To be considered material where more stringent than air-related standards.	Yes
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.	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
IRM – Interim Remedial Measure
mg/L – milligrams per liter
NYCRR – New York Code of Rules and Regulations
NYS – New York State
NYSDEC – New York State Department of Environmental Conservation
NYSDOH – New York State Department of Health
OSWER – Office of Solid Waste and Emergency Response
SCO – Soil Cleanup Objective
TAGM – Technical and Administrative Guidance Memorandum
TOGS – Technical and Operations Guidance Series
USEPA – United States Environmental Protection Agency

Table 4-2: Screening and Evaluation of Remedial Technologies and Process Options for Soil/Fill Material

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
No action	No action	No action*	No remedial actions addressing Site soil/fill material would be conducted.	Not effective in mitigating potential for migration of COCs from soil/fill material or contact with COCs in exposed soil/fill material.	Readily implementable.	No capital No O&M	Potentially applicable. Retained for further consideration. No action required for consideration by NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation.
Institutional controls/limited actions	Access/use restrictions/ administrative controls	Fencing*	Installation of fencing surrounding area(s) of contamination.	Effective means of restricting access and preventing trespassing onto portions of the Site.	Implementable.	Low capital Low O&M	Potentially applicable for the Site.
		Institutional controls*	Implementation and documentation of access and land use restrictions that would require activities that would potentially disturb or expose contaminated soil/fill material (and require health and safety precautions) be conducted in accordance with the site management plan. Institutional controls would also provide provisions to evaluate and address potential soil vapor intrusion, as necessary, if a new building(s) is constructed at the Site.	Effective means of controlling Site use.	Implementable. May require access/implementation agreements for areas either not owned by Honeywell.	Low capital No O&M	Potentially applicable. May required access agreement with other property owners. Retained for further consideration.
	Site controls	Site management plan*	Documentation of Site restrictions and provisions for continued operation and maintenance of the remedy. Presents requirements for periodic Site reviews.	Effective means of communicating Site restrictions to affected parties and documenting operation and monitoring of the remedy.	Implementable.	Low capital Low O&M	Potentially applicable
	Periodic reviews	Periodic site reviews*	Periodic reviews are required by 6 NYCRR Part 375 and DER-10 where institutional and engineering controls, monitoring plans, and/or operations and maintenance activities are implemented on a site. The purpose of the reviews is to evaluate the areas in regard to the continuing protection of human health and the environment and to provide documentation of remedy effectiveness. In accordance with 6 NYCRR Part 375-1.8(h)(3), the frequency of periodic reviews should be annual, unless a different frequency is approved by NYSDEC. Periodic site reviews would include the performance of Five Year Reviews in accordance with 40 CFR 300.430(f)(4)ii.	Effective means of evaluating continued protection to human health and the environment.	Readily implementable.	No capital Low O&M	Potentially applicable. Retained for further consideration.
Natural recovery	Natural Degradation	Natural attenuation*	The natural degradation of contaminants by *in situ* physical, chemical and/or biological processes. Over time, contaminants' toxicity, mobility and/or volume can be reduced by processes that include biodegradation, sorption, dilution, volatilization, and/or transformation.	Attenuation processes potentially effective for reduction of contaminant concentrations over the long-term; however, existing Site data is inconclusive.	Potentially implementable.	Low capital Low O&M	Not applicable for metals treatment. Naturally occurring attenuation processes are likely occurring; however, current Site data is inconclusive.

Table 4-2: Screening and Evaluation of Remedial Technologies and Process Options for Soil/Fill Material

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
Containment	Cover system	Engineered cover*	Use of soil/granular cover to minimize erosion of surface soil/fill material and prevent direct contact with soil/fill material, as well as control the inhalation of dust. Grading would be performed such that drainage is promoted, erosion is minimized, and cover integrity is protected.	Effective means of minimizing erosion of, and contact with exposed surface soil and soil/fill material.	Implementable. Coordination with future site redevelopment plans necessary. Routine cover maintenance and inspection would be necessary to maintain cover system integrity.	Medium capital Medium O&M	Potentially applicable. Retained for further consideration in areas where surface soils exhibit concentrations above NYCRR Part 375 SCOs corresponding to site use.
		Asphalt cover	Use of an asphalt layer to minimize surface water infiltration, encourage runoff and control erosion, and prevent direct contact with soil/fill material, as well as the inhalation of dust.	Effective means of minimizing erosion of and contact with exposed surface soil/fill material. Effective means of reducing infiltration that could reduce leaching of contaminants in soil/fill material to groundwater and reduce mobilization of COCs.	Implementable. Coordination with future site redevelopment plans necessary. Routine cover maintenance and inspection would be necessary to maintain cover system integrity.	Medium capital Medium O&M	Potentially applicable. Retained for further consideration in areas where surface soils exhibit concentrations above NYCRR Part 375 SCOs corresponding to site use.
		Low permeability cap	Use of a low permeability vegetated cover to minimize surface water infiltration, encourage runoff and control erosion, and isolate and contain impacted soil/fill material. Low permeability cover components may consist of low permeability clay or a geomembrane system. Vegetation, asphalt, or gravel may be utilized as the top layer based upon site use and restoration requirements within the covered area.	Effective means of minimizing erosion of and contact with exposed soil/fill material. Effective means of minimizing erosion of soil/fill material that could result in surface water contamination. Results in reduction in infiltration that could reduce leaching of contaminants in soil/fill material to groundwater and reduce mobilization of COCs. Effectiveness relies on maintaining integrity of cover system.	Potentially. Low permeability cap would not support future site redevelopment plans. Routine cover maintenance and inspection would be necessary to maintain cover system integrity.	High capital Medium O&M	Potentially applicable for minimizing direct contact and infiltration. Not retained for further consideration due to inconsistency with future site redevelopment plans.
Containment (cont.)	Cover system (cont.)	Evapotranspiration cover	Use of one or more vegetated soil layers to minimize erosion of surface soil/fill material, prevent direct contact with soil/fill material, and to facilitate evaporation and transpiration of precipitation.	Effective means of minimizing erosion of, and contact with exposed surface soil/fill material, and for reducing infiltration.	Potentially implementable. Evapotranspiration cover would not support future site redevelopment plans. Routine cover maintenance and inspection would be necessary to maintain cover system integrity.	Medium capital Medium O&M	Potentially applicable for minimizing direct contact and infiltration. Not retained for further consideration due to inconsistency with future site redevelopment plans.
In situ treatment	Physical/ chemical	Soil vapor extraction (SVE)	Vacuum is applied through extraction wells within the vadose zone to create a pressure/concentration gradient that induces organics sorbed on the soil, dissolved in soil-pore water, and/or present as vapor to volatilize. Extracted vapors are removed from the soil through extraction wells and treated *ex situ* as needed.	Limited effectiveness for VOCs in the unsaturated zone for certain areas due to the presence of heterogeneous and low permeability subsurface materials. Not effective for treatment of SVOCs, PCBs or metals. Underground utilities may provide preferential pathways for vapor migration, potentially causing short circuiting, and affecting treatment effectiveness. A treatability study would be	Absence of discrete on-Site source areas of VOCs renders this technology not practicable. Implementability in discrete areas also limited due to the presence of heterogeneous subsurface characteristics, access limitations in the vicinity of CSX, and underground utilities. Not implementable below the water table. Implementation of SVE and	Medium capital Medium O&M	Not practicable for site-wide treatment of non-discrete on-Site source areas of COCs. Variety of COCs in soil/fill material could limit effectiveness. Not effective for treatment of SVOCs, metals or PCBs. Not retained for further consideration

Table 4-2: Screening and Evaluation of Remedial Technologies and Process Options for Soil/Fill Material

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
				necessary to evaluate effectiveness.	associated dewatering (if necessary) not practical due to low permeability of soil/fill material, and limited radius of influence of SVE points. A pilot/pumping test would be necessary to identify radius of influence and implementability in low permeability soil/fill material. Implementability limitations in the immediate vicinity of roadways and the railroad tracks.		
In situ treatment (cont.)	Physical/ chemical (cont.)	Chemical oxidation	*In situ* treatment of contaminated soil/fill material using oxidants, such as ozone, hydrogen peroxide, hypochlorites, permanganate, and/or sodium persulfide. Oxidation reactions chemically convert constituents to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. Oxidation agents can be applied to the subsurface via injection points, deep soil mixing, or soil fracturing.	Potentially effective for treatment of VOCs, SVOCs, and PCBs in soil/fill material. Not effective for treatment of inorganics. Low permeability and subsurface heterogeneity could cause uneven distribution of the oxidant, resulting in areas of untreated contaminants. Effectiveness dependent on oxidant making contact with treatment area, which would be limited due to subsurface heterogeneity. Could potentially disrupt natural attenuation processes. Potential for production of hazardous intermediates if incomplete oxidation occurs. Potential for mobilization of contamination with injection of fluids. A treatability study would be necessary to evaluate effectiveness and selection of oxidants.	Absence of discrete on-Site source areas of VOCs, SVOCs and PCBs renders this technology not practicable. Implementability in discrete areas also limited due to the presence of heterogeneous subsurface characteristics, access limitations in the vicinity of CSX, and underground utilities. Potential for health and safety issues when handling large volumes of oxidant chemicals and working in the vicinity of potentially aggressive reactions. Heterogeneity of subsurface materials would likely require advanced delivery techniques (*i.e.,* tight injection point spacing).	Medium capital Low to Medium O&M	Not practicable for site-wide treatment of non-discrete on-Site source areas of COCs. Variety of COCs in soil/fill material could limit effectiveness. Not effective for treatment of inorganics. Not retained for further consideration.
		Solidification/ stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), and/or chemical reactions are induced between stabilizing agent and contaminants to reduce their mobility (stabilization), toxicity and leachability.	Potentially effective for the *in situ* stabilization and reduction in mobility of metals in soil/fill material. Limited effectiveness for treatment of VOCs, SVOCs, and PCBs in soil/fill material. Underground utilities, obstructions, and heterogeneous fill material may provide preferential pathways or obstructions for solidification/stabilizing agents	Absence of discrete on-Site source areas renders this technology not practicable. Implementability also limited due to the presence of heterogeneous subsurface characteristics, access limitations in the vicinity of CSX, and underground utilities. Heterogeneity of subsurface materials would likely	High capital No O&M	Not practicable for site-wide treatment of non-discrete on-Site source areas of COCs. Variety of COCs in soil/fill material could limit effectiveness. Not implementable for type of fill material at the Site (heterogeneous mixed industrial waste/debris).

Table 4-2: Screening and Evaluation of Remedial Technologies and Process Options for Soil/Fill Material

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
				mixed into the overburden, preventing complete contact. Large obstructions present in historic fill material (*i.e.,* industrial mixed waste/debris) present at the Ballfield Site would limit effectiveness of *in* situ mixing and could potentially damage *in situ* mixing equipment. A treatability study would be necessary to evaluate effectiveness and selection of reagents.	require advanced delivery techniques (*i.e.*, *in situ* mixing, tight injection point spacing). Implementability limitations in the immediate vicinity of roadways and the railroad tracks.		Not retained for further consideration.
In situ treatment (cont.)	Physical/ chemical (cont.)	Flushing	Water, aqueous solution, surfactants, or cosolvents are injected into the soil or groundwater. The extraction fluid is utilized to enhance contaminant solubility. Contaminants are leached into the groundwater, subsequently removed through a collection system, and treated *ex situ.*	Potentially effective for treatment of VOCs, SVOCs, PCBs and metals in the saturated and unsaturated zones. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by underground utilities, obstructions, and heterogeneous fill material, which may provide preferential pathways resulting in uneven distribution and recovery of the flushing solution. Effectiveness also potentially limited by presence of underground utilities and obstructions, which may provide preferential pathways or obstructions to solution injection and recovery, preventing complete contact.	Absence of discrete on-Site source areas of COCs renders this technology not practicable. Implementability limited due to low presence of heterogeneous subsurface characteristics, access limitations in the vicinity of CSX, and underground utilities. Injected fluid would require recovery and treatment/management. Implementability limitations in the immediate vicinity of roadways and the railroad tracks.	Medium capital No O&M	Not practicable for site-wide treatment of non-discrete on-Site source areas of COCs. Not implementable for type of fill material at the Site (heterogeneous mixed industrial waste/debris). Not retained for further consideration.
	Biological	Phytoremediation	Use of plants to remove, transfer, stabilize, or destroy contaminants in soil.	Potentially effective for VOCs, SVOCs, PCBs, and metals in shallow soil. Potentially effective for providing habitat and erosion control. Treatability study and ecological impact study would be required.	Likely implementable for shallow soil. Watering, fertilization, and insecticide application potentially required. Coordination with future site redevelopment plans necessary.	Low capital Low O&M	Potentially applicable to VOCs, SVOCs, PCBs, and metals in shallow soil.
		Enhanced bioremediation	Injection of microbial populations and potentially nutrient sources/electron donors into the subsurface to enhance biological degradation of organic constituents.	Potentially effective for treatment of VOCs and certain SVOCs in saturated soil. Not effective for treatment of metals or PCBs. A treatability study would be necessary to evaluate effectiveness. Effectiveness dependent on donor microbial and culture	Absence of discrete on-Site source areas of VOCs and SVOCs renders this technology not practicable. Implementability also limited due to the presence of heterogeneous subsurface characteristics, access limitations in the	High capital No O&M	Not practicable for site-wide treatment of non-discrete on-Site source areas of COCs. Not effective for treatment of metals and PCBs. Not implementable for the type of fill material at the Site (heterogeneous

