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Feasibility Study Report

Madison Avenue Former MGP Site,
Elmira, New York

January 2008

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Certification

I, Margaret A. Carrillo-Sheridan, P.E., as a Professional Engineer registered in the State of New York, to the best of my knowledge, and based on my inquiry of the persons involved in preparing this document under my direction, certify that this *Feasibility Study Report for the Madison Avenue Former MGP Site* (Feasibility Study Report) was completed in general accordance with the 1994 Administrative Order on Consent (Index # DO-0002-9309) between New York State Electric & Gas Corporation and the New York State Department of Environmental Conservation. This Feasibility Study Report identifies and evaluates potential remedial alternatives to address environmental concerns at the site.

Margaret A. Carrillo-Sheridan 18 Jan-2008

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Feasibility Study Report

Madison Avenue Former MGP Site, Elmira, New York

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List of Acronyms and Abbreviations

bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene and xylenes
CAMP	Community Air Monitoring Plan
CB	cement-bentonite
CFR	Code of Federal Regulations
COC	constituent of concern
DER	NYSDEC Division of Environmental Remediation
DNAPL	dense nonaqueous phase liquid
DUS/HPO	dynamic Underground Stripping and Hydrous Pyrolysis/Oxidation
FWRIA	Fish and Wildlife Resource Impact Analysis
GRA	general response action
HASP	Health and Safety Plan
HHEE	Human Health Exposure Evaluation
HWR	NYSDEC Division of Hazardous Waste Remediation
I.D. Booth	I.D. Booth, Inc.
IRM	interim remedial measure
ISCO	in-situ chemical oxidation
ISS	in-situ solidification/stabilization
LNAPL	light nonaqueous phase liquid
LTTD	low temperature thermal desorption
mg/kg	milligrams per kilogram
MGP	manufactured gas plant
MNA	monitored natural attenuation
NAPL	nonaqueous phase liquid
NCP	*National Oil and Hazardous Substances Pollution Contingency Plan*
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSEG	New York State Electric & Gas Corporation
O&M	operation and maintenance

OSHA	Occupational Safety and Health Association
Order	Administrative Order on Consent
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PDI	pre-design investigation
PEL	Permissible Exposure Limit
POTF	privately-owned treatment facility
POTW	publicly-owned treatment works
PPE	personal protective equipment
PSD	prevention of significant deterioration
RAO	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RD/RA	remedial design/remedial action
RSCO	Recommended Soil Cleanup Objective
SB	soil-bentonite
SCG	standards, criteria and guidelines
SMP	Site Management Plan
SRI	*Supplemental Remedial Investigation*
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TAGM	Technical and Administrative Guidance Memorandum
TCLP	toxicity characteristic leaching procedure
TOGS	Technical and Operational Guidance Series
Trayer	Trayer Products, Inc.
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
UTS/LDR	Universal Treatment Standards/Land Disposal Restriction
VOC	volatile organic compound

1. Introduction

1.1 Purpose and Objective

This *Feasibility Study Report for the Madison Avenue Former MGP Site* (Feasibility Study Report) documents the evaluation of remedial alternatives to select a preferred remedial strategy for media affected by manufactured gas plant (MGP) residuals at the New York State Electric & Gas Corporation's (NYSEG's) former MGP site located on Madison Avenue in Elmira, New York (site). This Feasibility Study Report accomplishes this by identifying and screening potential remedial alternatives that are appropriate for site-specific conditions, protective of human health and the environment and consistent with relevant laws, regulations and guidance documents. Based on this screening process, a recommendation for the most-appropriate remedial alternative for the site is presented.

1.2 Regulatory Framework

In March 1994, NYSEG entered into an Administrative Order on Consent (Index # DO-0002-9309) (Order) with the New York State Department of Environmental Conservation (NYSDEC) to investigate and, where necessary, remediate 33 former MGP sites in New York. Section II of the Order requires that NYSEG perform investigations at each of the sites where data are needed to characterize the nature and extent of impacts. The Order further requires NYSEG to prepare a feasibility study for any site that the NYSDEC determines, based on the results of the site investigations, to require remediation. The Madison Avenue former MGP site (Site No. 8-08-018) is included on this list of 33 sites.

NYSEG has completed remedial investigations at the Madison Avenue site that defined the nature and extent of MGP-related impacts to media. The comprehensive results of the remedial investigation activities were presented in the *Supplemental Remedial Investigation Report* (SRI Report) (ARCADIS BBL, 2007). The NYSDEC approved the SRI Report and requested that NYSEG begin scoping the feasibility study at the site, as documented in a February 28, 2007 letter addressed to NYSEG.

This Feasibility Study Report was prepared in accordance with the Order in addition to relevant sections of the following documents:

- *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (Interim Final), United States Environmental Protection Agency (USEPA). EPA/540/G-89/004. October 1988.

- *National Oil and Hazardous Substances Pollution Contingency Plan Under the Comprehensive Environmental Response, Compensation and Liability Act of 1980* (NCP). Applicable provisions contained in the Code of Federal Regulations (40 CFR Part 300). September 15, 1994.

- *Code of Federal Regulations: Protection of Environment*. 40 CFR. USEPA. March 8, 1990. Revised July 1, 1990.

- *Selection of Remedial Actions at Inactive Hazardous Waste Sites*. NYSDEC Division of Hazardous Waste Remediation (HWR), Technical and Administrative Guidance Memorandum (TAGM) (TAGM HWR-4030). May 15, 1990.

- *Guidelines for Remedial Investigations/Feasibility Studies*. NYSDEC Division of HWR, TAGM HWR-4025. March 31, 1989.

- *Draft DER-10 Technical Guidance for Site Investigation and Remediation*. NYSDEC Division of Environmental Remediation. December 25, 2002.

1.3 Report Organization

This Feasibility Study Report is organized into the following sections:

Section	Description
1 – Introduction	Presents the purpose and the regulatory framework governing the preparation of this Feasibility Study Report, describes the organization of this Feasibility Study Report and summarizes relevant background information and findings of investigations and interim remedial measures (IRMs) conducted at the site.
2 – Identification of Potential Standards, Criteria and Guidelines	Identifies the potential standards, criteria and guidelines (SCGs) that govern the development and selection of remedial alternatives.

Section	Description
3 – Development of Remedial Action Objectives	Presents the remedial action objectives (RAOs) for the site that are protective of human health and the environment, and identifies media to be addressed through implementation of the remedial alternatives.
4 – Technology Screening Summary and Development of Remedial Alternatives	Identifies and screens remedial technologies and process options, and develops potential remedial alternatives to address impacted media.
5 – Detailed Evaluation of Remedial Alternatives	Describes the NYSDEC and NCP criteria used to evaluate the remedial alternatives, and presents a detailed analysis of each potential remedial alternative for each media.
6 – Assembly and Comparative Analysis of Site-Wide Remedial Alternatives	Presents a comparative analysis of each site-wide alternative using the evaluation criteria.
7 – Recommended Site-Wide Remedy	Presents the recommended site-wide remedy for the site.
8 – References	Presents a list of references utilized throughout this Feasibility Study Report.

1.4 Background Information

This section summarizes the site-specific background information used to develop and evaluate potential remedial alternatives for the site, including:

- general information regarding the site, including the site location and physical setting
- site history
- previous investigations conducted at the site
- previous IRMs conducted at the site
- overview of the nature and extent of environmental impacts

1.4.1 Site Location and Physical Setting

The site is located in the City of Elmira (city), Chemung County, New York (Figure 1). The city occupies the floor of a glacially carved valley, flanked on the east and west by steep bedrock hills rising greater than 500 feet above the valley floor. The city itself is largely flat, sitting in the 500-year floodplain of the Chemung River, which flows west to east through the city, before turning toward the southeast and its junction with the Susquehanna River.

The site occupies most of a city block, bounded by East Clinton Street, Madison Avenue and East Fifth Street. The site is approximately 1,500 feet west of Newtown Creek, a tributary to the Chemung River that is just over 3,000 feet to the south of the site. The site is largely flat-lying, with a small topographic rise in the eastern corner, near the intersection of East Fifth and East Clinton Streets (Figure 2).

NYSEG currently owns the former MGP property, with the exception of a storage yard located on the northern portion of the site adjacent to East Fifth Street. NYSEG currently maintains an electrical substation on the property east of the storage yard. Land use in the surrounding area is mixed, with industrial and commercial operations immediately south and west, a public park to the northeast and residential properties within 1,000 feet of the site in all directions. The parcel immediately south of the site is owned by Trayer Products, Inc. (Trayer), a metal-parts manufacturer.

There are no known wells or groundwater usage within a 1 mile radius of the site; all businesses and residences near the site are supplied by city water. A municipal water supply well field is located on Sullivan Street approximately 1 mile north and upgradient of the site.

1.4.2 Site History

The MGP was built between 1865 and 1869 beside the Junction Canal, a waterway connecting the Chemung and North Branch Canals. On the south side, the original site boundary was the canal, which was used to transport coal. The canal was backfilled and replaced by a railroad in the late 1800s. The MGP operated for approximately 80 years (circa 1865 to 1947) using coal, oil and water to produce gas. The MGP initially produced coal gas, then water (or blue) gas and finally carbureted water gas. With plant closure in 1947, most of the aboveground MGP structures were dismantled. The last remaining MGP structure, the former gas house, was demolished by NYSEG during an IRM completed in 2004.

After 1947, NYSEG used the entire site as a service center for its electric and gas crews. Activities at the site included storage of various utility supplies, such as wire, insulators, line hardware, treated wood poles, cross-arms and oil-filled electrical equipment, and minor equipment maintenance (performed in the Transformer Repair Building).

NYSEG ceased active use of the site in 1975 when it moved operations to their current service center located in Horseheads, New York. The former Transformer Repair Building (shown on Figure 2) continued to be used for storage of various supplies, but was not used for equipment maintenance. The western portion of the site, including all the remaining buildings, was sold to I.D. Booth, Inc. (I.D. Booth) in 1977. I.D. Booth, an industrial supply wholesaler, used several of the old buildings as warehouses, augmenting their larger operations across Madison Avenue to the west. NYSEG retained ownership of the eastern portion of the site where it maintains an electrical substation and a storage yard. In 2003, NYSEG re-acquired the MGP portion of the property owned by I.D. Booth (western portion) and transferred ownership of the storage yard (to the west of the substation) to I.D. Booth.

1.4.3 Summary of Previous Investigations

Prior to initiation of this feasibility study, the site was the subject of seven environmental investigations and other studies starting in 1986 and culminating in 2006 with the completion of the SRI. During these investigations, approximately 84 soil borings were drilled, 29 monitoring wells and 23 temporary piezometers/wells were installed, 61 test pits were excavated and hundreds of samples of environmental media were analyzed. The primary objectives of this work were to characterize the nature and extent of impacts to the environment from the former MGP operations, to evaluate the risk posed to human health and the environment by those impacts and to collect sufficient information to perform a feasibility study to evaluate remedial alternatives for the site.

References for the previous investigation reports are provided in Section 8. The information collected during these investigations was used during the preparation of this Feasibility Study Report.

1.4.4 Summary of Previous Interim Remedial Measures

The site has undergone a considerable amount of remediation through the implementation of IRMs, including:

- *Polychlorinated Biphenyl (PCB) IRM (1996)* – Excavated and disposed of PCB-impacted soil (greater than 10 milligrams per kilogram [mg/kg]) in the eastern portion of the site; soil with PCB concentrations between 1 and 10 mg/kg was left in place and covered with clean soil or crushed stone.

- *Former Gas House IRM (2003)* – Demolished and disposed of the former gas house.
- *Former Gas Holders 1 and 2 IRM (2003 and 2004)* – Removed and disposed of the contents and foundations of former gas holders 1 and 2 and associated impacted subsurface materials (excavated to depths of 14 to 16 feet below grade)
- *Purifier Waste Area IRM (2004)* – Excavated and disposed of impacted soil associated with the purifier waste disposal area (excavated to a depth of 3 feet below grade)

These IRMs have significantly reduced the quantity of MGP-impacted materials at the site.

1.4.5 Geology and Groundwater Flow

The following paragraphs summarize the findings of the geology, hydrogeology and groundwater flow characteristics presented in the SRI Report (ARCADIS BBL, 2007).

Generalized Geologic Column

Upper Contact Elev.(ft. AMSL)	Thickness (ft)	Stratigraphic Unit
852	2 - 15	**Fill –** silt, sand, gravel, ash, cinders, slag. Also includes demolition debris, foundation remnants, and buried utilities.
850	0 - 12	**Alluvial Silt and Clay** – brownish gray silt and clay, occasional lenses of fine sand and peat, abundant root scars.
845	5 - 48	**Outwash Sand and Gravel** – generally fine-to-coarse sand, fine-to-coarse gravel, occasional lenses of fine sand, silt, and clay.
825	0 - 14	**Lacustrine Silt and Clay** – gray, uniform, cohesive, massively bedded.
820	30-40	**Sandy/Silty Till** – dense sand and silt matrix containing embedded sand and gravel, rounded to angular, mostly multi-colored rock fragments.

Note: elevations and thicknesses approximated for center of site.

Geologic Units

The site is situated on relatively flat-lying land at an elevation of approximately 850 feet above mean sea level. Investigations have identified five principal geologic units beneath the site, including:

- fill and an assortment of man-made structures, originating from the site's industrial history
- alluvial sequence of silt and clay with sand stringers and peat

- outwash deposit of sand and gravel with few discontinuous interspersed fine sand, silt and clay lenses deposited by meltwater rivers during glacial recession

- remnants of a lacustrine silt and clay likely deposited in a glacial meltwater lake

- dense glacial sandy/silty basal till

Hydrostratigraphy

Hydrostratigraphic units comprise one or more geologic units of similar hydrogeologic properties (e.g., hydraulic conductivity) that may be grouped together to aid interpretation and simplify the discussion of groundwater flow. Four hydrostratigraphic units (shown on Figure 3) have been identified beneath the site, including:

- *Alluvial Silt-and-Clay Unit* – This unit is the uppermost hydrostratigraphic unit at the site, and is comprised of recent alluvial deposits of silt and clay and occasional peat horizons and fine sand stringers. This unit is thickest (greater than 4 to 8 feet) near and south of the MGP operations area and essentially absent in the eastern portion of the site. The hydraulic conductivity of this unit is low (1.2 feet per day). The low-hydraulic conductivity of the unit significantly restricts infiltration of precipitation to the underlying sand-and-gravel unit. As such, pronounced groundwater mounding has been observed in areas where this unit is present.

- *Sand-and-Gravel Unit* – This unit is comprised of artificial fill and a sand-and-gravel outwash deposit. The composition of this unit is variable and contains intervals of fine sand and silt. The sand-and-gravel unit is the thickest unit beneath the site (approximately 5 to 50 feet), and is the most significant unit at the site in terms of groundwater flow and storage/transport of site-related constituents. The hydraulic conductivity of the unit is relatively high – about 70 feet per day. The sand-and-gravel unit is continuous across the area investigated in and around the site.

- *Lacustrine Silt-and-Clay Unit* – This unit was found primarily in the eastern portion of the site and appears to pinch-out just east of the MGP operations area. Where present, this unit was observed immediately above the till unit (described below) but below the sand-and-gravel unit. This unit is thickest near the area of monitoring wells MW-9S/D and MW-12S/D, and is comprised primarily of silt and clay. Groundwater likely flows around this unit and through the adjacent sand-and-gravel and till units. A vertical hydraulic conductivity test (based on laboratory analyses using a flexible-tube permeameter) of the unit supports this observation.

Testing of an undisturbed (i.e., Shelby tube) sample yielded a vertical hydraulic conductivity estimate of approximately 2 x 10^{-3} feet per day.

- *Till Unit* – This unit is the deepest unit investigated beneath the site and is about 30 to 40 feet thick. The surface of this unit is irregular, and is typically shallower in the eastern and western portions of the site and deeper in the central portion of the site. The unit is usually very dense and consists of sand and silt with varying amounts of gravel and clay. The hydraulic conductivity of this unit is low (approximately 7 feet per day) compared to the sand-and-gravel unit.

The hydrostratigraphic units encountered at the site appear to be representative of the regional groundwater flow system.

Groundwater Occurrence and Flow

The top of the groundwater table occurs in the sand-and-gravel unit at a depth between 5 and 10 feet below ground surface (bgs) across most of the site. Beneath the western half of the site, the water table appears to be mounded above the alluvial silt-and-clay unit, and therefore, occurs in the fill.

The majority of shallow groundwater on the western portion of the site moves radially away from the center of the groundwater mound located near monitoring well MW-6S, then spills off the edge of the alluvial unit into the sand-and-gravel unit. Once in the sand-and-gravel unit, groundwater flows to the Chemung River, Newtown Creek and/or, to a lesser extent, into the underlying till. A fraction of the shallow groundwater seeps vertically through the alluvial unit into the sand-and-gravel unit. The horizontal hydraulic gradient for shallow groundwater is approximately 0.014 foot per foot.

Groundwater in the till moves relatively uniformly south-southeast toward the Chemung River. The horizontal hydraulic gradient in the till is slight, approximately 0.004 foot per foot. Due to the relatively low permeability of the till, the net groundwater flow is believed to be small with respect to the volume of water flowing in the overlying sand and gravel.

1.4.6 Nature and Extent of Impacts

The Human Health Exposure Evaluation (HHEE) conducted during the SRI defined constituents of concern (COCs) as constituents detected at concentrations above applicable screening criteria, regardless of whether they are site-derived. Site data indicated that subsurface soil and groundwater contain elevated levels of benzene, toluene, ethylbenzene and xylenes (BTEX), a subset of volatile organic compounds (VOCs); a more general class of organic compounds called polycyclic aromatic hydrocarbons (PAHs) and cyanide. PAHs are a subgroup of semivolatile organic compounds (SVOCs) that consists of approximately 17 commonly recognized multi-ringed, aromatic compounds. These compounds, because of their physical and chemical characteristics, are commonly targeted as identifiers for discussion.

Analysis presented in the SRI Report (ARCADIS BBL, 2007) concluded that cyanide was present in its non-toxic form, mostly as iron-cyanide complexes, and therefore, is of no significant concern at the site. COCs at the site for both subsurface soil and groundwater, therefore, include BTEX and PAHs.

The primary MGP-related byproduct responsible for most of the impacts at the site is coal tar, which is a dense nonaqueous phase liquid (DNAPL). DNAPLs are heavier than water and tend to sink below the water table if released in sufficient quantities. Coal tar contains many organic compounds, a number of which have toxic properties and are regulated by the NYSDEC. Chief among these are BTEX and PAHs. These two groups of compounds, including nonaqueous phase liquids (NAPLs), prove to be most useful in characterizing the nature and extent of site-related impacts.

There is evidence that petroleum hydrocarbons, which are light NAPLs (LNAPLs), were also released during MGP operations, chiefly in the eastern portion of the site. Other relatively minor impacts have been observed at the site. These include chlorinated solvents and PCBs, which may have resulted from a transformer repair operation that was located in the eastern portion of the site. Chlorinated solvents were detected at low concentrations in shallow groundwater, and where detected, were found commingled with MGP-related constituents. PCB-affected soil above 10 mg/kg was removed during the IRM conducted in the eastern portion of the site (1996).

Surface soil, subsurface soil, groundwater, soil vapor and the presence of two subsurface pipes (one vitrified clay pipe and one concrete pipe) were investigated during the SRI. Based on the information presented in the SRI Report (ARCADIS BBL, 2007), only subsurface soil, groundwater and the concrete pipe were affected by MGP residuals, and therefore, evaluated for remedial action during this Feasibility Study Report.

During the SRI, analysis for PAHs, the primary chemical components of MGP coal tar, was conducted on the subsurface soil. A review of the site data was conducted prior to the SRI to establish a relationship between the total SVOCs and the total PAHs detected in the study area. This review indicated that, on average, PAHs comprised almost all of the SVOCs detected. Because PAHs represent essentially all of the SVOCs present within the study area, the TAGM 4046 Recommended Soil Cleanup Objective (RSCO) of 500 mg/kg for total PAHs was used in this Feasibility Study Report.

Similarly, a review of the SRI data was also conducted to determine the relationship between the total VOCs and total BTEX detected within the study area. This review also indicated that, on average, BTEX comprised essentially all of the MGP-related VOCs detected. Because BTEX represents essentially all of the MGP-related VOCs present within the study area, the RSCO of 10 mg/kg for total BTEX was used in this Feasibility Study Report. Total BTEX and total PAHs are referenced henceforth in this report because:

- The NYSDEC-approved remedial investigation program focused on the delineation of BTEX and PAHs; therefore, the nature and extent of impacts that were used to develop and screen potential site-wide alternatives were based on total BTEX and total PAHs (i.e., they are the only data available).

- Precedent had been set for the NYSDEC, and the NYSDEC has accepted total BTEX and total PAHs as remedial goals for MGP sites (ref.: ROD NYSEG Oneonta MGP Site, March 2005).

The balance of this section summarizes the nature and extent of impacts in the media investigated during the SRI.

1.4.6.1 Surface Soil

As presented in the SRI, no potentially complete exposure pathway is associated with surface soil. Several VOCs and SVOCs were detected in the surface soil samples; however, none of the VOCs were detected above the NYSDEC’s TAGM 4046 RSCOs. For SVOCs, several PAHs were detected in both on-site and background samples at concentrations greater than the TAGM 4046 RSCOs. However, PAH concentrations in on-site samples were not significantly higher than the background concentrations. In addition, potential exposure to constituents in surface soil has been reduced through the implementation of the IRMs conducted in 1996, 2003 and 2004. The western portion of the site is primarily covered by buildings or asphalt. Based on these results, the SRI Report (ARCADIS BBL, 2007) concluded that this medium does not require further consideration as part of the remedial action at the site.

1.4.6.2 Subsurface Soil

As presented in the SRI Report (ARCADIS BBL, 2007), when a comparison of the subsurface soil BTEX and PAH data was made, it was noted that if the RSCO for BTEX was exceeded in a sample, the RSCO for PAHs was also exceeded. Based on this information and because the PAH data set is the most robust for site soil (more samples were analyzed for PAHs than for BTEX), discussions regarding the extent of subsurface soil exceeding RSCOs in this Feasibility Study Report focuses on the extent of soil containing greater than 500 mg/kg of total PAHs. A data summary showing the range of COCs detected in subsurface soil and the frequency of detections exceeding SCGs is provided in Table 1-1.

A three-dimensional Mining Visualization Software model was developed to show the extent of subsurface soil with concentrations of total PAHs exceeding the RSCO of 500 mg/kg. In addition, a three-dimensional model was also developed to show the extent of observed NAPL and/or sheens in subsurface soil. Visual representations developed from these models are shown on Figure 4.

The following observations can be made based on review of Figure 4:

- Two areas of NAPL-impacted soil are present at the site – one in the area of the former MGP structures (gas house, holders, tar storage/handling vessels) and the other to the north and east of the former distribution holder.

- The NAPL-impacted soil to the east was present from approximately 8 to 14 feet bgs and appears to reside near, and several feet below, the water table. This NAPL may be neutrally buoyant and near the density of groundwater. This NAPL has a petroleum and coal tar chemical composition.

- NAPL beneath the area of the former MGP structures appears to have migrated deeper than at the eastern area, and has penetrated the till in some places. Given the deep distribution of the NAPL in this area, it is assumed that this NAPL is denser than water (i.e., DNAPL). The till surface, due to its coarse-grained texture, appears to have little control over the extent of DNAPL, and therefore, does not appear to provide a capillary barrier to downward DNAPL migration. This DNAPL has a chemical composition consistent with coal tar.

- NAPL-impacted soil in both areas is primarily constrained to within the site boundary. A potential exception is a small area south of former gas holders 1 and 2, where a finger of NAPL appears to have migrated south onto Trayer's property at approximately 20 to 25 feet below grade.

- The majority of NAPL-/sheen-containing soil occurs below the water table (calculations indicate that approximately 85 percent of the soil, by volume, containing total PAHs greater than 500 mg/kg and/or NAPL exists below the water table).

- The volume of subsurface soil exceeding the RSCO for total PAHs appears to be considerably smaller than the volume containing NAPL/sheen. The primary reason for this difference is that more samples were visually examined for NAPL than were analyzed for PAHs. Soil samples observed to contain sheens and/or NAPL were not sent to the laboratory for PAH analysis. This was done because of potential problems that the tar materials could cause to the analytical instrumentation, and because it was assumed that the sample would possess greater than 500 mg/kg of total PAHs. In addition, it was not practicable to analyze every soil sample collected. As a result, the NAPL observation data set is more robust than the PAH data set.

Site NAPLs are believed to be residual because DNAPL has not accumulated in the wells that were designed to collect it.

1.4.6.3 Groundwater

The SRI Report (ARCADIS BBL, 2007) characterized the nature and extent of groundwater impacts at the site by comparing analytical results to the NYSDEC Class GA Groundwater Standards. The primary constituents identified above Class GA Groundwater Standards were BTEX and benzo(a)pyrene (a PAH). The SRI characterized these five compounds as COCs for site groundwater. Figure 5 shows the distribution of dissolved-phase COCs in groundwater at concentrations above the Class GA Groundwater Standards. A data summary showing the range of COCs detected in groundwater and the frequency of detections exceeding SCGs is provided in Table 1-2.

The following observations can be made regarding the extent of groundwater impacts:

- The horizontal extent of the dissolved-phase BTEX and PAHs in site groundwater has been delineated.
- The vertical extent of dissolved-phase BTEX and PAHs has been delineated and appears to be limited to within approximately 50 feet of the ground surface.
- The extent of dissolved-phase BTEX and PAHs above Class GA Groundwater Standards appears to be limited to within approximately 100 feet of the site boundary to the south.
- The extent of dissolved-phase PAHs in groundwater appears much smaller than the extent of dissolved-phase BTEX.
- The deep groundwater zone (i.e., groundwater deeper than approximately 50 feet bgs) does not appear to have been impacted by the former MGP operations.

Four chlorinated VOCs (1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene and chloroethane) were detected in groundwater at two shallow monitoring wells (MW-3S and MW-4S) at the site during the April 2004 sampling event. These wells are located near the center of the MGP operations area and within the approximate extent of the BTEX and PAH plume in this area. Although these chlorinated compounds were detected above their respective Class GA Groundwater Standards, the SRI concluded that they were not of significant concern because their extent is localized and their concentrations are relatively low (7.3 to 130 micrograms per liter for individual constituents). Therefore, these compounds were not identified as COCs at the site.

The potential for site COCs to naturally attenuate was evaluated during the SRI. The SRI concluded that:

- All of the COCs identified in site groundwater are likely degraded by naturally-occurring subsurface microorganisms (i.e., biodegraded), resulting in harmless byproducts (e.g., carbon dioxide).
- Statistically significant decreases in COC concentrations at the site over time indicate overall shrinkage of COC plumes in shallow groundwater.

In addition, the SRI Report (ARCADIS BBL, 2007) concluded that dissolved COCs in groundwater do not pose a threat to the existing municipal water supply wells that are located approximately 1 mile north and upgradient of the site.

1.4.6.4 Soil Vapor

The potential for soil vapor intrusion of VOCs in buildings on and near the site, including the warehouse/storage building owned by I.D. Booth on the western portion of the site and the Trayer buildings along the southern edge of the site, was evaluated during the SRI.

Numerous VOCs were detected at low concentrations in sub-slab soil vapor samples collected at each sampling location; however, only three compounds (1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene and chloroform) exceeded the USEPA generic target shallow soil vapor screening levels. These three compounds are not likely associated with the former MGP; rather, they are likely attributable to current/former building uses. None of the compounds detected exceeded their respective Occupational Safety and Health Administration (OSHA) 8-hour Permissible Exposure Limit (PEL). The SRI concluded that further vapor intrusion assessment was not required. Based on these results and subsequent discussions with the NYSDEC and the New York State Department of Health (NYSDOH), soil vapor did not require further consideration as part of the feasibility study.

A process to assess the potential for soil vapor intrusion into future buildings on the site will be developed in a forthcoming site management plan (SMP).

1.4.6.5 Subsurface Piping

During the SRI, a concrete pipe located in the southeastern portion of the site was encountered during the excavation of one test pit (TP-100). The pipe was further investigated by conducting a geophysical survey using ground penetrating radar and inspecting nearby sewer manways. The pipe was accessed and a black sludge with a strong coal tar-like odor was observed inside the pipe. A sample of the black sludge was collected for analysis of BTEX and PAHs. BTEX and PAHs were detected in the sample above the TAGM 4046 criteria with total concentrations of 192.7 mg/kg and 24,330 mg/kg, respectively.

Investigations conducted to date were not successful in determining the origin and physical extent of the pipe (e.g., length, alignment and extent of the pipe across the site). Based on the lack of information, insufficient information exists to conduct a reliable remedial alternative analysis. As such, for the purposes of this Feasibility Study Report, NYSEG will use the most conservative approach for addressing the pipe (i.e., excavation and removal of the pipe and its contents, to the extent feasible). Excavation and removal of the pipe will be included as a component of each remedial alternative that is retained for a detailed evaluation. Additional investigation and remediation of the pipe and its contents will be performed as part of the remedial action at the site. The actual technology implemented for the remediation of the pipe may change based on additional information collected during remedy implementation.

2. Identification of Potential Standards, Criteria and Guidelines

As presented in Section 1.2, this Feasibility Study Report was prepared in general conformance with the applicable guidelines set forth in TAGM HWR 4025, TAGM HWR-4030 and applicable provisions of the New York State Environmental Conservation Law, the CFR and the NCP. This section identifies the potential SCGs that have been specifically identified for the site.

2.1 Definition of Standards, Criteria and Guidelines

"Standards and criteria" are cleanup standards, standards of control and other substantive environmental protection requirements, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance.

"Guidelines" are non-promulgated criteria, advisories and/or guidance that are not legal requirements and do not have the same status as "standards and criteria;" however, remedial programs should be designed with consideration given to guidance documents that, based on professional judgment, are determined to be applicable to the project [6 New York Codes, Rules and Regulations {NYCRR} 375-1.10(c)(1)(ii)].

2.2 Types of Standards, Criteria and Guidelines

The NYSDEC has provided guidance on the application of SCGs during the feasibility study process. SCGs are to be progressively identified on a site-specific basis as the feasibility study proceeds. The potential SCGs considered in this Feasibility Study Report were categorized into the following NYSDEC-recommended classifications:

- *Chemical-Specific SCGs* – These SCGs are usually health- or risk-based numerical values or methodologies, which, when applied to site-specific conditions, result in the establishment of numerical values for each COC. These values establish the acceptable amount or concentration of constituents that may be found in, or discharged to, the ambient environment.

- *Action-Specific SCGs* – These SCGs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous waste management and site cleanup.

- *Location-Specific SCGs* – These SCGs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in specific locations.

2.3 Standards, Criteria and Guidelines

The SCGs identified for the evaluation of remedial alternatives are presented below.

2.3.1 Chemical-Specific Standards, Criteria and Guidelines

The potential chemical-specific SCGs for the site are summarized in Table 2-1. Chemical-specific SCGs that potentially apply to the waste materials generated during remedial activities are the Resource Conservation and Recovery Act (RCRA) and New York State regulations regarding the identification and listing of hazardous wastes outlined in 40 CFR 261 and 6 NYCRR Part 371. Included in these regulations are the regulated levels for the toxicity characteristic leaching procedure (TCLP) constituents. The TCLP constituent levels are a set of numerical criteria at which solid waste is considered a hazardous waste by the characteristic of toxicity. In addition, the hazardous characteristics of ignitability, reactivity and corrosivity may also apply, depending upon the results of waste characterization activities.

Groundwater is subject to the NYSDEC Class GA Groundwater Standards defined in 6 NYCRR Parts 700-705. These standards identify acceptable levels of constituents in groundwater based on potable use. The Class GA Groundwater Standards and guidance values are also presented in the NYSDEC document entitled, *Division of Water, Technical and Operational Guidance Series (TOGS 1.1.1) Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations*. TOGS 1.1.1 also provides a compilation of guidance values for use where there are no standards (NYSDEC, reissued June 1998 and addended April 2000).

2.3.2 Action-Specific Standards, Criteria and Guidelines

The potential action-specific SCGs for this site are summarized in Table 2-2. Action-specific SCGs include general health and safety requirements and general requirements regarding handling and disposing of hazardous waste (including transportation and disposal, permitting, manifesting and disposal and treatment facilities).

One set of potential action-specific SCGs for the site consists of the Universal Treatment Standards/Land Disposal Restrictions (UTS/LDRs), which regulate treatment and land disposal of hazardous wastes. The UTS/LDRs are applicable to alternatives involving the off-site treatment and disposal of hazardous wastes (if any). Because MGP wastes resulted from historical operations that ended before the passage of RCRA, MGP-impacted material is only considered a hazardous waste in New York if it is removed (generated) and exhibits a characteristic of a hazardous waste. However, if the MGP-impacted material only exhibits the hazardous characteristic of toxicity for benzene (D018), it is conditionally exempt from the hazardous waste management requirements (6 NYCRR Parts 370-374 and 376) when destined for thermal treatment, in accordance with the requirements set forth in NYSDEC's TAGM HWR-4061, *Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants* (NYSDEC, 2002). If MGP-related hazardous wastes are destined for land disposal in New York, the state hazardous waste regulations apply, including LDRs and alternative LDR treatment standards for hazardous waste soil.

The United States Department of Transportation (USDOT) and New York State rules for the transport of hazardous materials are provided under 49 CFR Parts 107 and 171.1 through 172.558 and 6 NYCRR 372.3. These rules include procedures for packaging, labeling, manifesting and transporting of hazardous materials, and would be potentially applicable to the transport of hazardous materials under any remedial alternative. New York State requirements for waste transporter permits are included in 6 NYCRR Part 364, as well as with standards for the collection, transport and delivery of regulated wastes within New York. Contractors transporting waste materials off site during the selected remedial alternative would need to be properly permitted.

A remedial alternative conducted within the site would need to comply with applicable requirements outlined under OSHA. General industry standards are outlined under OSHA (29 CFR 1910) that specify time-weighted average concentrations for worker exposure to various compounds, and training requirements for workers involved with hazardous waste operations. The types of safety equipment and procedures to be followed during site remediation are specified under 29 CFR 1926, and recordkeeping and reporting-related regulations are outlined under 29 CFR 1904.

In addition to the requirements outlined under OSHA, the preparedness and prevention procedures, contingency plan and emergency procedures outlined under RCRA (40 CFR 264) are potentially relevant and appropriate to those remedial alternatives that include the generation, treatment or storage of hazardous wastes.

2.3.3 Location-Specific Standards, Criteria and Guidelines

The potential location-specific SCGs for the site are summarized in Table 2-3. Examples of potential location-specific SCGs include regulations and federal acts concerning activities conducted in floodplains, wetlands and historical areas and activities affecting navigable waters and endangered/threatened or rare species. Location-specific SCGs also include local requirements, such as local building permit conditions for permanent or semipermanent facilities constructed during the remedial activities (if any), and influent requirements of publicly-owned treatment works (POTW) if water is treated within the site and discharged to these facilities.