Table 4-2: Screening and Evaluation of Remedial Technologies and Process Options for Soil/Fill Material

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
				making contact with treatment area, which would be limited due to subsurface heterogeneity. Effectiveness potentially limited by underground utilities, obstructions, and heterogeneous fill material which may provide preferential pathways or obstructions for fluids injected into the overburden preventing complete contact.	vicinity of CSX, and underground utilities. Implementability limitations in the immediate vicinity of roadways and the railroad tracks.		mixed industrial waste/debris). Not retained for further consideration.
In situ treatment (cont.)	Thermal	Soil heating	Heating of soil using various techniques, including heating wells, thermal blankets, injection points, electrodes, or electromagnetic energy to heat and volatilize organic contaminants. Volatilized contaminants are removed by vapor extraction. Vapor is treated *ex situ* as needed and brine wastewater generated is either treated *ex situ* and discharged locally or disposed to a water body.	Potentially applicable to SVOCs, PCBs, pesticides, and mercury in unsaturated and saturated zone. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by low permeability and heterogeneous subsurface characteristics which could limit effectiveness of SVE systems, resulting in areas of untreated soil/fill material and unrecovered vapor. Pilot testing necessary to evaluate vapor controls. Treatability study necessary to evaluate effectiveness.	Absence of discrete on-Site source areas of COCs renders this technology not practicable. May require implementation in conjunction with SVE system and groundwater collection system for vapor and groundwater, recovery and/or hydraulic control system to maintain temperatures in the treatment area. Implementability also limited due to the presence of heterogeneous subsurface characteristics, access limitations in the vicinity of CSX, and underground utilities. Implementability limitations in the immediate vicinity of roadways and the railroad tracks. Potential for uncontrolled migration of vapors. High energy requirements and potential for related hazards.	Very high capital No O&M	Potentially applicable to SVOCs, PCBs, pesticides, and mercury in unsaturated and saturated zone. Pilot and treatability studies would be necessary to evaluate effectiveness and Implementability. Retained for further consideration.
In situ treatment (cont.)	Thermal (cont.)	Hot air or steam injection	Injection of hot air or steam through injection wells to enhance the recovery of organic contaminants. The injected steam heats the surrounding subsurface, volatilizing organic contaminants, with subsequent collection and treatment of vapors through a series of extraction wells.	Potentially effective for treating VOCs, SVOCs, PCBs, and mercury. Not effective for treatment of metals other than mercury. Emerging technology for mercury treatment. Effectiveness limited below the water table. Treatability study necessary to evaluate	Absence of discrete on-Site source areas of COCs renders this technology not practicable. May require implementation in conjunction with SVE system and groundwater collection system for vapor and groundwater, recovery and/or hydraulic control	Very High capital No O&M	Not practicable for site-wide treatment of non-discrete on-Site source areas of COCs. Not effective for treatment of inorganics. Not implementable for the type of fill material at the Site (heterogeneous mixed industrial waste/debris).

Table 4-2: Screening and Evaluation of Remedial Technologies and Process Options for Soil/Fill Material

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
				effectiveness. Potential to mobilize some metals.	system to maintain temperatures in the treatment area. Implementability also limited due to the presence of heterogeneous subsurface characteristics, access limitations in the vicinity of CSX, and underground utilities. Implementability limitations in the immediate vicinity of roadways and the railroad tracks. Potential for uncontrolled migration of vapors. High energy requirements and potential for related hazards.		
		Hot water injection	Injection of hot water through injection wells to enhance the recovery of organic constituents. The injected hot water heats the subsurface, increasing dissolution of organic contaminants, with subsequent collection and treatment through a series of groundwater and vapor extraction wells.	Potentially effective for treating VOCs, SVOCs, PCBs, and mercury. Not effective for treatment of metals other than mercury. Emerging technology for mercury treatment. Effectiveness limited below the water table. Treatability study necessary to evaluate effectiveness. Potential to mobilize some metals.	Absence of discrete on-Site source areas of COCs renders this technology not practicable. May require implementation in conjunction with SVE system and groundwater collection system for vapor and groundwater, recovery and/or hydraulic control system to maintain temperatures in the treatment area. Implementability also limited due to the presence of heterogeneous subsurface characteristics, access limitations in the vicinity of CSX, and underground utilities. Implementability limitations in the immediate vicinity of roadways and the railroad tracks. Potential for uncontrolled migration of vapors. High energy requirements and potential for related hazards.	Very High capital No O&M	Not practicable for site-wide treatment of non-discrete on-Site source areas of COCs. Not effective for treatment of inorganics. Not implementable for the type of fill material at the Site (heterogeneous mixed industrial waste/debris). Not retained for further consideration.

Table 4-2: Screening and Evaluation of Remedial Technologies and Process Options for Soil/Fill Material

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
In situ treatment (cont.)	Thermal (cont.)	Vitrification	An electric current is utilized to melt soil and fill material at extremely high temperatures (1,600 - 2,000 ºC to 2,900 - 3,650 ºF) and thereby immobilize most inorganics and destroy organics by pyrolysis.	Potentially effective for removal of organics and stabilization of metals in the unsaturated zone. Treatability study would be required.	Potentially implementable for unsaturated soil and fill material. Not implementable for saturated soil. Subsurface air pockets, if present, can present safety hazard. Potential for volume reduction. Off-gas treatment likely required.	High capital Medium O&M	Potentially applicable to organics and metals in unsaturated zone.
Removal	Excavation	Mechanical excavation*	Use of construction equipment to remove soil/fill material. Due to physical characteristics of soil/fill material and presence below groundwater table, dewatering and water treatment would likely be required. It is anticipated that in addition to dewatering, sludge management may also be required to render the excavated material sufficiently dry for management and transportation. Excavated areas would be backfilled, graded and restored based on restoration requirements. Soil/fill material would be transported and disposed off-site. Treated water would be discharged locally to a water body.	Effective for removal of impacted soil/fill material.	Site-wide excavation not practical due to excessive volume. Risks to workers associated with excavation of heterogeneous mixed industrial waste/debris. With shoring of side slopes required for deep excavations. Water management required for saturated soil. Further management of excavated soil required. Limitations to implementability would exist in the immediate vicinity of roadways, subsurface utilities, the railroad tracks, and in the vicinity of existing structures.	High capital No O&M	Not practicable for site-wide removal of non-discrete areas of COCs. Not implementable in the immediate vicinity of roadways, subsurface utilities, the railroad tracks, and existing structures. Potentially applicable for targeted removal of soil/fill material. Site-wide soil excavation potentially incompatible with anticipated Site use/redevelopment. Retained for further consideration.
Ex situ treatment	Chemical	Extraction/washing	Soil/fill material and extractant are mixed in an extractor, thereby dissolving the contaminants. The extracted solution is placed in a separator, where the contaminants and extractant are separated for treatment and further use.	Potentially effective for removal of PAHs, PCBs, pesticides, and metals from soil. Heterogeneous, low permeability soils may reduce performance. Treatability study would be required.	Difficult to implement for heterogeneous mixed industrial waste/debris; waste/debris/soil separation would be required. Wastewater treatment and residual management would be required.	Medium capital Low O&M	Not implementable for the type of fill material at the Site (heterogeneous mixed industrial waste/debris). *Ex situ* soil treatment potentially incompatible with anticipated Site use/redevelopment. Not retained for further consideration.
		Chemical Oxidation	*Ex situ* treatment of contaminated soil/fill material using oxidants such as ozone, hydrogen peroxide, hypochlorites, permanganate, and/or sodium persulfide. Oxidation reactions chemically convert constituents to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Limited applications of *ex situ* chemical oxidation for soil/fill material. Potentially effective for organic destruction. Treatability study would be required. Not effective for metals.	Difficult to implement for heterogeneous mixed industrial waste/debris; waste/debris/soil separation would be required. Potential for health and safety issues when handling large volumes of oxidant chemicals and working in the vicinity of potentially aggressive reactions.	High capital Low O&M	Not implementable for the type of fill material at the Site (heterogeneous mixed industrial waste/debris). Not effective for treatment of metals. *Ex situ* soil treatment potentially incompatible with anticipated Site use/redevelopment. Not retained for further consideration.

Table 4-2: Screening and Evaluation of Remedial Technologies and Process Options for Soil/Fill Material

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
Ex situ treatment (cont.)		Dehalogenation	Reagents are added to soil/fill material contaminated with halogenated organics, then heated in a reactor. The dehalogenation process is achieved by either the replacement of the halogen molecules or the decomposition and partial volatilization of the contaminants.	Dehalogenation potentially effective for the removal of PCBs. Treatability study would be required. Not effective for PAHs, pesticides, and metals.	Difficult to implement for heterogeneous mixed industrial waste/debris; waste/debris/soil separation would be required. Wastewater treatment and off-gas treatment likely required.	High capital Medium O&M	Not implementable for the type of fill material at the Site (heterogeneous mixed industrial waste/debris). Not effective for treatment of SVOCs, VOCs, metals, or pesticides. *Ex situ* soil treatment potentially incompatible with anticipated Site use/redevelopment. Not retained for further consideration.
	Physical	Particle size separation	Sieves and screens of different sizes are used to concentrate contaminants into smaller volumes. Most organic and inorganic contaminants tend to bind, either chemically or physically, to finer soil particles. Separating the fine particles from the coarser particles will effectively concentrate the contaminants into a smaller volume of soil that could be further treated or disposed.	Effective for separation of particles sizes and debris removal for further treatment and disposal.	Implementable. Further treatment and management of separated soil/fill material would be required.	Low capital Low O&M	Not implementable for the type of fill material at the Site (heterogeneous mixed industrial waste/debris). *Ex situ* soil treatment potentially incompatible with anticipated Site use/redevelopment. Not retained for further consideration.
	Physical (cont.)	Solidification/ stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), and/or chemical reactions are induced between stabilizing agent and contaminants to reduce their mobility (stabilization), toxicity and leachability. Solidification and stabilization involve mixing treatment agents with the contaminated soil yielding a crystalline, glassy, or polymeric framework around the contaminants.	Potentially effective for reducing mobility of metals and PCBs. Limited effectiveness for treatment of VOCs, SVOCs, and pesticides. Treatability study would be required. Not effective for pesticides.	Difficult to implement for heterogeneous mixed industrial waste/debris; waste/debris/soil separation would be required. Accommodation of volume increase with agent addition necessary.	Medium capital Low O&M	Not implementable for the type of fill material at the Site (heterogeneous mixed industrial waste/debris). *Ex situ* soil treatment potentially incompatible with anticipated Site use/redevelopment. Not effective for treatment of VOCs, SVOCs, and pesticides. Not retained for further consideration.
	Thermal	Low temperature thermal desorption	Use of direct or indirect heat to volatilize organic contaminants at temperatures generally between 200 and 600 ºF. Further treatment of vapor phase potentially required.	Potentially effective for removal of PAHs, pesticides, PCBs, and mercury. Treatability study would be required. Not effective for other metals.	Difficult to implement for heterogeneous mixed industrial waste/debris; waste/debris/soil separation would be required. Control and treatment of emissions from thermal treatment processes would be required. Significant permitting issues and potential community and local government acceptance issues related to noise, and odor/dust/emissions. Residual management required.	Medium capital Medium O&M	Not retained due to implementability limitations and community acceptance. *Ex situ* soil treatment potentially incompatible with anticipated Site use/redevelopment. Variety of COCs in soil/fill material would limit effectiveness. Not applicable for treatment of inorganics. Not retained for further consideration.

Table 4-2: Screening and Evaluation of Remedial Technologies and Process Options for Soil/Fill Material

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
Ex situ treatment (cont.)	Thermal (cont.)	Pyrolysis	Chemical decomposition of organic materials is induced by heat in the absence of oxygen at temperatures around 800 ºF. Organic materials are transformed into gaseous components and solid residue (coke) containing fixed carbon and ash.	Likely effective for destruction of PAHs, pesticides, and PCBs. Not effective for metals. Treatability study would be required.	Difficult to implement for heterogeneous mixed industrial waste/debris; waste/debris/soil separation would be required. Control and treatment of emissions from thermal treatment processes would be required. Significant permitting issues and potential community and local government acceptance issues related to noise, and odor/dust/emissions. Residual disposal required.	High capital High O&M	Not retained due to implementability limitations and community acceptance. *Ex situ* soil treatment potentially incompatible with anticipated Site use/redevelopment. Variety of COCs in soil/fill material would limit effectiveness. Not applicable for treatment of inorganics. Not retained for further consideration.
		Incineration	Combustion of organic contaminants present in soil in commercial incinerator at temperatures generally between 1,600 and 2,200 ºF.	Likely effective for destruction of PAHs, pesticides, and PCBs. Not effective for metals. Treatability study would be required.	Difficult to implement for heterogeneous mixed industrial waste/debris; waste/debris/soil separation would be required. Control and treatment of emissions from thermal treatment processes would be required. Significant permitting issues and potential community and local government acceptance issues related to noise, and odor/dust/emissions. Residual disposal required.	High capital High O&M	Not retained due to implementability limitations and community acceptance. *Ex situ* soil treatment potentially incompatible with anticipated Site use/redevelopment. Variety of COCs in soil/fill material would limit effectiveness. Not applicable for treatment of inorganics. Not retained for further consideration.
	Biological	Biopiles	Excavated soil is mixed with soil amendments and placed in aboveground enclosures. Compost is formed into piles and aerated with blowers or vacuum pumps using an aerated static pile composting process.	Potentially effective for degradation of PAHs and pesticides. Treatability study would be required. Saturated soil/fill material would require extensive aeration. Not effective for PCBs and metals.	Difficult to implement for heterogeneous mixed industrial waste/debris; waste/debris/soil separation would be required.	Medium capital Medium O&M	*Ex situ* soil treatment potentially incompatible with anticipated Site use/redevelopment. Variety of COCs in soil/fill material would limit effectiveness. Not retained for further consideration.
		Landfarming	Contaminated soil is excavated, applied into lined beds, and periodically turned over or tilled to aerate the waste.	Potentially effective for degradation of PAHs and pesticides. Treatability study would be required. Saturated soil/fill material would require extensive aeration. Not effective for PCBs and metals.	Difficult to implement for heterogeneous mixed industrial waste/debris; waste/debris/soil separation would be required.	Low capital Low O&M	*Ex situ* soil treatment potentially incompatible with anticipated Site use/redevelopment. Variety of COCs in soil/fill material would limit effectiveness. Not retained for further consideration.

Table 4-2: Screening and Evaluation of Remedial Technologies and Process Options for Soil/Fill Material

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
Ex situ treatment (cont.)	Biological (cont.)	Slurry-phase bioreactor	An aqueous slurry is created by combining soil with water and other additives. The slurry is mixed to keep solids suspended and microorganisms in contact with the soil contaminants. The slurry is dewatered, and the treated soil disposed of upon completion of the process.	Potentially effective for removal of PAHs and pesticides. Treatability study would be required. Not effective for PCBs and metals.	Difficult to implement for heterogeneous mixed industrial waste/debris; waste/debris/soil separation would be required.	High capital Medium O&M	*Ex situ* soil treatment potentially incompatible with anticipated Site use/redevelopment. Variety of COCs in soil/fill material would limit effectiveness. Not retained for further consideration.
Disposal	Off-site disposal	Commercial landfill*	Excavated soil/fill material would be transported to a permitted commercial landfill, if it meets land disposal restriction requirements. Due to physical characteristics of soil/fill material and presence below groundwater table, dewatering and water treatment would likely be required. It is anticipated that in addition to dewatering, sludge management may also be required to render the excavated material sufficiently dry for management and transportation. Excavated areas would be backfilled, graded and restored based on restoration requirements. Soil/fill material would be transported and disposed off-site. Treated water would be discharged locally to a water body.	Effective for treatment and management of excavated soil/fill material. A treatability study would be required to evaluate treatment capabilities and capacities of off-site commercial treatment/disposal facilities.	Difficult to implement for heterogeneous mixed industrial waste/debris; waste/debris/soil separation would be required. Potentially implementable for limited quantities of soil/fill material that does not meet land disposal restrictions.	High capital No O&M	Potentially applicable. Retained for further consideration.

Notes:
* Representative Process Option

Shaded Cells – Process option not retained for further consideration

Abbreviations/Acronyms:
°C - degrees Celsius
CFR - Code of Federal Regulations
COC – Constituent of Concern
DER - Division of Environmental Remediation
°F - degrees Fahrenheit
NYCRR - New York Code of Rules and Regulations
NYSDEC – New York State Department of Environmental Conservation
O&M – Operation and Maintenance
PCB – Polychlorinated biphenyls
SVE – Soil vapor extraction
SVOC – Semi-Volatile Organic Compound
VOC – Volatile Organic Compound

Table 4-3: Screening and Evaluation of Remedial Technologies and Process Options - Groundwater

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
No further action	None	No further action*	No further remedial action addressing shallow and intermediate groundwater would be conducted.	Not effective in mitigating the potential for exposure to groundwater. Potential impacts due to shallow and intermediate groundwater discharging to Onondaga Lake are addressed by IRMs conducted at the Willis Avenue and Wastebed B/Harbor Brook Sites, located hydraulically downgradient to the Site. Site groundwater is comingled with groundwater from the Willis Avenue and Wastebed B/Harbor Brook Sites.	Readily implementable.	No capital No O&M	Potentially applicable. Required for consideration by NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation. Retained for further consideration.
Institutional controls/limited actions	Monitoring	Monitoring*	Periodic sampling and analyses of media as a means of evaluating attenuation of shallow and intermediate groundwater and provides a means of evaluating the effectiveness of selected groundwater remedies.	Effective method for monitoring changes in constituent concentrations over time and evaluation of natural attenuation. Effective means for monitoring remedy effectiveness.	Implementable.	Low capital Low O&M	Potentially applicable. May require access agreements. Retained for further consideration.
	Access/Use restrictions/administrative controls	Institutional controls*	Implementation and documentation of groundwater use, access and land use restrictions that would require activities that would potentially disturb or expose contaminated groundwater (and require health and safety precautions) be conducted in accordance with the site management plan. Institutional controls would also provide provisions to evaluate and address potential soil vapor intrusion, as necessary, if a new building(s) is constructed at the Site.	Effective means of controlling use of groundwater and site use.	Implementable. May require access/implementation agreements for areas either not owned by Honeywell or only accessible by crossing of property owned by others.	Low capital No O&M	Potentially applicable. May required access agreement with other property owners. Retained for further consideration.
	Site controls	Site management plan*	Documentation of Site restrictions and provisions for continued operation and maintenance of the remedy. Presents requirements for monitoring and includes a provision for periodic Site reviews.	Effective means of communicating Site restrictions to affected parties and documenting operation and monitoring of the remedy.	Implementable.	Low capital Low O&M	Potentially applicable. Retained for further consideration.
	Periodic reviews	Periodic site reviews*	Periodic reviews are required by 6 NYCRR Part 375 and DER-10 where institutional and engineering controls, monitoring plans, and/or operations and maintenance activities are implemented on a site. The purpose of the reviews	Effective means of evaluating continued protection to human health and the environment.	Readily implementable.	No capital Low O&M	Potentially applicable. Retained for further consideration.

Table 4-3: Screening and Evaluation of Remedial Technologies and Process Options - Groundwater

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
			is to evaluate the areas in regard to the continuing protection of human health and the environment and to provide documentation of remedy effectiveness. In accordance with 6 NYCRR Part 375-1.8(h)(3), the frequency of periodic reviews should be annual, unless a different frequency is approved by NYSDEC. Periodic site reviews would include the performance of supplemental Five Year Reviews in accordance with 40 CFR 300.430(f)(4)ii.				
Natural recovery	Natural attenuation	Natural attenuation*	The natural degradation of contaminants by *in situ* physical, chemical and/or biological processes. Over time, contaminants' toxicity, mobility and/or volume can be reduced by processes that include biodegradation, sorption, dilution, volatilization, and/or transformation.	Potentially effective for long-term reduction of contaminant concentrations.	Potentially implementable.	No capital No O&M	Potentially applicable. Retained for further consideration.
Hydraulic Control (groundwater discharge)	Vertical barrier	Slurry wall	Soil- or cement-bentonite slurry wall placed along the perimeter of the area of contamination to contain shallow/ intermediate groundwater from discharge to other resources. Containment wall should extend into a confining layer.	Potentially effective at hydraulically containing groundwater discharge if used in conjunction with a groundwater extraction system.	Implementability limited due to depth of confining layer (approximately 50 feet for some areas). Compatibility testing indicated that bentonite was incompatible with groundwater at nearby sites.	High capital Low O&M	Potentially applicable.
		Sheet piles	Sheet piles installed along the area of contamination to contain groundwater discharge to other resources. Sheet pile materials include HDPE, fiberglass, vinyl and steel. Sheet piles should extend into a confining layer.	Steel sheet pile barrier walls installed along Onondaga Lake as part of the Willis-Semet Hydraulic Containment System IRM and the West Wall IRM to address migration of shallow and intermediate groundwater from the Willis Avenue and Wastebed B/Harbor Brook Sites (both located hydraulically downgradient of the Ballfield Site) to Onondaga Lake.			Potentially applicable. Part of existing shallow and intermediate groundwater IRMs. Retained for further consideration.
	Extraction	Recovery wells (vertical or horizontal)	Removal of shallow and intermediate groundwater by pumping from one or more recovery wells for hydraulic control.	Effective at collecting groundwater and hydraulically controlling groundwater discharge; however, effectiveness would be limited due to heterogeneous and low permeability subsurface conditions at the Site. Long-term maintenance would likely be required due to the effects of groundwater geochemistry.	Potentially implementable for limited use only due to heterogeneous and low permeability subsurface conditions at the Site. A pilot/pumping test would be necessary to design extraction wells.	Medium capital Medium O&M	Potentially applicable for limited use given low permeability conditions. Retained for further consideration.

Table 4-3: Screening and Evaluation of Remedial Technologies and Process Options - Groundwater

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
		Collection trench	Removal of groundwater by pumping from recovery trenches.	Groundwater recovery trenches are installed along Onondaga Lake as part of Willis-Semet Hydraulic Containment System IRM and the West Wall IRM to address discharge of groundwater from the Willis Avenue and Wastebed B/Harbor Brook Sites (located hydraulically downgradient of the Ballfield Site) to Onondaga Lake.			Potentially applicable. Part of existing shallow and intermediate groundwater IRMs. Retained for further consideration.
		Multi-phase extraction (MPE)	Simultaneous extraction of groundwater, DNAPL, and/or soil vapor from one or more MPE wells.	Effective at collecting groundwater, DNAPL and soil vapor. Effectiveness would be limited due to low permeability and subsurface heterogeneity conditions at the Site. Long-term maintenance would likely be required due to the effects of groundwater geochemistry. A treatability study would be necessary.	Implementability limited due to low permeability and heterogeneous subsurface conditions at the Site. Access limitations and underground utilities would also limit implementability at the Site. Off-gas treatment potentially required.	Medium capital High O&M	Potentially applicable. Retained for further consideration.
In situ treatment	Biological	Enhanced bioremediation	Injection of microbial populations and potentially nutrient sources/electron donors into shallow and intermediate groundwater to enhance biological degradation of organic constituents.	Potentially effective for dissolved-phase organics in groundwater. Low permeability soils and subsurface heterogeneity could cause uneven distribution of electron donors and/or microorganisms, resulting in pockets of untreated contaminants. Biological treatment can move with the contaminant plume. Depth of contaminants may limit effectiveness. Treatability study would be required. Not effective for metals or PCBs.	Implementability limited due low permeability conditions at the Site, potential for injection well fouling, and variability of geochemical conditions. Extensive injection well network potentially required to address areal extent due to low permeability subsurface conditions. Limitations to implementability would also exist in the immediate vicinity of subsurface utilities, roadways, and railroad tracks. Heterogeneity of subsurface materials would likely require advanced delivery techniques (*i.e.*, tight injection point spacing).	Medium capital Low O&M	Not implementable and not effective due to low permeability and heterogeneous conditions. Variety of COCs in shallow/ intermediate groundwater could limit effectiveness. Not applicable for treatment of inorganics. Not retained for further consideration.
	Chemical	Chemical oxidation	*In situ* treatment of shallow and intermediate groundwater using oxidants such as ozone, hydrogen peroxide, hypochlorites, permanganate, and/or sodium persulfide. Oxidation reactions chemically convert constituents to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Potentially effective for VOCs and SVOCs in groundwater. Low permeability soil and subsurface heterogeneity could cause uneven distribution of the oxidant, resulting in pockets of untreated contaminants. Could potentially disrupt natural attenuation processes. Treatability study would be required. Not effective for metals.	Implementability limited due low permeability conditions at the Site, potential for injection well fouling, and variability of geochemical conditions. Extensive injection well network potentially required to address areal extent due to low permeability subsurface conditions. Limitations to implementability would also exist in the immediate vicinity of subsurface utilities, roadways, and railroad tracks. Heterogeneity of subsurface materials would likely	Medium capital Low to Medium O&M	Not implementable and not effective due to low permeability and heterogeneous conditions. Site conditions could result in uneven oxidant distribution, resulting in untreated contaminants. Variety of COCs in shallow and intermediate groundwater could limit effectiveness. Not applicable for treatment of inorganics. Not retained for further consideration.