Because the site is located within the 500-year floodplain of the Chemung River, federal floodplain management laws and regulations are potential SCGs for remedial alternatives that would involve excavation or fill within the floodplain. Federal requirements for activities conducted within floodplains are provided in 40 CFR, Part 6, Appendix A.

As part of the SRI, a Fish and Wildlife Resource Impact Analysis (FWRIA) concluded that no endangered species were identified at the site. In addition, The National Register of Historic Places website was accessed (www.cr.nps.gov/nr/research/index.htm) and a location search for Elmira, New York was performed. No records were present for historical sites in the immediate vicinity of the MGP site.

2.3.4 Other Federal and State Criteria, Advisories and Guidance

The NYSDEC's TAGM 4046 entitled *Determination of Soil Cleanup Objectives and Cleanup Levels,* is a guidance document that presents the NYSDEC's recommended soil cleanup levels for organic and inorganic constituents. This document and the guidance values contained therein have been identified as potential guidelines for the project area.

3. Development of Remedial Action Objectives

3.1 General

This section presents the RAOs for the impacted media that have been identified within the project area. These RAOs represent medium-specific goals that are protective of human health and the environment (USEPA, 1988; NYSDEC, 2002). These objectives are, in general, developed by considering the results of the exposure evaluations (including an HHEE and an ecological assessment), and with reference to potential SCGs identified for the project area. The purposes for developing RAOs are to specify the COCs at the project area and to assist in developing goals for cleanup of the COCs in each medium that may require remediation.

The following subsections briefly summarize the results from the HHEE evaluations, and identify the RAOs for impacted media in the project area.

3.2 Exposure Evaluation Summary

Two exposure evaluation components were completed as part of the SRI. These components consisted of a qualitative HHEE and an FWRIA. The HHEE and FWRIA identified potential risks to human health and the environment that may result from exposure to COCs detected at the site. The results of these evaluations are summarized in the subsections below. The results from these exposure evaluations were used to help develop and evaluate potential remedial alternatives for the site.

3.2.1 Human Health Exposure Evaluation

The HHEE used information regarding current and foreseeable land use and available data to identify COCs and evaluate potential exposure of human receptors at the site. The HHEE first identified COCs at the site, then evaluated potential routes of exposure to those COCs. Detections of COCs alone do not necessarily indicate unacceptable risks to human health; variables, such as concentration, complete routes of exposure, and frequency and duration of exposure, were also considered.

The HHEE defined COCs as constituents detected at concentrations above applicable screening criteria in one or more samples of soil, soil vapor and groundwater regardless of whether or not they were site-derived. Applicable screening criteria for soil included TAGM 4046 RSCOs. Generic screening levels for target shallow soil vapor concentrations presented in *USEPA's Draft Guidance for Evaluating the Vapor*

Intrusion to Indoor Air Pathway from Groundwater and Soils (Table 2a) (Office of Solid Waste and Emergency Response, November 2002), United States Department of Labor OSHA PELs were used for comparison of soil vapor data, and NYSDEC Class GA Groundwater Standards were used as criteria for groundwater data.

The HHEE found that levels of site-related constituents (primarily BTEX and PAHs) in some soil and groundwater affected by the site exceeded appropriate screening criteria. As such, potentially complete exposure pathways for site-related constituents were evaluated. The HHEE concluded that:

- There are no potentially complete exposure pathways associated with surface soil as a result of the IRMs previously discussed.

- There are currently no complete exposure pathways associated with subsurface soil. Human exposure to impacted subsurface soil is limited to construction workers engaged in excavation activities (through incidental ingestion, dermal contact and inhalation).

- There are no complete exposure routes to groundwater because there are currently no supply wells in the affected area. Human exposure to impacted groundwater is highest during construction/excavation activities (i.e., maintenance of underground utilities).

- The potential exposure of construction workers to impacted soil and groundwater could be mitigated by using properly trained personnel, engineering and institutional controls and appropriate personal protective equipment (PPE).

- There were no complete exposure pathways identified for soil vapor intrusion into on-site buildings.

3.2.2 Fish and Wildlife Resource Impact Analysis

The objectives for completing an FWRIA at the site were to identify the fish and wildlife resources that exist on and in the vicinity of the site, and to evaluate the potential for exposure of these resources to site-related constituents in environmental media. The results of the FWRIA are used to aid in remedial decision-making and to determine if further ecological impact evaluation is warranted.

No threatened or endangered plant or animal species were found to inhabit the site or the immediate surrounding areas. The site itself is considered an industrial cover-type, characterized by asphalt, gravel and paved lots with existing buildings. Such a cover-type provides little value to wildlife for forage and inhabitance. Use of the site by wildlife is also limited by the majority of the surrounding areas, which are characterized as a commercial/industrial/residential cover-type.

The pathway analysis of the FWRIA identified that none of the site-related environmental media demonstrated complete ecological exposure pathways. A complete exposure pathway must have a source of COCs, a point of exposure and receptors with a viable route of exposure. Based on current site conditions, the source of COCs is limited as a result of IRMs that were conducted to remove and/or isolate impacted surficial soil for the majority of the site.

3.3 Remedial Action Objectives

According to the USEPA guidance, RAOs for protecting human receptors can express qualitative and quantitative remediation goals for COCs in association with an exposure route (e.g., surface and subsurface soil, groundwater) because protectiveness may be achieved qualitatively by eliminating exposure (such as capping an area, limiting access or providing an alternate water supply), as well as by reducing the quantifiable levels of COCs. RAOs were developed for the site using the following information and communications:

- results from the FWRIA and HHEE
- environmental sampling data generated from the numerous investigations and IRMs completed at the site
- preliminary discussions with the NYSDEC during the feasibility study scoping meeting conducted on May 14, 2007

The RAOs developed for the site are presented in the following table.

Remedial Action Objectives

Environmental Media	RAOs
Soil Vapor	An RAO for this medium was considered but not developed based on the low potential for vapor intrusion into on-site buildings and/or exposure to humans.
Surface Soil	Maintain the existing surface cover material to provide continued protection against potential human exposure to subsurface soil containing COCs.
Subsurface Soil	• Reduce, to the extent practicable, potential human exposure to subsurface soil containing COCs. • Remediate, to the extent practicable, areas containing sources of MGP-related NAPLs. • Reduce, to the extent practicable, potential human exposure to MGP-related NAPLs. • Reduce, to the extent practicable, further off-site migration of MGP-related NAPLs.
Groundwater	• Restore, to the extent practicable, COC-impacted groundwater to current New York State groundwater quality standards • Reduce, to the extent practicable, future COC impacts to groundwater. • Reduce, to the extent practicable, potential human exposure to groundwater containing COCs. • Prevent, to the extent practicable, off-site migration of COC-impacted groundwater.

The development of each of the RAOs is presented below.

3.3.1 Surface Soil

As stated in Section 1.4.6.1, several PAHs were detected in on-site surface soil at concentrations greater than the NYSDEC TAGM values; however, these concentrations were generally less than or similar to background concentrations. In addition, potential exposure to COCs in surface soil has been reduced through the implementation of several site IRMs (Section 1.4.4). As presented in Section 3.2.1, potentially complete exposure pathways do not exist for human exposure to COCs associated with surface soil. The FWRIA concluded that surface soil does not represent a complete ecological exposure pathway because wildlife is not expected to use the site to a significant extent given the lack of sustaining habitat.

The RAO for surface soil, therefore, was developed primarily to protect against potential human exposure to subsurface soil containing MGP-related COCs. This will be accomplished by maintaining the surface cover material that currently exists at the site.

3.3.2 Subsurface Soil

Visual observations of NAPL (including staining and sheens) and the analytical results from subsurface soil samples were used to create a three-dimensional representation of the approximate vertical and horizontal extent of NAPL/sheen and COC exceedences in the subsurface (Figure 4).

The potential for direct contact with subsurface soil is likely to occur only during construction/excavation activities. The FWRIA concluded that subsurface soil does not represent a complete ecological exposure pathway because wildlife are not expected to use the site to a significant extent, and MGP-related COCs are too deep for potential contact with ecological receptors.

RAOs for subsurface soil were developed to be protective of human health and the environment, to the extent practicable, and to assist in identifying potential remedial technologies. These RAOs are targeted at reducing potential risks associated with human exposure to subsurface soil COCs and NAPL. Protection of the environment will be accomplished by remediating areas containing MGP-related NAPLs, to the extent practicable. These areas include the following:

- an underground structure containing MGP materials with concentrated PAHs (i.e., NAPL)

- soil impacted with MGP-related NAPL (both tar-like and oil-like materials), excluding sheens and stains, hereafter referred to as heavily NAPL-impacted soil

The oil and tar separator, shown on Figure 2, has been identified as an underground structure that potentially contains MGP materials.

3.3.3 Groundwater

Although groundwater in the vicinity of the site is not used as a drinking water source, the groundwater beneath the site is classified as Class GA and, as such, the Class GA Groundwater Standards and guidance values are applicable. The extent of groundwater containing BTEX and PAHs above their respective criteria is presented in Section 1.4.5.

Because groundwater at the site is not used as a drinking water source, the greatest potential for exposure is via direct contact with groundwater that may be encountered during construction/excavation work. This potential exposure could be mitigated by using properly-trained personnel and PPE. The FWRIA concluded that groundwater does not represent a complete ecological exposure pathway because wildlife would generally not be exposed to groundwater at such depths during foraging, nesting or burrowing activities.

RAOs for groundwater were developed to be protective of both human health and the environment, to the extent practicable. Human health will be protected by reducing, to the extent practicable, exposure to site-related COCs. Protection of the environment will be accomplished by preventing, to the extent practicable, off-site migration of COC-impacted groundwater; reducing, to the extent practicable, future COC impacts to groundwater and restoring the quality of groundwater to current standards, to the extent practicable.

As stated in Section 1.4.6.3:

- All of the COCs identified in site groundwater are likely degraded by naturally-occurring subsurface microorganisms (i.e., biodegraded), resulting in harmless byproducts (e.g., carbon dioxide).

- Statistically significant decreases in COC concentrations at the site over time indicate overall shrinkage of COC plumes in shallow groundwater; specifically:

  - concentrations of BTEX and PAHs in groundwater from MW-8S (located at NYSEG's southern property boundary near the Trayer Products property, and at/near the fringe of the dissolved plume) showed significant decrease in concentrations to concentrations at/or below groundwater standards

  - concentrations of BTEX and PAHs in groundwater from MW-9S (also located at NYSEG's southern property boundary near the Trayer Products property) had decreased to concentrations below the associated laboratory detection limits

  - concentrations of BTEX and total PAHs within MW-3S and MW-4S (located near the suspected source(s) of the western plume) showed decreasing trends

- concentrations of total PAHs within MW-6S (located at the northern end of the NYSEG property) had decreased to concentrations below the associated laboratory detection limits

- remediation rate analyses were calculated and presented in the NYSDEC-approved SRI Report, along with the conclusion that the constituent plumes appear to be shrinking over time

Therefore, based on the observations noted above, the RAO for groundwater that consists of preventing, to the extent practicable, off-site migration of COC-impacted groundwater has been met through natural processes.

4. Technology Screening Summary and Development of Remedial Alternatives

4.1 Introduction

This section discusses potential remedial alternatives for each impacted medium at the site. As a first step, general response actions (GRAs) were identified to address subsurface soil and groundwater impacted by MGP constituents. GRAs are medium-specific and describe those actions that will satisfy the RAOs. They may include various actions, such as treatment, containment, institutional controls, excavation or a combination of such actions. From the GRAs, potential technology types and process options were identified and screened to identify those that were the most viable for the site. Process options that survived the screening were used to develop potential remedial alternatives. These potential remedial alternatives are evaluated in Section 5.

According to the USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988), the term "technology types" refers to general categories of technologies. The term "technology process options" refers to specific processes within each technology type. For each GRA identified, a series of technology types and associated process options has been assembled. Each identified technology type and process option is briefly described, and is evaluated against preliminary and secondary screening criteria. This approach was used to determine if a particular technology type or process option is applicable given the site-specific conditions for remediation of the impacted media. Based on this screening, remedial technology types and process options were eliminated or retained and subsequently combined into potential remedial alternatives for further evaluation.

This approach is consistent with the screening and selection process provided in the NYSDEC's TAGM 4030, *Selection of Remedial Actions at Inactive Hazardous Waste Sites* (NYSDEC, 1990). The NYSDEC Division of Environmental Remediation's (DER's) *Presumptive/Proven Remedial Technologies* (DER-15) allows for use of the industry's considerable experience on remedial cleanups to quickly focus the evaluation of technologies on those that have already been proven to be both feasible and cost-effective for specific site types/or contaminants. The objective of DER-15 is to use the NYSDEC's experience gained at remediation sites, and scientific and engineering evaluation of performance data to make remedy selection quicker and consistent. In addition, given the assumption that the use of the site and surrounding areas will not substantially change in the foreseeable future, the anticipated acceptance and support from the various stakeholders (including the city, the

NYSDEC, the surrounding property owners and NYSEG) was considered during the screening process.

4.2 General Response Actions

Based on the RAOs identified in Section 3.3, the following site-specific GRAs were established for subsurface soil and groundwater at the site:

- No Action
- Institutional Controls
- Surface Controls (subsurface soil only)
- In-Situ Containment/Controls
- In-Situ Treatment
- Removal
- Ex-Situ On-Site Treatment
- Off-Site Treatment and/or Disposal

Within each of these GRAs, remedial technology types were identified for each impacted medium as described below. A No Action GRA has been included and retained through the screening evaluation as required by the USEPA and NCP guidance.

4.3 Identification of Remedial Technologies

Remedial technology types that were potentially applicable for addressing the impacted media at the site were identified through a variety of sources, including vendor information, engineering experience and review of available literature that included the following documents:

- NYSDEC TAGM #4030 – *Selection of Remedial Actions at Inactive Hazardous Waste Sites* (NYSDEC, 1990)

- *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988)

- *Technology Screening Guide for Treatment of CERCLA Soils and Sludges* (USEPA, 1988)

- Technology Briefs - Data Requirements for Selecting Remedial Action Technologies, (USEPA, various dates)

- *Remediation Technologies Screening Matrix and Reference Guide* (USEPA and United States Air Force, 2002)

- *Management of Manufactured Gas Plant Sites* (Gas Research Institute, 1996).

According to the USEPA guidance (USEPA, 1988), technology types and process options can be identified by drawing on a variety of sources, including regulatory references and standard engineering texts not specifically directed toward impacted sites. Although each former MGP site offers its own unique site characteristics, the evaluation of remedial technology types and process options that are applicable to MGP-related impacts, or have been implemented at other MGP sites, is well documented. Therefore, this collective knowledge and experience and regulatory acceptance of previous feasibility studies performed on MGP-related sites with similar impacts, were used to reduce the universe of potentially applicable process options for the site to those with documented success with achieving similar RAOs.

The GRAs and technology types are included in Table 4-1 for subsurface soil and Table 4-2 for groundwater.

4.4 Remedial Technology Screening

The potentially applicable remedial technology types and technology process options associated with each of the GRAs underwent preliminary and secondary screening to select the technologies that would most effectively achieve the RAOs identified for the site.

For this Feasibility Study Report, the various alternatives for off-site treatment or disposal of impacted media (e.g., subsurface soil) that may be removed from the site (if a removal remedy is selected) were not evaluated. This was purposely done to avoid committing NYSEG to a specific process option at this time, and to allow for an evaluation of costs of potential off-site disposal/treatment facilities at the time that the preferred alternative is implemented. This was determined to be the best approach because disposal/treatment facility costs fluctuate significantly based on season, market conditions and facility capacity. For alternative evaluation purposes, this Feasibility Study Report does, however, include an estimated unit cost for off-site low temperature thermal desorption (LTTD) of materials, where appropriate. Additional potential off-site disposal options are presented with brief descriptions in the screening tables; however, all were retained for further consideration during the engineering design phase of the remediation.

The following subsections summarize the preliminary and secondary screening evaluations.

4.4.1 Preliminary Screening

Preliminary screening was performed to reduce the number of potentially applicable technology types on the basis of technical implementability and effectiveness (long- and short-term). Technical implementability was determined using site characterization information collected during the remedial investigations, including the types and concentrations of impacts and subsurface conditions, to screen out technology types and process options that could not effectively be implemented at the site. The effectiveness of a technology is measured by its ability to meet the established RAOs.

As presented in Sections 3.2.1 and 3.3.1, potentially complete exposure pathways do not exist for human exposure to surface soil. The RAO for surface soil, therefore, was developed to protect against potential human exposure to subsurface soil containing MGP-related COCs. This will be accomplished by maintaining the surface cover materials that currently exist at the site. Screening of technology types and process options for surface soil is, therefore, not required.

4.4.1.1 Subsurface Soil

As presented in Table 4-1, the following remedial technology types were identified to address the GRAs identified for subsurface soil:

- *No Action* – No active remedial activities would be implemented to address the subsurface soil containing MGP impacts.

- *Institutional Controls* – Remedial technology types associated with this GRA consist of non-intrusive administrative controls focused on minimizing potential contact with MGP impacts.

- *Surface Controls* – The existing surface cover would be maintained to provide continued protection against potential exposure to subsurface soil containing COCs.

- *In-Situ Containment/Controls* – Remedial technology types associated with this GRA involve addressing the mobility and/or exposure to impacted subsurface soil without removing or otherwise treating them. Remedial technology types evaluated under the preliminary screening process consisted of capping and containment.

- *In-Situ Treatment* – Remedial technology types associated with this GRA involve addressing the subsurface soil without removing the materials, but treating them to remove or otherwise alter the MGP impacts to achieve the established RAOs. Remedial technology types evaluated for the site included immobilization, biological treatment and chemical treatment.

- *Removal* – Remedial technology types associated with this GRA involve removal of subsurface soil containing COCs from the ground to achieve the established RAOs. Excavation was the technology type evaluated for this GRA.

- *Ex-Situ On-Site Treatment* – Remedial technology types associated with this GRA consider the treatment of materials after they have been removed from the ground. Ex-situ on-site remedial treatment technology types evaluated under the preliminary screening evaluation consist of immobilization, extraction (thermal desorption) and thermal destruction.

- *Off-Site Treatment and/or Disposal* – Potential remedial technology types associated with this GRA consider the off-site treatment of subsurface soil containing COCs after it has been removed from the ground. As stated above, the ultimate off-site treatment or disposal technology type was not evaluated. However, a list of potentially acceptable treatment or disposal technologies is included in Table 4-1 for future consideration. These remedial treatment technologies consist of recycle/reuse, extraction (thermal desorption) and disposal.

4.4.1.2 Groundwater

As presented in Table 4-2, the following remedial technology types were identified to address the GRAs identified for groundwater:

- *No Action* – No active remedial activities would be implemented to address the COC-impacted groundwater.

- *Institutional Controls* – Remedial technology types associated with this GRA generally consist of non-intrusive administrative controls focused on minimizing potential contact or use of the groundwater. Institutional controls evaluated under the preliminary screening consisted of groundwater use restrictions in the form of governmental and/or proprietary controls, enforcement and/or permit controls and informational devices.

- *In-Situ Treatment* – Remedial technology types associated with this GRA involve addressing the COC-impacted groundwater without extracting the groundwater. These remedial technology types would remove or otherwise alter the MGP residuals in groundwater to achieve the RAOs for the site. Remedial technology types evaluated included biological treatment and chemical treatment.

- *In-Situ Containment/Controls* – Remedial technology types associated with this GRA involve addressing the COC-impacted groundwater without removing or otherwise treating the groundwater. Remedial technology types evaluated under the preliminary screening process consisted of hydraulic control and groundwater and/or NAPL extraction.

- *Ex-Situ On-Site Treatment* – Remedial technology types associated with this GRA consider the treatment of COC-impacted groundwater after the groundwater has been removed. Ex-situ on-site remedial treatment technologies evaluated to address the extracted groundwater under the preliminary screening evaluation consisted of chemical treatment and physical treatment.

- *Off-Site Treatment and/or Disposal* – Remedial technology types associated with this GRA consider the off-site disposal of site groundwater that has been removed. Disposal technology process options evaluated to address COC-impacted groundwater consisted of discharge to a POTW and discharge to a privately-owned treatment facility (POTF).

4.4.2 Secondary Screening

To further reduce the potentially applicable technology types and process options to be assembled into remedial alternatives, process options for subsurface soil and groundwater were subjected to a secondary screening. The objective of the secondary screening was to choose, when possible, one process option to represent each technology type to simplify the subsequent development and evaluation of the remedial alternatives without limiting flexibility during the remedial design. The secondary screening criteria are described below:

- *Effectiveness* – This criterion is used to evaluate each technology process option with respect to other process options within the same technology type. This evaluation focused on the process option's:

  a) potential effectiveness at meeting the RAOs by reducing the toxicity, mobility and/or volume of chemical constituents in the impacted medium

  b) potential impacts to human health and the environment during the construction and implementation phase

  c) reliability with respect to the nature and extent of impacts and conditions at the site

- *Implementability* – Implementability encompasses both the technical and administrative feasibility of implementing a process option. Because technical implementability was used during the preliminary screening, this subsequent, more detailed evaluation places more emphasis on the institutional aspects of implementability. This criterion also evaluates the ability to construct the process option, and availability of specific equipment and technical specialists to design, implement and operate and maintain the equipment.

- *Relative Cost* – This criterion evaluates the overall cost required to implement the remedial technology. As a screening tool, relative capital and operation and maintenance (O&M) costs are used rather than detailed cost estimates. For each remedial technology and associated technology process, relative costs are presented as low, moderate or high and made on the basis of engineering judgment.

Per the USEPA guidance (USEPA, 1988), the evaluation focuses on the effectiveness criterion, with less emphasis on the implementability and cost evaluation.

The results of the secondary screening of technology types and process options are also presented in Table 4-1 (subsurface soil) and Table 4-2 (groundwater). The technology processes that were not retained have been shaded in these tables.

Based on the results of the secondary screening, the remedial technology types and process options that were retained for further evaluation are discussed below. The basis of selection for each representative subsurface soil and groundwater remedial technology type and process option is briefly presented.

For each medium, all ex-situ on-site treatment technologies were eliminated from further consideration. These technologies were eliminated due to considerations of the current and future uses of the former MGP site, space limitations and generally high costs. Specifically, potential issues associated with ex-situ on-site treatment included:

- time constraints associated with on-site treatment technologies
- potential exposure to/acceptance of an on-site treatment system
- adequate area within the former MGP property for treatment system construction, operation and soil/groundwater handling

4.4.2.1 Subsurface Soil

No Action – Consistent with the NCP and USEPA guidance for conducting feasibility studies, the No Action alternative must be developed and examined as a baseline to which other remedial alternatives will be compared. Although this technology does not include any active remedial activity, it will be retained for further consideration. It is not anticipated that this technology, however, would receive regulatory approval. Through time, natural attenuation processes would reduce the toxicity, mobility and volume of impacts to the environment.

Institutional Controls – Institutional controls for access restrictions (restrictions in the form of governmental, proprietary, enforcement or permit controls and/or informational devices) were retained for further evaluation. Because institutional controls would not treat, contain or remove any MGP-containing subsurface soil, institutional controls alone will not achieve the RAOs established for the site. However, institutional controls may partly achieve the RAO of reducing, to the extent practicable, potential human exposure to MGP-related NAPLs. Additionally, institutional controls could enhance the effectiveness and implementability of other technologies/process options, and thus, was retained for further consideration.

Surface Controls – Surface controls were retained for further consideration. The existing cover materials would be maintained to provide continued protection against potential exposure to subsurface soil containing COCs.

In-Situ Containment/Controls – Capping and containment were identified as potentially suitable remedial technology types for in-situ containment/controls. The capping options reviewed as part of the secondary screening included clay/soil, asphalt and multimedia caps. Containment options included sheet piles and slurry walls. All capping options are easily implemented, and their relative costs are comparable (moderate to high). Due to the continued use of the site (following completion of remedial activities) as a parking area and/or storage area for equipment, the clay/soil cap and multimedia cap technology processes were not retained because these types are not suitable for use in high-traffic areas. The asphalt cap was not retained because the existing cover materials have been shown to be protective of human health and will retained in each site-wide alternative.

Neither sheet pile nor slurry walls were retained for further evaluation. While these process options could reduce the mobility of the impacts, they would not be able to contain the impacts because bedrock is located approximately 70 to 80 feet bgs and its competency is unknown and therefore cannot be assumed to be a confining layer beneath the site.

In-Situ Treatment – The in-situ remedial treatment technologies identified for subsurface soil were immobilization, extraction, chemical treatment and biological treatment. Solidification/stabilization, the only immobilization option considered, is considered effective for immobilizing adsorbed impacts; however, limited data exists to confirm its ability to immobilize (i.e., not leach) NAPL through time. This technology is potentially implementable with moderate capital and O&M costs. The presence of underground structures and obstructions would affect the implementability and effectiveness of solidification/stabilization; therefore, removal of any subsurface structures would be required. Solidification/stabilization was retained for further evaluation.

The extraction option, dynamic Underground Stripping and Hydrous Pyrolysis/Oxidation (DUS/HPO), was not retained due to the potential issues with mobilization and recovery of the dissolved plume, reliability of vapor recovery, available space for treatment equipment and potential public acceptance issues.

The chemical treatment option considered was chemical oxidation. Based on the anticipated high oxidant demand of the soil, the high concentrations of PAHs (and NAPL) that would require treatment, the non-homogeneous nature of the subsurface geology and potential exposure issues during treatment, this technology would likely be very inefficient to implement and operate. A pilot test would be required. Chemical oxidation would not be appropriate for the site based on the following reasons:

- the lack of proven efficiency of chemical oxidation for treating MGP residuals; large quantities of oxidant have been required for small treatment areas at other sites

- adequate delivery of the oxidant to the required soil and need for oxidant contact with the MGP residuals presents a significant concern because of the variable geology within the potential treatment zone

- low pH conditions have been observed downgradient of treatment areas at other sites; thus, the potential exists for corrosion of utilities/steel structures downgradient from the site (i.e., Trayer property) that may exist within the saturated zone if the buffering capacity of the soil is not adequate

- the potential to adversely mobilize NAPL

Based on the above concerns, chemical oxidation was not retained for further evaluation.

Biological treatment options include biodegradation, enhanced biodegradation and biosparging. These options would be less effective than other options, especially for the heavier, more condensed PAHs, and would not achieve the remediation objectives for soil in a reasonable timeframe. Therefore, the biological treatment options were not retained for further consideration.

Removal – Excavation of subsurface soil was retained for further evaluation. This technology type and process is a proven process for removing impacted material, is readily implemented (i.e., equipment capable of soil excavation is available) and has a high capital cost; however, O&M costs are low.

Off-Site Treatment and/or Disposal – Remedial technology types and process options retained for evaluation consisted of recycle/reuse (asphalt concrete batch plant, brick/concrete manufacture and co-burn in a utility boiler), extraction (LTTD), chemical treatment (oxidation), biological treatment (biodegradation) and off-site disposal (nonhazardous solid waste landfill or RCRA landfill). Each of these technologies was retained due to the ease of implementability and effectiveness of the technologies. As stated above, these process options were included in the screening tables for potential consideration; however, the ultimate off-site treatment or disposal of materials that may be removed from the site was not evaluated to avoid committing NYSEG to a specific option at this time. In addition, multiple off-site treatment technologies could be utilized to treat or dispose of media with different concentrations of impacts.

4.4.2.2 Groundwater

No Action – Consistent with NCP and USEPA guidance for conducting feasibility studies, the No Action alternative must be developed and examined as a baseline to which other remedial alternatives will be compared. Although this technology does not include any active remedial activity, it will be retained for further consideration. It is not anticipated that this technology, however, would receive regulatory approval. Through time, natural attenuation processes would reduce the toxicity, mobility and volume of impacts to the environment.

Institutional Controls – Institutional controls for groundwater use restrictions (in the form of governmental, proprietary, enforcement or permit controls and/or informational devices and notification requirements) were retained for further evaluation. Because institutional controls would not treat, contain or remove any constituents of interest in the site groundwater, institutional controls alone will not achieve the RAOs established for the site. However, institutional controls may partly achieve the RAO of reducing, to the extent practicable, potential future human exposure to groundwater containing COCs. Institutional controls could enhance the effectiveness or implementability of other technologies/technology process options.

In-Situ Treatment – The in-situ remedial treatment technologies considered for groundwater consisted of biological treatment (including monitored natural attenuation [MNA] and oxygen enhancement via introduction of an oxygen-releasing compound), chemical treatment (using chemical oxidation) and extraction (using DUS/HPO). The biological treatment process options were retained due to the ease of implementation and low to moderate relative costs, although some options may require treatability studies to verify reliability and effectiveness, as well as the length of time necessary to achieve the RAOs. Chemical oxidation was not retained for further evaluation because access to areas that would require oxidant injection was considered limited and anticipated high oxidant demand would limit the cost-effectiveness of this option. The extraction option, DUS/HPO, was not retained due to the potential issues with mobilization and recovery of the dissolved plume, reliability of vapor recovery, available space for treatment equipment and potential public acceptance issues.

In-Situ Containment/Controls – The in-situ containment/control remedial treatment technologies considered for groundwater consisted of hydraulic control (groundwater extraction using recovery wells) and slurry walls. Neither containment/control process option was retained due to effectiveness, implementability, long-term operation and maintenance requirements and high relative costs.

Removal – For this technology type, four technology process options were evaluated for groundwater and/or NAPL extraction, including active pumping using vertical wells, horizontal wells and/or collection trenches and passive NAPL removal using vertical wells. Inefficiencies associated with pump and treat technologies exist, including large volumes of water that require recovery and treatment, potential lack of long-term access to areas that require wells (i.e., implementability issues) and the space required for pumping equipment. The active removal technology options will not be retained for further evaluation as a stand-alone process option; however, pumping and treatment of water may be considered, if it enhances the effectiveness or implementability of other technologies (i.e., dewatering during excavation).

Off-Site Treatment and/or Disposal – Technology process options evaluated for groundwater disposal consisted of discharge to a POTW and discharge to a POTF. These technology process options would be used as, or part of, a treatment regimen for extracted groundwater resulting from dewatering during excavation.

4.5 Summary of Retained Remedial Technologies

The following table summarizes the remedial technology types and process options that were retained through secondary screening:

Medium	Technology Type	Process Options
Subsurface Soil	No Action	No Action
	Institutional Controls	Governmental Controls, proprietary Controls, Enforcement and Permit Controls and Informational Devices
	Surface Controls	Surface Cover
	Immobilization	Solidification/Stabilization
	Excavation	Excavation

Medium	Technology Type	Process Options
Groundwater	No Action	No Action
	Institutional Controls	Governmental Controls, Proprietary Controls, Enforcement and Permit Controls and Informational Devices
	In-Situ Biological Treatment	MNA, Oxygen Enhancement
	Removal	Passive Removal of NAPL Using Vertical Wells
	Disposal	Discharge to POTW and/or POTF

As presented in Section 4.4, off-site treatment/disposal of soil will be determined by NYSEG during the remedial design.

4.6 Development of Remedial Alternatives

This section uses the screened technologies listed above to develop remedial alternatives capable of addressing the RAOs for impacted media at the site. The assembled subsurface soil and groundwater remedial alternatives are summarized in Sections 4.6.1 and 4.6.2.

As presented in Section 1.4.6.1, surface soil does not require further consideration as part of the remedial action at the site.

4.6.1 Subsurface Soil Remedial Alternatives

Six remedial alternatives, including a No Action alternative and Alternatives S1 through S5, were developed to address the impacted subsurface soil at the site. With the exception of the No Action alternative and Alternative S1, each potential remedial alternative that was developed to address subsurface soil includes the removal of the concrete pipe located in the southeastern portion of the site.

In the process of developing the subsurface soil remedial alternatives for evaluation, a number of considerations were made so that a broad range of alternatives were considered.

Alternative S1 includes only the implementation of institutional controls.

Three alternatives were developed that exclusively consider excavation/removal of subsurface soil based on increasingly stringent criteria. These removal alternatives include:

- Alternative S2, which considers removal of targeted sources of NAPL, where sources are defined as an underground structure containing MGP materials with concentrated PAHs (i.e., NAPL) or soil containing visible coal tar or brown oil.
- Alternative S3, which considers removal of soil with visual evidence of NAPL, as well as soil exhibiting values greater than NYSDEC TAGM 4046 values for total BTEX and total PAHs.
- Alternative S5, which considers excavation/removal of all site soil containing COCs greater than the TAGM RSCOs.

To round out the soil alternatives, the following combined alternative was identified:

- Alternative S4, which combines in-situ solidification/stabilization (ISS) and excavation.

Consistent with the feasibility study requirements, the No Action alternative is retained as the basis for comparison for the other alternatives. Under this alternative, no remedial activities would be conducted.

Brief descriptions of the five remaining remedial alternatives for subsurface soil are presented below; detailed descriptions are presented in Section 5.

4.6.1.1 Alternative S1 – Institutional Controls

Under this alternative, no active remedial activities would be conducted; however, implementation of institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices would be included to limit disturbance of the cover materials, excavation of the subsurface and groundwater usage. Maintenance of the existing cover materials would significantly reduce the potential for human exposure. This alternative is readily implementable. However, because NYSEG has committed to removing the concrete pipe located along the southeastern property boundary, it is not anticipated that this alternative would be selected as the preferred remedial strategy for subsurface soil.

4.6.1.2 Alternative S2 – Targeted Source of NAPL Removal

This alternative involves the excavation and off-site disposal of targeted sources of NAPL, including the underground oil and tar separator, and the removal of the concrete pipe located along the southeastern property boundary. It is anticipated that this alternative would include excavation support for stability of the excavation sidewalls and dewatering. Site restoration, in the form of maintaining/replacing the existing cover materials, would significantly reduce the potential for human exposure. In addition, institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices would be instituted to limit disturbance of the cover materials, monitor excavation of the subsurface and limit groundwater usage.

4.6.1.3 Alternative S3 – Removal of NAPL-Impacted Soil and Soil Containing PAHs Greater than 500 mg/kg and BTEX Greater than 10 mg/kg

This alternative involves the excavation and off-site disposal of soil containing NAPL and total PAHs and total BTEX concentrations greater than the TAGM 4046 criteria (500 mg/kg and 10 mg/kg, respectively) located above and below the groundwater table to a reasonable depth for utilization of excavation support (approximately 20 feet bgs), and includes the excavation and off-site disposal of the oil and tar separator and the concrete pipe located along the southeastern property boundary. This option would likely include excavation support for stability of the excavation sidewalls and dewatering.

Removal of the subsurface soil would be effective and implementable both above and below the groundwater table, and has been implemented in the past at many remediation sites. The quantity of impacted materials to be excavated is determined based on a calculation of the cost/benefit relationship of increasing the volume of soil removed (i.e., increasing the mass of MGP impacts removed) to the point of diminishing environmental protection. The following two removal scenarios will be evaluated.

Site restoration, in the form of maintaining/replacing the existing cover materials, would be implemented; this would significantly reduce the potential for human exposure. In addition, institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices would be instituted to limit disturbance of the cover materials, monitor excavation of the subsurface and limit groundwater usage.