Table 4-3: Screening and Evaluation of Remedial Technologies and Process Options - Groundwater

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
					require advanced delivery techniques (*i.e.*, tight injection point spacing).		
In situ Treatment (cont.)	Physical	Air sparging	Injection of air into the saturated zone to volatilize constituents within shallow and intermediate groundwater. Emissions are then collected in the unsaturated zone using a soil vapor extraction system.	Potentially effective for removal of VOCs in groundwater. Not effective for treatment of SVOCs or metals. Potential exists for uncontrolled movement of vapors. Subsurface heterogeneity could result in untreated zones. Depth of contaminants may limit effectiveness. Treatability study would be required. Not effective for SVOCs or metals.	Not implementable due to heterogeneous and low permeability conditions at the Site, potential for injection/extraction well fouling, and variability of geochemical conditions.	Medium capital Medium O&M	Variety of COCs in shallow and intermediate groundwater could limit effectiveness. Not applicable for treatment of SVOCs or inorganics. Not implementable and not effective due to low permeability and heterogeneous conditions. Not retained for further consideration.
		In-well air stripping	Injection of air into the water column within a well to volatilize constituents. Groundwater circulation is performed *in situ*, with shallow and intermediate groundwater entering the well at one screen interval and being discharged through a second screen interval. Air is collected and treated *ex situ* as needed.	Potentially effective for volatilizing VOCs in the saturated zone. Not effective for SVOCs and metals in groundwater. Subsurface heterogeneity could result in untreated zones. Shallow groundwater aquifers limit process effectiveness. Treatability study would be required.	Not implementable due to heterogeneous and low permeability conditions at the Site, potential for injection/extraction well fouling, and variability of geochemical conditions.	Medium capital Medium O&M	Variety of COCs in shallow and intermediate groundwater could limit effectiveness. Not applicable for treatment of SVOCs or inorganics. Not implementable and not effective due to low permeability and heterogeneous conditions. Not retained for further consideration.
In situ Treatment (cont.)	Treatment wall	Permeable reactive barrier	Construction of a wall of reactive material wall, air sparging zone, or biobarrier to treat shallow and intermediate groundwater as it flows through the treatment zone.	Generally effective for treating VOCs, SVOCs and inorganics. Variety of dissolved constituents would limit effectiveness. There is a potential for fouling of reactive materials due to ionic waste constituent concentrations in groundwater. Periodic replacement of reactive material would be anticipated.	Implementability limited due to access limitations, underground utilities, and depth of treatment zone. Limitations to implementability would also exist in areas due to access limitations and in the immediate vicinity of roadways and the railroad tracks.	High capital High O&M	Variety of COCs in shallow and intermediate groundwater could limit effectiveness. Potential for fouling of reactive materials may limit implementability. Retained for further consideration
Ex situ treatment	Off-site physical/chemical	Willis-Semet Groundwater Treatment Plant (GWTP) and/or Metro WWTP	Treatment of collected shallow and intermediate groundwater at the Willis-Semet GWTP with subsequent discharge to the Metro WWTP or directly to Onondaga Lake.	Effective for VOCs, SVOCs, and most inorganics.	Implementable. Discharge of treated water from the Willis-Semet GWTP to Metro WWTP and Onondaga Lake (during temporary Metro WWTP shutdowns) comply with pretreatment requirement identified in the Industrial Wastewater Discharge Permit issued by Onondaga County and direct discharge requirements identified in the SPDES requirements, respectively.	Medium capital Low O&M	Potentially applicable. Part of the Willis-Semet Hydraulic Containment System IRM and the West Wall IRM. Retained for further consideration.

Table 4-3: Screening and Evaluation of Remedial Technologies and Process Options - Groundwater

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Relative Cost	Screening Comments
Notes: * Representative Process Option Shaded Cells – Process option not retained for further consideration		Abbreviations/Acronyms: CFR - Code of Federal Regulations CIPP – Cured-in-place pipe COC – Constituent of Concern DER - Division of Environmental Remediation DNAPL – Dense non-aqueous phase liquid HDPE – High density polyethylene IRM – Interim Remedial Measure			NYCRR - New York Code of Rules and Regulations NYSDEC – New York State Department of Environmental Conservation O&M – Operation and Maintenance SPDES – State Pollutant Discharge Elimination System SVOC – Semi-Volatile Organic Compound VOC – Volatile Organic Compound WWTP – Wastewater treatment plant		

Table 5-1: Detailed Analysis of Remedial Alternatives

Criterion	Alternative 1 No Further Action	Alternative 2 Limited Action	Alternative 3 Engineered Cover System in Anticipation of Commercial Development	Alternative 4 Targeted Excavation of Historic Fill Material	Alternative 5 Site-Wide Excavation and Off-Site Disposal
		Common Remedial Components for Alternatives 2 through 5: Institutional controls/limited actions, Site Management Plan/periodic reviews, and shallow and intermediate groundwater natural attenuation.			
	• No Further Action	• Common components	• Site-Wide Soil Cover System • Cover System and O&M	• Targeted soil/fill material excavation • Off-site disposal • Backfill	• Site-wide soil/fill material excavation • Off-site disposal • Backfill
Overall Protection of Human Health and the Environment					
Overall Protection of Human Health	Not protective of human health. Alternative would not provide for mitigation of potentially unacceptable risks to human health associated with exposure to contaminated groundwater or soil/fill material.	Protection of human health would be provided relative to potential exposure to shallow and intermediate groundwater. Alternative relies on institutional controls/limited action to address potential exposure to soil/fill material. Access restrictions, site management plan, and periodic reviews would limit site use and minimize potentially unacceptable risks to human health associated with soil/fill material exceeding SCOs. Groundwater use restrictions would minimize potentially unacceptable risks to human health associated with groundwater exceeding Class GA standards.	Protection of human health would be provided. The Engineered cover system, buildings and/or parking areas would address potentially unacceptable risks to human health associated with inhalation of dust and direct exposure to soil/fill material. Maintenance of engineered cover system, access restrictions, site management plan, and periodic reviews would limit site use and minimize potentially unacceptable risks to human health associated with soil/fill material exceeding SCOs. Groundwater use restrictions would minimize potentially unacceptable risks to human health associated with groundwater exceeding Class GA standards.	Protection of human health would be provided. Targeted excavation of historic fill material would address potentially unacceptable risks to human health associated with inhalation of dust and direct exposure to soil/fill material. Access restrictions, site management plan, and periodic reviews would limit site use and minimize potentially unacceptable risks to human health associated with the soil/fill material exceeding SCOs that remains at the Site. Groundwater use restrictions would minimize potentially unacceptable risks to human health associated with groundwater exceeding Class GA standards.	Protection of human health would be provided. Excavation of soil/fill material would address potentially unacceptable risks to human health associated with inhalation of dust and direct exposure to soil/fill material. Groundwater use restrictions would minimize potentially unacceptable risks to human health associated with groundwater exceeding Class GA standards.
Overall Protection of the Environment	Not protective of the environment. Alternative would not provide for mitigation of potentially unacceptable effects to the environment associated with discharge of Site-related contaminants in groundwater that have the potential to adversely affect Onondaga Lake. Alternative would also not provide for mitigation of potentially unacceptable risks to the environment associated with dust and erosion of soil/fill material.	Protection of the environment would be provided relative to shallow and intermediate groundwater. Alternative would not provide for mitigation of potentially unacceptable risks to the environment associated with dust and erosion of soil/fill material. It should be noted that potential impacts resulting from shallow/intermediate groundwater discharge to Onondaga Lake are addressed by IRMs implemented at Sites located hydraulically downgradient for the Site.	Protection of the environment would be provided. Engineered cover system, buildings and/or parking areas would address potentially unacceptable risks to the environment associated with dust and erosion of soil/fill material. It should be noted that potential impacts to resulting from shallow/intermediate groundwater discharge to Onondaga Lake are addressed by IRMs implemented at Sites located hydraulically downgradient for the Site.	Protection of the environment would be provided. Targeted excavation of historic fill material would address potentially unacceptable risks to the environment associated with dust and erosion of soil/fill material. It should be noted that potential impacts resulting from shallow/intermediate groundwater discharge to Onondaga Lake are addressed by IRMs implemented at Sites located hydraulically downgradient for the Site.	Protection of the environment would be provided. Excavation of soil/fill material would address potentially unacceptable risks to the environment associated with dust and erosion of soil/fill material. It should be noted that potential impacts resulting from shallow/intermediate groundwater discharge to Onondaga Lake are addressed by IRMs implemented at Sites located hydraulically downgradient for the Site.

Table 5-1: Detailed Analysis of Remedial Alternatives

Criterion	Alternative 1 No Further Action	Alternative 2 Limited Action	Alternative 3 Engineered Cover System in Anticipation of Commercial Development	Alternative 4 Targeted Excavation of Historic Fill Material	Alternative 5 Site-Wide Excavation and Off-Site Disposal
Attainment of Remedial Action Objectives (RAOs)	Alternative 1 would not address RAOs for the protection of human health and the environment.	Alternative 2 relies on institutional controls/limited action to address RAOs for the protection of human health. RAOs related to exposure and erosion of COCs in surface soils are not attained. It should be noted that RAOs related to protection of the environment associated with potential impacts resulting from shallow/intermediate groundwater discharge to Onondaga Lake are addressed by IRMs implemented at Sites located hydraulically downgradient for the Site.	Alternative 3 would address RAOs for the protection of human health through placement of a cover system, buildings and parking areas, and through institutional controls and a Site Management Plan. Alternative 3 would address RAOs for the protection of the environment through placement of a cover system. It should be noted that RAOs related to protection of the environment associated with potential impacts resulting from shallow/intermediate groundwater discharge to Onondaga Lake are addressed by IRMs implemented at Sites located hydraulically downgradient for the Site.	Alternative 4 would address RAOs for the protection of human health through targeted excavation of the historic fill material, and through institutional controls and a Site Management Plan. Alternative 4 would address RAOs for the protection of the environment through targeted excavation of historic fill material. It should be noted that RAOs related to protection of the environment associated with potential impacts resulting from shallow/intermediate groundwater discharge to Onondaga Lake are addressed by IRMs implemented at Sites located hydraulically downgradient for the Site.	Alternative 5 would address RAOs for the protection of human health through removal of the soil/fill material, and through institutional controls and a Site Management Plan. Alternative 5 would address RAOs for the protection of the environment through removal of soil/fill material. It should be noted that RAOs related to protection of the environment associated with potential impacts resulting from shallow/intermediate groundwater discharge to Onondaga Lake are addressed by IRMs implemented at Sites located hydraulically downgradient for the Site.
Compliance with Site-Specific Applicable or Relevant and Appropriate Requirements					
Compliance with Chemical-Specific SCGs	Relies on natural attenuation to address soil/fill material and shallow and intermediate groundwater SCGs.	Alternative 2 would not actively address chemical-specific SCGs relative to soil/fill material.	Installation of the engineered cover system, buildings and/or parking areas over areas of surface soil/fill material that exhibit exceedances of SCOs, institutional controls, site management plan and periodic reviews would address soil SCGs by minimizing the potential for erosion of soil/fill material and the potential for direct contact with Site soil/fill material.	Targeted excavation of historic fill material overlying soil/fill material associated with Solvay Wastebed C would address a targeted horizon of soil exceeding chemical-specific SCGs.	Excavation of soil/fill materials, including historic fill material and underlying soil/fill material associated with Solvay Wastebed C, that exhibit exceedances of Unrestricted Use SCOs would address soil SCGs.
Compliance with Location-Specific SCGs	No location-specific SCGs triggered for this alternative.	No location-specific SCGs triggered for this alternative.	Activities would also be conducted consistent with federal and state requirements for cultural, archeological, and historical resources.	Activities would also be conducted consistent with federal and state requirements for cultural, archeological, and historical resources.	Activities would also be conducted consistent with federal and state requirements for cultural, archeological, and historical resources.