4.6.1.4 Alternative S4 – In-Situ Solidification/Stabilization and Excavation of Heavily NAPL-Impacted Soil

This alternative uses ISS and excavation to treat or remove soil that is heavily impacted with potentially mobile MGP-related NAPL and consists of the following components:

- Excavation/removal of shallow, heavily NAPL-impacted soil in the unsaturated zone (to approximately 8 feet bgs).
- Excavation/removal of the oil and tar separator area (excavation to approximately 18 feet bgs).
- Excavation/removal of the concrete pipe.
- ISS of heavily NAPL-impacted soil above the till layer to depths ranging from approximately 13 to 28 feet bgs, based on boring log descriptions.

Site restoration, in the form of maintaining/replacing the existing surface cover materials, would significantly limit the potential for human exposure. In addition, institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices would be instituted to limit disturbance of the cover materials, monitor excavation of the subsurface and limit groundwater usage. Details of the institutional controls and site restrictions will be provided in an SMP.

4.6.1.5 Alternative S5 – Removal of Soil Containing Constituents Greater than TAGM 4046 RSCOs

This alternative involves the excavation and off-site disposal of soil containing individual constituents greater than their respective TAGM 4046 RSCOs, and includes the excavation and off-site disposal of the oil and tar separator and the concrete pipe located along the southeastern property boundary. This alternative represents the most aggressive remedial strategy for the site. It is anticipated that this alternative would include installing temporary sheet pile walls for dewatering and excavation support.

A temporary water treatment facility would be designed and constructed on site to provide treatment of groundwater collected during excavation and treatment of water generated from dewatering of the excavated soil. Treated water would be discharged for off-site disposal at a POTW.

4.6.2 Groundwater Remedial Alternatives

Five remedial alternatives, including a No Action alternative and Alternatives GW1 through GW4, were developed to address groundwater impacted with MGP residuals at the site. Impacted groundwater appears to be almost entirely confined to the sand-and-gravel hydrostratigraphic unit with minimal impacts in the alluvial silt-and-clay unit. The areal limits of impacted groundwater are largely confined to the site.

Consistent with the feasibility study requirements, the No Action alternative is retained as the basis for comparison for the other alternatives. Under this alternative, no remedial activities would be conducted. The remaining alternatives include:

- *Alternative GW1* – Institutional Controls
- *Alternative GW2* – Monitored Natural Attenuation
- *Alternative GW3* – Passive NAPL Recovery
- *Alternative GW4* – NAPL Recovery and Oxygen Enhancement

Brief descriptions of the potential remedial alternatives for groundwater are presented below; detailed descriptions are presented in Section 5.

4.6.2.1 Alternative GW1 – Institutional Controls

Under this alternative, no active remedial activities would be conducted. However, this alternative would include implementing institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices to limit use of groundwater.

4.6.2.2 Alternative GW2 – Monitored Natural Attenuation

Under this alternative, groundwater and NAPL monitoring would be conducted to document the natural attenuation of MGP constituents dissolved in the groundwater, as well as monitoring well locations where mobile NAPL is observed (if any). In addition, this alternative would include implementing institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices to limit the use of groundwater containing COCs above NYSDEC Class GA Groundwater Standards and guidance values. This alternative could be easily implemented, only requiring monitoring to demonstrate reduction of impacts. Because groundwater at the site contains several naturally-occurring fate and transport processes that contribute to natural attenuation, this alternative could achieve the RAOs for groundwater over an extended period of time.

4.6.2.3 Alternative GW3 – Passive NAPL Recovery

This alternative involves passively recovering NAPL from beneath the site. Passive NAPL recovery would be accomplished by conducting periodic manual bailing from a number of wells installed in areas containing NAPL-impacted soil. The wells would be screened across subsurface zones where NAPL-impacted soil has been identified. Recovered NAPL would be transferred to containers for future transportation and off-site treatment/disposal. Additionally, groundwater monitoring would be conducted to document the natural attenuation of MGP constituents dissolved in the groundwater. This alternative would include implementing institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices to limit the use of groundwater containing COCs above NYSDEC Class GA Groundwater Standards and guidance values.

4.6.2.4 Alternative GW4 – NAPL Recovery and Oxygen Enhancement

This alternative involves installing a series of two types of wells, one type to recover NAPL and another to introduce an oxygen-releasing compound. Both types of wells would be installed along the southwestern property boundary, south of the former gas holders. The NAPL recovery wells would be installed where heavily-NAPL-impacted soil is identified in soil borings to mitigate potential NAPL migration south of the former gas holders (i.e., off site). Recovered NAPL would be transferred to containers for future transportation and off-site treatment/disposal. The oxygen introduction wells would be installed in borings adjacent to the NAPL recovery wells to mitigate migration of the COC plume by enhancing biodegradation of dissolved COCs.

Additionally, groundwater monitoring would be conducted to document the attenuation of COCs dissolved in groundwater. This alternative would also include implementing institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices to limit the use of groundwater containing COCs above NYSDEC Class GA Groundwater Standards and guidance values.

5. Detailed Evaluation of Remedial Alternatives

5.1 General

This section presents the detailed descriptions and evaluations of the potential remedial alternatives developed in Section 4 for impacted subsurface soil and groundwater at the site. As presented in Section 1.4.6.1, surface soil does not require further consideration as part of the remedial action at the site and is therefore not included in the detailed evaluation of alternatives. These remedial alternatives were evaluated with respect to the NCP criteria specified in 40 CFR Part 300 and the USEPA's guidance (USEPA, 1988). The purpose of the detailed analysis is to present adequate information on each alternative to allow selection of the most appropriate remedy based on the evaluation criteria. These criteria encompass statutory requirements and include other measures, such as overall feasibility and acceptability of remedial options.

To adequately address these requirements, nine evaluation criteria were developed and defined in the USEPA remedial investigation/feasibility study guidance (USEPA, 1988). The NYSDEC has adopted seven of these criteria, which are defined in NYSDEC TAGM 4030 (1990). These seven criteria were used for evaluation during this feasibility study.

5.2 Description of Evaluation Criteria

The detailed evaluation of remedial alternatives presented in this section consists of an assessment of each assembled alternative (presented in Section 4.6) against the following seven evaluation criteria:

- compliance with SCGs
- protection of human health and the environment
- short-term effectiveness
- long-term effectiveness and permanence
- reduction of toxicity, mobility and volume
- implementability
- cost

According to 40 CFR Part 300, another criterion to be considered when determining appropriate remedial alternatives is community acceptance. The community acceptance assessment will be completed by the NYSDEC after the community's comments on the NYSDEC's *Proposed Remedial Action Plan* are received. The community's comments received during the public comment period will be considered by the NYSDEC when selecting the remedial actions that will be required for the site.

A brief description of each of the seven evaluation criteria is presented in the following subsections.

5.2.1 Compliance with Standards, Criteria and Guidelines

These criteria evaluate each remedial alternative's ability to comply with SCGs that were identified in Section 2 and summarized in Tables 2-1, 2-2 and 2-3. Compliance with the following analysis factors was considered during the evaluation process:

- chemical-specific SCGs
- action-specific SCGs
- location-specific SCGs

5.2.2 Protection of Human Health and the Environment

This criterion provides an overall assessment of the protection of human health and the environment provided by each alternative. The assessment of overall protectiveness draws on the analysis of other criteria evaluated for each alternative (specifically short- and long-term effectiveness and compliance with SCGs). It also included such analysis factors as: the manner in which the site-wide alternative achieves protection over time; the degree to which site risks would be reduced; and the manner in which each source of impacts would be eliminated, reduced, or controlled.

5.2.3 Short-Term Effectiveness

The short-term effectiveness of a remedial alternative is evaluated relative to its potential effect on human health and the environment during the construction and implementation phases until the remedial response objectives are met. The evaluation of each alternative with respect to its short-term effectiveness considered the following:

- potential short-term impacts to the community during implementation
- potential short-term impacts to workers during implementation and the effectiveness and reliability of protective measures
- potential short-term environmental impacts and the effectiveness of mitigative measures to be used
- time required to achieve the RAOs for protection of health and the environment

5.2.4 Long-Term Effectiveness and Permanence

This criterion addresses the results of the potential remedial action in terms of the risk remaining at the site after the response objectives have been met. The following factors were assessed during the evaluation of each alternative's long-term effectiveness:

- potential environmental impacts from untreated waste or treatment residuals remaining at the completion of the remedial alternative
- the adequacy and reliability of controls (if any) that would be used to manage treatment residuals or remaining untreated waste
- the magnitude of the risk remaining after the response objectives have been met
- the alternative's ability to meet RAOs established for the medium

5.2.5 Reduction of Toxicity, Mobility and Volume

This evaluation criterion addresses the degree to which a remedial alternative would permanently reduce the toxicity, mobility or volume of the impacts present in the site media. This criterion addresses the preference for remedial actions that permanently and significantly reduce the toxicity of impacts, irreversibly reduce the mobility of the impacts and/or reduce the total volume of media containing impacts. The evaluation focused on the following factors:

- the process the remedy would employ and the amount of materials that would be treated

- the remedy's anticipated ability to reduce the toxicity, mobility or volume of impacts present in site media

- the nature and quantity of residuals that would remain after treatment

- the relative amount of MGP-related residuals that would be destroyed, treated or recycled

- the degree to which the treatment is irreversible

5.2.6 Implementability

This evaluation criterion addresses the technical and administrative feasibility of implementing a remedial alternative, including the availability of the various services and materials required. The following analysis factors were considered during the implementability evaluation:

- *Technical Feasibility* – This refers to the relative ease of implementing or completing the remedial alternative based on site-specific constraints. In addition, the remedial alternative's constructability and operational reliability are considered, as well as reliability of the technology and the ability to monitor the effectiveness of the remedial alternative.

- *Administrative Feasibility* – This refers to items, such as coordination with other agencies and availability of services and materials, such as treatment, storage and disposal services, as well as required technical specialists and contractor services.

5.2.7 Cost

This criterion refers to the total cost to implement the remedial alternative on the basis of present worth analysis. Present worth analysis allows remedial actions to be compared based on a single cost representing the amount that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial actions over the planned life. The total cost of each alternative represents the sum of the direct capital costs (materials, equipment and labor), indirect capital costs (engineering, licenses or permits and contingency allowances), O&M costs (operating labor, energy, chemicals and sampling and analysis) and future capital costs (when appropriate, when there is a reasonable expectation that a major component will require replacement).

The present worth costs, which were developed to allow the comparison of the remedial alternatives, were estimated with expected accuracies of -30 percent to +50 percent, in accordance with both the NYSDEC and USEPA guidance. A contingency factor of 25 percent has been included for each alternative to cover unforeseen costs incurred during implementation. Present value costs are calculated for alternatives expected to last more than 2 years. In accordance with the USEPA guidance (USEPA, 1988), a 7 percent discount rate (before taxes and after inflation) was used to calculate present worth.

5.3 No Action Alternative

The No Action alternative was retained for evaluation for each of the environmental media to be addressed at the site as required by USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988a) and NCP regulations. The No Action alternative was evaluated as a baseline for comparison to other alternative actions. Because the No Action alternative applies to each medium, this alternative is evaluated in detail only once below and is applied to subsurface soil and groundwater without further discussion.

Technical Description

The No Action alternative serves as the baseline for comparison of the overall effectiveness of the other remedial alternatives. The No Action alternative would not involve implementation of any remedial activities to address the COCs in the subsurface soil and groundwater at the site. No effort would be made to change the current site conditions.

Compliance with Standards, Criteria and Guidelines

Chemical-Specific Standards, Criteria and Guidelines

The chemical-specific SCGs identified for this alternative are presented in Table 2-1. Because removal or treatment is not included as part of this alternative, the chemical-specific SCGs would not be met with this alternative.

Action-Specific Standards, Criteria and Guidelines

This alternative does not involve implementation of any remedial activities; therefore, the action-specific SCGs are not applicable.

Location-Specific Standards, Criteria and Guidelines

Because no remedial activities would be conducted under this alternative, the location-specific SCGs are not applicable.

Protection of Human Health and the Environment

The No Action alternative does not address the impacted subsurface soil and groundwater. Therefore, the No Action alternative would be ineffective and would not meet the RAOs established for subsurface soil and groundwater at the site.

Short-Term Effectiveness

No remedial action would be implemented for the impacted subsurface soil and groundwater at the site; therefore, there would be no short-term environmental impacts or risks posed to the community.

Long-Term Effectiveness and Permanence

Under the No Action alternative, the COCs in the subsurface soil and groundwater would not be addressed. As a result, this alternative would not meet the RAOs identified for the site.

Reduction of Toxicity, Mobility and Volume

Under the No Action alternative, subsurface soil and groundwater would not be treated, recycled or destroyed. Reduction of mass, mobility and toxicity of the impacts would only occur over an extended period of time as a result of natural processes.

Implementability

The No Action alternative does not require implementation of any remedial activities.

Cost

The No Action alternative does not involve implementation of any remedial activities; therefore, there are no costs associated with this alternative.

5.4 Detailed Evaluation of Alternatives

As presented in Section 1.4.6.1, surface soil does not require further consideration as part of the remedial action at the site.

5.4.1 Potential Subsurface Soil Remedial Alternatives

This section presents the detailed evaluation of five potential subsurface soil remedial alternatives identified in Section 4.6.1. These potential remedial alternatives include:

- *Alternative S1* – Institutional Controls
- *Alternative S2* – Targeted Source of NAPL Removal
- *Alternative S3* – Removal of NAPL-Impacted Soil and Soil Containing PAHs Greater than 500 mg/kg and BTEX Greater than 10 mg/kg
- *Alternative S4* – In-Situ Solidification/Stabilization and Excavation of Heavily NAPL-Impacted Soil
- *Alternative S5* – Removal of Soil Containing Constituents Greater than TAGM 4046 RSCOs

With the exception of Alternative S1, the subsurface soil remedial alternatives include removal of the concrete pipe located along the southeastern property boundary.

In the following sections, a technical description for each alternative is provided followed by an evaluation of the alternative using the seven evaluation criteria described in Section 5.2.

5.4.1.1 Alternative S1 – Institutional Controls

Alternative S1 – Technical Description

Alternative S1 would not involve the implementation of any active remediation to remove, treat or contain MGP-impacted subsurface soil at the site. No active effort would be made to change the current site conditions. Natural biological and degradation processes would likely reduce MGP impacts in subsurface soil over time. The existing cover materials would be maintained; this would significantly reduce the potential for human exposure. Institutional controls would be implemented that limit disturbance of the cover materials, control subsurface activities and restrict groundwater use and/or groundwater extraction within the project area. Such institutional controls may include:

- *Governmental Controls* – land zoning restrictions, designation of a water protection area and local ordinance requiring a construction permit
- *Proprietary Controls* – deed modifications, standard easements, conservation easements and/or covenants prohibiting certain activities on the property
- *Informational Devices* – deed notices, advisories and notifications

The actual institutional controls implemented under this alternative would be determined in consultation with the NYSDEC. Periodic reports would be filed with the NYSDEC to demonstrate that the institutional controls are being maintained and remain effective.

Alternative S1 – Compliance with Standards, Criteria and Guidelines

Chemical-Specific Standards, Criteria and Guidelines

This alternative would not remove, treat or contain MGP-impacted subsurface soil. Under this alternative, potential exposures to construction workers during excavation activities presented in Section 3.2.1 would remain, and applicable SCGs identified in Table 2-1 would not be achieved until natural processes had reduced the MGP impacts in soil.

Action-Specific Standards, Criteria and Guidelines

This alternative would not involve the implementation of active remedial actions; therefore, the action-specific SCGs identified in Table 2-2 are not applicable.

Location-Specific Standards, Criteria and Guidelines

This alternative would not involve the implementation of active remedial actions; therefore, the location-specific SCGs identified in Table 2-3 are not applicable.

Alternative S1 – Protection of Human Health and the Environment

This alternative is not considered an effective means of reducing the toxicity, mobility or volume of the impacted subsurface soil. The long-term effectiveness of institutional controls would largely be determined by the extent to which governmental or private entities adopt and enforce them. Alternative S1 does not sufficiently address the potential release of MGP impacts to the environment, and therefore, is not considered to be effective on a long-term basis. In addition, this alternative does not reduce, to the extent practicable, further off-site migration of MGP-related NAPLs. Therefore, this alternative does not meet the RAOs for subsurface soil.

Alternative S1 – Short-Term Effectiveness

Under this alternative, no active remediation would be implemented for the impacted subsurface soil at the site; therefore, there would be no short-term risks to the community or construction workers or impacts to the environment.

Alternative S1 – Long-Term Effectiveness and Permanence

Based on the current conditions, there is the potential for site/construction workers to be exposed to MGP impacts during intrusive activities in the area of the former MGP structures. The long-term effectiveness of institutional controls would largely be determined by the extent to which governmental or private entities adopt and enforce them. This alternative does not sufficiently address the potential release of MGP impacts to the environment, and therefore, is not considered to be effective on a long-term basis.

Alternative S1 – Reduction of Toxicity, Mobility and Volume

Under this alternative, NAPL- and MGP-impacted soil would be left in place. Reduction of mass, mobility and toxicity of the impacts would only occur over an extended period of time as a result of natural processes. Overall, Alternative S1 is not considered a reasonably effective means of reducing the toxicity, mobility or volume of the impacted subsurface soil.

Alternative S1 – Implementability

This alternative would be both technically and administratively implementable. No permit approval, and only minimal coordination with other agencies would be required.

Implementation of institutional controls would require the approval of the current property owner.

Alternative S1 – Cost

The estimated costs associated with Alternative S1 are presented in Table 5-1. The total estimated present worth cost for implementation of this alternative is approximately $150,000.

5.4.1.2 Alternative S2 – Targeted Source of NAPL Removal

Alternative S2 – Technical Description

Alternative S2, as shown on Figure 7, involves the excavation and off-site disposal of targeted sources of NAPL and the removal of the concrete pipe located along the southeastern property boundary. Targeted sources of NAPL include excavation to a maximum depth of 20 feet bgs of the following: the oil and tar separator and targeted soil containing visible MGP coal tar or brown oil. This depth is intended to represent the vertical extent of potential future use of the site (e.g., basement) and a reasonable maximum depth for utilization of standard excavation support.

Alternative S2 was developed to reduce potential future contact exposures to site construction workers; to remediate, to the extent practicable, areas containing sources of MGP-related NAPLs; and to reduce, to the extent practicable, further off-site migration of MGP-related NAPLs. It is important to note that two large sources of MGP NAPL, gas holders 1 and 2, were removed during the 2003/2004 IRM. Shallow subsurface purifier waste-impacted soil to the southeast of the holders was removed during this IRM. In addition, shallow subsurface soil (to a maximum depth of 2 feet bgs) was removed in selected eastern and northern areas of the site during a 1996 PCB IRM.

The concrete pipe and its contents would be excavated and removed to the extent feasible. Additional investigation and remediation of the pipe and its contents would be performed as part of the remedial action at the site. Due to limited available information about the concrete pipe, it is assumed that approximately 100 linear feet of pipe would be removed. NAPL found within the pipe would be collected separately, containerized and disposed of at a permitted facility.

An estimated in-place volume of 4,800 cubic yards of soil would be excavated. Based on available site data, it is assumed that approximately 25 percent of the material excavated would be stockpiled, tested and reused as backfill. Thus, 3,600 cubic yards of impacted soil and debris would be transported off-site for treatment and disposal. The excavation of the structures and their contents would be conducted using conventional construction equipment, such as, but not limited to, backhoes, front-end loaders and dump trucks. In areas where underground utilities or other piping structures are anticipated to be encountered, soil removal would be conducted by hand and/or the utilities will be removed and replaced or relocated. Excavated soil would be staged on site in temporary staging areas for pre-treatment (if needed), segregation and subsequent off-site disposition. Demolition materials associated with removal of the former MGP subsurface structures are expected to include concrete/masonry, steel and a concrete pipe. The contents of the structures would be transported off site for treatment/disposal.

It is anticipated that this alternative would include excavation support for stability of the excavation sidewalls and to minimize infiltration of groundwater into the excavated area. Cantilever sheetpiling, without pretrenching would be utilized for excavation depths ranging from 10 to 18 feet below grade and trench boxes would be utilized for excavations shallower than 10 feet deep. The actual sheetpiling depth and excavation support would be determined during the remedial design.

Soil excavated from below the groundwater table would be subject to post-excavation gravity dewatering and pre-treatment (e.g., mixing/conditioning, stabilization). The dewatering process would remove some of the most impacted waters from the targeted areas.

Odor control and modified soil handling techniques would be employed to reduce the release of odors and/or organic vapors (e.g., polyethylene sheeting, misting with water/BIO SOLVE®, foam).

During the excavation activities, removal methods would be implemented to collect water from within the excavation areas and transfer it to the on-site storage tank(s) prior to shipment to a treatment facility. The removal methods would most likely include the installation of water collection sumps at the excavation surface. For the purposes of this Feasibility Study Report, it was assumed that water collected from the dewatering operations, the waste staging and handling areas and personnel and equipment decontamination areas would be collected and shipped for off-site treatment.

Separate phase NAPL encountered/removed during excavation activities would be segregated from the soil and groundwater (to the extent possible) and placed in appropriate USDOT-approved containers (i.e., 55-gallon drums) for off-site disposal.

The excavated area would be backfilled with select fill material and stockpiled excavated soil (if deemed suitable for reuse) to within 18 inches of the original ground surface.

Site restoration, in the form of maintaining/replacing the existing cover materials, would be implemented; this would significantly reduce the potential for human exposure. In addition, institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices would be instituted to limit disturbance of the cover materials, monitor excavation of the subsurface and limit groundwater usage.

Alternative S2 – Compliance with Standards, Criteria and Guidelines

Chemical-Specific Standards, Criteria and Guidelines

Alternative S2 would not immediately achieve compliance with chemical-specific SCGs including TAGM 4046 criteria and the NYSDEC Class GA Groundwater Standards. These SCGs, identified in Table 2-1, would not be achieved until natural processes had reduced the remaining MGP impacts in subsurface soil.

Other applicable chemical-specific SCGs identified for this alternative are associated with the identification of hazardous waste (based on TCLP analysis) and compliance with UTS/LDRs. These applicable chemical-specific SCGs would be achieved by completing appropriate characterization and profiling of the excavated materials prior to off-site transportation and treatment/disposal in accordance with applicable rules and regulations at a properly permitted facility. The NYSDEC's *Guidance on the Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants*, which outlines criteria for conditionally excluding MGP-tar and impacted soil from the state hazardous waste requirements, would also be considered, as appropriate, when dealing with treatment/disposal of excavated materials. The removal of targeted sources of NAPL would comply with chemical-specific SCGs, specifically New York State and RCRA regulations regarding the identification and listing of hazardous wastes, LDRs and USDOT shipping requirements.

Action-Specific Standards, Criteria and Guidelines

Implementation of this alternative would comply with action-specific SCGs, including both federal and New York State requirements. Action-specific SCGs include general health and safety requirements and general requirements regarding the handling and disposal of hazardous waste (including transportation and disposal, permitting, manifesting, disposal and treatment facilities).

Because MGP-impacted material typically only exhibits the hazardous characteristic of toxicity for benzene (D018), it is conditionally exempt from the hazardous waste management requirements (6 NYCRR Parts 370-374 and 376) when destined for thermal treatment, in accordance with NYSDEC's TAGM 4061 (NYSDEC, 2002). If MGP-related hazardous wastes are destined for land disposal in New York State, the state hazardous waste regulations apply, including the LDRs and the alternative LDR treatment standards for hazardous waste soil.

The USDOT's and New York State's rules for the transport of hazardous materials are provided in 49 CFR Parts 107 and 171.1 through 172.558 and 6 NYCRR 372.3. These rules include procedures for the packaging, labeling, manifesting and transporting of hazardous materials, and would be potentially applicable to the transport of hazardous materials under any remedial alternative. New York State requirements for waste transporter permits are included in 6 NYCRR Part 364, as well as with standards for the collection, transport and delivery of regulated wastes within New York State. Contractors transporting waste materials off site during the selected remedial alternative would need to be permitted.

Proper documentation would be prepared for this alternative to comply with applicable requirements outlined under OSHA, including, but not limited to, the general industry standards (29 CFR 1910), safety equipment and procedures to be followed during site remediation (29 CFR 1926) and recordkeeping and reporting-related regulations (29 CFR 1904). In addition to the requirements outlined under OSHA, the preparedness and prevention procedures, contingency plan and emergency procedures outlined under RCRA (40 CFR 264) are potentially relevant and appropriate.

Location-Specific Standards, Criteria and Guidelines

Implementation of this alternative would comply with location-specific SCGs. Remedial activities at the site would be conducted in accordance with local building/construction codes and ordinances. Because the site is located within the 500-year floodplain of the

Chemung River, federal floodplain management laws and regulations are potential SCGs for remedial alternatives that would involve excavation or fill within the floodplain. Federal requirements for activities conducted within floodplains are provided in 40 CFR 6.302, and 40 CFR Part 6, Appendix A – Statement of Procedures on Floodplain Management and Wetlands Protection.

Alternative S2* – *Protection of Human Health and the Environment

Through the removal of the contents of the subsurface structures and subsurface sources of NAPL, Alternative S2 would meet the RAOs of reducing potential human exposure to subsurface soil containing COCs and MGP-related NAPLs, reducing, to the extent practicable, further off-site migration of MGP-related NAPLs and remediating, to the extent practicable, areas containing sources of MGP-related NAPLs.

Site restoration, in the form of maintaining/replacing the existing surface cover materials, and institutional controls would be required to significantly reduce the potential for human exposure.

Alternative S2* – *Short-Term Effectiveness

In the short term, management of construction activities would be required to minimize potential short-term exposures to the community and site workers. Potential exposure mechanisms would include ingestion or dermal contact with the impacted media and inhalation of dust and/or volatilized organic vapors. Potential exposure of on-site workers to MGP impacts would be mitigated by the use of PPE and engineering controls (e.g., use of water/BIO SOLVE® misting sprays, use of hay bales, modifying the rate of construction activities) so that dust, odors and/or volatized organic vapors are within acceptable levels, as specified in a site-specific Health and Safety Plan (HASP), that would be developed during the remedial design phase.

Additional worker safety concerns associated with working with and around large construction equipment, noise generation from operating construction equipment and increased vehicular traffic associated with delivery of equipment/materials would be minimized by the use of engineering controls and proper health and safety practices. Short-term impacts to the community associated with transporting impacted materials off site and clean fill materials on site are anticipated to be manageable. The transportation activities would be managed to minimize en-route risks to the community. Waste transport trucks would have water-tight tailgates with a gasket between the box and tailgate regardless of the designation of the load. A transportation plan would be presented in the remedial design that would detail routing patterns that minimize interference with, and impacts to, the community.

The excavated soil would pose a risk while on site and during transportation from the site to the treatment/disposal facility since it would be more assessable to human exposure. Under this alternative, traffic resulting from the transportation of approximately 3,600 cubic yards of impacted soil for off-site treatment/disposal (approximately 1,080 one-way truckloads for soil removal and importing clean fill materials) would pose a potential nuisance to the community and increase the risk for accidents and spills. This remedial alternative may require approximately 8 to 12 months to complete.

No significant impacts to human health or the environment during the implementation activities would be expected if these control measures are implemented. The remedial construction component is expected to be completed within one construction season.

The community would not have access to the site during implementation of the remedial activities as the site is currently and would continue to be fenced. In work areas where site fencing is not present, a temporary fence would be constructed during remedial activities. Community air monitoring would be performed during implementation of this alternative to maintain compliance with air quality requirements, to minimize odors and to determine the need for additional engineering controls. Activities to control odors generated during the soil removal, staging and handling activities (e.g., use of water/BIO SOLVE® misting sprays, tarps to cover soil, minimizing open excavations, air handling systems) would be evaluated during the remedial design; however, it is assumed that a sprung structure would not be required.

This alternative has limited construction in the vicinity of the Trayer property southeast of the site; therefore, short-term impacts (noise, dust and truck traffic) to the users of this facility would be limited in both duration and type.

No adverse environmental impacts would result from the implementation of this alternative if control measures are implemented.

Alternative S2 – Long-Term Effectiveness and Permanence

Alternative S2 is considered effective on a long-term basis. The excavation/removal of the subsurface structures and impacted soil would result in improved groundwater quality, a reduction in the potential off-site migration of MGP impacts and a reduction in the potential construction worker risks associated with MGP-impacted subsurface material. Periodic reports would be filed with the NYSDEC to demonstrate that the institutional controls are being maintained and that the cover is being inspected and maintained. The effectiveness and permanence of the institutional controls would largely be determined by the extent to which governmental or private entities adopt and enforce them. In addition, natural attenuation processes would continue to further reduce any residual PAH concentrations that may remain after implementing this alternative.

Alternative S2 – Reduction of Toxicity, Mobility and Volume

This alternative would reduce the toxicity, mobility and volume of impacts at the site through the removal of the contents of the former MGP structures, their contents and impacted subsurface soil. Approximately 3,600 cubic yards of MGP-impacted materials would be removed from the site as a result of the removal of the structures and subsurface source materials. This remedial alternative is an irreversible process as the impacted soil and NAPL would be excavated and transported for off-site treatment/disposal.

Alternative S2 – Implementability

This alternative is both technically and administratively implementable. Remedial contractors for the removal of impacted soil are readily available.

A pre-design investigation (PDI) would be conducted to appropriately design the remedial action.

Alternative S2 – Cost

The estimated costs associated with Alternative S2 are presented in Table 5-2. The total estimated present worth cost for implementing this alternative is approximately $3,340,000.

5.4.1.3 Alternative S3 – Removal of NAPL-Impacted Soil and Soil Containing PAHs Greater than 500 mg/kg and BTEX Greater than 10 mg/kg

Alternative S3** – **Technical Description

As described above, this alternative would involve the excavation and off-site disposal of NAPL-impacted soil and soil containing total PAHs at concentrations greater than 500 mg/kg and total BTEX at concentrations greater than 10 mg/kg to a depth of approximately 20 feet bgs. This depth is intended to represent the vertical extent of potential future use of the site (e.g., basement) and a reasonable maximum depth for utilization of standard excavation support. This alternative would also involve the excavation and off-site disposal of structures, including the underground oil and tar separator (a suspected source of NAPL) and the concrete pipe located along the southeastern property boundary as shown on Figure 8.

Excavation of impacted soil would generally be conducted using conventional construction equipment, such as, but not limited to, backhoes, excavators, front-end loaders and dump trucks. An estimated in-place volume of 36,000 cubic yards of soil would be excavated. Based on available site data, it is assumed that approximately 25 percent of the material excavated would be suitable for reuse as backfill. Thus, approximately 27,000 cubic yards of soil would be transported off-site for treatment and disposal.

It is anticipated that this alternative would include excavation support for stability of the excavation sidewalls and to minimize infiltration of groundwater into the excavated area. Cantilever sheetpiling, without pre-trenching would be utilized for excavation depths ranging from 10 to 18 feet below grade and trench boxes would be utilized for excavations shallower than 10 feet deep. The actual sheetpiling depth and excavation support would be determined during the remedial design.

Soil excavated from below the groundwater table would be subject to post-excavation gravity dewatering and pre-treatment (e.g., mixing/conditioning, stabilization). The dewatering process would remove some of the most impacted waters from the targeted areas.

The concrete pipe and its contents would be excavated and removed to the extent feasible. Additional investigation and remediation of the pipe and its contents would be performed as part of the remedial action at the site. Due to limited available information about the concrete pipe, it is assumed that approximately 100 linear feet of pipe would be removed. NAPL found within the pipe would be collected separately, containerized and disposed of appropriately.

Site restoration, in the form of maintaining/replacing the existing cover materials, would be implemented; this would significantly reduce the potential for human exposure. In addition, institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices would be instituted to limit disturbance of the cover materials, monitor excavation of the subsurface and limit groundwater usage.

The excavated soil would be stockpiled in on-site staging areas to facilitate handling, stabilization (via gravity dewatering or mixing with dryer soil or stabilizing agents), consolidation and characterization for off-site treatment/disposal purposes. Disposal of MGP-impacted materials would be conducted in accordance with NYSDEC MGP disposal regulations presented in TAGM 4061 (NYSDEC, 2002a). For the purpose of providing a cost for this alternative, it was assumed that soil that is managed for disposal would be transported to a permitted LTTD facility in compliance with TAGM 4061. Additionally, soil determined to be not MGP-impacted, but unsuitable for reuse as backfill will be consolidated and transported for off-site treatment/disposal at an approved facility (i.e., a solid waste landfill). Based on available site data, it is assumed that approximately 25 percent of the material excavated would be stockpiled, tested and, if suitable, reused as backfill. Additional disposal/treatment alternatives would be reviewed as part of the RD/RA Work Plan.

During the excavation activities, removal methods would be implemented to collect water from within the excavation areas and transfer it to the on-site storage tank(s) prior to shipment to a treatment facility. The removal methods would most likely include the installation of water collection sumps at the excavation surface. For the purposes of this Feasibility Study Report, it was assumed that water collected from the dewatering operations, the waste staging and handling areas and personnel and equipment decontamination areas would be collected and shipped for off-site treatment. Details related to water treatment, handling and discharge would need to be addressed as part of the remedial design phase.

Separate phase NAPL encountered/removed during excavation activities would be segregated from the soil (to the extent possible) and placed in appropriate USDOT-approved containers (i.e., 55-gallon drums) for disposal.

Alternative S3 – Compliance with Standards, Criteria and Guidelines

Chemical-Specific Standards, Criteria and Guidelines

Chemical-specific SCGs are presented in Table 2-1. NAPL-impacted soil and soil containing total PAHs at concentrations greater than 500 mg/kg and total BTEX at concentrations greater than 10 mg/kg to a depth of approximately 20 feet would be removed under this remedial alternative. However, chemical constituents would remain in site soil at concentrations greater than the TAGM 4046 recommended cleanup objectives.

Chemical-specific SCGs that may apply to site groundwater include the New York State Groundwater Quality Standards (6 NYCRR Parts 700-705), which identify acceptable chemical constituent concentrations in groundwater. Because this alternative includes the removal of NAPL-impacted soil and removal and treatment of groundwater that collects within the excavation area (i.e., likely the most impacted groundwater at the site), future impacts to groundwater by site soil should be significantly reduced, and this alternative would likely achieve this SCG.

Another chemical-specific SCG that may apply for this alternative is associated with discharging treated groundwater to a POTW. A discharge permit would need to be obtained from the local POTW and the treated water would need to meet influent requirements.

Action-Specific Standards, Criteria and Guidelines

Action-specific SCGs are presented in Table 2-2. Action-specific SCGs that apply to this alternative are associated with the excavation and treatment/disposal of the impacted soil, removal and treatment of groundwater from the excavations, monitoring requirements and OSHA health and safety requirements. Workers and worker activities that occur during implementation of this alternative must comply with OSHA requirements for training, safety equipment and procedures, monitoring, recordkeeping and reporting as identified in 29 CFR 1910, 29 CFR 1926 and 29 CFR 1904. Measures would be taken as needed to control levels of airborne particulate matter during soil excavation activities, in accordance with 40 CFR 50 National Ambient Air Quality Standards.

Additional SCGs applicable to this alternative are associated with the transportation and treatment/disposal of the excavated materials. Transportation of the excavated materials would be completed in accordance with procedures identified in 6 NYCRR 364 and 372; 49 CFR 107; and 40 CFR 262, 263, 171, and 172. Disposal activities would be completed in accordance with 6 NYCRR 372 and 373 and 40 CFR 262, 263, 170-179 and 270.

National Ambient Air Quality Standards (including particulate levels) would be applicable and adhered to during excavation activities.

If any of the materials are characterized as a hazardous waste, then the RCRA, UTS/LDR and USDOT requirements for the packaging, labeling, transportation and disposal of hazardous or regulated materials may be applicable. Compliance with these requirements would be achieved by utilizing a licensed waste transporter and permitted disposal facilities.

Location-Specific Standards, Criteria and Guidelines

Location-specific SCGs are presented in Table 2-3. Remedial activities at the site would be conducted in accordance with local building/construction codes and ordinances. There are several location-specific SCGs that may pertain to this alternative, some of which apply to construction within the 500-year floodplain.

Alternative S3 – Protection of Human Health and the Environment

The excavation and off-site treatment/disposal of NAPL-impacted soil and soil containing total PAHs at concentrations greater than 500 mg/kg and total BTEX at concentrations greater than 10 mg/kg, followed by placement of clean backfill material and replacement of the existing cover materials, would meet the soil RAOs of reducing, to the extent practicable, potential human exposure to subsurface soil containing COCs and MGP-related NAPLs and reducing further off-site migration of MGP-related NAPLs. Potential human and environmental exposure to the impacted soil would be minimized following remedial activities because the majority of impacted soil would be physically removed from the site and treated/disposed of at permitted facilities. In addition, institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices would be instituted to limit disturbance of the cover materials, monitor excavation of the subsurface and limit groundwater usage. All soil within the limits of the soil removal area would be removed to a maximum depth of 20 feet bgs as part of this alternative, and therefore, would not be readily accessible by site workers or personnel.

Alternative S3 – Short-Term Effectiveness

During the implementation of this alternative, on-site remedial workers may be exposed to chemical constituents in soil, groundwater and NAPL by ingestion, dermal contact and/or inhalation. Potential on-site worker exposure to chemical constituents would be mitigated by the use of engineering and institutional controls and use of PPE, as specified in a site-specific HASP. Air monitoring would be performed during implementation of this alternative to determine the need for additional engineering controls (e.g., use of water sprays/foam suppressants to suppress dust/vapors/odors during soil excavation, performing excavation work within temporary enclosures, modifying the rate of construction activities,), and to confirm that dust or volatilized organic vapors are within acceptable levels, as specified in a site-specific HASP.

The community would not have access to the site during the implementation of the remedial activities as the site is currently and would continue to be fenced. In work areas where site fencing is not present, a temporary fence would be constructed during remedial activities. Risks to the community also would be minimized by providing security at the site and implementing a CAMP to minimize the potential migration of volatile organic vapors or impacted dust from the site. The excavated soil would pose a risk while on site and during transportation from the site to the treatment/disposal facility since it would be more assessable to human exposure. Under this alternative, traffic resulting from the transportation of approximately 27,000 cubic yards of impacted soil for off-site treatment/disposal (approximately 8,100 one-way truckloads for soil removal and importing clean fill materials) would pose a potential nuisance to the community and increase the risk for accidents and spills. Based on the extent of remedial activities described herein, soil removal activities under this remedial alternative may require approximately 18 to 24 months to complete.

Alternative S3 – Long-Term Effectiveness and Permanence

The implementation of this alternative would permanently remove a large mass of impacted soil from the site. However, some soil containing total PAHs and BTEX at concentrations less than or equal to 500 mg/kg and less than or equal to 10 mg/kg (respectively) would remain. Soil removal under this alternative would minimize the potential for future off-site migration of NAPL, as NAPL-impacted soil, to an approximate depth of 20 feet bgs, would be permanently removed and disposed off site.

This alternative would largely attain the RAOs of reducing future impacts to groundwater and restoring COC-impacted groundwater to current New York State Groundwater Quality Standards, as NAPL-impacted soil that contributes to ongoing dissolved-phase impacts to groundwater and impacted groundwater/NAPL at the site would be permanently removed.

While short-term groundwater monitoring may be required, no long-term monitoring or maintenance would be related to this soil excavation remedial alternative since the soil would be permanently removed as part of this remedy.

Alternative S3 – Reduction of Toxicity, Mobility and Volume

Implementation of this alternative would reduce the toxicity, mobility and volume of impacted soil and groundwater, as well as LNAPL and DNAPL beneath the site. This remedial alternative is an irreversible process since the impacted soil and NAPL would be excavated and transported for off-site treatment/disposal. In addition, impacted groundwater would be removed from the excavation area to facilitate soil removal, and groundwater would be treated and disposed off-site. The chemical constituents remaining in subsurface soil and groundwater following excavation will likely be reduced via natural attenuation over time, as constituents within subsurface soil dissolve/disperse into groundwater.

Alternative S3 – Implementability

Removal and treatment of impacted soil to a depth of approximately 20 feet is technically feasible. Remedial contractors for the removal of the impacted soil are readily available.

Difficulties with implementation of this remedial alternative would consist of the following:

- managing the anticipated volume of soil
- obtaining and transporting approximately 27,000 cubic yards of clean fill materials
- managing and disposing the anticipated volume of groundwater and precipitation that would accumulate in the excavation area, and through dewatering

- availability of waste transportation and LTTD facilities
- working around subsurface utilities

Uncertainties related to the soil removal and construction activities are associated with soil handling and treatment and interference with above/belowground infrastructure. In addition, the need to lower the water table to facilitate the excavation activities may limit the rate of soil removal. The installation of shoring or sheeting would require a test boring program prior to installation to confirm that excavation reinforcements (e.g., sheetpiling) can be driven into the subgrade at the required depths. It is likely that technical problems such as, but not limited to, equipment failure, treatment difficulties, traffic issues and the presence of underground structures and/or obstructions, will lead to schedule delays. These technical problems can be minimized with proper advance planning and coordination of the remedial activities.

Based on the nature of the materials to be excavated (i.e., MGP-impacted soil), pre-mixing with less impacted soil may be necessary to meet the treatment requirements for thermal treatment. Adequate treatment/disposal facility capacity should be available; however, coordination to balance the removal, transportation and treatment/disposal activities would be required due to limited space at the site and due to the limited capacity of the thermal treatment and/or disposal facilities. The necessary equipment and personnel capable of implementing the soil removal activities are available. The anticipated time necessary to complete the activities associated with this alternative is approximately 18 to 24 months, not including the pre-design soil boring program or time to obtain necessary permits to conduct these activities.

Alternative S3* – *Cost

The estimated costs associated with Alternative S3 are presented in Table 5-3. The total estimated present worth cost for implementing this alternative is approximately $14,600,000.

5.4.1.4 Alternative S4 – In-Situ Solidification/Stabilization and Excavation of Heavily NAPL-Impacted Soil

Alternative S4 – Technical Description

This alternative, as shown on Figure 9, uses ISS and excavation to treat in-situ or remove soil that is heavily impacted with potentially mobile MGP-related NAPL. It consists of the following components:

- Excavation/removal of shallow, heavily NAPL-impacted soil in the unsaturated zone (to approximately 8 feet bgs).
- Excavation/removal of the oil and tar separator area (excavation to approximately 18 feet bgs).
- Excavation/removal of the concrete pipe.
- ISS of heavily NAPL-impacted soil above the till layer to depths ranging from approximately 13 to 28 feet bgs, based on boring log descriptions.

ISS would be implemented in the area located on the eastern portion of the site and the area east of the former oil tank (pending additional delineation during a PDI).

This alternative includes a pre-excavation and off-site disposal and/or reuse (if appropriate) of soil to approximately 10 percent of the ISS treatment depth. This alternative also includes the excavation and off-site disposal and/or reuse (if appropriate) of an additional 10 percent of the ISS-treated soil volume. Pre-excavated soil would be removed by open-cut excavation, using conventional construction equipment. This would allow room for “fluff” (i.e., expansion of stabilized soil), estimated to be approximately 20 percent of the soil volume with the mixing tool method, during the ISS treatment. Specific design details would be addressed as part of the remedial design.

The ISS process would stabilize impacted soil by both solidifying the soil into a solid mass (microencapsulation) and by solidifying the soil around the NAPL-impacted soil (macroencapsulation), forming a containment barrier to prevent migration of the NAPL outside of the solidified shell. Additionally, the curing process is an exothermic reaction and the heat from the reaction could serve to volatilize a portion of the COCs associated with the impacted media.

Due to equipment limitations and the presence of potential subsurface obstructions within the areas identified for ISS (i.e., debris or cobbles greater than approximately 6 inches in any dimension), the following strategy would be used:

- The perimeter of the NAPL-impacted soil would be stabilized using standard or specialty (e.g., jet grout) ISS equipment to maintain continuous overlapping columns and create a perimeter of stabilized soil that could serve as a containment barrier. If an obstruction is encountered along the perimeter of the ISS area, an attempt would be made to remove or drill through the obstruction to provide a solid, low-permeability exterior boundary.

- The interior of the area to be stabilized would be treated using standard ISS equipment (such as mixing augers).

- If obstructions are encountered during the ISS activities in the interior, the equipment would be removed from the column (where the obstruction was encountered) and the next ISS column would be initiated.

An estimated volume of 22,400 cubic yards of impacted soil would be treated via ISS.

The concrete pipe and its contents would be excavated and removed to the extent feasible. Additional investigation and remediation of the pipe and its contents would be performed as part of the remedial action at the site. Due to limited available information about the concrete pipe, it is assumed that approximately 100 linear feet of pipe is assumed to be removed. NAPL found within the pipe would be collected separately, containerized and disposed of appropriately.

In addition to the ISS soil removal, an estimated in-place volume of 4,500 cubic yards of soil would be excavated. Based on available site data, it is assumed that approximately 25 percent of the material excavated would be stockpiled, tested and reused as backfill. Thus, 3,375 cubic yards of NAPL-impacted soil and debris would be transported off site for treatment and disposal. The excavation of the structures and their contents would be conducted using conventional construction equipment, such as, but not limited to, excavators, front-end loaders and dump trucks. In areas where underground utilities or other piping structures are anticipated to be encountered, soil removal would be conducted by hand and/or the utilities will be removed and replaced or relocated. Demolition materials associated with removal of the former MGP subsurface structures are expected to include concrete/masonry, steel and a concrete pipe. The contents of the structures would be transported off site for treatment/disposal.

The excavated soil would be stockpiled in on-site staging areas to facilitate handling, stabilization, consolidation and characterization for off-site treatment/disposal purposes. Disposal of MGP-impacted materials would be conducted in accordance with NYSDEC MGP disposal regulations presented in TAGM 4061. For costing purposes, it was assumed that excavated soil that is managed for disposal would be transported to a permitted LTTD facility in compliance with TAGM 4061. Excavated materials that are determined to be not MGP-impacted, but unsuitable for reuse as backfill will be consolidated and transported for off-site treatment/disposal at a solid waste landfill. Additional treatment/disposal alternatives would be reviewed as part of the RD/RA Work Plan.

Odor control and modified soil handling techniques would be employed to reduce the release of odors and/or organic vapors (e.g., polyethylene sheeting, misting with water/BIO SOLVE®, foam).

Separate phase NAPL encountered/removed during the ISS pre-excavation and the excavation activities would be segregated from the soil (to the extent possible) and placed in appropriate USDOT-approved containers (i.e., 55-gallon drums) for disposal.

Site restoration, in the form of maintaining/replacing the existing cover materials, would be implemented; this would significantly reduce the potential for human exposure. In addition, institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices would be instituted to limit disturbance of the cover materials, monitor excavation of the subsurface and limit groundwater usage.

Post-ISS quality control sampling would consist of sampling the stabilized soil columns to verify that performance criteria (e.g., permeability) are met. Long-term O&M would consist of monitoring constituent concentrations in the groundwater downgradient of ISS treatment areas and periodically collecting cores from the solidified material to assess the integrity of the material. If performance criteria are not specifically met in some locations, columns can be over-bored and additional stabilizing agents can be added.

Alternative S4 – Compliance with Standards, Criteria and Guidelines

Chemical-Specific Standards, Criteria and Guidelines

Chemical-specific SCGs are presented in Table 2-1. Subsurface soil beneath the property contains COCs at concentrations greater than the RSCOs presented in NYSDEC TAGM 4046 (USEPA, 1994). This alternative utilizes encapsulation to prevent migration of heavily NAPL-impacted soil. As such, this alternative would not achieve the chemical-specific SCGs presented in NYSDEC TAGM 4046. However, implementation of ISS would minimize potential downgradient off-site migration of NAPL and/or chemical constituents present in the on-site soil.

Other applicable chemical-specific SCGs identified for this alternative are associated with the identification of hazardous waste (based on TCLP analysis) and compliance with UTS/LDRs. These applicable chemical-specific SCGs would be achieved by completing appropriate characterization and profiling of the excavated materials prior to off-site transportation and treatment/disposal in accordance with applicable rules and regulations at a properly permitted facility. The NYSDEC's *Guidance on the Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants*, which outlines criteria for conditionally excluding MGP-tar and impacted soil from the state hazardous waste requirements, would also be considered, as appropriate, when dealing with treatment/disposal of excavated materials. The removal and ISS of heavily NAPL-impacted soil would comply with chemical-specific SCGs, specifically New York State and RCRA regulations regarding the identification and listing of hazardous wastes, LDRs and USDOT shipping requirements.

Action-Specific Standards, Criteria and Guidelines

Action-specific SCGs are presented in Table 2-2. Action-specific SCGs that apply to this alternative are associated with the excavation and disposal of the impacted soil, ISS monitoring and OSHA health and safety requirements. Workers and work activities that occur during implementation of this alternative must comply with OSHA requirements for training, safety equipment and procedures, monitoring, recordkeeping and reporting as identified in 29 CFR 1910, 29 CFR 1926 and 29 CFR 1904. Measures would be taken as needed to control levels of airborne particulate matter during soil excavation activities, in accordance with 40 CFR 50 National Ambient Air Quality Standards.

Additional SCGs applicable to this alternative are associated with the transportation and disposal of the excavated materials. Transportation of the excavated materials would be completed in accordance with procedures identified in 6 NYCRR 364 and 372; 49 CFR 107; and 40 CFR 262, 263, 171, and 172. Disposal activities would be completed in accordance with 6 NYCRR 372 and 373 and 40 CFR 262, 263, 170-179 and 270. Waste materials generated during implementation of this alternative (i.e., excavated soil and spoils from soil mixing and grouting) would be characterized to determine appropriate off-site disposal requirements. Disposal of MGP-impacted materials would be in accordance with NYSDEC MGP disposal regulations presented in TAGM 4061, as indicated above. Compliance with these requirements would be achieved by utilizing licensed waste transporters and permitted disposal facilities.

Location-Specific Standards, Criteria and Guidelines

Location-specific SCGs are presented in Table 2-3. Remedial activities at the site would be conducted in accordance with local building/construction codes and ordinances. There are several location-specific SCGs that may pertain to this alternative, some of which apply to construction within the 500-year floodplain.

Alternative S4 – Protection of Human Health and the Environment

Through the removal or treatment of soil that is heavily impacted with potentially mobile NAPL, this alternative would meet the soil RAOs of reducing potential human exposure to subsurface soil containing COCs and MGP-related NAPLs, reducing, to the extent practicable, further off-site migration of MGP-related NAPLs and remediating, to the extent practicable, areas containing sources of MGP-related NAPLs. This alternative reduces the volume of site impacts and potential for human exposure and therefore, is protective of human health and the environment.

Site restoration, in the form of maintaining/replacing the existing cover materials, and institutional controls would also be required to mitigate the potential for human exposure.

Alternative S4 – Short-Term Effectiveness

In the short term, management of construction activities would be required to minimize potential short-term exposures to the community and site workers. During the implementation of this alternative, on-site remedial workers may be exposed to chemical constituents in soil, groundwater and NAPL by ingestion, dermal contact and/or inhalation. Potential exposure of on-site workers to chemical constituents would be mitigated by the use of engineering and institutional controls and use of PPE, as specified in a site-specific HASP. Air monitoring would be performed during implementation of this alternative to determine the need for additional engineering controls (e.g., use of water sprays/foam suppressants to suppress dust/vapors/odors during soil excavation, performing excavation work within temporary enclosures, modifying the rate of construction activities), and to confirm that dust or volatilized organic vapors are within acceptable levels, as specified in a site-specific HASP.

Additional worker safety concerns associated with working with and around large construction equipment, noise generation from operating construction equipment and increased vehicular traffic associated with delivery of equipment/materials would be minimized by the use of engineering controls and proper health and safety practices. Short-term impacts to the community associated with transporting impacted materials off site and clean fill materials on site are anticipated to be manageable. The transportation activities would be managed to minimize en-route risks to the community. Waste transport trucks would have water-tight tailgates with a gasket between the box and tailgate regardless of the designation of the load. A transportation plan would be presented in the remedial design that would detail routing patterns that minimize interference with, and impacts to, the community.

The excavated soil would pose a risk while on site and during transportation from the site to the treatment/disposal facility since it would be more assessable to human exposure. Under this alternative, traffic resulting from the transportation of approximately 10,100 cubic yards of impacted soil for off-site treatment/disposal (approximately 3,000 one-way truckloads for soil removal and importing clean fill materials) would pose a potential nuisance to the community and increase the risk for accidents and spills. This remedial alternative may require approximately 1 to 2 years to complete (excluding pilot and treatability studies and relocation of existing utilities), and the long-term monitoring and maintenance could last 10 years or more.

No significant impacts to human health or the environment during the construction activities would be expected if these control measures are implemented. The remedial construction component is expected to be completed within one to two construction seasons.

The community would not have access to the site during implementation of the remedial activities as the site is currently and would continue to be fenced. In work areas where site fencing is not present, a temporary fence would be constructed during remedial activities. Community air monitoring would be performed during implementation of this alternative to maintain compliance with air quality requirements, to minimize odors and to determine the need for additional engineering controls. Activities to control odors generated during the soil removal, staging and handling activities (e.g., use of water/BIO SOLVE® misting sprays, tarps to cover soil, minimizing open excavations, air handling systems) would be evaluated during the remedial design; however, it is assumed that a sprung structure would not be required.

Alternative S4 – Long-Term Effectiveness and Permanence

The excavation/removal and ISS of heavily NAPL-impacted soil would result in improved groundwater quality, a reduction in the potential off-site migration of MGP impacts and a reduction in the potential construction worker risks associated with MGP-impacted subsurface material. Following solidification, NAPL, NAPL-impacted soil and associated COCs would be stabilized.

A long-term O&M program would be implemented to confirm the ongoing effectiveness of the ISS. O&M activities would consist of monitoring constituent concentrations in the groundwater downgradient of the ISS treatment areas.

Periodic reports would be filed with the NYSDEC to demonstrate that the institutional controls are being maintained and that the cover is being inspected and maintained. The effectiveness and permanence of the institutional controls would largely be determined by the extent to which governmental or private entities adopt and enforce them. In addition, natural attenuation processes would continue to further reduce any residual PAH concentrations that may remain after implementing this alternative. Therefore, based on the above, this alternative is considered effective on a long-term basis.

Alternative S4 – Reduction of Toxicity, Mobility and Volume

This alternative would reduce the toxicity, mobility and volume of impacts at the site through the excavation/removal of shallow, heavily NAPL-impacted soil. This process is irreversible as the impacted soil and NAPL would be excavated and transported for off-site treatment/disposal.

ISS treatment would minimize the potential for future downgradient migration of on-site NAPL and impacted groundwater. In addition, the toxicity and volume of chemical constituents in on-site and off-site groundwater would be expected to be reduced because NAPL-impacted soil would be stabilized, effectively minimizing the dissolution of COCs from the impacted soil into the dissolved phase. Also, during ISS, the heat of the reaction would volatilize certain COCs from the impacted soil, thus reducing the volume of COCs. Potential volatile organic vapors generated during ISS would be captured by the ISS apparatus through an attachment on the drill rig and treated on-site. Additionally, COCs associated with stabilized material within the solidified mixture would no longer be able to volatilize, thus minimizing potential vapor issues at the ground surface.

Alternative S4 – Implementability

This alternative is technically and administratively feasible. Remedial contractors for the removal of the impacted soil are readily available. Remedial contractors for implementing ISS are also available. There have been a number of applications of ISS on MGP sites, including sites in Georgia, Wisconsin, New Hampshire, Massachusetts, Pennsylvania and New York. The applicability of ISS depends on the nature of the COCs and the intended future use of the property. Past studies have concluded that ISS is an available and effective cleanup alternative for MGP sites.

Technical problems could result in schedule delays (e.g., equipment failure, treatment difficulties, traffic issues, coordination issues, the presence and removal of underground structures and obstructions), but can be minimized with proper advanced planning and coordination of the remedial activities.

A treatability study and PDI would be conducted to better delineate the impacted areas and appropriately design the remedial action.

Alternative S4 – Cost

The estimated costs associated with this alternative are presented in Table 5-4. The total estimated present worth cost for implementing this alternative is approximately $8,900,000.

5.4.1.5 Alternative S5 – Removal of Soil Containing Constituents Greater than TAGM 4046 RSCOs

Alternative S5 – Technical Description

This alternative would involve excavation and off-site disposal of soil containing individual constituents greater than their respective TAGM 4046 RSCOs and the concrete pipe located along the southeastern property boundary. Soil excavation activities would include the removal of unsaturated and saturated soil to a maximum depth of approximately 40 feet bgs. Based on the extent of COCs in site soil, this alternative would include the removal of an estimated in-place volume of 240,000 cubic yards of soil. Based on available site data, it is assumed that approximately 10 percent of the material excavated would be suitable for reuse as backfill. Thus, approximately 216,000 cubic yards of soil would be transported off-site for treatment and disposal. The anticipated extent of the soil removal under this alternative is shown on Figure 10.

Similar to the soil removal alternative presented under Section 5.4.1.5, excavation of impacted soil would generally be conducted using conventional construction equipment, such as, but not limited to, backhoes, excavators, front-end loaders and dump trucks. It is anticipated that this alternative would include installing temporary sheet pile walls for groundwater management and excavation support. Cantilever sheetpiling, without pretrenching would be utilized for excavation depths ranging from 10 to 40 feet below grade. The actual sheetpiling depth and excavation support would be determined during the remedial design.

The concrete pipe and its contents would be excavated and removed to the extent feasible. Additional investigation and remediation of the pipe and its contents would be performed as part of the remedial action at the site. Due to limited available information about the concrete pipe, it is assumed that approximately 100 linear feet of pipe would be removed. NAPL found within the pipe would be collected separately, containerized and disposed of appropriately.

The excavated soil would be stockpiled in on-site staging areas to facilitate handling, stabilization (via gravity dewatering or mixing with dryer soil or stabilizing agents), consolidation and characterization for off-site treatment/disposal purposes. Disposal of MGP-impacted materials would be conducted in accordance with NYSDEC MGP disposal regulations presented in TAGM 4061. For costing purposes, it was assumed that excavated soil that is managed for disposal would be transported to a permitted LTTD facility in compliance with TAGM 4061. Excavated materials that are determined to be not MGP-impacted, but unsuitable for reuse as backfill will be consolidated and transported for off-site treatment/disposal at a solid waste landfill. Additional treatment/disposal alternatives would be reviewed as part of the RD/RA Work Plan.

It is also assumed that water generated during excavation and soil dewatering activities would be treated on-site using a temporary water treatment system that would likely consist of oil-water separation, filtration, air stripping and vapor-phase carbon adsorption prior to being discharged to on-site sanitary sewers for subsequent treatment at the local POTW. Details related to water treatment, handling and discharge would need to be addressed as part of the remedial design phase.

Separate phase NAPL encountered/removed during excavation activities would be segregated from the soil (to the extent possible) and placed in appropriate USDOT-approved containers (i.e., 55-gallon drums) for disposal.

The need for a long-term O&M program would not be required following completion of this alternative because the large majority of impacted soil and groundwater would be permanently removed and treated/disposed.

Alternative S5 – Compliance with Standards, Criteria and Guidelines

Chemical-Specific Standards, Criteria and Guidelines

Chemical-specific SCGs are presented in Table 2-1. Subsurface soil at the site containing COCs at concentrations greater than individual TAGM 4046 guidance values would be removed under this remedial alternative and would satisfy this SCG.

Chemical-specific SCGs that may apply to site groundwater include the New York State Groundwater Quality Standards (6 NYCRR Parts 700-705), which identify acceptable chemical constituent concentrations in groundwater. Because this alternative includes the removal of NAPL-impacted soil and removal and treatment of groundwater that collects within the excavation area (i.e., likely the most impacted groundwater at the site), future impacts to groundwater by site soil should be significantly reduced, and this alternative would likely achieve this SCG.

Another chemical-specific SCG that may apply for this alternative is associated with discharging treated groundwater generated by excavation/soil dewatering activities to a POTW. A discharge permit would need to be obtained from the local POTW and the treated water would need to meet influent requirements.

Action-Specific Standards, Criteria and Guidelines

Action-specific SCGs are presented in Table 2-2. Action-specific SCGs that apply to this alternative are associated with the excavation and disposal of the impacted soil, removal and treatment of groundwater, monitoring requirements and OSHA health and safety requirements. Workers and worker activities that occur during implementation of this alternative must comply with OSHA requirements for training, safety equipment and procedures, monitoring, recordkeeping and reporting as identified in 29 CFR 1910, 29 CFR 1926 and 29 CFR 1904. Measures would be taken as needed to control levels of airborne particulate matter during soil excavation activities, in accordance with 40 CFR 50 National Ambient Air Quality Standards.

Additional SCGs applicable to this alternative are associated with the transportation and disposal of the excavated materials. Transportation of the excavated materials would be completed in accordance with procedures identified in 6 NYCRR 364 and 372; 49 CFR 107; and 40 CFR 262, 263, 171, and 172. Disposal activities would be completed in accordance with 6 NYCRR 372 and 373 and 40 CFR 262, 263, 170-179 and 270.

The implementation of this alternative would result in the generation of air emissions from the operation of a temporary groundwater treatment system. The SCGs applicable to air emissions include the PSD air emission provisions contained in 40 CFR 51 and all relevant requirements under the Clean Air Act contained in 40 CFR 1-99. In addition, New York State regulations regarding air emissions would apply. To comply with these SCGs, a temporary groundwater treatment system would be designed and operated, such that PSD limits would not be exceeded and the system would comply with all state and federal air emission requirements.

Process residuals generated during the implementation of this remedial alternative and not reused (e.g., activated carbon used in the temporary groundwater treatment system) would be characterized to determine the appropriate off-site disposal requirements. If any of the materials are characterized as a hazardous waste, then RCRA, UTS/LDR and USDOT requirements for the packaging, labeling, transportation and disposal of hazardous or regulated materials may be applicable to this unit. Compliance with these requirements would be achieved by utilizing a licensed waste transporter and permitted disposal facilities.

Location-Specific Standards, Criteria and Guidelines

Location-specific SCGs are presented in Table 2-3. Remedial activities at the site would be conducted in accordance with local building/construction codes and ordinances. There are several location-specific SCGs that may pertain to this alternative, some of which apply to construction within the 500-year floodplain.

Alternative S5 – Protection of Human Health and the Environment

The excavation and off-site treatment/disposal of soil containing individual constituents greater than their respective TAGM 4046 RSCOs, followed by placement of clean backfill material would meet the soil RAOs of reducing, to the extent practicable, potential human exposure to subsurface soil containing COCs and MGP-related NAPLs and reducing further off-site migration of MGP-related NAPLs. Potential human and environmental exposure to the impacted soil would be minimized following remedial activities because the impacted soil would be physically removed from the site and treated/disposed of at permitted facilities.

Alternative S5 – Short-Term Effectiveness

During the implementation of this alternative, on-site remedial workers may be exposed to chemical constituents in soil, groundwater and NAPL by ingestion, dermal contact and/or inhalation. Potential exposure of on-site workers to chemical constituents would be mitigated by the use of engineering and institutional controls and use of PPE, as specified in a site-specific HASP. Air monitoring would be performed during implementation of this alternative to determine the need for additional engineering controls (e.g., use of water sprays/foam suppressants to suppress dust/vapors/odors during soil excavation, performing excavation work within temporary enclosures, modifying the rate of construction activities), and to confirm that dust or volatilized organic vapors are within acceptable levels, as specified in a site-specific HASP.

The community would not have access to the site during the implementation of the remedial activities as the site is currently and would continue to be fenced. In work areas where site fencing is not present, a temporary fence would be constructed during remedial activities. Risks to the community also would be minimized by providing security at the site and implementing a CAMP to minimize the potential migration of volatile organic vapors or impacted dust from the site. Under this alternative, traffic resulting from the transportation of approximately 216,000 cubic yards of impacted soil for off-site treatment/disposal (approximately 65,000 one-way truckloads for soil removal and importing clean fill materials) would pose a potential nuisance to the community and increase the risk for accidents and spills. Based on the extent of remedial activities described herein, this remedial alternative may require approximately 3 to 5 years to complete.

Alternative S5 – Long-Term Effectiveness and Permanence

The implementation of this alternative would permanently remove soil containing individual constituents greater than their respective TAGM 4046 RSCOs. Soil removal under this alternative would minimize the potential for future off-site migration of NAPL, as NAPL-impacted soil would be permanently removed and disposed off site.

This alternative would largely attain the RAOs of reducing future impacts to groundwater and restoring COC-impacted groundwater to current New York State Groundwater Quality Standards. NAPL-impacted soil that contributes to ongoing dissolved-phase impacts to groundwater and impacted groundwater/NAPL at the site would be permanently removed.

No long-term monitoring or maintenance would be directly related to the soil excavation remedial alternative since the soil would be permanently removed as part of this remedy.

Alternative S5 – Reduction of Toxicity, Mobility and Volume

Implementation of this alternative would significantly reduce the toxicity, mobility and volume of impacted soil and groundwater, as well as LNAPL and DNAPL beneath the site.

This remedial alternative is an irreversible process since the impacted soil and NAPL would be excavated and transported for off-site treatment/disposal. In addition, impacted groundwater would be removed from the excavation area to facilitate soil removal, and groundwater would be treated and disposed off site.

Alternative S5 – Implementability

Impacted soil removal and treatment is technically feasible. Remedial contractors for the removal of the impacted soil are readily available.

Difficulties with implementation of this remedial alternative would consist of the following:

- managing the anticipated volume of soil (estimated as 240,000 cubic yards)
- obtaining and transporting approximately 216,000 cubic yards of clean fill materials to the site
- managing and disposing the anticipated volume of groundwater and precipitation that would accumulate in the excavation area, and through dewatering
- excavating to 40 feet bgs and the complex excavation support required for this task
- availability of transportation and LTTD facilities
- working around subsurface utilities

Uncertainties related to the soil removal and construction activities are associated with soil handling and treatment and interference with above/belowground infrastructure. In addition, the need to lower the water table to facilitate the excavation activities may limit the rate of soil removal. The installation of shoring or sheeting would require a test boring program prior to installation to confirm that excavation reinforcements (e.g., sheetpiling) can be driven into the subgrade at the required depths. It is likely that technical problems such as, but not limited to, equipment failure, treatment difficulties, traffic issues and the presence of underground structures and/or obstructions, will lead to schedule delays. These technical problems can be minimized with proper advance planning and coordination of the remedial activities.

Based on the nature of the materials to be excavated (i.e., MGP-impacted soil), pre-mixing with less impacted soil may be necessary to meet the treatment requirements for thermal treatment (as necessary). Based on the large volume of soil, adequate treatment/disposal facility capacity may be difficult to obtain; coordination to balance the removal and treatment/disposal activities would be required due to limited space at the site and due to the capacity of the thermal treatment facilities. The necessary equipment and personnel capable of implementing the soil removal activities are available. The anticipated time necessary to complete the activities associated with this alternative is approximately 3 to 5 years, not including the pre-design soil boring program or time to obtain necessary permits to conduct these activities.

Alternative S5* – *Cost

The capital costs associated with this alternative include site preparation, groundwater dewatering well construction, temporary groundwater treatment system construction and operation costs through excavation activities, soil excavation, soil stabilization, transportation and treatment/disposal. No direct operation or maintenance costs have been identified for this alternative. The estimated present worth cost of this alternative is $80,000,000. A detailed breakdown of the estimated costs associated with this alternative is presented in Table 5-5.

5.4.2 Potential Groundwater Remedial Alternatives

This section presents the detailed analysis of each potential groundwater remedial alternative identified in Section 4.6.2. A total of four potential alternatives of sufficient merit to undergo a more extensive detailed analysis were developed. These potential remedial alternatives include:

- *Alternative GW1* – Institutional Controls
- *Alternative GW2* –Monitored Natural Attenuation
- *Alternative GW3* – Passive NAPL Recovery
- *Alternative GW4* – NAPL Recovery and Oxygen Enhancement

In the following sections, a technical description for each alternative is provided followed by an evaluation of the alternative using the seven evaluation criteria described in Section 5.2.

5.4.2.1 Alternative GW1 – Institutional Controls

Alternative GW1* – *Technical Description

This alternative would not involve the implementation of any active remediation to remove, treat or contain MGP-impacted groundwater. The site would be allowed to remain in its current condition until natural biological and degradation processes reduce the impacts over time, and no active effort would be made to change the current site conditions. Institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices that would limit groundwater usage would be implemented.

Alternative GW1 – Compliance with Standards, Criteria and Guidelines

Chemical-Specific Standards, Criteria and Guidelines

The chemical-specific SCGs identified for this site are presented in Table 2-1. Chemical-specific SCGs that may apply to site groundwater are the New York State Groundwater Quality Standards (6 NYCRR Parts 700-705), which identify acceptable concentrations of chemical constituents in groundwater. This alternative would not contain, remove or treat impacted groundwater or NAPL. For this alternative, the potential direct contact exposures for site workers performing intrusive construction activities would remain, and the applicable SCGs identified in Table 2-1 would not be achieved until natural processes had reduced the impacts. Because of these natural processes, after an extended period of time, this alternative would be expected to achieve the RAOs for groundwater.

Action-Specific Standards, Criteria and Guidelines

This alternative would not involve the implementation of any remedial activities; therefore, the action-specific SCGs identified in Table 2-2 are not applicable.

Location-Specific Standards, Criteria and Guidelines

This alternative would not involve the implementation of any remedial activities; therefore, the location-specific SCGs identified in Table 2-3 are not applicable.

Alternative GW1 – Protection of Human Health and the Environment

This alternative does not include active remedial activities; therefore, there would be no additional short-term risks to the community. The dissolved plumes appear to be stabilized and limited to within approximately 100 feet of the site boundary. Natural biological and degradation processes appear to be effective; however, this alternative would not monitor/document the reduction in toxicity, mobility or volume of the MGP impacts in the near term. Because of these natural processes, this alternative would be expected to achieve the RAOs for groundwater through time. It is anticipated that institutional controls would reduce potential human exposure to groundwater containing COCs. Overall, this alternative is considered moderately protective of human health and the environment.

Alternative GW1 – Short-Term Effectiveness

Under this alternative, no active remedial action would be implemented for the impacted groundwater; therefore, there would be no short-term risks to the community or environmental construction workers.