Table 5-1: Detailed Analysis of Remedial Alternatives

Criterion	Alternative 1 No Further Action	Alternative 2 Limited Action	Alternative 3 Engineered Cover System in Anticipation of Commercial Development	Alternative 4 Targeted Excavation of Historic Fill Material	Alternative 5 Site-Wide Excavation and Off-Site Disposal
Compliance with Action-Specific SCGs	No action-specific SCGs triggered for this alternative.	Institutional controls would be implemented in general conformance with NYSDEC DER-33.	Proposed engineered cover system would be constructed consistent with applicable standards and DER-10. 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. Institutional controls would be implemented in general conformance with NYSDEC DER-33.	Excavated historic fill material 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. Institutional controls would be implemented in general conformance with NYSDEC DER-33.	Excavated soil/fill material 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. Institutional controls would be implemented in general conformance with NYSDEC DER-33.
Long-term effectiveness and permanence					
Magnitude of Residual Risk	Residual risks associated with soil/fill material and potential exposures to shallow and intermediate groundwater exceeding chemical-specific SCGs would remain. The effectiveness of the Onondaga Lake remedies is not supported under Alternative 1.	Alternative 2 would rely on institutional controls/limited actions to address residual risks associated with soil/fill material. Residual risks associated with potential exposure to shallow and intermediate groundwater would be addressed by institutional controls.	Minimal residual risk. Residual risks associated with soil/fill material would be mitigated through the engineered cover system, institutional controls, site management plan, periodic reviews, and O&M. Residual risks associated with potential exposure to shallow and intermediate groundwater would be addressed by institutional controls.	Minimal residual risk. Residual risks associated with potential exposure to shallow and intermediate groundwater would be addressed by institutional controls.	Minimal residual risk. Residual risks associated with potential exposure to shallow and intermediate groundwater would be addressed by institutional controls.
Adequacy and Reliability of Controls	Alternative 1 does not provide for adequate and reliable control to support the effectiveness of the Onondaga Lake remedies. Alternative 1 does not provide a means to address erosion of and exposures to soil/fill material, and groundwater impacts.	Institutional controls are an adequate and reliable means of controlling Site use and direct contact with Site soil/fill material.	Placement and maintenance of engineered cover system would provide adequate and reliable means of controlling erosion of and exposures to soil/fill material. Institutional controls are an adequate and reliable means of controlling Site use and direct contact with Site soil/fill material.	Targeted excavation and proper off-site management of historic fill material are an adequate and reliable means for controlling exposures.	Excavation and proper off-site management are an adequate and reliable means for controlling exposures to soil/fill material.
Long-Term Sustainability	No fuel/energy use/greenhouse gas emissions associated with Alternative 1.	Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance.	Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance.	Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance.	Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance.
Reduction of toxicity, mobility, or volume through treatment					
Treatment Process Used and Materials Treated	No treatment processes or materials treated under Alternative 1.	No treatment processes or materials treated under Alternative 2.	No treatment processes or materials treated under Alternative 3.	No treatment processes or materials treated under Alternative 4.	No treatment processes or materials treated under Alternative 5.

Table 5-1: Detailed Analysis of Remedial Alternatives

Criterion	Alternative 1 No Further Action	Alternative 2 Limited Action	Alternative 3 Engineered Cover System in Anticipation of Commercial Development	Alternative 4 Targeted Excavation of Historic Fill Material	Alternative 5 Site-Wide Excavation and Off-Site Disposal
Amount of Hazardous Material Destroyed or Treated	No treatment or disposal of hazardous material under Alternative 1.	No treatment or disposal of hazardous material under Alternative 2.	No treatment or disposal of hazardous material under Alternative 3.	Approximately 297,000 cy of historic fill material would be removed from the Site.	Approximately 1,013,000 cy of soil/fill material would be removed from the Site.
Degree of Expected Reduction in Toxicity, Mobility, or Volume	Alternative 1 would not reduce the toxicity, mobility or volume of groundwater containing COCs.	Alternative 2 would not reduce the toxicity, mobility or volume of groundwater containing COCs.	The mobility of COCs (*i.e.*, associated with erosion) in surface soil/fill material would be reduced by installation of the engineered cover system.	Toxicity, mobility, and volume of historic fill material would be reduced through removal.	Toxicity, mobility, and volume of soil/fill material would be reduced through removal.
Degree to Which Treatment is Irreversible	Alternative 1 does not include treatment or removal actions.	Alternative 2 does not include treatment or removal actions.	Alternative 3 does not include treatment or removal actions.	Excavation and off-site disposal are considered irreversible.	Excavation and off-site disposal are considered irreversible.
Type and Quantity of Residuals Remaining After Treatment	Alternative 1 does not include treatment actions.	Alternative 2 does not include treatment actions.	Alternative 3 does not include treatment actions.	Alternative 4 does not include treatment actions.	Alternative 5 does not include treatment actions.
Short-term effectiveness					
Protection of Community During Remedial Actions	No active components are related to this alternative.	No active components are related to this alternative.	Dust and volatile emissions, if any, would be controlled during construction activities. Cover construction would result in impacts to the community relative to truck traffic and noise during the construction.	Dust and volatile emissions, if any, would be controlled during construction activities. Excavation and off-site disposal would result in significant impacts to the community relative to truck traffic and noise during the construction.	Dust and volatile emissions, if any, would be controlled during construction activities. Excavation 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	No active components are related to this alternative.	No active components are related to 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, to protect workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, to protect workers from exposure to contaminants.
Environmental Impacts	No active components are related to this alternative.	No active components are related to this alternative.	Dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation of this alternative. Minimal clearing would be required prior to engineered cover installation.	Dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation of this alternative. Minimal clearing would be required prior to excavation.	Dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation of this alternative. Minimal clearing would be required prior to excavation.
Time Until Remedial Action Objectives are Achieved	Remedial action objectives related to public health protection and migration of contaminants in soil/fill material would not be met with this alternative. Remedial action objectives related to the discharge of shallow and intermediate groundwater to off-	Remedial action objectives would be achieved upon completion of the remedy.	Remedial action objectives would be achieved upon completion of the remedy. The remedy would be completed in approximately one construction season.	Remedial action objectives would be achieved upon completion of the remedy. The remedy would be completed in approximately three construction seasons.	Remedial action objectives would be achieved upon completion of the remedy. The remedy would be completed in approximately nine construction seasons.

Table 5-1: Detailed Analysis of Remedial Alternatives

Criterion	Alternative 1 No Further Action	Alternative 2 Limited Action	Alternative 3 Engineered Cover System in Anticipation of Commercial Development	Alternative 4 Targeted Excavation of Historic Fill Material	Alternative 5 Site-Wide Excavation and Off-Site Disposal
	site resources would also not be met with this alternative.				
Short-Term Sustainability	No active components result in no fuel/energy consumption, greenhouse gas or pollutant emissions, no water or resource use, and no impacts to water or ecology from construction related activities.	No active components result in no fuel/energy consumption, greenhouse gas or pollutant emissions, no water or resource use, and no impacts to water or ecology from construction related activities.	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on- and off-site during cover installation is estimated at approximately 150 MTCO2e.	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on- and off-site during cover installation is estimated at approximately 10,000 MTCO2e.	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on- and off-site during cover installation is estimated at approximately 35,000 MTCO2e.
Implementability					
Ability to Construct and Operate the Technology	There are no technologies to be constructed in this alternative.	The groundwater collection systems are readily maintained and operated.	Engineered cover systems are readily constructible. The groundwater collection systems are readily maintained and operated.	Not considered implementable. Excavation and off-site disposal of 297,000 cy of historic fill material is limited by landfill capacity and construction water management needs. Excavation to depths required in certain areas of Site is not implementable due to stability concerns. Specifically, excavation depths are likely to cause stability problems that would potentially impact the existing roadways and railroad.	Not considered implementable. Excavation and off-site disposal of 1,013,000 cy of soil/fill material is limited by landfill capacity and construction water management needs. Excavation to depths required in certain areas of Site is not implementable due to stability concerns. Specifically, excavation depths are likely to cause stability problems that would potentially impact the existing roadways and railroad.
Reliability of Technology	There are no technologies to be constructed in this alternative.	There are no technologies to be constructed in this alternative.	An engineered cover system is a reliable technology.	Excavation and disposal are reliable technologies.	Excavation and disposal are reliable technologies.
Ease of Undertaking Additional Remedial Actions, if Necessary	Additional remedial actions, if necessary, would be readily implementable.	Additional remedial actions, if necessary, would be implementable.	Additional remedial actions, if necessary, would be implementable.	Additional remedial actions, if necessary, would be implementable.	Additional remedial actions, if necessary, would be implementable.
Ability to Monitor Effectiveness of Remedy	No monitoring components are related to this alternative.	Groundwater quality would be monitored.	Effectiveness of remedy could be monitored through inspection and maintenance of the engineered cover system to verify continued cover integrity, visual signs of erosion, and condition of the engineered cover. Groundwater quality would be monitored.	Groundwater quality would be monitored.	Groundwater quality would be monitored.
Coordination with Other Agencies and Property Owners	None required.	Coordination with other agencies including NYSDEC, NYSDOH, Town of Geddes, City of Syracuse, and Onondaga County would be	Coordination with other agencies including NYSDEC, NYSDOH, NYSDOT, Town of Geddes, City of Syracuse, and Onondaga County would be necessary. Coordination	Coordination with other agencies including NYSDEC, NYSDOH, NYSDOT, Town of Geddes, City of Syracuse, and Onondaga County would be necessary. Coordination	Coordination with other agencies including NYSDEC, NYSDOH, NYSDOT, Town of Geddes, City of Syracuse, and Onondaga County would be necessary.

Table 5-1: Detailed Analysis of Remedial Alternatives

Criterion	Alternative 1 No Further Action	Alternative 2 Limited Action	Alternative 3 Engineered Cover System in Anticipation of Commercial Development	Alternative 4 Targeted Excavation of Historic Fill Material	Alternative 5 Site-Wide Excavation and Off-Site Disposal
		necessary. Coordination with property owners would be necessary.	with property owners would be necessary.	with property owners would be necessary.	Coordination with property owners would be necessary.
Availability of Off-Site Treatment Storage and Disposal Services and Capacities	None required.	None required.	None required.	Large quantities of historic fill material requiring off-site disposal may require use of multiple landfills.	Large quantities of soil/fill material requiring off-site disposal may require use of multiple landfills.
Availability of Necessary Equipment, Specialists, and Materials	None required.	Equipment, specialists, and materials are available.	Equipment, specialists, and materials are available.	Equipment, specialists, and materials are available.	Equipment, specialists, and materials are available.
Cost					
Total Estimated Capital Cost	$0	$0.08 M	$3.2 M	$104.3 M	$379.4 M
Present Worth of Operation and Maintenance Cost (30 years, 7% Discount Factor)	$0	$0.32 M	$0.36 M	$0.34 M	$0.30 M
Total Estimated Net Present Worth Cost	$0	$0.4 M	$3.6 M	$104.6 M	$379.7 M
Land Use					
Consistency with Proposed Future Use	Not protective or consistent with current, intended, and reasonably anticipated future uses of the Site.	Alternative 2 would rely on institutional controls/limited actions for protectiveness under the current, intended, and reasonably anticipated future uses of the Site.	Engineered cover system, building, and parking areas would be consistent with current, intended, and reasonably anticipated future uses of the Site.	Targeted excavation of historic fill material would temporarily disrupt current land use and traffic patterns along portions of State Fair Boulevard, Willis Avenue, and the CSX rail line. Following restoration, conditions would be consistent with current, intended, and reasonably anticipated future uses of the Site. Duration of remedy implementation could be disruptive to the timing of anticipated development plans.	Full excavation of soil/fill material would temporarily disrupt current land use and traffic patterns along portions of State Fair Boulevard, Willis Avenue, and the CSX rail line. Following restoration, conditions would be consistent with current, intended, and reasonably anticipated future uses of the Site. Duration of remedy implementation could be disruptive to the timing of anticipated development plans.