Alternative GW1 – Long-Term Effectiveness and Permanence

The MGP components dissolved in groundwater (specifically dissolved BTEX and PAHs) would not be actively addressed; however, the dissolved plumes appear to be stabilized and limited to within approximately 100 feet of the site boundary. Alternative GW1 does not address the potential ongoing release of constituents from NAPL to the groundwater. It is anticipated that institutional controls would reduce potential human exposures. Overall, this alternative is considered only moderately effective on a long-term basis.

Alternative GW1 – Reduction of Toxicity, Mobility and Volume

Under this alternative, COC-impacted groundwater would not be contained, removed or actively treated. Therefore, the toxicity, mobility and volume of chemical constituents present in groundwater would not be reduced, except by long-term natural processes. The reduction in toxicity, mobility or volume of the MGP impacts would not be monitored/documented as part of this alternative.

Alternative GW1 – Implementability

This alternative is both technically and administratively implementable. No permit approval or coordination with other agencies would be required. Implementation of institutional controls would require the approval of the current property owner. Selection of appropriate institutional controls would be performed in consultation with the NYSDEC.

Alternative GW1 – Cost

The estimated costs associated with Alternative GW1, including assumptions made in developing this cost estimate and a detailed breakdown of the estimated costs, are presented in Table 5-6. The total estimated cost for implementation of this alternative is approximately $150,000.

5.4.2.2 Alternative GW2 –Monitored Natural Attenuation

Alternative GW2 – Technical Description

This alternative would use environmental easements to prevent (to the extent possible) future use of on-site groundwater, as well as maintain the existing surface cover materials to minimize potential exposure to subsurface soil and infiltration through impacted soil. Groundwater is currently not used for potable purposes at or downgradient of the site.

A detailed natural attenuation evaluation was conducted during the NYSDEC-approved SRI. The natural attenuation evaluation consisted of an analysis of the nature and extent of dissolved-phase COCs at the site, the advective and diffusive transport of the COCs and the intrinsic biodegradation of the COCs in groundwater. Based on the results of the evaluation, the geochemical characteristics of the groundwater at the site are favorable to anaerobic biodegradation of COCs. In addition, there is a relatively healthy and diverse anaerobic community structure currently in place at the site that is capable of inducing enzymes that degrade COCs to less toxic byproducts (i.e., carbon dioxide and water). The subsurface conditions at the site appear to be favorable for natural microbial degradation of COCs at the site.

Under this alternative, groundwater and NAPL monitoring would be conducted to document the natural attenuation of MGP constituents dissolved in the groundwater, as well as monitoring well locations where mobile NAPL is observed (if any). In addition, this alternative would include implementing institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices to limit the use of groundwater containing COCs above NYSDEC Class GA standards and guidance values.

Groundwater and NAPL monitoring activities would be conducted for an extended period to document groundwater quality beneath and near the site. For feasibility study purposes and because modeling has not been conducted, monitoring would be conducted for an estimated period of 30 years. Monitoring activities would consist of collecting groundwater field data (e.g., pH, turbidity, temperature), collecting groundwater samples for laboratory analysis from select monitoring wells within the existing monitoring well network and bailing and monitoring of any NAPL in the monitoring wells.

The results of the groundwater and NAPL monitoring would be summarized and presented to the NYSDEC in annual reports. Based on the field observations, analytical results of the monitoring and trends in groundwater COC concentrations, NYSEG may request from the NYSDEC to modify the monitoring program and/or to monitor groundwater less frequently or cease site monitoring altogether.

Alternative GW2 – Compliance with Standards, Criteria and Guidelines

Chemical-Specific Standards, Criteria and Guidelines

The chemical-specific SCGs identified for this alternative are presented in Table 2-1. Chemical-specific SCGs that may apply to site groundwater are the New York State Groundwater Quality Standards (6 NYCRR Parts 700-705), which identify acceptable concentrations of chemical constituents in groundwater. Depending on the reduction of COC concentrations in groundwater as a result of natural processes, this alternative potentially could meet this SCG after an extended period of time.

Action-Specific Standards, Criteria and Guidelines

The action-specific SCGs identified for this alternative are presented in Table 2-2. Action-specific SCGs that may apply to this alternative include the OSHA 29 CFR 1910 and 1926 regulations.

Location-Specific Standards, Criteria and Guidelines

This alternative does not involve the implementation of any remedial activities; therefore, the location-specific SCGs identified in Table 2-3 are not applicable.

Alternative GW2 – Protection of Human Health and the Environment

This alternative does not actively address impacted site groundwater. However, the groundwater and NAPL monitoring activities associated with this alternative could document the reduction of COC concentrations in groundwater via natural processes (e.g., biodegradation, dispersion, dilution, sorption, volatilization, chemical or biological stabilization, transformation, destruction of COCs). Potential off-site migration of impacted groundwater would be periodically monitored to protect potential off-site groundwater users. Ongoing dissolution of COCs from NAPL would continue following implementation of this alternative. This alternative does not satisfy the groundwater RAOs of reducing future COC impacts to groundwater and restoring, to the extent practicable, COC-impacted groundwater to current New York State Groundwater Quality Standards.

Institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices would be instituted to limit the use of groundwater containing COCs above NYSDEC Class GA standards and guidance values.

Alternative GW2 -– Short-Term Effectiveness

Implementation of this alternative may result in the exposure of on-site workers to impacted groundwater during monitoring activities via ingestion or dermal contact with the impacted groundwater, NAPL (if present) and inhalation of volatile organic vapors. Potential exposure of on-site workers to COCs would be mitigated by the use of engineering and institutional controls and use of PPE, as specified in a site-specific HASP that would be developed during the remedial design phase. Air monitoring would be performed during implementation of this alternative to confirm that volatilized organic vapors are within acceptable levels, as specified in a site-specific HASP.

Under this alternative, there would be no contact with impacted groundwater, with the exception of the groundwater sampling activities associated with periodic monitoring. Soil would not be disturbed during the groundwater monitoring; therefore, there would be no short-term environmental impacts or risks posed to the community. The site is currently fenced, restricting access to on-site monitoring wells. Off-site monitoring wells are equipped with locks to restrict access to the wells.

This alternative could be implemented immediately.

Alternative GW2 – Long-Term Effectiveness and Permanence

Under this alternative, the COCs present in the groundwater would not be actively addressed through treatment. However, if COC concentrations are reduced via natural processes, the process is permanent and the RAO of restoring, to the extent practicable, COC-impacted groundwater to current New York State Groundwater Quality Standards could be met over an extended period of time. Long-term monitoring hydraulically downgradient of the site would be required to evaluate any potential off-site migration of COCs in groundwater.

As presented in the technical description for this alternative, subsurface conditions at the site appear to be favorable for natural attenuation of COCs.

Alternative GW2 – Reduction of Toxicity, Mobility and Volume

Under this alternative, the COCs associated with impacted groundwater would not be directly treated, recycled or destroyed. However, monitoring may indicate that concentrations of COCs, and therefore, toxicity and volume are being reduced via natural processes, which would be monitored directly by this alternative.

Alternative GW2 – Implementability

This alternative does not require the implementation of any remedial activities. Equipment and personnel qualified to conduct groundwater monitoring activities are readily available as are analytical laboratories to perform the analyses for the groundwater samples.

Alternative GW2 – Cost

The estimated present worth cost of this alternative (including an estimated 30 years of monitoring) is approximately $783,000. A detailed breakdown of the estimated costs associated with this alternative is presented in Table 5-7.

5.4.2.3 Alternative GW3 – Passive NAPL Recovery

Alternative GW3 – Technical Description

Passive NAPL recovery efforts would be implemented to remove DNAPL that accumulates within collection wells. Collection wells would be constructed to target areas containing DNAPL-impacted soil. The wells would be screened across subsurface zones where NAPL-impacted soil has been identified. DNAPL recovery would be performed periodically using manual recovery methods (i.e., dedicated bailers) as DNAPL accumulates within the wells. Periodic monitoring of the collection wells would be conducted to evaluate the presence/absence of DNAPL and to recover accumulated DNAPL, to the extent practical. Recovered DNAPL would be placed into appropriate containers for off-site treatment/disposal.

There is evidence that petroleum hydrocarbons, which are LNAPLs, were also released during MGP operations, chiefly in the eastern portion of the site. LNAPL recovery efforts would be conducted to remove any LNAPL that is observed in existing monitoring wells. LNAPL recovery would be performed periodically using manual recovery methods (i.e., dedicated bailers). Periodic monitoring of the collection wells would be conducted to evaluate the presence/absence of LNAPL and to recover accumulated LNAPL, to the extent practical. Recovered LNAPL would be placed into appropriate containers for off-site treatment/disposal.

It is expected that some groundwater will be removed during DNAPL and LNAPL recovery; however, significant volumes of groundwater would not be removed during these activities other than the volume associated with manual bailing of NAPL. Groundwater that is recovered would be drummed and characterized prior to off-site transportation for treatment/disposal.

If NAPL is observed in any of the collection wells or the existing monitoring wells, NAPL recovery would be conducted in conformance with a future site-specific Operation, Maintenance and Monitoring Plan at regular intervals until NAPL is no longer recoverable.

Additionally, periodic groundwater monitoring would be conducted to document the natural attenuation of MGP constituents dissolved in the groundwater.

Groundwater and NAPL monitoring activities would be conducted for an extended period to document groundwater quality beneath and near the site. For feasibility study purposes and because modeling has not been conducted, monitoring would be conducted for an estimated period of 30 years. Monitoring activities would consist of collecting groundwater field data (e.g., pH, turbidity, temperature), collecting groundwater samples for laboratory analysis from select monitoring wells within the existing monitoring well network, as well as installing additional monitoring wells, if required, and bailing and monitoring of NAPL (if present) in the monitoring wells.

The results of the groundwater and NAPL monitoring and NAPL recovery would be summarized and presented to the NYSDEC in annual reports. Based on the field observations, analytical results of the monitoring and trends in groundwater COC concentrations, NYSEG may request permission from the NYSDEC to modify the monitoring program and/or to monitor groundwater less frequently or cease site monitoring altogether.

This alternative would include implementing institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices to limit the use of groundwater containing COCs above NYSDEC Class GA standards and guidance values.

Alternative GW3 – Compliance with Standards, Criteria and Guidelines

Chemical-Specific Standards, Criteria and Guidelines

The chemical-specific SCGs identified for this alternative are presented in Table 2-1. Chemical-specific SCGs that may apply to site groundwater are the New York State Groundwater Quality Standards (6 NYCRR Parts 700-705), which identify acceptable chemical constituent concentrations in groundwater. Depending on the reduction of COC concentrations in groundwater as a result of natural processes and potential NAPL recovery, this alternative could meet this SCG over time.

Action-Specific Standards, Criteria and Guidelines

Action-specific SCGs (Table 2-2) that apply to this alternative are associated with installation of NAPL collection wells, disposal of recovered NAPL, monitoring requirements and OSHA health and safety requirements. Workers and worker activities that occur during implementation of this alternative must comply with OSHA requirements for training, safety equipment and procedures, monitoring, recordkeeping and reporting as identified in 29 CFR 1910, 29 CFR 1926 and 29 CFR 1904. Compliance with action-specific SCGs would be accomplished by following an NYSDEC-approved RD/RA Work Plan and site-specific HASP.

Process residuals generated during the implementation of the alternative (e.g., drilling waste from well installation) would be characterized to determine appropriate off-site disposal requirements. If any of the materials are characterized as a hazardous waste, then RCRA UTSs/LDRs and USDOT requirements for the packaging, labeling, transportation and disposal of hazardous or regulated materials may be applicable. Compliance with these requirements would be achieved by utilizing licensed waste transporters and permitted disposal facilities.

Location-Specific Standards, Criteria and Guidelines

Location-specific SCGs are presented in Table 2-3. Remedial activities at the site would be conducted in accordance with local building/construction codes and ordinances. There are several location-specific SCGs that may pertain to this alternative, some of which apply to construction within a 500-year floodplain.

Alternative GW3 – Protection of Human Health and the Environment

The groundwater remedial alternative of passive NAPL recovery could generally address the RAO of reducing future COC impacts to groundwater by removing NAPL from the subsurface. However, these activities would not likely remove the bulk of the NAPL from the site. Based on the site-specific nature of NAPL (i.e., very viscous, semi-solid tar-like material), the potential volume of NAPL that could be physically recovered via passive recovery is limited. Therefore, ongoing dissolution of COCs from NAPL would continue following implementation of this alternative. Subsequently, the groundwater RAO of restoring, to the extent practicable, COC-impacted groundwater to current New York State groundwater quality standards would not be achieved. Based on the conclusions presented in Sections 1.4.6.3 and 3.3.3, the RAO for groundwater that consists of preventing, to the extent practicable, off-site migration of COC-impacted groundwater has been met through natural processes.

Institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices would be instituted to limit the use of groundwater, and thus, reduce potential human exposure to groundwater containing COCs.

Alternative GW3 – Short-Term Effectiveness

During the implementation of this alternative, on-site workers may be exposed to chemical constituents in soil, groundwater and NAPL by ingestion, dermal contact and/or inhalation. Potential exposure of on-site workers to COCs would be mitigated by the use of engineering and institutional controls and use of PPE, as specified in a site-specific HASP that would be developed during the remedial design phase. Air monitoring would be performed during implementation of this alternative to confirm volatilized organic vapors are within acceptable levels, as specified in a site-specific HASP.

Drums utilized for NAPL storage would not be accessible to the community, as they would be temporarily stored in an existing secured area.

Alternative GW3 – Long-Term Effectiveness and Permanence

As indicated above, this alternative is not anticipated to remove a substantial percentage of the NAPL present at the site. However, NAPL most likely to have the potential to migrate would have the greatest potential to be collected, and therefore, this alternative may be somewhat effective at meeting the soil RAO of reducing future off-site migration of NAPL. Under this alternative, the COCs present in the groundwater would not be addressed through direct treatment of the groundwater. Impacted soil is not addressed under this alternative, per se and therefore, would continue to serve as a source of dissolved-phase impacts to groundwater. NAPL recovery activities would reduce the volume of NAPL present in the subsurface, potentially reducing the mass flux of dissolution of COCs from impacted soil and NAPL to groundwater. Used in conjunction with a soil remedial alternative, discussed in Section 5.4.1, passive NAPL recovery could reduce future impacts to groundwater in addition to removing NAPL mass. Groundwater and NAPL monitoring would be required to evaluate the effectiveness of the NAPL recovery activities.

Alternative GW3 – Reduction of Toxicity, Mobility and Volume

Passive NAPL recovery would reduce the potential for future downgradient migration of NAPL, and the volume of NAPL present at the site would be somewhat reduced. In addition, the concentrations of COCs in the on-site groundwater would potentially be reduced (by reducing the mass of NAPL, and thereby the mass flux of dissolution of COCs from NAPL to the groundwater); however, this alternative does not address the impacted soil, per se, and is not anticipated to remove a large percentage of the NAPL present at the site, which would continue to serve as a source of dissolved-phase impacts to groundwater. Used in conjunction with a soil remedial alternative, discussed in Section 5.4.1, passive NAPL recovery could reduce future impacts to groundwater in addition to removing NAPL mass. Mobility of the NAPL could be reduced as the NAPL that is most likely to migrate may be recovered by passive methods.

Alternative GW3 – Implementability

This alternative is technically feasible and easily implemented. Collection/recovery wells are proven remedial technologies that are commonly used for passive recovery of NAPL. Based on the findings of previous investigations/monitoring activities, highly viscous NAPL was encountered beneath the site, and recovery attempts to date have failed to recover NAPL. Large diameter recovery wells with a larger slot-size well screen would be utilized to facilitate NAPL recovery. Equipment and remedial contractors capable of installing NAPL recovery wells are readily available. Construction of this alternative could be completed within a few months.

Alternative GW3 – Cost

The capital costs associated with this alternative include construction of the NAPL recovery wells. O&M costs associated with this alternative include NAPL monitoring and recovery activities. The estimated present worth cost of this alternative (including an estimated 30 years of monitoring) is approximately $1,110,000. A detailed breakdown of the estimated costs associated with this alternative is presented in Table 5-8.

5.4.2.4 Alternative GW4 – NAPL Recovery and Oxygen Enhancement

Alternative GW4 – Technical Description

This alternative involves the installation of up to 20 NAPL recovery wells and up to 20 oxygen introduction wells along the southwestern property boundary, south of the former gas holders. The NAPL recovery wells would be installed where heavily NAPL-impacted soil is identified in soil borings with the objective of mitigating potential migration south of the former gas holders (i.e., off site). The oxygen introduction wells would be installed in borings adjacent to the NAPL recovery wells to mitigate migration of the COC plume by enhancing biodegradation of dissolved COCs.

Oxygen enhancement of groundwater would consist of installing wells to introduce oxygen to the groundwater, to enhance the natural biodegradation rate of dissolved COCs and therefore mitigate the migration of the COC plume.

The NAPL recovery and oxygen introduction wells would be 6 inches in diameter. The NAPL recovery wells would be up to 50 feet deep with 5-foot sumps and would be spaced at approximately 10 to 15 feet on centers. The oxygen introduction wells would be approximately 15 feet deep.

Periodic monitoring of the new and existing NAPL recovery wells would be conducted to evaluate the presence/absence of NAPL and to recover accumulated NAPL, to the extent practicable. Recovered NAPL, if existing, would be transferred to containers for future transportation and off-site treatment/disposal.

It is expected that some groundwater would be removed during NAPL recovery; however, significant volumes of groundwater would not be removed other than the volume associated with manual bailing of NAPL. Groundwater that is recovered would be drummed and characterized prior to off-site transportation for treatment/disposal.

Periodic groundwater monitoring would be conducted to evaluate the effectiveness and/or continued need for the oxygen enhancement, and to check the existing groundwater monitoring wells for accumulated NAPL.

Accumulated NAPL (if any) observed in any site wells would be recovered in conformance with a future site-specific Operation, Maintenance and Monitoring Plan at regular intervals.

Groundwater and NAPL monitoring activities would be conducted to document groundwater quality beneath and near the site. For feasibility study purposes, it is estimated that groundwater monitoring would be conducted for a period of 30 years. Monitoring activities would consist of:

- collecting groundwater field data (e.g., pH, dissolved oxygen, temperature)
- collecting groundwater samples for laboratory analysis from selected monitoring wells within the existing monitoring well network
- installing additional monitoring wells, if required, and bailing and monitoring of NAPL (if present) in the monitoring wells

The results of the groundwater and NAPL monitoring and NAPL recovery would be summarized and presented to the NYSDEC in annual reports. Based on the field observations, analytical results of the monitoring and trends in groundwater COC concentrations, NYSEG may request permission from the NYSDEC to modify the monitoring program and/or to monitor groundwater less frequently or cease monitoring altogether.

This alternative would include implementing institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices to limit the use of groundwater containing COCs above NYSDEC Class GA Groundwater Standards and guidance values.

Alternative GW4* – *Compliance with Standards, Criteria and Guidelines

Chemical-Specific Standards, Criteria and Guidelines

Chemical-specific SCGs are presented in Table 2-1. Chemical-specific SCGs that may apply to site groundwater are the New York State Groundwater Quality Standards (6

NYCRR Parts 700-705), which identify acceptable chemical constituent concentrations in groundwater. Depending on the reduction of COC concentrations in groundwater as a result of natural processes, oxygen enhancement and potential NAPL recovery, this alternative could meet this SCG over time.

Action-Specific Standards, Criteria and Guidelines

Action-specific SCGs are presented in Table 2-2. Action-specific SCGs that apply to this alternative are associated with installation of NAPL recovery and oxygen enhancement wells, disposal of recovered NAPL, monitoring requirements and OSHA health and safety requirements. Workers and worker activities that occur during implementation of this alternative must comply with OSHA requirements for training, safety equipment and procedures, monitoring, recordkeeping and reporting as identified in 29 CFR 1910, 29 CFR 1926 and 29 CFR 1904. Compliance with action-specific SCGs would be accomplished by following an NYSDEC-approved RD/RA Work Plan and site-specific HASP.

Process residuals generated during the implementation of the alternative (e.g., drilling waste from well installation) would be characterized to determine appropriate off-site disposal requirements. If any of the materials are characterized as a hazardous waste, then RCRA UTSs/LDRs and USDOT requirements for the packaging, labeling, transportation and disposal of hazardous or regulated materials may be applicable. Compliance with these requirements would be achieved by utilizing licensed waste transporters and permitted disposal facilities.

Location-Specific Standards, Criteria and Guidelines

Location-specific SCGs are presented in Table 2-3. Remedial activities at the site would be conducted in accordance with local building/construction codes and ordinances. There are several location-specific SCGs that may pertain to this alternative, some of which apply to construction within a 500-year floodplain.

Alternative GW4* – *Protection of Human Health and the Environment

This alternative would permanently reduce the toxicity, mobility and volume of impacted groundwater via natural attenuating mechanisms enhanced by the addition of oxygen. In addition, removal of NAPL from the subsurface via recovery wells would also permanently reduce future COC impacts to groundwater, thereby reducing the toxicity, mobility and volume of impacts. This alternative is therefore considered effective on a long-term basis. Potential risks to the community are easily managed through monitoring and engineering controls (e.g., misting for vapor control during well installation). Monitoring to document the reduction in toxicity, mobility and volume of impacts would be conducted. Because ongoing dissolution of COCs from impacted soil and NAPL would continue following implementation of this alternative, if combined with a soil removal/treatment alternative, the RAO of restoring, to the extent practicable, COC-impacted groundwater to current New York State groundwater quality standards could be achieved over time. As presented in Sections 1.4.6.3 and 3.3.3, the RAO of preventing, to the extent practicable, off-site migration of COC-impacted groundwater has been met due to natural processes. Enhancing these natural processes would provide additional protection to the environment.

While groundwater in the vicinity of the site is not used, institutional controls in the form of governmental, proprietary, enforcement or permit controls and/or informational devices would be instituted to insure that groundwater use is limited, and thus, continue to eliminate potential human exposure to groundwater containing COCs.

Overall, this alternative is considered protective of human health and the environment.

Alternative GW4 – Short-Term Effectiveness

During the implementation of this alternative, on-site workers may be exposed to chemical constituents in soil, groundwater, oxygen-releasing material and NAPL by ingestion, dermal contact and/or inhalation. Potential exposure of on-site workers to chemicals and COCs would be mitigated by the use of engineering and institutional controls and use of PPE, as specified in a site-specific HASP that would be developed during the remedial design phase. Air monitoring would be performed during implementation of this alternative to confirm volatilized organic vapors are within acceptable levels, as specified in a site-specific HASP.

Drums utilized for NAPL storage would not be accessible to the community, as they would be temporarily staged in a secured area.

Alternative GW4 – Long-Term Effectiveness and Permanence

For this alternative, dissolved COCs would be addressed by enhancing the natural degradation processes, potentially mobile NAPL would be removed via NAPL recovery wells and monitoring would be conducted to document the effectiveness of the alternative. NAPL recovery is permanent in reducing the volume of NAPL present in the subsurface soil and would reduce the mass flux dissolution of COCs from NAPL to the groundwater. In addition, the application of an oxygen-releasing compound into the groundwater has been proven to be effective at MGP sites to enhance the biodegradation of dissolved COCs. These measures are considered effective at managing the risks at the site and therefore, this alternative is considered effective on a long-term basis. When combined with a soil removal/treatment alternative, this alternative would potentially achieve the groundwater RAOs over time.

Alternative GW4 – Reduction of Toxicity, Mobility and Volume

Passive NAPL recovery would reduce the potential for future downgradient migration of NAPL, and the volume of NAPL present at the site would be somewhat reduced. In addition, the concentrations of COCs in the on-site groundwater would potentially be reduced (by enhancing the biological degradation of dissolved BTEX and reducing the mass of NAPL, thereby reducing the mass flux of dissolution of COCs from NAPL to the groundwater); however, this alternative does not address the impacted soil, per se, and is not anticipated to remove a large percentage of the NAPL present at the site, which would continue to serve as a source of dissolved-phase impacts to groundwater. Used in conjunction with a soil remedial alternative, discussed in Section 5.4.1, this alternative could reduce future impacts to groundwater in addition to removing NAPL mass. Mobility of the NAPL could be reduced as the NAPL that is most likely to migrate may be recovered by passive methods.

Alternative GW4 – Implementability

This alternative is technically feasible and easily implemented. NAPL recovery and oxygen enhancement via application of an oxygen-releasing compound are proven remedial technologies. Large diameter recovery wells, potentially with a larger slot-size well screen, would be used to recover NAPL. Equipment and remedial contractors capable of installing NAPL recovery wells are readily available. Construction of this alternative could be completed within a few months.

Alternative GW4 – Cost

The capital costs associated with this alternative include construction of the NAPL recovery and oxygen enhancement wells. O&M costs associated with this alternative include NAPL monitoring and recovery activities and groundwater monitoring. The estimated present worth cost of this alternative (including an estimated 30 years of monitoring) is approximately $1,540,000. A detailed breakdown of the estimated costs associated with this alternative is presented in Table 5-9.

6. Assembly and Comparative Analysis of Site-Wide Remedial Alternatives

6.1 General

This section assembles the individual soil and groundwater remedial alternatives evaluated in detail in Section 5 into a number of site-wide remedial alternatives.

6.2 Assembled Site-Wide Remedial Alternatives

As discussed in Section 5, the individual media specific remedial alternatives, with the exception of Alternative S5, would not address all of the RAOs established for the site. Therefore, several combinations of the remedial alternatives are evaluated in this section. Site-wide alternatives have been assembled from the remedial alternatives that address specific media as summarized in the following table:

Site-Wide Alternative	Description	
	Soil	Groundwater
SW1	• Alternative S1 – Institutional Controls	• Alternative GW1 – Institutional Controls
SW2	• Alternative S2 – Targeted Source of NAPL Removal	• Alternative GW3 – Passive NAPL Recovery
SW3	• Alternative S3 – Removal of NAPL-Impacted Soil and Soil Containing PAHs Greater than 500 mg/kg and BTEX Greater than 10 mg/kg (to a depth of approximately 20 feet belowgrade)	• Alternative GW2 – Monitored Natural Attenuation
SW4	• Alternative S4 – In-Situ Solidification/Stabilization and Excavation of Heavily NAPL-Impacted Soil	• Alternative GW4 – NAPL Recovery and Oxygen Enhancement
SW5	• Alternative S5 – Removal of Soil Containing Constituents Greater than TAGM 4046 RSCOs	• Alternative GW2 – Monitored Natural Attenuation

6.3 Comparative Analysis of Site-Wide Alternatives

This section presents a comparative analysis of each site-wide remedial alternative using the seven evaluation criteria identified in Section 5. This comparative analysis identifies the advantages and disadvantages of each site-wide alternative relative to each other and with respect to the seven evaluation criteria. The results of the comparative analysis will be used as the basis for recommending a remedial alternative (Section 7).

6.3.1 Compliance with Standards, Criteria and Guidelines

Each of the site-wide alternatives could be designed and implemented to comply with the majority of the SCGs identified for this site.

- Alternative SW1 does not address the SCGs for the site. This alternative would only be able to meet the TAGM 4046 criteria and the New York State Groundwater Quality Standards after natural processes had reduced the impacts over an extended period of time.

- Alternative SW2 would address the SCGs through soil removal and off-site treatment/disposal, as well as groundwater monitoring and passive NAPL recovery. While this alternative would not immediately achieve compliance with chemical-specific SCGs including TAGM 4046 criteria, it would eventually achieve TAGM 4046 after natural processes had reduced the remaining MGP impacts in subsurface soil. Depending on the reduction of COC concentrations in groundwater as a result of natural processes and potential NAPL recovery, this alternative could meet the New York State Groundwater Quality Standards over time.

- Alternative SW3 would address the SCGs through soil removal and off-site treatment/disposal and groundwater and NAPL monitoring. Under this alternative, chemical constituents would remain in soil at concentrations greater than the TAGM 4046 recommended cleanup objectives. This alternative would only be able to meet the New York State Groundwater Quality Standards after natural processes had reduced the impacts over an extended period of time.

- Alternative SW4 would address the SCGs through ISS and soil removal and off-site treatment/disposal, as well as oxygen enhancement of groundwater and passive NAPL recovery. While this alternative would not immediately achieve compliance with chemical-specific SCGs including TAGM 4046 criteria, it would eventually achieve TAGM 4046 after natural processes had reduced the remaining MGP impacts in subsurface soil. This alternative could meet the New York State Groundwater Quality Standards over time based on the reduction of COC concentrations in groundwater as a result of natural processes, oxygen enhancement and potential NAPL recovery.

- Alternative SW5 would address the SCGs through soil removal and off-site treatment/disposal and groundwater and NAPL monitoring. This alternative would achieve the chemical-specific SCGs presented in NYSDEC TAGM 4046. Because this alternative includes the removal of NAPL-impacted soil and removal and treatment of groundwater that collects within the excavation area (i.e., likely the most impacted groundwater at the site), future impacts to groundwater by site soil should be significantly reduced, and this alternative would likely achieve the New York State Groundwater Quality Standards.

Implementation of Alternative SW5 would include compliance with applicable permit requirements to treat impacted groundwater and discharge treated water to the POTW.

6.3.2 Protection of Human Health and the Environment

With the exception of Alternative SW1, each of the site-wide alternatives would achieve the established RAOs for protection of human health and the environment, as discussed below:

- Alternative SW2 provides substantial protection of human health and the environment by removing the most impacted soil and groundwater at the site, and minimizing the potential for future direct contact with these media through the use of a physical barrier (i.e., soil cover), targeted source of NAPL removal and institutional controls. Furthermore, soil removal is combined with ongoing groundwater monitoring and NAPL recovery. This alternative would achieve the RAOs of reducing, to the extent practicable, potential human exposure to subsurface soil containing COCs, MGP-related NAPLs and groundwater containing COCs.

- Alternative SW3 provides protection of human health and the environment by removing most of the impacted soil at the site and minimizing the potential for direct contact with these media through the use of a physical barrier (i.e., soil cover) and institutional controls. Soil removal is combined with ongoing groundwater and NAPL monitoring. This alternative would achieve the RAOs of reducing, to the extent practicable, potential human exposure to subsurface soil containing COCs, MGP-related NAPLs and groundwater containing COCs.

- Alternative SW4 provides protection of human health and the environment by removing/addressing the most impacted soil and groundwater at the site, recovering NAPL, and minimizing the potential for future direct contact with these media through the use of a physical barrier (i.e., maintaining existing cover) and institutional controls. Stabilization of heavily NAPL-impacted soil also minimizes the potential for ongoing impacts to groundwater. In addition, oxygen enhancement of groundwater will mitigate the off-site migration of the dissolved COC plume to further protect human health and the environment. This alternative would achieve the RAOs of reducing, to the extent practicable, potential human exposure to subsurface soil containing COCs, MGP-related NAPLs and groundwater containing COCs.

- Alternative SW5 would permanently remove impacted soil and soil containing the greatest concentrations of chemical constituents, minimize the potential downgradient migration of constituents and minimize potential human exposure. Soil removal is combined with ongoing groundwater and NAPL monitoring. This alternative would achieve the RAOs of reducing, to the extent practicable, potential human exposure to subsurface soil containing COCs, MGP-related NAPLs and groundwater containing COCs.

6.3.3 Short-Term Effectiveness

With the exception of Alternative SW1, each of the alternatives involves potential exposure of on-site workers to chemical constituents within impacted soil and groundwater during the remedial activities. The short-term effectiveness of individual site-wide alternatives is as follows:

- Alternative SW2 has the potential for exposure of on-site workers to impacted soil and groundwater. Potential exposures would be addressed through planning and engineering controls, monitoring programs and use of PPE.

- Alternatives SW3 and SW5 have the potential for exposure between on-site workers and impacted soil and groundwater, and would present the greatest potential for short-term risks, because these alternatives involve the excavation and handling (including dewatering) of a large volume of impacted soil with the potential to generate volatile organic vapors and fugitive dust containing chemical constituents. Potential exposures would be addressed through planning and engineering controls, monitoring programs and use of PPE.

- Alternative SW4 has the potential for exposure of on-site workers to impacted soil and groundwater. Potential exposures would be addressed through planning and engineering controls, monitoring programs and use of PPE.

Short-term risks to the community include the potential generation of volatile organic vapors and nuisance odors during construction activities under Alternatives SW2 through SW5. Risks to the community would be minimized by providing security at the site and implementing a CAMP to minimize the potential migration of volatile organic vapors and/or particulates from the site and to determine the need for additional engineering controls. Alternative SW5 would be the most disruptive alternative and would present the greatest potential nuisance to the community because this alternative would generate an extremely large volume of excavated soil that would require years of transport through the community for off-site treatment/disposal.

6.3.4 Long-Term Effectiveness and Permanence

A comparative analysis of long-term effectiveness and permanence for each of the alternatives is as follows:

- Alternative SW1 would not be effective at addressing environmental impacts and would not have long-term permanence. However, natural processes that may reduce the volume of NAPL and COCs would occur over time and be permanent.

- Alternative SW2 involves the removal of targeted sources of NAPL and transportation of excavated materials for off-site disposal. This is generally considered an irreversible process since the material is no longer present at the site. This alternative has long-term effectiveness at reducing the mass of NAPL-impacted soil in targeted areas.

- Alternatives SW3 and SW5 involve the removal of impacted soil and transportation of excavated materials for off-site disposal. This is generally considered an irreversible process since the material is no longer present at the site. This alternative has long-term effectiveness at reducing the mass of NAPL-impacted soil and removing soil containing total PAHs at concentrations greater than 500 mg/kg (and effectively BTEX at concentrations greater than 10 mg/kg as they are co-located within the soil).

- Alternative SW4 includes removal of heavily NAPL-impacted soil and transportation of excavated materials for off-site disposal. This is considered an irreversible process since the material is no longer present at the site. This alternative also involves ISS, which is considered effective for stabilizing MGP-related impacts and is considered a permanent process. ISS involves solidification (micro- and macro-encapsulation) of NAPL and MGP-impacted soil. This process is generally irreversible since the material is homogenized with imported stabilizing materials and solidified. As a result, this alternative is considered to represent a long-term permanence. ISS has been shown to be effective on a long-term basis at MGP sites under similar circumstances. A quality assurance/quality control program would be implemented during the implementation of this process to demonstrate that a homogeneous stabilized mass is formed, and an ongoing O&M program would be implemented to monitor the effectiveness of this alternative.

6.3.5 Reduction of Toxicity, Mobility and Volume

With the exception of Alternative SW1, each site-wide alternative reduces toxicity, mobility and/or volume of impacted media at the site, as discussed below:

- Alternative SW2 involves soil removal. The removal of NAPL, targeted NAPL-impacted soil and impacted groundwater from the excavation areas is certain under this alternative, as it is physically removed from the ground for treatment/disposal.

- Alternatives SW3 and SW5 involve impacted soil removal. The removal of NAPL-impacted soil and impacted groundwater from the excavation area is certain under these alternatives, as it is physically removed from the ground for treatment/disposal.