Notes:

COC – Constituent of Concern
Cy – Cubic Yard
DER – Division of Environmental Remediation
GWTP – Groundwater Treatment Plant
IRM – Interim Remedial Measure
RAO – Remedial Action Objective
SCG – Standards, Criteria and Guidance
SCO – Soil Cleanup Objective
USEPA – United States Environmental Protection Agency

Table 5-2. Alternative 1, No Further Action

Site: Honeywell Ballfield Site
Location: Geddes, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2019

Conceptual Basis: No Further Action

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
DIRECT CAPITAL COST					
			TOTAL ESTIMATED DIRECT CAPITAL COST:	**$0**	rounded
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$0**	
			Engineering / Management, Construction Oversight, OH&P	**$0**	6%, 8%, and 5% respectively
			Contingency	**$0**	Scope Contingency at 30%
Institutional Controls					
			TOTAL ESTIMATED CAPITAL COST:	**$0**	rounded
OPERATION AND MAINTENANCE COSTS					

PRESENT WORTH ANALYSIS (YEARS 1-30)		DISCOUNT FACTOR	PRESENT WORTH	
	Cost	Df=7	(rounded)	
ESTIMATED CAPITAL COST - Year 0	0	$1	$0	
ANNUAL O&M - YEARS 1-30	0	$0.414	$0	Average discount factor for years 1-30
PERIODIC O&M - YEARS 5, 10, 15, 20, 25, 30	0	$0.360	$0	Average discount factor for years 5, 10, 15, 20, 25 and 30
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:			**$0**	rounded

Table 5-3. Alternative 2, Limited Action

Site: Honeywell Ballfield Site
Location: Geddes, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2019

Conceptual Basis: Institutional Controls
Continued Operation of IRMs

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
DIRECT CAPITAL COST					
			TOTAL ESTIMATED DIRECT CAPITAL COST:	**$0**	rounded
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$0**	
			Engineering / Management, Construction Oversight, OH&P	**$0**	6%, 8%, and 5% respectively
			Contingency	**$0**	Scope Contingency at 30%
Institutional Controls					
Environmental Easement	LS	1	$30,000	$30,000	
Site Management Plan	LS	1	$50,000	$50,000	
			TOTAL ESTIMATED CAPITAL COST:	**$80,000**	rounded
OPERATION AND MAINTENANCE COSTS					
Annual					
Reporting and Recordkeeping	EA	1	$20,000	$20,000	
Groundwater Monitoring (Yr 1-5)					
Monitoring Event	EA	2	$3,600	$7,200	Sampling and Analysis of 6 wells (3 shallow/3 intermediate) per event
Groundwater Monitoring (Yr 6-10, 15, 20, 25, 30)					
Monitoring Event	EA	1	$3,600	$3,600	Sampling and Analysis of 6 wells (3 shallow/3 intermediate) per event
Years 5, 10, 15, 20, 25, 30					
Periodic Review	EA	1	$15,000	$15,000	

PRESENT WORTH ANALYSIS (YEARS 1-30)	Cost	DISCOUNT FACTOR Df=7	PRESENT WORTH (rounded)	
ESTIMATED CAPITAL COST - Year 0	$80,000	1.00	$80,000	
ANNUAL O&M COST - Years 1-30	$20,000	0.41	$248,000	Average discount factor for years 1-30
PERIODIC O&M COST - Years 1-4	$7,200	0.85	$24,000	Average discount factor for noted years
PERIODIC O&M COST- Year 5	$22,200	0.71	$16,000	Average discount factor for noted years
PERIODIC O&M COST - Years 6-9	$3,600	0.60	$9,000	Average discount factor for noted years
PERIODIC O&M COST - Year 10	$18,600	0.51	$9,000	Average discount factor for noted years
PERIODIC O&M COST - Years 15, 20, 25, 30	$18,600	0.23	$17,000	Average discount factor for noted years
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:			**$400,000**	rounded

Table 5-4. Alternative 3, Engineered Cover System in Anticipation of Commercial Development

Site: Honeywell Ballfield Site
Location: Geddes, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2019

Conceptual Basis: Engineered Cover (1-ft)
Continued Operation of IRMs

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
DIRECT CAPITAL COST					
General Conditions	WK	23	$15,000	$345,000	Trailer, fuel, small tools, consumables and safety
Mobilization	EA	1	$60,000	$60,000	
Air Monitoring	LS	1	$41,000	$41,000	
Surveys and Layouts	EA	2	$2,500	$5,000	Pre-construction, post-construction
Irrigation	WK	4	$5,000	$20,000	Following seeding, 4 weeks per season
Truck Wash/ Spoils control	WK	21	$7,500	$157,500	Wash rack and operation
Dust Suppression/Control	WK	21	$3,500	$73,500	5,000 gallon water truck and operation
Site Preparation					
Clearing and Grubbing	AC	4.0	$11,000	$44,000	Tree and underbrush chipped and left onsite.
Rough Grading	AC	10.6	$3,500	$37,100	
Construction Entrance	LS	1	$15,000	$15,000	6-inch stone entrance
Erosion and Sediment Control	LF	3,400	$5	$17,000	Reinforced silt fence along perimeter
Decommission existing wells	LS	1	$10,000	$10,000	assume decommission of 4 wells within cap area
Install new monitoring wells	LS	1	$20,000	$20,000	install 2 shallow (30-ft) and 2 intermediate (55-ft) groundwater monitoring wells
QA/QC					
Import Materials QA/QC Testing	EA	31	$1,200	$37,200	1/500 cy of imported materials
Performance QA/QC - Compaction	WK	11	$1,700	$18,700	during material placement only
Place Engineered Vegetative Cover (1-ft)					
Fine grading	AC	8.2	$8,300	$68,060	within proposed Western parcel cover area
Place Imported Topsoil	CY	6,610	$58	$383,380	Placement by conventional equipment in 6-inch lifts
Place Imported Fill	CY	6,610	$43	$284,230	Placement by conventional equipment in 6-inch lifts
Seeding	AC	8.2	$18,000	$147,600	Modified old field successional with fertilizer and hydromulch
Demarcation layer	AC	8.2	$8,300	$68,060	single layer geotextile below cap; need for demarcation layer to be considered during remedial design
Excavate and Place Engineered Vegetative Cover (1-ft)					
Excavation and on-site placement	CY	1,610	$30	$48,300	remove swale area soils to depth of 1-ft from grade
Place Imported Topsoil	CY	810	$58	$46,980	Placement by conventional equipment in 6-inch lifts
Place Imported Fill	CY	810	$43	$34,830	Placement by conventional equipment in 6-inch lifts
Seeding	AC	1	$18,000	$18,000	Modified old field successional with fertilizer and hydromulch
Demarcation layer	AC	1	$8,300	$8,300	single layer geotextile below cap; need for demarcation layer to be considered during remedial design
Utility Support	DA	7	$7,500	$52,500	Site supervisor and pole support crew provided by National Grid
Evaluate Fill and Amend					
Pre-design investigation	LS	1	$25,000	$25,000	conduct test pits within existing Clark property and Clean Fill area
Placement of Stone Fill	CY	600	$45	$27,000	assume 6-inches over 30% of existing Clark parcel area
			TOTAL ESTIMATED DIRECT CAPITAL COST:	**$2,113,000**	rounded
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$2,113,000**	
			Engineering / Management, Construction Oversight, OH&P	**$401,500**	6%, 8%, and 5% respectively
			Contingency	**$633,900**	Scope Contingency at 30%
Institutional Controls					
Environmental Easement	LS	1	$30,000	$30,000	
Site Management Plan	LS	1	$50,000	$50,000	
			TOTAL ESTIMATED CAPITAL COST:	**$3,228,000**	rounded

Table 5-4. Alternative 3, Engineered Cover System in Anticipation of Commercial Development

Site: Honeywell Ballfield Site
Location: Geddes, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2019

Conceptual Basis: Engineered Cover (1-ft)
Continued Operation of IRMs

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
OPERATION AND MAINTENANCE COSTS					
Annual					
Reporting and Recordkeeping	EA	1	$20,000	$20,000	
Cover inspection	LS	1	$2,500	$2,500	Assumes 2 scientists/engineers, 1 days, 8 hours/day, twice annually
Cover Maintenance					
Vegetation Maintenance	AC	1	$2,400	$1,200	Spot seeding (5% of all areas annually)
Cover maintenance and incidental repairs	AC	1	$300	$150	Topsoil repair, 5 cy/acre annually
Groundwater Monitoring (Yr 1-5)					
Monitoring Event	EA	2	$3,600	$7,200	Sampling and Analysis of 6 wells (3 shallow/3 intermediate) per event
Groundwater Monitoring (Yr 6-10, 15, 20, 25, 30)					
Monitoring Event	EA	1	$3,600	$3,600	Sampling and Analysis of 6 wells (3 shallow/3 intermediate) per event
Years 5, 10, 15, 20, 25, 30					
Periodic Review	EA	1	$15,000	$15,000	

PRESENT WORTH ANALYSIS (YEARS 1-30)		DISCOUNT FACTOR	PRESENT WORTH	
	Cost	Df=7	(rounded)	
ESTIMATED CAPITAL COST - Year 0	$3,228,000	1.00	$3,230,000	
ANNUAL O&M COST - Years 1-30	$23,850	0.41	$296,000	Average discount factor for years 1-30
PERIODIC O&M COST - Years 1-4	$7,200	0.85	$24,000	Average discount factor for noted years
PERIODIC O&M COST- Year 5	$22,200	0.71	$16,000	Average discount factor for noted years
PERIODIC O&M COST - Years 6-9	$3,600	0.60	$9,000	Average discount factor for noted years
PERIODIC O&M COST - Year 10	$18,600	0.51	$9,000	Average discount factor for noted years
PERIODIC O&M COST - Years 15, 20, 25, 30	$15,000	0.23	$14,000	Average discount factor for noted years
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:			**$3,600,000**	rounded

Table 5-5. Alternative 4, Targeted Excavation of Historic Fill Material

Site: Honeywell Ballfield Site
Location: Geddes, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2019

Conceptual Basis: Excavation of fill materials
Backfill with clean materials
Continued Operation of IRMs

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
DIRECT CAPITAL COST					
General Conditions	WK	96	$15,000	$1,440,000	Trailer, fuel, small tools, consumables and safety
Mobilization	EA	3	$60,000	$180,000	
Air Monitoring	LS	1	$41,000	$41,000	
Surveys and Layouts	EA	2	$4,500	$9,000	Pre-construction, post-construction
Irrigation	WK	12	$5,000	$60,000	Following seeding, 4 weeks per season
Truck Wash/ Spoils control	WK	90	$7,500	$675,000	Wash rack and operation
Dust Suppression/Control	WK	90	$3,500	$315,000	5,000 gallon water truck and operation
Pre-design investigation					
Site Preparation					
Building demolition	LS	1	$175,000	$175,000	removal of existing structures on Parcel 114.-01-02.0 (Clark Equipment)
Clearing and Grubbing	AC	4.0	$11,000	$44,000	Tree and underbrush chipped and left onsite.
Rough Grading	AC	10.6	$3,500	$37,100	
Construction Entrance	LS	1	$15,000	$15,000	6-inch stone entrance
Erosion and Sediment Control	LF	3,400	$5	$17,000	Reinforced silt fence along perimeter
Decommission existing wells	LS	1	$40,000	$40,000	assume decommission of 16 wells within cap area
Install new monitoring wells	LS	1	$20,000	$20,000	install 2 shallow (30-ft) and 2 intermediate (55-ft) groundwater monitoring wells
QA/QC					
Import Materials QA/QC Testing	EA	304	$1,200	$364,800	1/500 cy of imported materials
Performance QA/QC - Compaction	WK	39	$1,700	$66,300	during material placement only
Excavate and Backfill Swale Area					
Excavation of surface soils	CY	3,230	$15	$48,450	remove swale area soils to depth of 2-ft from grade
Place Imported Topsoil	CY	810	$58	$46,980	Placement by conventional equipment in 6-inch lifts
Place Imported Fill	CY	2,420	$43	$104,060	Placement by conventional equipment in 6-inch lifts
Seeding	AC	1	$18,000	$18,000	Modified old field successional with fertilizer and hydromulch
Utility Support	DA	6	$7,500	$45,000	Site supervisor and pole support crew provided by National Grid
Remove Historic Fill Material					
Excavation up to 20-ft bgs	CY	297,000	$10	$2,970,000	by conventional equipment and benching/sloping techniques; to approx. El. 385
Backfill and Restoration					
Place Imported Topsoil	CY	7,400	$58	$429,200	Placement by conventional equipment in 6-inch lifts; to approx. El. 395
Place Imported Fill	CY	141,000	$43	$6,063,000	Placement by conventional equipment in 6-inch lifts
Seeding	AC	9.2	$18,000	$165,600	Modified old field successional with fertilizer and hydromulch
Transportation and Disposal					
T&D by Truck - Non-Hazardous	TON	510,400	$110	$56,144,000	remove swale area soils to depth of 1-ft from grade
T&D by Truck - C&D	TON	3,900	$55	$214,500	Placement by conventional equipment in 6-inch lifts
		TOTAL ESTIMATED DIRECT CAPITAL COST:		**$69,748,000**	rounded
INDIRECT CAPITAL COST					
		Total Estimated Direct Capital Cost:		**$69,748,000**	
		Engineering / Management, Construction Oversight, OH&P		**$13,252,100**	6%, 8%, and 5% respectively
		Contingency		**$20,924,400**	Scope Contingency at 30%
Property Acquisition	LS	1	$273,000	$273,000	purchase of Parcel 114.-01-02.0 (Clark Equipment)
Institutional Controls					
Environmental Easement	LS	1	$30,000	$30,000	
Site Management Plan	LS	1	$50,000	$50,000	
		TOTAL ESTIMATED CAPITAL COST:		**$104,278,000**	rounded

Table 5-5. Alternative 4, Targeted Excavation of Historic Fill Material

Site: Honeywell Ballfield Site
Location: Geddes, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2019

Conceptual Basis: Excavation of fill materials
Backfill with clean materials
Continued Operation of IRMs

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
OPERATION AND MAINTENANCE COSTS					
Annual					
Reporting and Recordkeeping	EA	1	$20,000	$20,000	
Cover inspection	LS	1	$2,500	$2,500	Assumes 2 scientists/engineers, 1 days, 8 hours/day, twice annually
Cover Maintenance					
Vegetation Maintenance	AC	1	$2,400	$1,200	Spot seeding (5% of all areas annually)
Cover maintenance and incidental repairs	AC	1	$100	$50	Topsoil repair, 5 cy/acre annually
Groundwater Monitoring (Yr 1-5)					
Monitoring Event	EA	2	$3,600	$7,200	Sampling and Analysis of 6 wells (3 shallow/3 intermediate) per event
Groundwater Monitoring (Yr 6-10, 15, 20, 25, 30)					
Monitoring Event	EA	1	$3,600	$3,600	Sampling and Analysis of 6 wells (3 shallow/3 intermediate) per event
Years 5, 10, 15, 20, 25, 30					
Periodic Review	EA	1	$15,000	$15,000	

PRESENT WORTH ANALYSIS (YEARS 1-30)		DISCOUNT FACTOR	PRESENT WORTH	
	Cost	Df=7	(rounded)	
ESTIMATED CAPITAL COST - Year 0	$104,278,000	1.00	$104,280,000	
ANNUAL O&M COST - Years 1-30	$23,750	0.38	$270,000	Average discount factor for years 1-30
PERIODIC O&M COST - Years 1-4	$7,200	0.74	$21,000	Average discount factor for noted years
PERIODIC O&M COST- Year 5	$22,200	0.62	$14,000	Average discount factor for noted years
PERIODIC O&M COST - Years 6-9	$3,600	0.53	$8,000	Average discount factor for noted years
PERIODIC O&M COST - Year 10	$18,600	0.44	$8,000	Average discount factor for noted years
PERIODIC O&M COST - Years 15, 20, 25, 30	$15,000	0.23	$14,000	Average discount factor for noted years
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:			**$104,600,000**	rounded

Table 5-6. Alternative 5, Site-Wide Excavation and Off-Site Disposal

Site: Honeywell Ballfield Site
Location: Geddes, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2019

Conceptual Basis: Excavation of impacted materials
Backfill with clean materials
Continued Operation of IRMs

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
DIRECT CAPITAL COST					
General Conditions	WK	363	$15,000	$5,445,000	Trailer, fuel, small tools, consumables and safety
Mobilization	EA	10	$60,000	$600,000	
Air Monitoring	LS	1	$41,000	$41,000	
Surveys and Layouts	EA	2	$4,500	$9,000	Pre-construction, post-construction
Irrigation	WK	40	$5,000	$200,000	Following seeding, 4 weeks per season
Truck Wash/ Spoils control	WK	343	$7,500	$2,572,500	Wash rack and operation
Dust Suppression/Control	WK	343	$3,500	$1,200,500	5,000 gallon water truck and operation
Pre-design investigation					
Site Preparation					
Building demolition	LS	1	$175,000	$175,000	removal of existing structures on Parcel 114.-01-02.0 (Clark Equipment)
Clearing and Grubbing	AC	4.0	$11,000	$44,000	Tree and underbrush chipped and left onsite.
Rough Grading	AC	10.6	$3,500	$37,100	
Construction Entrance	LS	1	$15,000	$15,000	6-inch stone entrance
Erosion and Sediment Control	LF	3,400	$5	$17,000	Reinforced silt fence along perimeter
Sheeting	SF	217,800	$40	$8,712,000	sheetpiling; various lengths
Dewatering	WK	123	$10,000	$1,230,000	for excavation below groundwater (assume El. 375); treatment at Willis-Semet GWTP
Decommission existing wells	LS	1	$40,000	$40,000	assume decommission of 16 wells within cap area
Install new monitoring wells	LS	1	$16,000	$16,000	install 2 intermediate (55-ft) groundwater monitoring wells
QA/QC					
Import Materials QA/QC Testing	EA	1,457	$1,200	$1,748,400	1/500 cy of imported materials
Performance QA/QC - Compaction	WK	183	$1,700	$311,100	during material placement only
Remove/Reinstall Utilities					
Relocate/replace natural gas piping	LS	1	$350,000	$350,000	1,600 linear feet; 6-inch diameter
Relocate/replace utility poles	LS	1	$120,000	$120,000	12 utility poles and wiring
Remove/reinstall State Fair Blvd	LS	1	$120,000	$120,000	1,600 LF of roadway; single lane
Remove Historic Fill Material					
Excavation up to 45-ft bgs	CY	1,012,600	$10	$10,126,000	by conventional equipment and benching/sloping techniques; to approx. El. 358
Backfill and Restoration					
Place Imported Topsoil	CY	10,400	$58	$603,200	Placement by conventional equipment in 6-inch lifts; to approx. El. 395
Place Imported Fill	CY	718,000	$43	$30,874,000	Placement by conventional equipment in 6-inch lifts
Seeding	AC	12.9	$18,000	$232,200	Modified old field successional with fertilizer and hydromulch
Transportation and Disposal					
T&D by Truck - Non-Hazardous	TON	1,721,400	$110	$189,354,000	
T&D by Truck - C&D	TON	3,900	$55	$214,500	
TOTAL ESTIMATED DIRECT CAPITAL COST:				**$254,408,000**	rounded

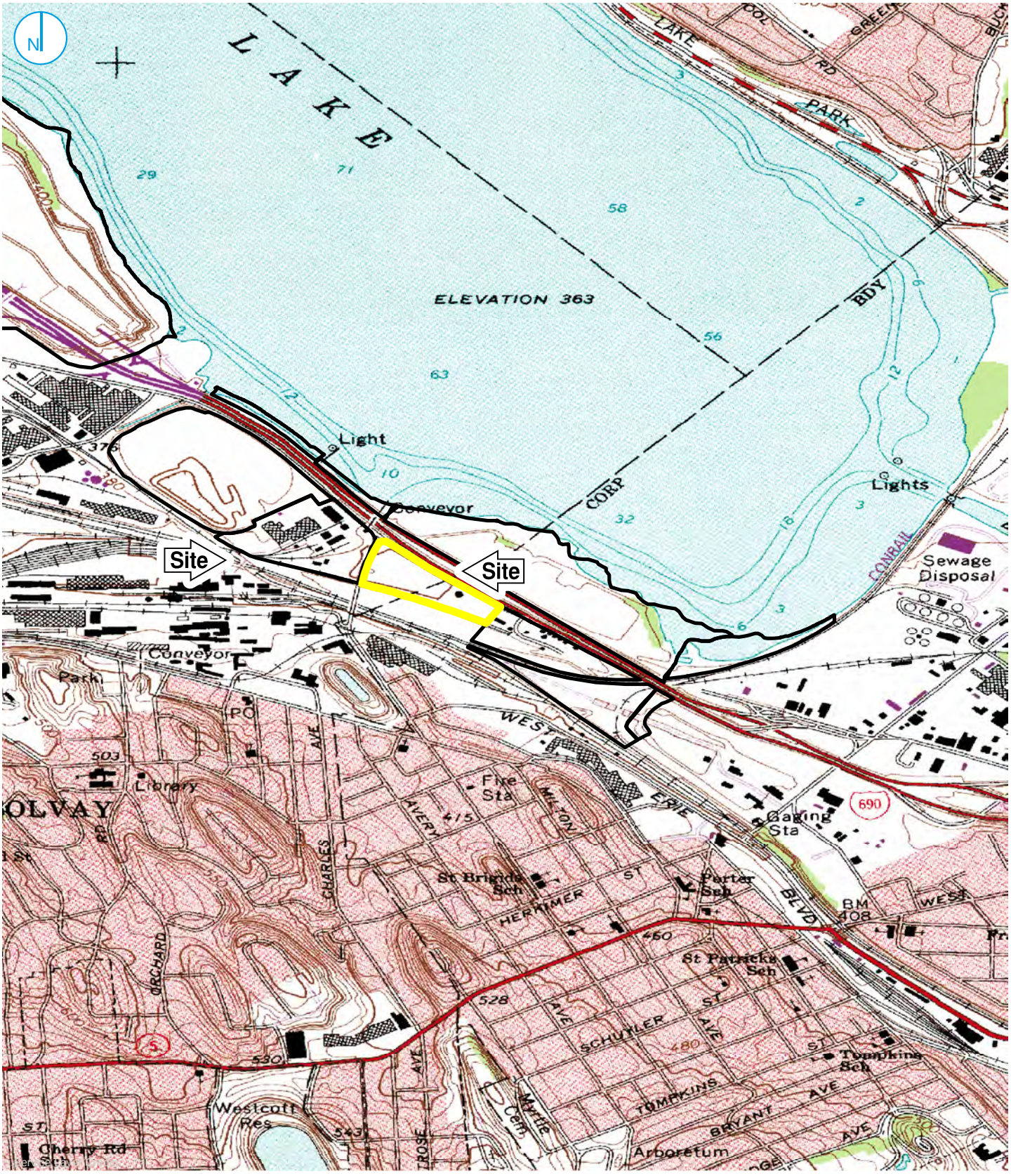
Table 5-6. Alternative 5, Site-Wide Excavation and Off-Site Disposal

Site: Honeywell Ballfield Site
Location: Geddes, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2019

Conceptual Basis: Excavation of impacted materials
Backfill with clean materials
Continued Operation of IRMs

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$254,408,000**	
			Engineering / Management, Construction Oversight, OH&P	**$48,337,500**	6%, 8%, and 5% respectively
			Contingency	**$76,322,400**	Scope Contingency at 30%
Property Acquisition	LS	1	$273,000	$273,000	purchase of Parcel 114.-01-02.0 (Clark Equipment)
Institutional Controls					
Environmental Easement	LS	1	$30,000	$30,000	
Site Management Plan	LS	1	$50,000	$50,000	
			TOTAL ESTIMATED CAPITAL COST:	**$379,421,000**	rounded
OPERATION AND MAINTENANCE COSTS					
Annual					
Reporting and Recordkeeping	EA	1	$20,000	$20,000	
Groundwater Monitoring (Yr 1-5)					
Monitoring Event	EA	2	$2,000	$4,000	Sampling and Analysis of 3 wells (3 intermediate) per event
Groundwater Monitoring (Yr 6-10, 15, 20, 25, 30)					
Monitoring Event	EA	1	$2,000	$2,000	Sampling and Analysis of 3 wells (3 intermediate) per event
Years 5, 10, 15, 20, 25, 30					
Periodic Review	EA	1	$15,000	$15,000	
PRESENT WORTH ANALYSIS (YEARS 1-30)			DISCOUNT FACTOR	PRESENT WORTH	
		Cost	Df=7	(rounded)	
ESTIMATED CAPITAL COST - Year 0		$379,421,000	1.00	$379,420,000	
ANNUAL O&M COST - Years 1-30		$20,000	0.41	$248,000	Average discount factor for years 1-30
PERIODIC O&M COST - Years 1-4		$4,000	0.85	$14,000	Average discount factor for noted years
PERIODIC O&M COST- Year 5		$19,000	0.71	$14,000	Average discount factor for noted years
PERIODIC O&M COST - Years 6-9		$2,000	0.60	$5,000	Average discount factor for noted years
PERIODIC O&M COST - Year 10		$17,000	0.51	$9,000	Average discount factor for noted years
PERIODIC O&M COST - Years 15, 20, 25, 30		$15,000	0.23	$14,000	Average discount factor for noted years
			TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:	**$379,700,000**	rounded