- Alternative SW4 involves the removal of heavily NAPL-impacted soil, as well as oxygen enhancement of groundwater and passive NAPL recovery. Therefore the volume and mobility of MGP-related impacts would be reduced. In addition, the mobility (through solidification) and toxicity (through homogenization) of impacted soil and NAPL not included in the excavated areas would be reduced through solidification/stabilization via ISS.

6.3.6 Implementability

Each of the site-wide alternatives is technically and administratively feasible and could be implemented at the site, as discussed below:

- Alternative SW1 is readily implementable because it requires no active remedial work or groundwater monitoring.

- Alternative SW2 could be easily implemented. Remedial contractors needed for the removal of impacted soil, as well as materials, equipment and personnel needed to implement passive NAPL recovery, are readily available. Pre-design investigation activities would be conducted to appropriately design the remedial action. Uncertainties related to soil removal and construction activities are associated with soil handling and interference with the above/belowground infrastructure. Technical problems could possibly lead to schedule delays (e.g., equipment failure, treatment difficulties, traffic issues) but can be minimized with proper advance planning and coordination of the remedial activities. Based on the nature of the materials to be excavated (i.e., targeted MGP-impacted soil containing visible coal tar or brown oil), pre-mixing with less impacted soil may be necessary to meet the treatment requirements for off-site thermal treatment (as necessary). Adequate treatment/disposal facility capacity should be available; however, coordination to balance the removal, transportation and treatment/disposal activities would be required due to limited space at the site and due to the limited capacity of the thermal treatment and/or disposal facilities.

- Alternative SW3 could be implemented with some difficulty. Remedial contractors needed for the removal of impacted soil, as well as materials, equipment and personnel needed to conduct groundwater and NAPL monitoring, are readily available. The uncertainties and technical problems associated with Alternative SW2 would also be associated with this alternative. Additional difficulties associated with this alternative include:

  - excavation of soil beneath the groundwater table, excavation dewatering and soil dewatering

  - treatment/excavation adjacent to (or removal of) existing above grade structures and underground utilities

  - control of the potential generation and migration of volatile organic vapors, nuisance odors and fugitive dust; excavation/handling of large volumes of soil within relatively confined areas in close proximity to active work areas (e.g., office areas, garages)

  - availability of transportation and LTTD facilities

- Alternative SW4 could be implemented with some difficulty. Remedial contractors with experience and capability required for the implementation of ISS and the removal of impacted soil are available. Materials, equipment and personnel needed to design and implement the oxygen enhancement treatment system, and passive NAPL recovery system, and to conduct periodic groundwater monitoring, are readily available. A PDI would be conducted to collect the required additional information to prepare the remedial design. Uncertainties related to soil removal and ISS implementation are primarily associated with soil handling and interference with the above/belowground infrastructure/obstructions (debris greater than 6 inches). Technical problems could possibly lead to schedule delays (e.g., equipment failure, treatment difficulties, traffic issues) but can be minimized with proper planning and coordination of the remedial activities. Based on the nature of the materials to be excavated (i.e., heavily MGP-impacted soil), conditioning of soil may be necessary to meet the treatment requirements for off-site thermal treatment. Coordination with the treatment/disposal facility would be required to coordinate the removal, transportation and treatment/disposal activities due to limited space at the site and due to the limited capacity of the thermal treatment and/or disposal facilities. Preparation for the ISS technology would require accurate location of subsurface utilities and excavation of subsurface impedances (e.g., concrete foundations) and a treatability study.

- Alternative SW5 would cause the greatest disruption. This alternative would be the most difficult to implement because soil excavation would be conducted across a significant portion of the site. The uncertainties and technical problems associated with Alternatives SW2 and SW3 would also be associated with this alternative. Similar to the difficulties associated with Alternative SW3 but on a grander scale, additional difficulties associated with this alternative include:

    - excavation of soil beneath the groundwater table, excavation dewatering and soil dewatering

    - treatment/excavation adjacent to (or removal of) existing above grade structures and underground utilities

    - control of the potential generation and migration of volatile organic vapors, nuisance odors and fugitive dust; excavation/handling of large volumes of soil within relatively confined areas in close proximity to active work areas (e.g., office areas, garages)

    - availability of transportation and LTTD facilities

Treatability and pilot-scale studies may be required under Alternative SW5 to confirm that the water treatment system can be designed to meet necessary effluent quality to satisfy POTW requirements. In addition, pump tests may be required to confirm the groundwater extraction rates necessary to attain hydraulic containment.

The likelihood of technical and administrative problems under Alternatives SW3 and SW5 is greatest due to the increased complexity associated with extensive soil excavation.

6.3.7 Cost

A summary of the estimated cost for each site-wide alternative is presented below. Detailed cost estimates for the individual soil and groundwater alternatives are provided in Tables 5-1 through 5-9.

Site-Wide Alternative	Estimated Capital Cost	Estimated Present Worth O&M Cost	Total Estimated Present Worth Cost
SW1	$ 140,000	$ 160,000	$ 300,000
SW2	$ 3,550,000	$ 900,000	$ 4,450,000
SW3	$ 14,685,000	$ 698,000	$ 15,383,000
SW4	$ 9,320,000	$ 1,112,000	$ 10,440,000
SW5	$ 80,163,000	$ 620,000	$ 80,783,000

7. Recommended Site-Wide Remedy

This section presents the recommended site-wide remedy, as well as justification for selection of the alternative as the remedy for the site.

Based on the results of the detailed analysis of the individual soil and groundwater remedial alternatives (presented in Section 5) and the assembled site-wide remedial alternatives (presented in Section 6), Alternative SW4 has been selected as the recommended remedy.

As presented in Section 6, each of the assembled site-wide alternatives, with the exception of SW-1, could achieve the RAOs established for the site. Alternative SW4 was selected because it is protective of human health and the environment, achieves the RAOs for the site, is considered implementable, permanently reduces the toxicity, mobility, and volume of impacts at the site, and the equipment, materials and contractors necessary to implement this alternative are available. Although there are wide-spread impacts across the site, this alternative addresses the most impacted soil present at the site.

It is important to note that two large former sources of MGP NAPL, gas holders 1 and 2, were removed during the 2003/2004 IRM. Shallow subsurface purifier waste-impacted soil to the southeast of the holders was also removed during the 2003/2004 IRM. In addition, shallow subsurface soil (to a maximum depth of 5 feet bgs) was removed in selected eastern and northern areas of the site during a 1996 PCB IRM. The IRM removal areas are shown on Figure 6.

Alternative SW4 (Figure 9) involves the following elements:

- excavation/removal of shallow, heavily NAPL-impacted soil in the unsaturated zone
- excavation/removal of the oil and tar separator area
- excavation/removal of the concrete pipe
- ISS of heavily NAPL-impacted soil above the till layer
- passive NAPL recovery

- oxygen enhancement of groundwater
- site restoration (maintaining/replacing existing surface cover materials)
- implementation of institutional controls
- continued groundwater monitoring

The ISS/excavation activities would include: removal of the existing surface cover; installation of temporary sheetpiling where required for deeper excavations; ISS treatment of approximately 22,400 cubic yards of soil; excavation and handling of approximately 4,500 cubic yards of soil and debris; importation and placement of backfill material; surface cover restoration; and transportation and off-site disposal of MGP structures, NAPL, and contaminated soil and debris. Excavated soil that appears to be clean would be stockpiled and tested for potential reuse as subsurface fill.

A treatability study and PDI would be required to define the extent/volume of heavily impacted soil that requires excavation or ISS treatment including, but not limited to:

- further delineation around SB-233
- further delineation around SB-210

In addition, evaluation of the potential need for an additional deep monitoring well along E. Clinton Street, south of Trayer Products, to confirm that NAPL has not migrated beyond the Trayer facility.

While implementation of this alternative could be disruptive and could pose short-term exposure risks to the surrounding community, these risks would be managed through proper planning of the construction activities and adherence to a CAMP. The work activities associated with Alternative SW4 could be conducted in one to two construction seasons.

This alternative has limited construction in the vicinity of the Trayer property southeast of the site; therefore, short-term impacts (noise, dust and truck traffic) to the users of this facility would be limited in duration. This alternative is implementable and would be effective in meeting the RAOs. The surface cover would provide continued protection against potential human exposure to shallow subsurface soil containing COCs that may remain at the conclusion of the remedial action. Implementation of institutional controls would also reduce, to the extent practicable, potential human exposure to MGP-related NAPLs and subsurface soil and groundwater containing COCs that may remain at the site. Details of the institutional controls and site restrictions will be provided in an SMP. This alternative would remediate, to the extent practicable, areas containing sources of MGP-related NAPLs; therefore, reducing, to the extent practicable, future COC impacts to groundwater. In addition, groundwater monitoring would be conducted to demonstrate that COCs in groundwater are attenuating via enhanced natural processes.

Passive NAPL recovery would consist of periodically recovering NAPL (via manual methods) from newly constructed wells and existing monitoring wells. This would serve to reduce the NAPL volume in the subsurface and reduce, to the extent practicable, further off-site migration of NAPL. Based on the findings of previous investigations/monitoring activities, however, highly viscous NAPL was encountered beneath the site, and attempts to recover NAPL have not been successful.

Oxygen enhancement of groundwater would consist of installing wells to introduce oxygen to the groundwater, to enhance the natural biodegradation rate of dissolved COCs and therefore mitigate the migration of the COC plume. When used in combination with NAPL recovery, excavation of shallow soil, and ISS, oxygen enhancement of groundwater could achieve the RAO of restoring, to the extent practicable, COC-impacted groundwater to current New York State groundwater quality standards over time.

Periodic groundwater monitoring would be conducted to document ongoing attenuation of MGP constituents dissolved in the groundwater. The potential for site COCs to naturally attenuate was evaluated during the SRI. The SRI concluded the following:

- All of the COCs identified in site groundwater are likely subject to in-situ biodegradation processes by naturally-occurring subsurface microorganisms.
- COCs are being biodegraded in shallow groundwater by a variety of naturally-occurring oxidation-reduction processes.
- Statistically significant decreases in COC concentrations at the site over time indicate overall shrinkage of COC plumes in shallow groundwater.

Based on data provided in the NYSDEC-approved SRI, the dissolved phase plume appears to be stabilized and limited to within approximately 100 feet of the site boundary. Furthermore, the site is located downgradient of (i.e., outside the capture zone of) the existing municipal water supply wells that are located approximately 1 mile north of the site. As such, the dissolved phase COCs do not pose a threat to that well field. Based on the above conclusions, the RAO for groundwater that consists of preventing, to the extent practicable, off-site migration of COC-impacted groundwater has been met through natural processes.

Soil vapor sampling conducted during the SRI concluded that the potential for soil vapor intrusion from volatile MGP COCs into the Trayer and I.D. Booth buildings is relatively low. A process to assess the potential for soil vapor intrusion into future buildings on the site will be developed in the forthcoming SMP.

The total estimated cost for Alternative SW4 is $10,440,000, and this alternative would require approximately 1 to 2 years to complete.

8. References

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ARCADIS

Tables

Table 1-1

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Subsurface Soil Data Summary

Analyte	Range of Detections (min - max)		NYSDEC TAGM 4046 Soil Guidance Values	Frequency of Exceedences (count only)
VOCs (ppm)				
Benzene	0.0003	3.9	0.06	13 of 61
Ethylbenzene	0.0002	44	5.5	7 of 61
Toluene	0.0008	18	1.5	3 of 61
Xylenes, Total	0.0009	43	1.2	13 of 61
Total BTEX	0.0008	101.9	10	10 of 61
SVOCs (ppm)				
2-Methylnaphthalene	0.014	180	36.4	12 of 78
Acenaphthene	0.0084	130	50	11 of 78
Acenaphthylene	0.0087	71	41	4 of 78
Anthracene	0.0083	81	50	3 of 78
Benzo(a)anthracene	0.011	76	0.224	36 of 78
Benzo(a)pyrene	0.011	100	0.061	47 of 78
Benzo(b)fluoranthene	0.0077	50	1.1	28 of 78
Benzo(g,h,i)perylene	0.0045	88	0	52 of 78
Benzo(k)fluoranthene	0.0098	66	1.1	29 of 78
Chrysene	0.012	96	0.4	32 of 78
Dibenz(a,h)anthracene	0.016	13	0.014	37 of 78
Fluoranthene	0.013	210	50	7 of 78
Fluorene	0.014	75	50	3 of 78
Indeno(1,2,3-cd)pyrene	0.012	54	3.2	21 of 78
Naphthalene	0.01	880	13	20 of 78
Phenanthrene	0.0089	660	50	17 of 78
Pyrene	0.0084	370	50	13 of 78
Total PAHs	0.0134	2,458	500	15 of 78
Inorganics (ppm)				
Sulfur	0.037	0.76	NA	0 of 6
Misc. Parameters				
TCLP Benzene	0.0062	0.023	NA	0 of 8
Percent Sulfur (%)	0.027	0.031	NA	0 of 2
Reactive Sulfide	77.5	112	NA	0 of 8
Total Organic Carbon	640	24,500	NA	0 of 6
Total Diesel Range Organics	1.6	8,500	NA	0 of 21

Notes:
1. Only detected analytes included.
2. All concentrations in milligrams per kilogram (mg/kg), equivalent to parts per million (ppm).
3. Analytical results for subsurface piping (concrete pipe) were not included in range and frequency calculations.
4. * TAGM 4046 provides recommended soil cleanup objectives for total PCBs.
5. NA = No criteria listed.

Table 1-2

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Groundwater Data Summary

Analyte	Range of Detections (min - max)		NYSDEC TOGS	Frequency of Exceedences (count only)
VOCs (ppb)				
1,1,1-Trichloroethane	0.8	130	5	1 of 31
1,1-Dichloroethane	0.9	79	5	2 of 31
1,1-Dichloroethene	0.8	26	5	1 of 31
Acetone	12	12	NA	NA of 31
Benzene	0.5	5,400	1	5 of 36
Bromodichloromethane	1.1	1.1	NA	NA of 31
Carbon disulfide	0.4	0.4	60	0 of 31
Chloroethane	7.3	7.3	5	1 of 31
Chloroform	0.6	3.4	7	0 of 31
cis-1,2-Dichloroethene	1.7	1.7	5	0 of 31
Ethylbenzene	1.3	2,200	5	5 of 36
Tetrachloroethene	0.7	0.7	5	0 of 31
Toluene	1.2	4,800	5	5 of 36
Trichloroethene	0.8	2.1	5	0 of 31
Xylenes, Total	6	2,100	5	6 of 36
Total BTEX	0.6	13,400	NA	NA of 36
Total VOCs	1.2	13,400	NA	NA of 36
SVOCs (ppb)				
Acenaphthene	0.7	280	NA	NA of 36
Acenaphthylene	1.1	110	NA	NA of 36
Anthracene	4.4	36	NA	NA of 36
Benzo(a)anthracene	17	17	NA	NA of 36
Benzo(a)pyrene	0.06	14	NA	1 of 36
Benzo(k)fluoranthene	10	10	NA	NA of 36
Carbazole	1.7	52	NA	NA of 31
Chrysene	13	13	NA	NA of 36
Dibenzofuran	0.2	15	NA	NA of 31
Fluoranthene	0.4	26	NA	NA of 36
Fluorene	1.7	110	NA	NA of 36
Naphthalene	14	9,100	NA	NA of 36
Phenanthrene	0.2	140	NA	NA of 36
Pyrene	0.3	40	NA	NA of 36
Total PAHs	1.2	11,096	NA	NA of 36
Total SVOCs	1.4	11,108	NA	NA of 36
Inorganics (total) (ppb)				
Iron	253	18,300	300	9 of 14
Manganese	21.5	7,730	300	10 of 14
Inorganics (dissolved) (ppb)				
Iron	100	3,350	300	4 of 14
Manganese	4.8	7,590	300	10 of 14

Notes:
1. Only detected analytes included.
2. All concentrations in micrograms per liter (ug/L), equivalent to parts per billion (ppb).
3. NYS TOGS = New York State Technical and Operational Guidance Series, June 1998.
4. NA = No criteria listed.

Table 2-1

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Potential Chemical-Specific SCGs

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/Remedial Action
Federal				
Clean Water Act (CWA) - Ambient Water Quality Criteria	40 CFR Part 131; EPA 440/5-86/001 "Quality Criteria for Water - 1986", superseded by EPA-822-R-02-047 "National Recommended Water Quality Criteria: 2002"	S	Criteria for protection of aquatic life and/or human health depending on designated water use.	Does not appear to be applicable as no surface water is in the vicinity of the site.
CWA Section 136	40 CFR 136	G	Identifies guidelines for test procedures for the analysis of pollutants.	Does not appear to be applicable as no surface water is in the vicinity of the site.
CWA Section 404	33 USC 1344	S	Regulates discharges to surface water or ocean, indirect discharges to POTWs, and discharge of dredged or fill material into waters of the U.S. (including wetlands).	Potentially applicable for remedial activities that include dredging or capping and/or the treatment of water generated during excavation and dewatering activities.
National Primary Drinking Water Standards	40 CFR Part 141	S	Establishes maximum contaminant levels (MCLs) which are health-based standards for public water supply systems.	These standards are potentially applicable if an action involves future use of ground water as a public supply source.
RCRA-Regulated Levels for Toxic Characteristics Leaching Procedure (TCLP) Constituents	40 CFR Part 261	S	These regulations specify the TCLP constituent levels for identification of hazardous wastes that exhibit the characteristic of toxicity.	Excavated soil may be sampled and analyzed for TCLP constituents prior to disposal to determine if the materials are hazardous based on the characteristic of toxicity.

Table 2-1

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Potential Chemical-Specific SCGs

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/Remedial Action
Universal Treatment Standards/Land Disposal Restrictions (UTS/LDRs)	40 CFR Part 268	S	Identifies hazardous wastes for which land disposal is restricted and provides a set of numerical constituent concentration criteria at which hazardous waste is restricted from land disposal (without treatment).	Applicable if waste is determined to be hazardous and for remedial alternatives involving off-site land disposal.
New York State				
NYSDEC Guidance on Determination of Soil Cleanup Objectives and Cleanup Levels	Technical and Administrative Guidance Memorandum (TAGM) #4046 (1/24/94)	G	Provides a basis and procedures to determine soil cleanup levels, as appropriate, for sites when cleanup to pre-disposal conditions is not possible or feasible. Contains generic soil cleanup objectives.	These guidance values are to be considered, as appropriate, in evaluating soil quality.
NYSDEC Guidance on Remedial Program Soil Cleanup Objectives	6 NYCRR Part 375	G	Provides an outline for the development and execution of the soil remedial programs. Includes soil cleanup objective tables.	These guidance values are to be considered, as appropriate, in evaluating soil quality.
NYSDEC Guidance on the Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants (“MGPs”)	TAGM 4061(2002)	G	Outlines the criteria for conditionally excluding coal tar waste and impacted soil from former MGPs which exhibit the hazardous characteristic of toxicity for benzene (D018) from the hazardous waste requirements of 6 NYCRR Parts 370 - 374 and 376 when destined for thermal treatment.	This guidance will be used as appropriate in the management of MGP-impacted soil and coal tar waste generated during the remedial activities.
NYSDEC Ambient Water Quality Standards and Guidance Values	Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 (6/98)	G	Provides a compilation of ambient water quality standards and guidance values for toxic and non-conventional pollutants for use in the NYSDEC programs.	These standards are to be considered in evaluating groundwater and surface water quality.

Table 2-1

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Potential Chemical-Specific SCGs

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/Remedial Action
Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	S	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 371-376.	Applicable for determining if soil generated during implementation of remedial activities are hazardous wastes. These regulations do not set cleanup standards, but are considered when developing remedial alternatives.
New York State Surface Water and Groundwater Quality Standards	6 NYCRR Part 703	S	Establishes quality standards for surface water and groundwater.	Potentially applicable for assessing water quality at the site during remedial activities.

Table 2-2

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Potential Action-Specific SCGs

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/ Remedial Action
Federal				
Occupational Safety and Health Act (OSHA) - General Industry Standards	29 CFR Part 1910	S	These regulations specify the 8-hour time-weighted average concentration for worker exposure to various compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 1910.120.	Proper respiratory equipment will be worn if it is not possible to maintain the work atmosphere below required concentrations. Appropriate training requirements will be met for remedial workers.
OSHA - Safety and Health Standards	29 CFR Part 1926	S	These regulations specify the type of safety equipment and procedures to be followed during site remediation.	Appropriate safety equipment will be on-site and appropriate procedures will be followed during remedial activities.
OSHA - Record-keeping, Reporting and Related Regulations	29 CFR Part 1904	S	These regulations outline record-keeping and reporting requirements for an employer under OSHA.	These regulations apply to the company(s) contracted to install, operate and maintain remedial actions at hazardous waste sites.
RCRA - Preparedness and Prevention	40 CFR Part 264.30 - 264.31	S	These regulations outline requirements for safety equipment and spill control when treating, handling and/or storing hazardous wastes.	Safety and communication equipment will be installed at the site as necessary. Local authorities will be familiarized with the site.
RCRA - Contingency Plan and Emergency Procedures	40 CFR Part 264.50 - 264.56	S	Provides requirements for outlining emergency procedures to be used following explosions, fires, etc. when storing hazardous wastes.	Plans will be developed and implemented during remedial design. Copies of the plan will be kept on-site.
CWA - Discharge to Waters of the U.S., and Section 404	40 CFR Parts 403, and 230 Section 404 (b) (1); 33 USC 1344	S	Establishes site-specific pollutant limitations and performance standards which are designed to protect surface water quality. Types of discharges regulated under CWA include: indirect discharge to a POTW, and discharge of dredged or fill material into U.S. waters.	Does not appear to be applicable as no surface water is in the vicinity of the site.

Table 2-2

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Potential Action-Specific SCGs

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/ Remedial Action
CWA Section 401	33 U.S.C. 1341	S	Requires that 401 Water Quality Certification permit be provided to federal permitting agency (USACE) for any activity including, but not limited to, the construction or operation of facilities which may result in any discharge into jurisdictional waters of the U.S. and/or state.	Does not appear to be applicable as no surface water is in the vicinity of the site.
90 Day Accumulation Rule for Hazardous Waste	40 CFR Part 262.34	S	Allows generators of hazardous waste to store and treat hazardous waste at the generation site for up to 90 days in tanks, containers and containment buildings without having to obtain a RCRA hazardous waste permit.	Potentially applicable to remedial alternatives that involve the storing or treating of hazardous materials on-site.
Rivers and Harbors Act, Sections 9 & 10	33 USC 401 and 403; 33 CFR Parts 320-330	S	Prohibits unauthorized obstruction or alteration of navigable waters of the U.S. (dredging, fill, cofferdams, piers, etc.). Requirements for permits affecting navigable waters of the U.S.	Does not appear to be applicable as no rivers or harbors are in the vicinity of the site.
Land Disposal Facility Notice in Deed	40 CFR Parts 264 and 265 Sections 116-119(b)(1)	S	Establishes provisions for a deed notation for closed hazardous waste disposal units, to prevent land disturbance by future owners.	The regulations are potentially applicable because closed areas may be similar to closed RCRA units.

Table 2-2

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Potential Action-Specific SCGs

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/ Remedial Action
RCRA - General Standards	40 CFR Part 264.111	S	General performance standards requiring minimization of need for further maintenance and control; minimization or elimination of post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products. Also requires decontamination or disposal of contaminated equipment, structures and soils.	Decontamination actions and facilities will be constructed for remedial activities and disassembled after completion.
Standards Applicable to Transporters of Applicable Hazardous Waste - RCRA Section 3003	40 CFR Parts 170-179, 262, and 263	S	Establishes the responsibility of off-site transporters of hazardous waste in the handling, transportation and management of the waste. Requires manifesting, recordkeeping and immediate action in the event of a discharge.	These requirements will be applicable to any company(s) contracted to transport hazardous material from the site.
United States Department of Transportation (USDOT) Rules for Transportation of Hazardous Materials	49 CFR Parts 107 and 171.1 - 172.558	S	Outlines procedures for the packaging, labeling, manifesting and transporting of hazardous materials.	These requirements will be applicable to any company(s) contracted to transport hazardous material from the site.
Clean Air Act-National Ambient Air Quality Standards	40 CFR Part 60	S	Establishes ambient air quality standards for protection of public health.	Remedial operations will be performed in a manner that minimizes the production of benzene and particulate matter.
USEPA-Administered Permit Program: The Hazardous Waste Permit Program	RCRA Section 3005; 40 CFR Part 270.124	S	Covers the basic permitting, application, monitoring and reporting requirements for off-site hazardous waste management facilities.	Any off-site facility accepting hazardous waste from the site must be properly permitted. Implementation of the site remedy will include consideration of these requirements.

Table 2-2

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Potential Action-Specific SCGs

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/ Remedial Action
Land Disposal Restrictions	40 CFR Part 368	S	Restricts land disposal of hazardous wastes that exceed specific criteria. Establishes Universal Treatment Standards (UTSs) to which hazardous waste must be treated prior to land disposal.	Excavated soils that display the characteristic of hazardous waste or that are decharacterized after generation must be treated to 90% constituent concentration reduction capped at 10 times the UTS.
RCRA Subtitle C	40 U.S.C. Section 6901 et seq.; 40 CFR Part 268	S	Restricts land disposal of hazardous wastes that exceed specific criteria. Establishes UTSs to which hazardous wastes must be treated prior to land disposal.	Potentially applicable to remedial activities that include the dredging and disposal of soil from the site.
New York State				
Use and Protection of Waters Program	6 NYCRR Part 608	S	Protection of waters permit program regulates: 1) any disturbance of the bed or banks of a protected stream or water course; 2) construction and maintenance of dams; and 3) excavation or fill in navigable waters of the State.	Does not appear to be applicable as no surface water is in the vicinity of the site.
Discharges to Public Waters	New York State Environmental Conservation Law, Section 71-3503	S	Provides that a person who deposits gas tar, or the refuse of a gas house or gas factory, or offal, refuse, or any other noxious, offensive, or poisonous substances into any public waters, or into any sewer or stream running or entering into such public waters, is guilty of a misdemeanor.	During the remedial activities, MGP-impacted materials will not be deposited into public waters or sewers.
New York Hazardous Waste Management System - General	6 NYCRR Part 370	S	Provides definitions of terms and general instructions for the Part 370 series of hazardous waste management.	Hazardous waste is to be managed according to this regulation.

Table 2-2

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Potential Action-Specific SCGs

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/ Remedial Action
Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	S	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 371-376.	Applicable for determining if soil generated during implementation of remedial activities are hazardous wastes. These regulations do not set cleanup standards, but are considered when developing remedial alternatives.
Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities	6 NYCRR Part 372	S	Provides guidelines relating to the use of the manifest system and its recordkeeping requirements. It applies to generators, transporters and facilities in New York State.	This regulation will be applicable to any company(s) contracted to do treatment work at the site or to transport or manage hazardous material generated at the site.
New York Regulations for Transportation of Hazardous Waste	6 NYCRR Part 372.3 a-d	S	Outlines procedures for the packaging, labeling, manifesting and transporting of hazardous waste.	These requirements will be applicable to any company(s) contracted to transport hazardous material from the site.
Waste Transporter Permits	6 NYCRR Part 364	S	Governs the collection, transport and delivery of regulated waste within New York State.	Properly permitted haulers will be used if any waste materials are transported off-site.
NYSDEC Technical and Administrative Guidance Memorandums (TAGMs)	NYSDEC TAGMs	G	TAGMs are NYSDEC guidance that are to be considered during the remedial process.	Appropriate TAGMs will be considered during the remedial process.
New York Regulations for Hazardous Waste Management Facilities	6 NYCRR Part 373.1.1 - 373.1.8	S	Provides requirements and procedures for obtaining a permit to operate a hazardous waste treatment, storage and disposal facility. Also lists contents and conditions of permits.	Any off-site facility accepting waste from the site must be properly permitted.

Table 2-2

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Potential Action-Specific SCGs

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/ Remedial Action
Management of Soil and Sediment Contaminated With Coal Tar From Former Manufactured Gas Plants	NYSDEC Program Policy	G	Purpose of the guidance is to facilitate the permanent treatment of soil contaminated with coal tar from the sites of former MGPs.	Policy will be considered for D018 hazardous and non-hazardous soil removed during removal activities.
Land Disposal of a Hazardous Waste	6 NYCRR Part 376	S	Restricts land disposal of hazardous wastes that exceed specific criteria.	New York defers to USEPA for UTS/LDR regulations.
NYSDEC Guidance on the Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants	TAGM 4061(2002)	G	Outlines the criteria for conditionally excluding coal tar waste and impacted soils from former MGPs which exhibit the hazardous characteristic of toxicity for benzene (D018) from the hazardous waste requirements of 6 NYCRR Parts 370 - 374 and 376 when destined for thermal treatment.	This guidance will be used as appropriate in the management of MGP-impacted soil and coal tar waste generated during the remedial activities.
National Pollutant Discharge Elimination System (NPDES) Program Requirements, Administered Under New York State Pollution Discharge Elimination System (SPDES)	40 CFR Parts 122 Subpart B, 125, 301, 303, and 307 (Administered under 6 NYCRR 750-758)	S	Establishes permitting requirements for point source discharges; regulates discharge of water into navigable waters including the quantity and quality of discharge.	Does not appear to be applicable as no navigable water is in the vicinity of the site.

Table 2-3

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Potential Location-Specific SCGs

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/ Remedial Action
Federal				
National Environmental Policy Act Executive Orders 11988 and 11990	40 CFR 6.302; 40 CFR Part 6, Appendix A	S	Requires federal agencies, where possible, to avoid or minimize adverse impact of federal actions upon wetlands/floodplains and enhance natural values of such. Establishes the "no-net-loss" of waters/wetland area and/or function policy.	To be considered if remedial activities are conducted within the floodplain or wetlands.
CWA Section 404	33 USC 1344, Section 404; 33 CFR Parts 320-330; 40 CFR Part 230	S	Discharge of dredge or fill materials into waters of the U.S., including wetlands, are regulated by the USACE.	Does not appear to be applicable as no surface water or wetlands are in the vicinity of the site.
Fish and Wildlife Coordination Act	16 USC 661; 40 CFR 6.302	S	Actions must be taken to protect fish or wildlife when diverting, channeling or otherwise modifying a stream or river.	Does not appear to be applicable as no streams or rivers are in the vicinity of the site.
Historical and Archaeological Data Preservation Act	16 USC 469a-1	S	Provides for the preservation of historical and archaeological data that might otherwise be lost as the result of alteration of the terrain.	The National Register of Historic Places website indicated no records present for historical sites in the immediate vicinity of the MGP site.
National Historic and Historical Preservation Act	16 USC 470; 36 CFR Part 65; 36 CFR Part 800	S	Requirements for the preservation of historic properties.	The National Register of Historic Places website indicated no records present for historical sites in the immediate vicinity of the MGP site.
Rivers and Harbors Act	33 USC 401/403	S	Prohibits unauthorized obstruction or alteration of navigable waters of the U.S. (dredging, fill, cofferdams, piers, etc.). Requirement for permits affecting navigable waters of the U.S.	Does not appear to be applicable as no navigable water is in the vicinity of the site.
Hazardous Waste Facility Located on a Floodplain	40 CFR Part 264.18(b)	S	Requirements for a treatment, storage and disposal (TSD) facility built within a 100-year floodplain.	Hazardous waste TSD activities (if any) will be designed to comply with applicable requirements cited in this regulation.

Table 2-3

New York State Electric and Gas Corporation
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Potential Location-Specific SCGs

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/ Remedial Action
Endangered Species Act	16 USC 1531 et seq.; 50 CFR Part 200; 50 CFR Part 402	S	Requires federal agencies to confirm that the continued existence of any endangered or threatened species and their habitat will not be jeopardized by a site action.	Does not appear to be applicable as no endangered species were identified during the Fish and Wildlife Resource Impact Analysis.
Floodplains Management and Wetlands Protection	40 CFR 6 Appendix A	S	Activities taking place within floodplains and/or wetlands must be conducted to avoid adverse impacts and preserve beneficial value. Procedures for floodplain management and wetlands protection provided.	To be considered if remedial activities are conducted within the floodplain or wetlands.
New York State				
New York State Floodplain Management Development Permits	6 NYCRR Part 500	S	Provides conditions necessitating NYSDEC permits and provides definitions and procedures for activities conducted within floodplains.	Does not appear to be applicable as the site is not located within a 100-year floodplain.
New York State Freshwater Wetlands Act	ECL Article 24 and 71; 6 NYCRR Parts 662-665	S	Activities in wetlands areas must be conducted to preserve and protect wetlands.	Does not appear to be applicable as the site is not located in a wetlands area.
New York State Parks, Recreation, and Historic Preservation Law	New York Executive Law Article 14;	S	Requirements for the preservation of historic properties.	The National Register of Historic Places website indicated no records present for historical sites in the immediate vicinity of the MGP site.
Use and Protection of Waters Program	6 NYCRR Part 608	S	Protection of waters permit program regulates: 1) any disturbance of the bed or banks of a protected stream or water course; 2) construction and maintenance of dams; and 3) excavation or fill in navigable waters of the state.	Does not appear to be applicable as no surface water is in the vicinity of the site.

Table 2-3

New York State Electric and Gas Corporation
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Elmira, New York

Potential Location-Specific SCGs

Regulation	Citation	Potential Standard (S) or Guidance (G)	Summary of Requirements	Applicability to the Remedial Design/ Remedial Action
Endangered & Threatened Species of Fish and Wildlife	6 NYCRR Part 182	S	Identifies endangered and threatened species of fish and wildlife in New York.	Does not appear to be applicable as no endangered species were identified during the Fish and Wildlife Resource Impact Analysis
New York Preservation of Historic Structures or Artifacts	New York State Historic Preservation Act, Section 14.09	S	Requirements for preservation of historical/ archeological artifacts.	The National Register of Historic Places website indicated no records present for historical sites in the immediate vicinity of the MGP site.
Floodplain Management Criteria for State Projects	6 NYCRR Part 502	S	Establishes floodplain management practices for projects involving state-owned and state-financed facilities.	Does not appear to be applicable as the site is not located within a 100-year floodplain.
Local				
Local Building Permits	N/A	S	Local authorities may require a building permit for any permanent or semi-permanent structure, such as an on-site water treatment system building or a retaining wall.	Substantive provisions are potentially applicable to remedial activities that require construction of permanent or semi-permanent structures.

Table 4-1

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Technology Screening Evaluation for Impacted Subsurface Soil

General Response Action	Technology Type	Technology Process Option	Description of Option/Comments	Effectiveness	Implementability	Relative Cost	Retained for Further Analysis?
No Action	No Action	No Action	Alternative would not include any active remedial action. A No Action alternative serves as a baseline for comparison of the overall effectiveness of other remedial alternatives. Consideration of a No Action alternative is required by the NCP and USEPA.	Maintenance of the existing surface cover would not be performed. Would not achieve RAOs for subsurface soil. May not achieve RAO for continued protection against potential exposure to subsurface soil containing COCs.	Implementable	Low	Yes
Institutional Controls	Institutional Controls	Governmental Controls, Proprietary Controls, Enforcement and Permit Controls, Informational Devices	Institutional controls would include legal and/or administrative controls that mitigate the potential for exposure to impacted soils and/or jeopardize the integrity of a remedy. Examples of potential institutional controls include establishing land use restrictions, health and safety requirements for subsurface activities, and restrictions on groundwater use and/or extraction.	This option would not meet the RAOs for remediating, to the extent practical, areas containing sources of MGP-related NAPLs, and/or reduce, to the extent practicable, off-site migration of NAPLs. This option could reduce potential exposures, and may be effective when combined with other process options.	Implementable	Low	Yes
Surface Controls	Surface Controls	Maintain Existing Surface Materials	The existing surface cover would be maintained to achieve the RAO of providing continued protection against potential exposure to subsurface soils containing COCs.	Current and future use of site is anticipated to be for parking or high-traffic storage area; therefore, considered effective.	Easily implementable. Resources to maintain the existing cover are readily available.	Low	Yes
In-Situ Containment/ Controls	Capping	Clay/Soil Cap	Placing and compacting clay material or soil material over impacted soil.	May reduce the mobility of chemical constituents by reducing infiltration; would not reduce toxicity or volume of impacts, or further off-site migration of NAPLs. Current and future use of site is a parking lot or high-traffic storage area; therefore, long-term effectiveness is diminished.	Implementable. Equipment and materials necessary to construct the cap are readily available.	Moderate capital and O&M costs.	No
		Asphalt/Concrete Cap	Application of a layer of asphalt or concrete over impacted soils.	May reduce the mobility of chemical constituents by reducing infiltration; would not reduce toxicity or volume of impacts, or further off-site migration of NAPLs. Asphalt concrete cap is consistent with current and future site uses. Long-term effectiveness requires ongoing maintenance.	Implementable. Equipment and materials necessary to construct the cap are readily available.	Moderate capital and O&M costs.	No
		Multi-Media Cap	Application of a combination of clay/soils and synthetic membrane(s) over impacted soil.	May reduce the mobility of chemical constituents by reducing infiltration; would not reduce toxicity or volume of impacts, or further off-site migration of NAPLs. Current and future use of site is a parking lot or high-traffic area; therefore, long-term effectiveness is diminished.	Implementable. Equipment and materials necessary to construct the cap are readily available.	High capital and O&M costs.	No

Table 4-1

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Technology Screening Evaluation for Impacted Subsurface Soil

General Response Action	Technology Type	Technology Process Option	Description of Option/Comments	Effectiveness	Implementability	Relative Cost	Retained for Further Analysis?
In-Situ Containment/ Controls (Cont'd.)	Containment	Sheetpile	Steel sheetpiles are driven into the subsurface to contain impacted soils and NAPLs. The sheetpile wall is typically keyed into a confining unit and could be permeable or impermeable to groundwater flow.	Effective for reducing the migration of COCs and NAPL. May help achieve RAOs when combined with treatment/removal technology.	Implementable. Equipment and materials necessary to install sheetpile barriers are readily available. Potential subsurface obstructions may hinder technology use.	High capital and O&M costs.	No
		Slurry Walls	Involves excavating a trench and adding a slurry (e.g., soil/cement-bentonite mixture) to control migration of subsurface soils, groundwater and NAPL from an area. Slurry walls are typically keyed into a low permeability unit (e.g., an underlying silt/clay layer).	Effective for reducing the migration of groundwater, COCs, and NAPL. May help achieve RAOs when combined with treatment/removal technology.	Implementable. Equipment and materials required to install slurry walls are readily available. Presence of underground MGP structures may hinder technology use.	High capital and O&M costs.	No
In-Situ Treatment	Immobilization	Solidification/ Stabilization	Addition of material to the impacted soil that limits the solubility or mobility of the constituents present. Involves treating soil to produce a stable, non-leachable material, that physically or chemically locks the constituents within the solidified matrix.	Overall effectiveness of this process would need to be evaluated during a bench-scale treatability study. Underground structures and obstructions would need to be removed.	Potentially implementable. Solidification/ stabilization materials are readily available. Underground structures would hinder technology use. Technology may alter groundwater patterns and affect current conditions of the dissolved plume and NAPL migration.	Moderate capital and O&M costs.	Yes
	Extraction	Dynamic Underground Stripping and Hydrous Pyrolysis/Oxidation (DUS/HPO)	Steam is injected into the subsurface to mobilize contaminants and NAPLs. The mobilized contaminants are captured and constituents are recondensed, collected, and treated. In addition, HPO can degrade contaminants in subsurface heated zones. In most cases, this technology requires long-term operation and maintenance of on-site injection, collection and/or treatment systems.	This option would require a pilot scale study to determine effectiveness. Underground structures and obstructions would need to be removed prior to implementation. Mobilization of dissolved plume a concern.	Potentially implementable. Process may result in uncontrolled NAPL migration. Limited space for vapor recovery system and treatment. Presence of underground MGP structures may hinder technology use.	High	No

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Technology Screening Evaluation for Impacted Subsurface Soil

General Response Action	Technology Type	Technology Process Option	Description of Option/Comments	Effectiveness	Implementability	Relative Cost	Retained for Further Analysis?
In-Situ Treatment (cont.)	Chemical Treatment	Chemical Oxidation	Oxidizing agents are added to oxidize and reduce the mass of organic constituents *In-situ* chemical oxidation involves the introduction of chemicals such as ozone, hydrogen peroxide, magnesium peroxide, sodium persulfate or potassium permanganate. A pilot study would be required to evaluate/determine oxidant application requirements. Large amounts of oxidizing agents would be needed to oxidize NAPL.	Would require multiple treatments of chemicals to reduce constituents. May not be a cost effective means to achieve the RAOs. Time requirements may not be acceptable for site.	Implementable. Equipment and materials necessary to inject/apply oxidizing agents are readily available. May require special provisions for storage of process chemicals.	High capital and O&M costs.	No
	Biological Treatment	Biodegradation	Natural biological and physical processes that, under favorable conditions, act without human intervention to reduce the mass, volume, concentration, toxicity, and/or mobility of COCs. This process relies on long-term monitoring to demonstrate the reduction of impacts.	Less effective for heavier, more condensed PAHs; not effective for NAPLs; would not achieve RAOs in an acceptable time frame.	Implementable.	Low Capital and Moderate O&M costs.	No
		Enhanced Biodegradation	Addition of amendments (e.g., oxygen, nutrients) and controls to the subsurface to enhance indigenous microbial populations to improve the rate of natural degradation.	Less effective for heavier, more condensed PAHs; not effective for NAPLs.	Implementable	Low Capital and Moderate O&M costs.	No
		Biosparging	Air/oxygen injection wells are installed within the impacted regions to enhance biodegradation of constituents by increasing oxygen availability. Low-flow injection technology may be incorporated. This technology requires long-term monitoring.	Access to areas that would require injection wells for this process option to be effective is limited, therefore it is not effective as a stand-alone option. Could help to reduce toxicity, mobility, and volume of dissolved constituents when combined with other process options.	Implementable. Equipment capable of installing wells is readily available.	Low Capital and Moderate O&M costs.	No
Removal	Excavation	Excavation	Physical removal of impacted soil. Typical excavation equipment would include backhoes, loaders, and/or dozers. Temporary structures and extraction wells may be used to lower the groundwater to create "dry" areas to allow use of typical excavation equipment to physically remove soil.	Proven process for effectively removing impacted soil.	Implementable. Equipment capable of excavating the soil is readily available.	High capital cost and low O&M costs.	Yes
Ex-Situ On-Site Treatment	Immobilization	Solidification/ Stabilization	Addition of material to the removed soil that limits the solubility or mobility of the constituents present. Involves treating soil to produce a stable, non-leachable material, that physically or chemically locks the constituents within the solidified matrix.	Proven process for effectively reducing mobility and toxicity of organic and select inorganic constituents. Overall effectiveness of this process would need to be evaluated during a bench-scale study. Timeline requirements associated with on-site treatment may not be feasible.	Implementable. Solidification/ stabilization materials are readily available. Space to perform treatment technology is limited.	High capital and O&M costs.	No

Table 4-1

New York State Electric and Gas Corporation
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Technology Screening Evaluation for Impacted Subsurface Soil

General Response Action	Technology Type	Technology Process Option	Description of Option/Comments	Effectiveness	Implementability	Relative Cost	Retained for Further Analysis?
Ex-Situ On-Site Treatment (Cont'd.)	Extraction	Low Temperature Thermal Desorption	Process by which soils containing organics with boiling point temperatures less than 800° Fahrenheit are excavated, conditioned, and heated; the organic compounds are desorbed from the soils into an induced airflow. The resulting gas is treated either by condensation and filtration or by thermal destruction. Treated soils are returned to the subsurface.	Proven process for effectively addressing organic constituents. The efficiency of the system and rate of removal of organic constituents would require evaluation during bench-scale and/or pilot-scale testing. Timeline requirements associated with on-site treatment may limit feasibility of process.	Implementable. Treatment facilities are available. Space to perform treatment technology is limited.	Moderate capital and O&M costs.	No
	Thermal Destruction	Incineration	Use of a mobile incineration unit installed on-site for high temperature thermal destruction of the organic compounds present in the media. Soils are excavated and conditioned prior to incineration. Treated soils are returned to the subsurface.	Proven process for effectively addressing organic constituents. The efficiency of the system and rate of removal of organic constituents would need to be verified during bench-scale and/or pilot-scale testing. Timeline requirements associated with on-site treatment may not meet needs of property.	Not implementable due to limited number of treatment facilities. Space to perform treatment technology is limited.	High capital and O&M costs.	No
Off-Site Treatment and/or Disposal	Recycle/ Reuse	Asphalt Concrete Batch Plant	Soil is used as a raw material in asphalt concrete paving mixtures. The impacted soil is transported to an offsite asphalt concrete facility and can replace part of the aggregate and asphalt concrete fraction. The hot-mix process melts asphalt concrete prior to mixing with aggregate. During the cold-mix process, aggregate is mixed at ambient temperature with an asphalt concrete/water emulsion. Organics and inorganics are bound in the asphalt concrete. Some organics may volatilize in the hot-mix.	Effective for treating organics and inorganics through volatilization and/or encapsulation. Thermal pretreatment may be required to prevent leaching. No long-term data available.	Potentially Implementable. Soil may require conditioning with clean soil to achieve appropriate consistency. Permitted facilities and demand are limited. Screening and disposal of off-spec. materials can be costly.	Moderate capital costs.	Yes
		Brick/Concrete Manufacture	Soil is used as a raw material in manufacture of bricks or concrete. Heating in ovens during manufacture volatilizes organics and some inorganics. Other inorganics are bound in the product.	Effective for treating organics and inorganics through volatilization and/or vitrification. A bench-scale/pilot study may be necessary to determine effectiveness.	Potentially Implementable.	Moderate-high capital costs.	Yes
		Co-Burn in Utility Boiler	Soil is blended with feed coal to fire a utility boiler used to generate steam. Organics are destroyed.	Effective for treating organic constituents. Soil would be blended with coal prior to burning. Overall effectiveness of this process would need to be evaluated during a trial burn.	Permitted facilities available for burning MGP soils are limited.	Moderate capital costs.	Yes

Table 4-1

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Technology Screening Evaluation for Impacted Subsurface Soil

General Response Action	Technology Type	Technology Process Option	Description of Option/Comments	Effectiveness	Implementability	Relative Cost	Retained for Further Analysis?
Off-Site Treatment and/or Disposal (Cont'd.)	Extraction	Low Temperature Thermal Desorption	Process by which soils containing organics with boiling point temperatures less than 800^{o} Fahrenheit are heated and the organic compounds are desorbed from the soils into an induced airflow. The resulting gas is treated either by condensation and filtration or by thermal destruction.	Proven process for effectively addressing organic constituents.	Implementable. Treatment facilities are available.	Moderate capital costs.	Yes
	Disposal	Solid Waste Landfill	Disposal of impacted soil in an existing permitted non-hazardous landfill.	Proven process that can effectively achieve the RAOs for non-hazardous solid waste.	Implementable	Moderate capital costs.	Yes
		RCRA Landfill	Disposal of impacted soil in an existing RCRA permitted landfill facility.	Proven process that can effectively achieve the RAOs for hazardous waste.	Implementable	Moderate capital costs.	Yes

Note:
1. Shading indicates that technology process has not been retained for development of a remedial alternative.

Table 4-2

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira , New York

Technology Screening Evaluation for Impacted Groundwater

General Response Action	Technology Type	Technology Process Option	Description	Effectiveness	Implementability	Relative Cost	Retained for Further Analysis?
No Action	No Action	No Action	Alternative would not include any active remedial action. A No Action alternative serves as a baseline for comparison of the overall effectiveness of other remedial alternatives. Consideration of a No Action alternative is required by the NCP and USEPA.	Would not achieve the RAOs for groundwater in an acceptable time frame.	Implementable	Low	Yes
Institutional Controls	Institutional Controls	Governmental Controls, Proprietary Controls, Enforcement and Permit Controls, Informational Devices	Institutional controls would include legal and/or administrative controls that mitigate the potential for exposure to impacted materials and/or jeopardize the integrity of a remedy. Examples of potential institutional controls include establishing land use restrictions, health and safety requirements for subsurface activities, and restrictions on groundwater use and/or extraction.	May be effective for reducing the potential for human exposure. This option would not meet the RAO for restoring, to the extent practicable, the quality of groundwater in the sand and gravel aquifer. This option may be effective when combined with other process options.	Implementable	Low	Yes
In-Situ Treatment	Biological Treatment	Monitored Natural Attenuation (MNA)	Natural biological, chemical and physical processes that under favorable conditions, act without human intervention to reduce the mass, volume, concentration, toxicity and mobility of chemical constituents. This process relies on long-term monitoring to demonstrate the reduction of impacts caused by chemical constituents.	A preliminary study of MNA presented in the SRI Report indicated that groundwater at the site contains several naturally-occurring fate and transport processes that contribute to naturally attenuating concentrations of constituents including advection hydrodynamic dispersion, dilution, hydrophobic sorption, and natural in-situ biodegradation. Could achieve RAOs over extended period of time.	Easily implemented. Would require monitoring to demonstrate reduction of impacts.	Low Capital and O&M costs.	Yes
		Oxygen Enhancement	Addition of amendments (e.g., nutrients, oxygen) to the subsurface to enhance indigenous microbial populations to improve the rate of natural biodegradation.	Could achieve RAOs over extended period of time. Preliminary study indicates that natural attenuation appears to be occurring at the site.	Easily implemented. Would require monitoring to demonstrate reduction of COCs.	Low Capital and Moderate O&M costs.	Yes
		Biosparging	Air/oxygen injection wells are installed within the dissolved plume to enhance biodegradation of constituents by increasing oxygen availability. Low-flow injection technology may be incorporated. This technology requires long-term monitoring.	Access to areas that would require injection wells for this process option to be effective is limited, therefore not effective as a stand-alone option. Could help to reduce toxicity, mobility, and volume of dissolved constituents when combined with other process options.	Implementable. Equipment capable of installing wells is readily available.	Low Capital and Moderate O&M costs.	No
	Chemical Treatment	Chemical Oxidation	Oxidizing agents are added to oxidize and reduce the mass of organic constituents. *In-situ* chemical oxidation involves the introduction of chemicals such as ozone, hydrogen peroxide, magnesium peroxide, sodium persulfate, or potassium permanganate. A bench scale treatability study would be required to evaluate/estimate the amount of oxidizing agent. Large amounts of oxidizing agents are needed to oxidize NAPL.	Would require long-term treatment to reduce constituents unless combined with source removal technology. May not be a cost effective means to achieve the RAOs. Access to areas that would require injection wells for this process option to be effective is limited.	Implementable. Equipment and materials necessary to inject/apply oxidizing agents are readily available. May require special provisions for storage of process chemicals.	High Capital and O&M costs.	No

Table 4-2

New York State Electric and Gas Corporation
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Technology Screening Evaluation for Impacted Groundwater

General Response Action	Technology Type	Technology Process Option	Description	Effectiveness	Implementability	Relative Cost	Retained for Further Analysis?
In-Situ Treatment (Cont'd.)	Extraction	Dynamic Underground Stripping and Hydrous Pyrolysis/Oxidation (DUS/HPO)	Steam is injected into the subsurface to mobilize contaminants and NAPLs. The mobilized contaminants are captured and constituents are recondensed, collected and treated. In addition, HPO can degrade contaminants in subsurface heated zones. In most cases, this technology requires long-term operation and maintenance of on-site injection, collection, and/or treatment systems.	This option would require a pilot scale study to determine effectiveness. Process may result in NAPL and/or dissolved plume migration.	Potentially implementable. Limited space for vapor recovery system and treatment. Presence of underground MGP structures may hinder/impede technology use.	High	No
In-Situ Containment/ Controls	Hydraulic Control	Groundwater Extraction Using Recovery Wells	Provide hydraulic control across dissolved plume by pumping and treating groundwater and NAPL from wells and/or drains. Monitoring wells are also used to determine whether required hydraulic controls have been obtained. Typically requires extensive design/testing to determine required hydraulic gradients and feasibility of achieving those gradients.	Proven process for effectively containing dissolved groundwater plume; however, plume appears to be stabilized. Access to locations for installation of recovery wells is limited. Would require pumping and treating large quantities of water over long periods of time. Stability of NAPL plume is unknown; however, hydraulic control may not affect NAPL migration, therefore may not be effective.	Not implementable. Materials and equipment required to install extraction wells are readily available. Access for well installation and space to perform water treatment is limited.	High Capital and O&M costs.	No
		Slurry Walls	Involves excavating a trench and adding a slurry (e.g., soil/cement-bentonite mixture) to control subsurface groundwater and NAPL flow into or out of an area (e.g., mitigate the potential for NAPL migration). Slurry walls are typically keyed into a low permeability unit (e.g., an underlying silt/clay layer).	Effective for reducing the migration of chemical constituents; however, dissolved plume appears to be stabilized.	Not implementable due to site logistics. Access for slurry wall installation and space to perform water treatment is limited.	High Capital and O&M costs.	No
Removal	Groundwater and/or NAPL Extraction	Pump and Treatment using Vertical Wells	Vertical wells are installed to recover groundwater and/or NAPL for treatment/disposal.	Effective, but inefficient for recovery/treatment of dissolved plume and NAPL. Access to locations for installation of recovery wells is limited. Would require pumping and treating large quantities of water over long periods of time. Implementation of this process could achieve the RAOs over a long period of time. Dissolved plume appears to be stabilized.	Not implementable. Space to perform water treatment technology is limited. Public resistance may be high as the site is located near a park.	Moderate Capital and High O&M costs.	No
		Pump and Treatment using Horizontal Wells	Horizontal wells are utilized to replace a series of conventional vertical wells.	Effective for recovering groundwater; however, not effective for NAPL recovery at this location. Subsurface obstructions may inhibit use of this technology.	Not implementable. Space to perform water treatment is limited.	Moderate Capital and High O&M costs.	No

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Technology Screening Evaluation for Impacted Groundwater

General Response Action	Technology Type	Technology Process Option	Description	Effectiveness	Implementability	Relative Cost	Retained for Further Analysis?
Removal (Cont'd.)	Groundwater and/or NAPL Extraction (Cont'd.)	Collection Trenches	A zone of higher permeability material is installed within the desired capture area with a perforated collection laterally placed along the base to direct groundwater to a collection area for treatment and/or disposal.	Potentially effective for recovering groundwater/ NAPL for treatment/disposal.	Not implementable. Space to perform water treatment is limited.	Moderate Capital and High O&M costs.	No
		Passive NAPL Removal	NAPL is passively collected in vertical wells and removed.	Potentially effective for recovering NAPL for treatment/disposal.	Implementable. Space to place the vertical wells is limited.	Low Capital and O&M costs.	Yes
Ex-Situ On-Site Treatment	Chemical Treatment	UV/Oxidation	Extraction of groundwater and treatment using oxidation by subjecting groundwater to ultraviolet light and ozone.	Proven process for effectively treating organic compounds. Use of this process may effectively achieve the RAOs. A bench-scale treatability study may be required to evaluate the efficiency of this process and to make project-specific adjustments to the process. May require special provisions for the storage of process chemicals.	Not implementable due to limited space. Public resistance may be high as the site is located near a park.	High capital and O&M costs.	No
		Chemical Oxidation	Extraction of groundwater and treatment using oxidizing agents. Oxidizing agents are injected into the groundwater treatment train to oxidize and reduce the mass of dissolved organic constituents. Chemical oxidation involves the introduction of chemicals such as ozone, hydrogen peroxide, magnesium peroxide, sodium persulfate or potassium permanganate. Large amounts of oxidizing agents are needed to oxidize NAPL.	A bench-scale treatability study may be required to evaluate the efficiency of this process and to make project-specific adjustments to the process. May require special provisions for the storage of process chemicals.	Not implementable due to limited space. Space to perform water treatment is limited. May require special provisions for storage of process chemicals. Public resistance may be high as the site is located near a park.	High capital and high O&M costs.	No
	Physical Treatment	Carbon Adsorption	Extraction of groundwater and treatment using carbon adsorption. Process by which organic constituents are absorbed to the carbon as groundwater is passed through the carbon.	Effective at removing organic constituents. Use of this treatment process may effectively achieve the RAOs when combined with groundwater extraction.	Implementable, although space is limited.	High capital and O&M costs.	No
		Filtration	Extraction of groundwater and treatment using filtration. Process in which the groundwater is passed through a granular media to removed suspended solids by interception, straining, flocculation, and sedimentation activity within the filter.	Effective pre-treatment process to reduce suspended solids. Use of this process along with other processes that address organic constituents could effectively achieve the RAOs.	Not implementable due to limited space. Disposal of solid wastes will be required.	Low capital and moderate O&M costs.	No

Table 4-2

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Technology Screening Evaluation for Impacted Groundwater

General Response Action	Technology Type	Technology Process Option	Description	Effectiveness	Implementability	Relative Cost	Retained for Further Analysis?
Disposal	Groundwater Disposal	Discharge to a local Publicly Owned Treatment Works (POTW)	Treated or untreated water is discharged to a sanitary sewer and treated at a local POTW facility.	Proven process for effectively disposing of groundwater. Typically requires the least amount of pretreatment because the discharged water will be subjected to additional treatment at the POTW.	Implementable. Equipment and materials necessary to extract, pretreat (if necessary), and discharge the water to the sewer system are readily available. Discharges to the sewer will require a POTW-issued discharge permit. Space to perform water treatment is limited.	High capital and O&M costs.	Yes
		Discharge to a privately owned treatment facility.	Treated or untreated water is collected and transported to a privately owned treatment facility.	Proven process for effectively disposing of groundwater. Typically requires the least amount of pretreatment because the discharged water will be subjected to additional treatment at the disposal facility.	Not implementable. Equipment and materials to pretreat the water at the site are readily available on a commercial basis. Facilities capable of transporting and disposing of the groundwater are available. Treatment would be required prior to discharge. Space to perform water treatment is limited.	High capital and O&M costs.	Yes

Note:
1. Shading indicates that technology process has not been retained for development of a remedial alternative.

Table 5-1

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative S1 - Institutional Controls

Item #	Description	Quantity	Unit	Unit Price	Amount
CAPITAL COSTS					
1	Institutional Controls	1	LS	$50,000	$50,000
				Subtotal Capital Cost	$50,000
				Engineering (15%)	$7,500
				Contingency (25%)	$12,500
				Total Capital Cost	$70,000
OPERATION AND MAINTENANCE (O&M) COSTS					
2	Verification of Institutional Controls and Notifications to NYSDEC	1	LS	$5,000	$5,000
				Subtotal O&M Costs	$5,000
				Contingency (25%)	$1,250
				Total O&M Costs	$6,250
				Present Worth Factor (30 years at 7%)	12.41
				Present Worth O&M Cost	$77,563
				Total Estimated Cost	$147,563
				Rounded to	$150,000

General Notes:

1. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability reserves.
2. This cost estimate was based on 2007 dollars and ARCADIS's past experience and vendor quotes.
3. Present worth is estimated based on a 7% beginning-of-year discount rate (adjusted for inflation) in accordance with OSWER Directive 9355.3-20 "Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis" (USEPA, 1993). It is assumed that "year zero" is 2007.
4. Costs do not include legal fees, permitting, obtaining access, negotiations or agency oversight.

Notes:

1. Institutional controls cost estimate includes administrative costs associated with implementing controls to minimize the potential for human exposure to remaining impacted subsurface soil. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, permit controls and/or informational devices.
2. Annual costs associated with verification of institutional controls include verifying the status of controls and preparing/submitting notification to the NYSDEC to demonstrate that the controls are being maintained and remain effective. This cost estimate includes costs associated with the annual maintenance of the surface cover material.

Table 5-2

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative S2 - Targeted Source of NAPL Removal

Item #	Description	Quantity	Unit	Unit Price	Amount
CAPITAL COSTS					
1	Pre-design Investigation	1	LS	$100,000	$100,000
2	Institutional Controls	1	LS	$50,000	$50,000
3	Mobilization/Demobilization	1	LS	$10,000	$10,000
4	Concrete Pipe Removal	1	LS	$75,000	$75,000
5	Decontamination Pad	1	LS	$10,000	$10,000
6	Excavation Support	22,250	SF	$50	$1,112,500
7	Soil Staging Area	1	LS	$15,000	$15,000
8	Soil Excavation and Handling	4,800	CY	$30	$144,000
9	Groundwater Management	1	LS	$75,000	$75,000
10	Backfill	1,200	CY	$15	$18,000
11	Select Fill	3,600	CY	$35	$126,000
12	Waste Characterization	48	EA	$1,000	$48,000
13	Soil Transportation and Disposal	4,900	Ton	$100	$490,000
14	Debris Transportation and Disposal	500	Ton	$75	$37,500
15	Site Restoration/Surface Cover Replacement	1	LS	$15,000	$15,000
				Subtotal Capital Cost	$2,326,000
				Engineering (15%)	$348,900
				Contingency (25%)	$581,500
				Total Capital Cost	$3,256,400
OPERATION AND MAINTENANCE (O&M) COSTS					
16	Verification of Institutional Controls and Notifications to NYSDEC	1	LS	$5,000	$5,000
				Subtotal O&M Costs	$5,000
				Contingency (25%)	$1,250
				Total O&M Costs	$6,250
				Present Worth Factor (30 years at 7%)	12.41
				Present Worth O&M Cost	$77,563
				Total Estimated Cost	$3,333,963
				Rounded to	$3,340,000

General Notes:

1. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability reserves.
2. This cost estimate was based on 2007 dollars and ARCADIS's past experience and vendor quotes.
3. Present worth is estimated based on a 7% beginning-of-year discount rate (adjusted for inflation) in accordance with OSWER Directive 9355.3-20 "Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis" (USEPA, 1993). It is assumed that "year zero" is 2007.
4. Costs do not include legal fees, permitting, obtaining access, negotiations or agency oversight.

Table 5-2

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative S2 - Targeted Source of NAPL Removal

Notes:

1. Pre-design investigation cost estimate includes labor, equipment and materials necessary to complete a pre-design investigation and confirmation sampling necessary to confirm the proposed limits of the remedial action.
2. Institutional controls cost estimate includes administrative costs associated with implementing controls to minimize the potential for human exposure to remaining impacted subsurface soil. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, permit controls and/or informational devices.
3. Mobilization/demobilization cost estimate includes mobilization and demobilization of labor, equipment and materials necessary to excavate targeted sources of NAPL and implement institutional controls, deed restrictions and site restoration. This cost estimate assumes that the work will be performed without temporary enclosure(s) and associated air treatment system(s).
4. Concrete pipe removal cost estimate includes labor, equipment and materials necessary to excavate, backfill, and dispose of an assumed (100 linear feet) length of the concrete pipe located along the southeastern property boundary. Actual location and extent of excavation to be determined when the remedy for the site is implemented.
5. Decontamination pad cost estimate includes labor, equipment and materials necessary to construct and remove a 30 foot by 15 foot decontamination pad and appurtenances.
6. Excavation support cost estimate includes labor, equipment and materials necessary to install, remove and decontaminate excavation support at each excavation area. Cost estimate assumes that cantilever sheetpiling (no pretrenching and minimal subsurface obstructions), with an embedment depth at 1.5 times the excavation depth (total sheeting depth = excavation depth + embedment depth), would be utilized for excavations depths ranging from 10 to 18 feet below grade and trench boxes would be utilized for excavations shallower than 10 feet deep. The actual sheetpiling depth and excavation support would be determined during excavation design.
7. Soil staging area cost estimate includes labor, equipment and materials to construct a material staging, mixing, and dewatering area consisting of a 12-inch gravel fill layer and geomembrane liner.
8. Soil excavation and handling cost estimate includes labor, equipment and materials necessary to excavate targeted sources of NAPL; handling of removed soil and debris within the staging area and subsequently loading into trucks prior to off-site disposal.
9. Groundwater management cost estimate includes labor, equipment and materials necessary to collect, handle and dispose of liquids from within the excavation areas.
10. Backfill cost estimate includes labor, equipment and materials necessary to place and compact in-place quantity of backfill (assumes 25 percent of excavated material is designated for reuse as backfill).
11. Select fill cost estimate includes labor, equipment and materials necessary to import, place and compact in-place quantity of select fill to backfill the excavation areas.
12. Waste characterization cost estimate includes the analysis of soil samples obtained once per every 100 cubic yards of excavated material destined for off-site treatment/disposal as well as material to be used as backfill. The actual sampling frequency will be determined by generator, receiving disposal facility and heterogeneity of materials.
13. Soil transportation and disposal cost estimate includes transporting stabilized material to an off-site facility for thermal treatment and disposal. The weight of material was based on an assumed 1.5 tons per cubic yard of soil destined for off-site treatment/disposal (volume of soil assumes 10% of excavated material consists of debris that would be screened out separately and processed to a diameter of 8 inches or less).
14. Debris transportation and disposal cost estimate includes transporting screened out debris to a non-hazardous off-site disposal facility. The weight of material was based on an assumed 1.5 tons per cubic yard of screened out debris (volume of debris assumes 10% of excavated material consists of debris that would be screened out separately and processed to a diameter of 8 inches or less).
15. Site restoration/surface cover replacement cost estimate includes all labor, equipment and materials necessary to replace the existing surface cover material in the disturbed areas.

Table 5-2

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative S2 - Targeted Source of NAPL Removal

16. Annual costs associated with verification of institutional controls include verifying the status of controls and preparing/submitting notification to the NYSDEC to demonstrate that the controls are being maintained and remain effective. This cost estimate includes costs associated with the annual maintenance of the surface cover material.

Table 5-3

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative S3 - Removal of NAPL-Impacted Soil and Soil Containing PAHs Greater than 500 mg/kg and BTEX Greater than 10 mg/kg

Item #	Description	Quantity	Unit	Unit Price	Amount
CAPITAL COSTS					
1	Pre-design Investigation	1	LS	$100,000	$100,000
2	Institutional Controls	1	LS	$50,000	$50,000
3	Mobilization/Demobilization	1	LS	$250,000	$250,000
4	Concrete Pipe Removal	1	LS	$75,000	$75,000
5	Decontamination Pad	1	LS	$30,000	$30,000
6	Temporary Fencing	1,000	LF	$15	$15,000
7	Excavation Support	61,600	SF	$55	$3,388,000
8	Soil Staging Area	1	LS	$50,000	$50,000
9	Groundwater Management	1	LS	$150,000	$150,000
10	Soil Excavation and Handling	36,000	CY	$30	$1,080,000
11	Backfill	9,000	CY	$15	$135,000
12	Select Fill	27,000	CY	$35	$945,000
13	Waste Characterization	72	EA	$1,000	$72,000
14	Soil Transportation and Disposal	36,500	Ton	$100	$3,650,000
15	Debris Transportation and Disposal	4,100	Ton	$75	$307,500
16	Site Restoration/Surface Cover Replacement	1	LS	$50,000	$50,000
				Subtotal Capital Cost	$10,347,500
				Engineering (15%)	$1,552,125
				Contingency (25%)	$2,586,875
				Total Capital Cost	$14,486,500
OPERATION AND MAINTENANCE (O&M) COSTS					
17	Verification of Institutional Controls and Notifications to NYSDEC	1	LS	$5,000	$5,000
				Subtotal O&M Costs	$5,000
				Contingency (25%)	$1,250
				Total O&M Costs	$6,250
				Present Worth Factor (30 years at 7%)	12.41
				Present Worth O&M Cost	$77,563
				Total Estimated Cost	$14,564,063
				Rounded to	$14,600,000

General Notes:

1. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability reserves.
2. This cost estimate was based on 2007 dollars and ARCADIS's past experience and vendor quotes.
3. Present worth is estimated based on a 7% beginning-of-year discount rate (adjusted for inflation) in accordance with OSWER Directive 9355.3-20 "Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis" (USEPA, 1993). It is assumed that "year zero" is 2007.
4. Costs do not include legal fees, permitting, obtaining access, negotiations or agency oversight.

Table 5-3

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative S3 - Removal of NAPL-Impacted Soil and Soil Containing PAHs Greater than 500 mg/kg and BTEX Greater than 10 mg/kg

Notes:

1. Pre-design investigation cost estimate includes labor, equipment and materials necessary to complete a pre-design investigation and confirmation sampling necessary to confirm the proposed limits of the remedial action.
2. Institutional controls cost estimate includes administrative costs associated with implementing controls to minimize the potential for human exposure to remaining impacted subsurface soil. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, permit controls and/or informational devices.
3. Mobilization/demobilization cost estimate includes mobilization and demobilization of labor, equipment and materials necessary to excavate, transport and dispose off-site the underground oil and tar separator and soil that contains NAPL and total PAHs and total BTEX concentrations greater than TAGM 4046 criteria (500 mg/kg and 10 mg/kg, respectively) located above and below the groundwater table. This cost estimate assumes that the work will be performed without temporary enclosure(s) and associated air treatment system(s). This cost estimate also includes labor, equipment and materials necessary to locate, identify and markout underground utilities at the site.
4. Concrete pipe removal cost estimate includes labor, equipment and materials necessary to excavate, backfill, and dispose of an assumed (100 linear feet) length of the concrete pipe located along the southeastern property boundary. Actual location and extent of excavation to be determined when the remedy for the site is implemented.
5. Decontamination pad cost estimate includes labor, equipment and materials necessary to construct and remove a 60-foot by 30-foot decontamination pad and appurtenances. The decontamination pad would consist of 20-mil high density polyethylene (HDPE) with a 6-inch gravel drainage layer placed over the HDPE liner, surrounded by a 1-foot high berm and sloped to a collection sump for the collection of decontamination water.
6. Temporary fencing cost estimate includes labor, equipment and materials necessary to install and remove temporary fencing around the subsurface source material area.
7. Excavation support cost estimate includes labor, equipment and materials necessary to install, remove and decontaminate excavation support at each excavation area. Cost estimate assumes that cantilever sheetpiling (no pretrenching and minimal subsurface obstructions), with an embedment depth at 1.5 times the excavation depth (total sheeting depth = excavation depth + embedment depth), would be utilized for excavations depths ranging from 10 to18 feet below grade and trench boxes would be utilized for excavations shallower than 10 feet deep. The actual sheetpiling depth and excavation support would be determined during excavation design.
8. Soil staging area cost estimate includes labor, equipment and materials to construct a material staging, mixing, and dewatering area consisting of a 12-inch gravel fill layer and geomembrane liner.
9. Groundwater management cost estimate includes labor, equipment and materials necessary to collect, handle and dispose of liquids from within the excavation areas.
10. Soil excavation, handling and screening of materials cost estimate includes labor, equipment and materials necessary to remove the underground oil and tar separator and excavate soil that contains visual sheens, NAPL and total PAHs and total BTEX concentrations greater than TAGM 4046 criteria (500 mg/kg and 10 mg/kg, respectively) located above and below the groundwater table; handling of removed soil, debris, and gravel within the staging area and subsequently loading into trucks prior to off-site disposal; and screening excavated soil (excluding gravel) to remove debris larger than 2 inches in diameter. The associated volume estimate is based on information provided by NYSEG, and was multiplied by a factor of 1.5 to account for additional material removed as a result of benching/sloping the excavation areas.
11. Backfill cost estimate includes labor, equipment and materials necessary to place and compact in-place quantity of backfill (assumes 25 percent of excavated material is designated for reuse as backfill).

Table 5-3

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative S3 - Removal of NAPL-Impacted Soil and Soil Containing PAHs Greater than 500 mg/kg and BTEX Greater than 10 mg/kg

12. Select fill cost estimate includes labor, equipment and materials necessary to import, place and compact in-place quantity of select fill to backfill the excavation areas.
13. Waste characterization cost estimate includes the analysis of soil samples obtained once per every 500 cubic yards of excavated material destined for off-site treatment/disposal as well as material to be used as backfill. The actual sampling frequency will be determined by generator, receiving disposal facility and heterogeneity of materials.
14. Soil transportation and disposal cost estimate includes transporting stabilized material to an off-site facility for thermal treatment and disposal. The weight of material was based on an assumed 1.5 tons per cubic yard of soil destined for offsite treatment/disposal (volume of soil assumes 10% of excavated material consists of debris that would be screened out separately and processed to a diameter of 8 inches or less).
15. Debris transportation and disposal cost estimate includes transporting screened out debris to a non-hazardous off-site disposal facility. The weight of material was based on an assumed 1.5 tons per cubic yard of screened out debris (volume of debris assumes 10% of excavated material consists of debris that would be screened out separately and processed to a diameter of 8 inches or less).
16. Site restoration/surface cover replacement cost estimate includes all labor, equipment and materials necessary to replace the existing surface cover material in the disturbed areas.
17. Annual costs associated with verification of Institutional controls include verifying the status of controls and preparing/submitting notification to the NYSDEC to demonstrate that the controls are being maintained and remain effective. This cost estimate includes costs associated with the annual maintenance of the surface cover material.

Table 5-4

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative S4 - In-Situ Solidification/Stabilization and Excavation of Heavily NAPL-Impacted Soil

Item #	Description	Quantity	Unit	Unit Price	Amount
CAPITAL COSTS					
1	Pre-design Investigation	1	LS	$250,000	$250,000
2	Institutional Controls	1	LS	$50,000	$50,000
3	Mobilization/Demobilization	1	LS	$150,000	$150,000
4	Concrete Pipe Removal	1	LS	$75,000	$75,000
5	Decontamination Pad	1	LS	$30,000	$30,000
6	Temporary Fencing	1,000	LF	$15	$15,000
7	Soil Staging Area	1	LS	$35,000	$35,000
				Subtotal Capital Cost	$605,000
CAPITAL COSTS - In-Situ Solidification/Stabilization					
8	Pre-Excavation	2,240	CY	$30	$67,200
9	Jet Grouting	2,240	CY	$525	$1,176,000
10	ISS Treatment	22,400	CY	$80	$1,792,000
11	Spoils Handling	6,720	CY	$30	$201,600
12	Waste Characterization	67	EA	$1,000	$67,200
13	Soil Transportation and Disposal	10,100	ton	$100	$1,010,000
				Subtotal In-Situ Solidification/Stabilization Capital Cost	$4,314,000
CAPITAL COSTS - Excavation					
14	Excavation Support	9,450	SF	$50	$472,500
15	Soil Excavation and Handling	4,500	CY	$30	$135,000
16	Groundwater Management	1	LS	$75,000	$75,000
17	Backfill	1,125	CY	$15	$16,875
18	Select Fill	3,375	CY	$35	$118,125
19	Waste Characterization	45	EA	$1,000	$45,000
20	Soil Transportation and Disposal	4,600	Ton	$100	$460,000
21	Debris Transportation and Disposal	500	Ton	$75	$37,500
22	Site Restoration/Surface Cover Replacement	1	LS	$15,000	$15,000
				Subtotal Excavation Capital Cost	$1,375,000
				Subtotal Capital Cost	$6,294,000
				Engineering (15%)	$944,100
				Contingency (25%)	$1,573,500
				Total Capital Cost	$8,811,600
OPERATION AND MAINTENANCE (O&M) COSTS					
23	Verification of Institutional Controls and Notifications to NYSDEC	1	LS	$5,000	$5,000
				Subtotal O&M Costs	$5,000
				Contingency (25%)	$1,250
				Total O&M Costs	$6,250
				Present Worth Factor (30 years at 7%)	12.41
				Present Worth O&M Cost	$77,563
				Total Estimated Cost	$8,889,163
				Rounded to	$8,900,000

Table 5-4

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative S4 - In-Situ Solidification/Stabilization and Excavation of Heavily NAPL-Impacted Soil

General Notes:

1. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability reserves.
2. This cost estimate was based on 2007 dollars and ARCADIS's past experience and vendor quotes.
3. Present worth is estimated based on a 7% beginning-of-year discount rate (adjusted for inflation) in accordance with OSWER Directive 9355.3-20 "Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis" (USEPA, 1993). It is assumed that "year zero" is 2007.
4. Costs do not include legal fees, permitting, obtaining access, negotiations or agency oversight.

Notes:

1. Pre-design investigation cost estimate includes labor, equipment and materials necessary to complete a pre-design investigation and confirmation sampling necessary to confirm the proposed limits of the remedial action.
2. Institutional controls cost estimate includes administrative costs associated with implementing controls to minimize the potential for human exposure to remaining impacted subsurface soil. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, permit controls and/or informational devices.
3. Mobilization/demobilization cost includes mobilization and demobilization of all labor, equipment and materials necessary to perform in-situ soil stabilization of NAPL-impacted soil above the till layer and excavation/removal of shallow, heavily NAPL-impacted soil. This cost estimate also includes labor, equipment and materials necessary to locate, identify and markout underground utilities at the site.
4. Concrete pipe removal cost estimate includes labor, equipment and materials necessary to excavate, backfill, and dispose of an assumed (100 linear feet) length of the concrete pipe located along the southeastern property boundary. Actual location and extent of excavation to be determined when the remedy for the site is implemented.
5. Decontamination pad cost estimate includes labor, equipment and materials necessary to construct and remove a 60-foot by 30-foot decontamination pad and appurtenances. The decontamination pad would consist of 20-mil high density polyethylene (HDPE) with a 6-inch gravel drainage layer placed over the HDPE liner, surrounded by a 1-foot high berm and sloped to a collection sump for the collection of decontamination water.
6. Temporary fencing cost estimate includes labor, equipment and materials necessary to install and remove temporary fencing around the working area.
7. Soil staging area cost estimate includes labor, equipment and materials to construct an approximate 100-foot by 200-foot material staging area consisting of a 12-inch gravel fill layer bermed and sloped to a sump and covered with a 40-mil HDPE liner. Maintenance costs include inspecting and repairing staging area as necessary and covering staged soil with polyethylene sheeting or odor suppressing foam, as necessary.
8. Pre-excavation cost estimate includes labor, equipment and materials to pre-excavate soils to approximately 10% of the ISS treatment depth.
9. Jet-grouting cost estimate includes labor, equipment and materials necessary to perform jet-grouting to facilitate ISS around subsurface utilities. Jet grouting volume is assumed to be 10% of ISS treatment volume.
10. ISS treatment cost estimate includes all labor, equipment and materials necessary to stabilize/immobilize NAPL-impacted soil above the till layer using ISS technology to depths ranging from 13 to 28 feet bgs. This cost estimate includes the cost for providing mix water that would be used during implementation of the ISS process and water that would be obtained from the on-site municipal water supply. It has been assumed that bench-scale study costs will be included in the Engineering Design.

Table 5-4

New York State Electric and Gas Corporation
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Alternative S4 - In-Situ Solidification/Stabilization and Excavation of Heavily NAPL-Impacted Soil

11. Spoils handling cost estimate includes labor, equipment and materials necessary to manage ISS spoils (i.e., excess material generated during ISS treatment). Soil volume was assumed to be 20% of the ISS treatment volume (10% from the pre-excavation and 10% from the application of ISS) and 100% of the jet-grouting volume.
12. Waste characterization cost estimate includes the analysis of soil samples obtained once per every 100 cubic yards of excavated material destined for off-site treatment/disposal. The actual sampling frequency will be determined by generator, receiving disposal facility and heterogeneity of waste materials.
13. Soil transportation and disposal cost estimate includes all labor, equipment and materials necessary to transport and dispose of ISS spoils as non-hazardous waste at a permitted disposal facility.
14. Excavation support cost estimate includes labor, equipment and materials necessary to install, remove and decontaminate excavation support at each excavation area. Cost estimate assumes that cantilever sheetpiling (no pretrenching and minimal subsurface obstructions), with an embedment depth at 1.5 times the excavation depth (total sheeting depth = excavation depth + embedment depth), would be utilized for excavations depths ranging from 10 to 18 feet below grade and trench boxes would be utilized for excavations shallower than 10 feet deep. The actual sheetpiling depth and excavation support would be determined during excavation design.
15. Soil excavation and handling cost estimate includes labor, equipment and materials necessary to excavate shallow, heavily NAPL-impacted soil and the oil and tar separator area as well as handling of removed soil and debris within the staging area and subsequently loading into trucks prior to off-site disposal.
16. Groundwater management cost estimate includes labor, equipment and materials necessary to collect, handle and dispose of liquids from within the excavation areas. Cost assumes localized sumps and/or dewatering wells would be utilized for one construction season.
17. Backfill cost estimate includes labor, equipment and materials necessary to place and compact in-place quantity of backfill (assumes 25 percent of excavated material would be stockpiled, tested, and reused as backfill).
18. Select fill cost estimate includes labor, equipment and materials necessary to import, place, and compact in-place quantity of select fill to backfill the excavation areas.
19. Waste characterization cost estimate includes the analysis of soil samples obtained once per every 100 cubic yards of excavated material destined for off-site treatment/disposal as well as material to be used as backfill. The actual sampling frequency will be determined by generator, receiving disposal facility and heterogeneity of materials.
20. Soil transportation and disposal cost estimate includes transporting stabilized material to an off-site facility for thermal treatment and disposal. The weight of material was based on an assumed 1.5 tons per cubic yard of soil destined for off-site treatment/disposal (volume of soil assumes 10% of excavated material consists of debris that would be screened out separately and processed to a diameter of 8 inches or less).
21. Debris transportation and disposal cost estimate includes transporting screened out debris to a non-hazardous off-site disposal facility. The weight of material was based on an assumed 1.5 tons per cubic yard of screened out debris (volume of debris assumes 10% of excavated material consists of debris that would be screened out separately and processed to a diameter of 8 inches or less).
22. Site restoration/surface cover replacement cost estimate includes all labor, equipment and materials necessary to replace the existing surface cover material in the disturbed areas.
23. Annual costs associated with verification of institutional controls include verifying the status of controls and preparing/submitting notification to the NYSDEC to demonstrate that the controls are being maintained and remain effective. This cost estimate includes costs associated with the annual maintenance of the surface cover material.

Table 5-5

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative S5 - Removal of Soil Containing Constituents Greater than TAGM 4046 RSCOs

Item #	Description	Quantity	Unit	Unit Price	Amount
CAPITAL COSTS					
1	Pre-design Investigation	1	LS	$100,000	$100,000
2	Mobilization/Demobilization	1	LS	$250,000	$250,000
3	Concrete Pipe Removal	1	LS	$75,000	$75,000
4	Decontamination Pad	1	LS	$100,000	$100,000
5	Temporary Fencing	4,000	LF	$20	$80,000
6	Excavation Support	268,000	SF	$50	$13,400,000
7	Soil Staging Area	1	LS	$100,000	$100,000
8	Groundwater Management	1	LS	$7,500,000	$7,500,000
9	Soil Excavation and Handling	240,000	CY	$30	$7,200,000
10	Backfill	24,000	CY	$15	$360,000
11	Select Fill	216,000	CY	$35	$7,560,000
12	Waste Characterization	480	EA	$1,000	$480,000
13	Soil Transportation and Disposal	291,600	Ton	$55	$16,038,000
14	Debris Transportation and Disposal	32,400	Ton	$75	$2,430,000
				Subtotal Capital Cost	$55,673,000
				Engineering (15%)	$8,350,950
				Contingency (25%)	$13,918,250
				Total Estimated Cost	$77,942,200
				Rounded to	$80,000,000

General Notes:

1. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability reserves.
2. This cost estimate was based on 2007 dollars and ARCADIS's past experience and vendor quotes.
3. Costs do not include legal fees, permitting, obtaining access, negotiations or agency oversight.

Notes:

1. Pre-design investigation cost estimate includes labor, equipment and materials necessary to complete a pre-design investigation and confirmation sampling necessary to confirm the proposed limits of the remedial action.
2. Mobilization/demobilization cost estimate includes mobilization and demobilization of all labor, equipment and materials necessary to excavate, transport and dispose off-site the underground oil and tar separator and soil containing individual constituents greater than their respective TAGM 4046 RSCOs. This cost assumes that the work will be performed without temporary enclosure(s) and associated air treatment system(s). This cost estimate also includes labor, equipment and materials necessary to locate, identify and markout underground utilities at the site.
3. Concrete pipe removal cost estimate includes labor, equipment and materials necessary to excavate, backfill, and dispose of an assumed (100 linear feet) length of the concrete pipe located along the southeastern property boundary. Actual location and extent of excavation to be determined when the remedy for the site is implemented.

Table 5-5

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative S5 - Removal of Soil Containing Constituents Greater than TAGM 4046 RSCOs

4. Decontamination pad cost estimate includes labor, equipment and materials necessary to construct and remove a 60-foot by 30-foot decontamination pad and appurtenances. The decontamination pad would consist of 40-mil high-density polyethylene (HDPE) with a 6-inch gravel drainage layer placed over the HDPE liner, surrounded by a 1-foot high berm and sloped to a collection sump for the collection of decontamination water.
5. Temporary fencing cost estimate includes labor, equipment and materials necessary to install and remove temporary fencing around the working area.
6. Excavation support cost estimate includes labor, equipment and materials necessary to install, remove and decontaminate excavation support at each excavation area. Cost estimate assumes that cantilever sheetpiling (no pretrenching and minimal subsurface obstructions), with an embedment depth at 1.5 times the excavation depth (total sheeting depth = excavation depth + embedment depth), would be utilized for excavations depths ranging from 10 to 40 feet below grade. The actual sheetpiling depth and excavation support would be determined during excavation design.
7. Soil staging area cost estimate includes labor, equipment and materials to construct a material staging, mixing, and dewatering area consisting of a 12-inch gravel fill layer and geomembrane liner.
8. Groundwater management cost estimate includes labor, equipment and materials necessary to collect, handle and dispose of liquids from within the excavation areas. Cost based on installing dewatering points, operation and maintenance of pumps, and associated equipment and materials and operating pumps 24 hours per day, 7 days per week. Costs include constructing a temporary on-site groundwater treatment system including: two 5,000-gallon equalization tanks, oil-water separator, two transfer pump stations, clarifier system, bag filter system, OrganoClay Vessel skid, low-profile air stripper, vapor-phase carbon skid, liquid phase carbon skid, ion exchange resin vessel skid, two 21,000-gallon effluent holding tanks, miscellaneous instrumentation, control system, enclosure, utility installation, miscellaneous electrical, and miscellaneous mechanical.

   Costs include the O&M of a temporary on-site groundwater treatment system including: on-site labor, office administration, vapor-phase carbon changeout (once annually), liquid-phase carbon changeout (once annually), spare parts & miscellaneous expenses, treatment system monitoring, electrical usage, waste disposal of NAPL and a discharge fee to local POTW (assumed disposal of approximately 4.6 million gallons per year at $0.005 per gallon).
9. Soil excavation, handling and screening of materials cost estimate includes labor, equipment and materials necessary to excavate the underground oil and tar separator and soil containing individual constituents greater than their respective TAGM 4046 RSCOs to depths ranging from 10 to 40 feet below grade and transferring excavated soil and debris to the material staging area.
10. Backfill cost estimate includes labor, equipment and materials necessary to place and compact in-place quantity of backfill (assumes 10 percent of excavated material is designated for reuse as backfill).
11. Select fill cost estimate includes labor, equipment and materials necessary to import, place and compact in-place quantity of select fill to backfill the excavation areas.
12. Waste characterization cost estimate includes the analysis of soil samples obtained once per every 500 cubic yards of excavated material destined for off-site treatment/disposal. The actual sampling frequency will be determined by generator, receiving disposal facility and heterogeneity of waste materials.
13. Soil transportation and disposal cost estimate includes transporting stabilized material to an off-site facility for thermal treatment and disposal. The weight of material was based on an assumed 1.5 tons per cubic yard of soil destined for off-site treatment/disposal (volume of soil assumes 10% of excavated material consists of debris that would be screened out separately and processed to a diameter of 8 inches or less).
14. Debris transportation and disposal cost estimate includes transporting screened out debris to a non-hazardous off-site disposal facility. The weight of material was based on an assumed 1.5 tons per cubic yard of screened out debris (volume of debris assumes 10% of excavated material consists of debris that would be screened out separately and processed to a diameter of 8 inches or less).

Table 5-6

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative GW1 - Institutional Controls

Item #	Description	Quantity	Unit	Unit Price	Amount
CAPITAL COSTS					
1	Institutional Controls	1	LS	$50,000	$50,000
				Subtotal Capital Cost	$50,000
				Engineering (15%)	$7,500
				Contingency (25%)	$12,500
				Total Capital Cost	$70,000
OPERATION AND MAINTENANCE (O&M) COSTS					
2	Verification of Institutional Controls and Notifications to NYSDEC	1	LS	$5,000	$5,000
				Subtotal O&M Costs	$5,000
				Contingency (25%)	$1,250
				Total O&M Costs	$6,250
				Present Worth Factor (30 years at 7%)	12.41
				Present Worth O&M Cost	$77,563
				Total Estimated Cost	$147,563
				Rounded to	$150,000

General Notes:

1. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability reserves.
2. This cost estimate was based on 2007 dollars and ARCADIS's past experience and vendor quotes.
3. Present worth is estimated based on a 7% beginning-of-year discount rate (adjusted for inflation) in accordance with OSWER Directive 9355.3-20 "Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis" (USEPA, 1993). It is assumed that "year zero" is 2007.
4. Costs do not include legal fees, permitting, obtaining access, negotiations or agency oversight.

Notes:

1. Institutional controls cost estimate includes administrative costs associated with implementing controls to minimize the potential for human exposure to remaining impacted groundwater. Such institutional controls may include governmental controls, proprietary controls, enforcement tools, permit controls and/or informational devices.
2. Annual costs associated with verification of institutional controls include verifying the status of controls and preparing/submitting notification to the NYSDEC to demonstrate that the controls are being maintained and remain effective.

Table 5-7

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative GW2 - Monitored Natural Attenuation

Item #	Description	Quantity	Unit	Unit Price	Amount
CAPITAL COSTS					
1	Institutional Controls	1	LS	$50,000	$50,000
2	Semi-annual Groundwater Monitoring	2	ea	$10,000	$20,000
3	Laboratory Analysis	2	ea	$14,500	$29,000
4	Prepare Annual Groundwater Monitoring Report	1	LS	$15,000	$15,000
5	Waste Disposal	4	drum	$500	$2,000
				Subtotal Capital Cost	$116,000
				Engineering (15%)	$17,400
				Contingency (25%)	$29,000
				Total Capital Cost	$162,400
OPERATION AND MAINTENANCE (O&M) COSTS					
6	Verification of Institutional Controls and Notifications to NYSDEC	1	LS	$5,000	$5,000
7	Annual Groundwater Monitoring	1	LS	$35,000	$35,000
				Subtotal O&M Costs	$40,000
				Contingency (25%)	$10,000
				Total O&M Costs	$50,000
				Present Worth Factor (30 years at 7%)	12.41
				Present Worth O&M Cost	$620,500
				Total Estimated Cost	$782,900
				Rounded to	$783,000

General Notes:

1. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability reserves.
2. This cost estimate was based on 2007 dollars and ARCADIS's past experience and vendor quotes.
3. Present worth is estimated based on a 7% beginning-of-year discount rate (adjusted for inflation) in accordance with OSWER Directive 9355.3-20 "Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis" (USEPA, 1993). It is assumed that "year zero" is 2007.
4 Costs do not include legal fees, permitting, obtaining access, negotiations or agency oversight.

Notes:

1. Institutional controls cost estimate includes all labor and materials necessary to institute deed restrictions for the site to prevent potential future use of site groundwater.
2. Semi-annual groundwater monitoring cost estimate includes: all labor, equipment, travel, subsistence and materials necessary to conduct semi-annual groundwater and NAPL monitoring for a 1-year period. Groundwater and NAPL monitoring will consist of collecting groundwater samples from 20-24 existing monitoring wells and NAPL recovery wells using low-flow sampling methods. Cost assumes two project level personnel could complete the monitoring activities in 4 work days.

Table 5-7

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

<u>Alternative GW2 - Monitored Natural Attenuation</u>

3. Laboratory analysis cost estimate includes all labor, equipment and materials necessary to submit groundwater samples to an analytical laboratory for analysis for chemical constituents of concern (BTEX compounds and PAHs) and natural attenuation indicator parameters (i.e., total biomass, PAH-degrading indicator compounds, geochemical parameters). Cost assumes standard analytical turnaround time. No costs have been included for data validation.
4. Prepare annual groundwater monitoring report cost estimate includes all labor, equipment and materials necessary to prepare a report summarizing the results of the groundwater and NAPL monitoring activities and the observed trends from the first year of monitored natural attenuation.
5. Waste disposal cost estimate includes all labor, equipment and materials necessary to characterize and dispose of NAPL and groundwater waste material generated during the semi-annual groundwater monitoring activities. Costs assume that the NAPL and groundwater would be disposed of as a non-hazardous waste at an appropriate treatment/disposal facility. Cost assumes two drums of liquid would be generated during each sampling event.
6. Annual costs associated with verification of institutional controls include verifying the status of controls and preparing/submitting notification to the NYSDEC to demonstrate that the controls are being maintained and remain effective.
7. Annual groundwater monitoring cost estimate includes all labor, equipment and materials necessary to conduct annual sampling events, analyze groundwater samples and prepare an annual groundwater monitoring report to summarize the results of the groundwater monitoring activities. This cost estimate also includes containerizing NAPL and groundwater waste materials generated during the sampling activities. This cost estimate also includes transportation of the containerized liquid waste for disposal as a non-hazardous waste at an appropriate treatment/disposal facility.

Table 5-8

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative GW3 - Passive NAPL Recovery

Item #	Description	Quantity	Unit	Unit Price	Amount
CAPITAL COSTS					
1	Institutional Controls	1	LS	$50,000	$50,000
2	Mobilization/Demobilization	1	LS	$15,000	$15,000
3	Decontamination Pad	1	LS	$10,000	$10,000
4	Install NAPL Recovery Wells	6	ea	$10,000	$60,000
5	Miscellaneous Waste Disposal	1	LS	$5,000	$5,000
6	Semi-annual Groundwater Monitoring	2	ea	$10,000	$20,000
7	Laboratory Analysis	2	ea	$14,500	$29,000
8	Prepare Annual Groundwater Monitoring Report	1	LS	$15,000	$15,000
9	Waste Disposal	4	drum	$500	$2,000
				Subtotal Capital Cost	$206,000
				Engineering (15%)	$30,900
				Contingency (25%)	$51,500
				Total Capital Cost	$288,400
OPERATION AND MAINTENANCE (O&M) COSTS					
10	NAPL Monitoring/Recovery	1	LS	$12,000	$12,000
11	Waste Disposal	1	LS	$1,000	$1,000
12	Verification of Institutional Controls and Notifications to NYSDEC	1	LS	$5,000	$5,000
13	Annual Groundwater Monitoring	1	LS	$35,000	$35,000
				Subtotal O&M Costs	$53,000
				Contingency (25%)	$13,250
				Total O&M Costs	$66,250
				Present Worth Factor (30 years at 7%)	12.41
				Present Worth O&M Cost	$822,163
				Total Estimated Cost	$1,110,563
				Rounded to	$1,110,000

General Notes:

1. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability reserves.
2. This cost estimate was based on 2007 dollars and ARCADIS's past experience and vendor quotes.
3. Present worth is estimated based on a 7% beginning-of-year discount rate (adjusted for inflation) in accordance with OSWER Directive 9355.3-20 "Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis" (USEPA, 1993). It is assumed that "year zero" is 2007.

4 Costs do not include legal fees, permitting, obtaining access, negotiations, or agency oversight.

Table 5-8

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative GW3 - Passive NAPL Recovery

Notes:

1. Institutional controls cost estimate includes all labor and materials necessary to institute deed restrictions for the site to prevent potential future use of site groundwater.
2. Mobilization/demobilization cost includes mobilization and demobilization of all labor, equipment and materials necessary to install new wells to facilitate passive recovery of DNAPL from the site.
3. Decontamination pad cost estimate includes labor, equipment and materials necessary to construct and remove a 60-foot by 30-foot decontamination pad and appurtenances. The decontamination pad would consist of 40-mil high density polyethylene (HDPE) with a 6-inch gravel drainage layer placed over the HDPE liner, surrounded by a 1-foot high berm and sloped to a collection sump for the collection of decontamination water.
4. Install NAPL recovery wells cost estimate includes all labor, equipment and materials necessary to install and develop six 4-inch diameter passive NAPL recovery wells up to 60-feet deep.
5. Miscellaneous waste disposal cost estimate is based on disposal of PPE and disposable equipment used during construction/installation of NAPL recovery structures at a facility permitted to accept the waste. Cost estimate includes waste characterization sampling and analysis and assumes that material will be disposed of as non-hazardous waste.
6. Semi-annual groundwater monitoring cost estimate includes: all labor, equipment, travel, subsistence and materials necessary to conduct semi-annual groundwater and NAPL monitoring for a 1-year period. Groundwater and NAPL monitoring will consist of collecting groundwater samples from 20-24 existing monitoring wells and NAPL recovery wells using low-flow sampling methods. Cost assumes two project level personnel could complete the monitoring activities in 4 work days.
7. Laboratory analysis cost estimate includes all labor, equipment and materials necessary to submit groundwater samples to an analytical laboratory for analysis for chemical constituents of concern (BTEX compounds and PAHs) and natural attenuation indicator parameters (i.e., total biomass, PAH-degrading indicator compounds, geochemical parameters). Cost assumes standard analytical turnaround time. No costs have been included for data validation.
8. Prepare annual groundwater monitoring report cost estimate includes all labor, equipment and materials necessary to prepare a report summarizing the results of the groundwater and NAPL monitoring activities and the observed trends from the first year of monitored natural attenuation.
9. Waste disposal cost estimate includes all labor, equipment and materials necessary to characterize and dispose of NAPL and groundwater waste material generated during the semi-annual groundwater monitoring activities. Costs assume that the NAPL and groundwater would be disposed of as a non-hazardous waste at an appropriate treatment/disposal facility. Cost assumes two drums of liquid would be generated during each sampling event.
10. NAPL monitoring/recovery cost estimate includes all labor, equipment and materials necessary to monitor NAPL recovery wells and remove accumulated NAPL, if encountered. Cost estimate assumes NAPL monitoring/recovery will be performed on a quarterly basis. Cost estimate includes preparation of quarterly summary reports for the NAPL monitoring.
11. Waste disposal cost estimate includes all labor, equipment and materials necessary to dispose of waste material generated during O&M activities. Costs assume that waste would be disposed of once per year and would be managed as a hazardous waste. Cost assumes on average one 55-gallon drum of NAPL would require management and disposal per year.
12. Annual costs associated with verification of institutional controls include verifying the status of controls and preparing/submitting notification to the NYSDEC to demonstrate that the controls are being maintained and remain effective.

Table 5-8

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative GW3 - Passive NAPL Recovery

13. Annual groundwater monitoring cost estimate includes all labor, equipment and materials necessary to conduct annual sampling events, analyze groundwater samples and prepare an annual groundwater monitoring report to summarize the results of the groundwater monitoring activities. This cost estimate also includes containerizing NAPL and groundwater waste materials generated during the sampling activities. This cost estimate also includes transportation of the containerized liquid waste for disposal as a non-hazardous waste at an appropriate treatment/disposal facility.

Table 5-9

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative GW4 - NAPL Recovery and Oxygen Enhancement

Item #	Description	Quantity	Unit	Unit Price	Amount
CAPITAL COSTS					
1	Institutional Controls	1	LS	$50,000	$50,000
2	Mobilization/Demobilization	1	LS	$50,000	$50,000
3	Decontamination Pad	1	LS	$20,000	$20,000
4	NAPL Recovery Wells	1,100	LF	$150	$165,000
5	Oxygen Enhancement Wells	300	LF	$200	$60,000
6	Stainless Steel Canisters	20	ea	$260	$5,200
7	Miscellaneous Waste Disposal	1	LS	$5,000	$5,000
8	Waste Disposal	4	drum	$500	$2,000
				Subtotal Capital Cost	$357,200
				Engineering (15%)	$53,580
				Contingency (25%)	$89,300
				Total Capital Cost	$500,080
OPERATION AND MAINTENANCE (O&M) COSTS					
9	Oxygen Enhancement	1	LS	$16,000	$16,000
10	Redevelop Oxygen Enhancement Wells	1	LS	$3,500	$3,500
11	Waste Disposal	1	LS	$1,000	$1,000
12	Verification of Institutional Controls and Notifications to NYSDEC	1	LS	$5,000	$5,000
13	Prepare Annual Groundwater Monitoring Report	1	LS	$10,000	$10,000
14	Quarterly NAPL Monitoring/Recovery (Years 1-5)	1	LS	$16,000	$16,000
15	Annual NAPL Monitoring/Recovery (Years 6-30)	1	LS	$4,000	$4,000
16	Semi-annual Groundwater Monitoring (Years 1-5)	1	LS	$30,000	$30,000
17	Annual Groundwater Monitoring (Years 6-30)	1	LS	$20,000	$20,000
				Subtotal Annual O&M Costs (Years 1-5)	$46,000
				Subtotal Annual O&M Costs (Years 6-30)	$24,000
				Subtotal Annual O&M Costs (Years 1-30)	$35,500
				Present Worth Factor (5 years at 7%)	4.1
				Present Worth Factor (25 years at 7%)	11.65
				Present Worth Factor (30 years at 7%)	12.41
				Future Worth Factor (5 years at 7%)	0.71
				Subtotal O&M Costs	$827,671
				Contingency (25%)	$206,918
				Total Present Worth O&M Costs	$1,034,589
				Total Estimated Cost	$1,534,669
				Rounded to	$1,540,000

General Notes:

1. This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability reserves.
2. This cost estimate was based on 2007 dollars and ARCADIS's past experience and vendor quotes.

Table 5-9

New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative GW4 - NAPL Recovery and Oxygen Enhancement

3. Present worth is estimated based on a 7% beginning-of-year discount rate (adjusted for inflation) in accordance with OSWER Directive 9355.3-20 "Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis" (USEPA, 1993). It is assumed that "year zero" is 2007.
4 Costs do not include legal fees, permitting, obtaining access, negotiations, or agency oversight.

Notes:

1. Institutional controls cost estimate includes all labor and materials necessary to institute deed restrictions for the site to prevent potential future use of site groundwater.
2. Mobilization/demobilization cost includes mobilization and demobilization of all labor, equipment and materials necessary to install new wells for passive NAPL collection and oxygen enhancement.
3. Decontamination pad cost estimate includes labor, equipment and materials necessary to construct and remove a 60-foot by 30-foot decontamination pad and appurtenances. The decontamination pad would consist of 40-mil high density polyethylene (HDPE) with a 6-inch gravel drainage layer placed over the HDPE liner, surrounded by a 1-foot high berm and sloped to a collection sump for the collection of decontamination water.
4. NAPL recovery well cost estimate includes all labor, equipment and materials necessary to install and develop up to 20, 6-inch-diameter, 55-foot deep passive NAPL recovery wells with 5-foot sumps.
5. Oxygen enhancement well cost estimate includes all labor, equipment and materials necessary to install and develop up to 20, 4-inch-diameter, 15-foot deep wells for the introduction of an oxygen-releasing compound to the
6. Stainless steel canister cost estimate includes all labor, equipment and materials necessary to purchase and install for the introduction of an oxygen-releasing compound to the groundwater.
7. Miscellaneous waste disposal cost estimate is based on disposal of PPE and disposable equipment used during construction/installation of NAPL recovery structures at a facility permitted to accept the waste. Cost estimate includes waste characterization sampling and analysis and assumes that material will be disposed of as non-hazardous waste.
8. Waste disposal cost estimate includes all labor, equipment and materials necessary to characterize and dispose of NAPL and groundwater waste material generated during the semi-annual groundwater monitoring activities. Costs assume that the NAPL and groundwater would be disposed of as a non-hazardous waste at an appropriate treatment/disposal facility. Cost assumes two drums of liquid would be generated during each sampling event.
9. Oxygen enhancement cost estimate includes all labor, equipment and materials necessary to introduce an oxygen-releasing compound to the groundwater on a semi-annual basis.
10. Redevelop oxygen enhancement wells cost estimate includes all labor, equipment and materials necessary to redevelop wells to introduce an oxygen-releasing compound to the groundwater every 3 years at a cost of $500 per well.
11. Waste disposal cost estimate includes all labor, equipment and materials necessary to dispose of waste material generated during O&M activities. Costs assume that waste would be disposed of once per year and would be managed as a hazardous waste. Cost assumes on average one 55-gallon drum of NAPL would require management and disposal per year.
12. Annual costs associated with verification of institutional controls include verifying the status of controls and preparing/submitting notification to the NYSDEC to demonstrate that the controls are being maintained and remain
13. Prepare annual groundwater monitoring report cost estimate includes all labor, equipment and materials necessary to prepare a report summarizing the results of the groundwater and NAPL monitoring activities and the observed trends from oxygen enhancement.
14. NAPL monitoring/recovery cost estimate includes all labor, equipment and materials necessary to monitor NAPL recovery wells and remove accumulated NAPL, if encountered. Cost estimate assumes NAPL monitoring/recovery will be performed on a quarterly basis for years 1-5. Cost estimate includes preparation of quarterly summary reports for the NAPL monitoring.
15. NAPL monitoring/recovery cost estimate includes all labor, equipment and materials necessary to monitor NAPL recovery wells and remove accumulated NAPL, if encountered. Cost estimate assumes NAPL monitoring/recovery will be performed on a annual basis for years 6-30.

Table 5-9