FIGURES



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KEY MAP

Map Scale: 1:1:21,324;
Map Center: 76°11'38"W 43°3'52"N

LEGEND

SITE BORDER

0 1,000 2,000 Feet

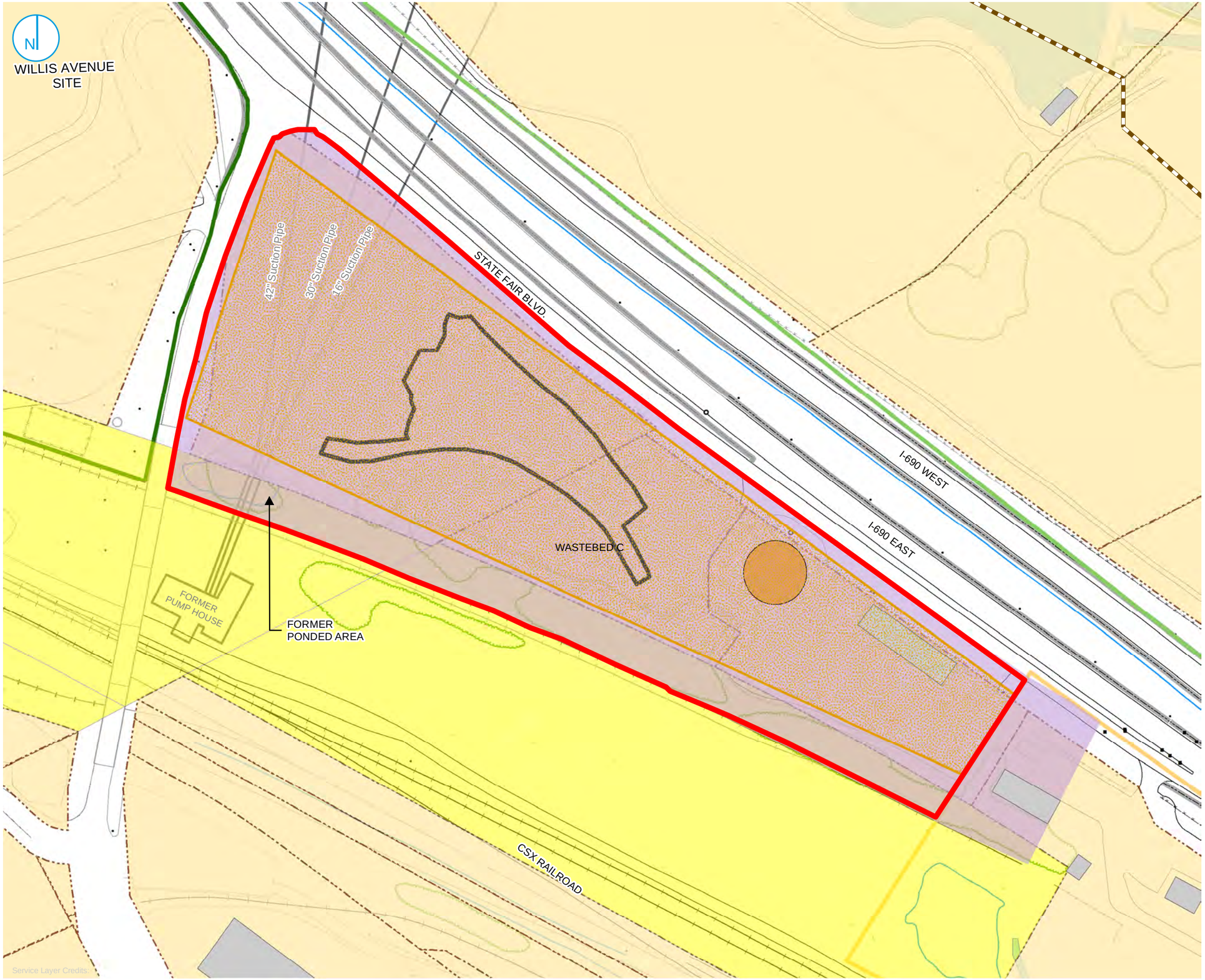
SITE LOCATION

HONEYWELL
BALLFIELD SITE
FEASIBILITY STUDY
GEDDES, NEW YORK

FIGURE 1-1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL



LEGEND

- WEST WALL IRM
- HISTORIC STRUCTURES
- HIGHWAY
- ROAD
- SITE BORDER
- EXISTING BUILDING
- EXISTING TANK
- WASTEBED C
- APPROXIMATE EXTENT OF FILL
- CURRENT STAGING AREA
- BALLFIELD SITE
- WASTEBED B LAKESHORE AREA BOUNDARY
- WASTEBED B PENN-CAN PROPERTY BOUNDARY
- WILLIS AVENUE PLANT BOUNDARY
- BELIEVED TO BE CSX RAILROAD
- ONONDAGA COUNTY PARCEL BOUNDARY

0 75 150 Feet

SITE PLAN

HONEYWELL
BALLFIELD SITE
FEASIBILITY STUDY
GEDDES, NEW YORK

FIGURE 1-2

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

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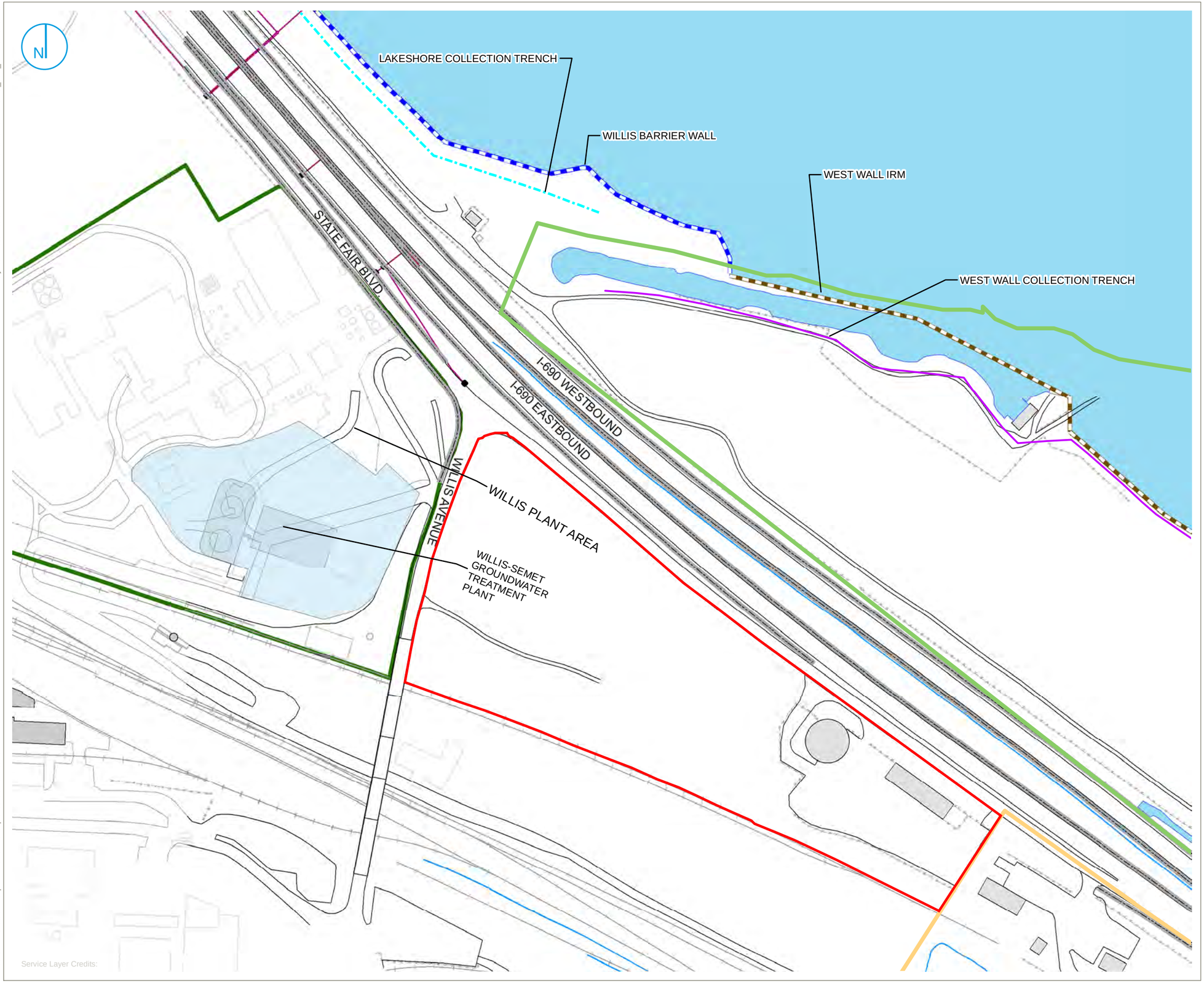

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LEGEND

- SITE BORDER
- LAKESHORE COLLECTION TRENCH
- WILLIS-SEMET GROUNDWATER TREATMENT PLANT FOOTPRINT
- WILLIS AVENUE PLANT BOUNDARY
- WASTEBED B LAKESHORE AREA BOUNDARY
- WASTEBED B PENN-CAN PROPERTY BOUNDARY

0 100 200 Feet

INTERIM REMEDIAL MEASURES

HONEYWELL
BALLFIELD SITE
FEASIBILITY STUDY
GEDDES, NEW YORK

FIGURE 3-1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

LEGEND

- CONFIRM CLEAN FILL THICKNESS (1-FT MINIMUM)
- EXCAVATE / REPLACE SWALE AREA (1FT)
- CONFIRM AND AMEND CLEAN FILL THICKNESS (1-FT MINIMUM)
- ENGINEERING COVER (1-FT)
- BALLFIELD BOUNDARY PROPERTY

0 100 200 Feet

ALTERNATIVE 3

HONEYWELL
BALLFIELD SITE
FEASIBILITY STUDY
GEDDES, NEW YORK

FIGURE 4-1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

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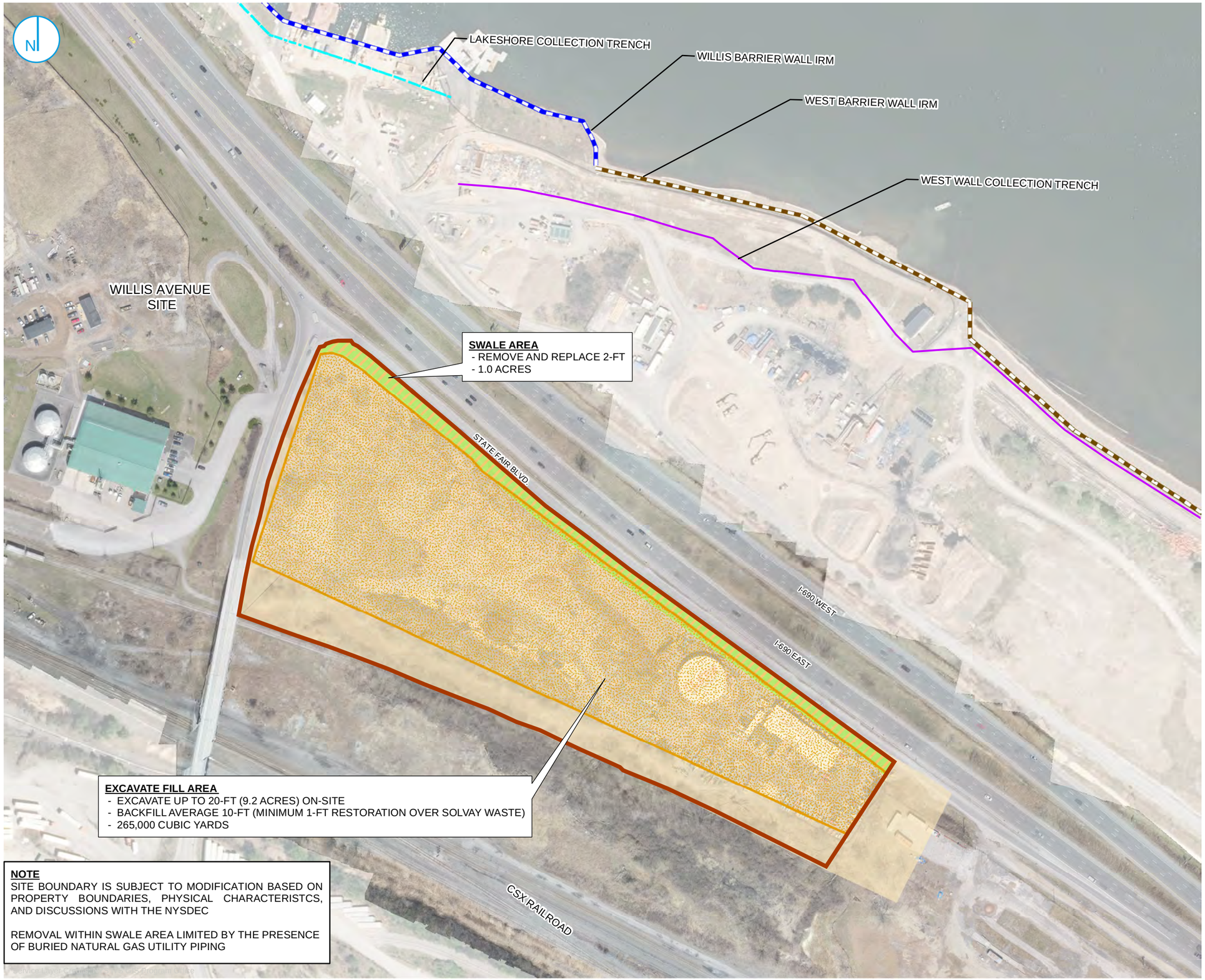

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LEGEND

- WASTEBED C
- APPROXIMATE EXTENT OF FILL
- BALLFIELD SITE
- EXCAVATE / REPLACE SWALE AREA (2-FT)

0 100 200 Feet

ALTERNATIVE 4

HONEYWELL
BALLFIELD SITE
FEASIBILITY STUDY
GEDDES, NEW YORK

FIGURE 4-2

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

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NOTE
SITE BOUNDARY IS SUBJECT TO MODIFICATION BASED ON PROPERTY BOUNDARIES, PHYSICAL CHARACTERISTCS, AND DISCUSSIONS WITH THE NYSDEC

Base Map Data: NYS ITS GIS Program Office

PROJECT: 169000XXXX | DATED: 6/4/2020 | DESIGNER: MOTAY

LEGEND

- WASTEBED C
- BALLFIELD SITE

0 100 200 Feet

ALTERNATIVE 5

HONEYWELL
BALLFIELD SITE
FEASIBILITY STUDY
GEDDES, NEW YORK

FIGURE 4-3

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL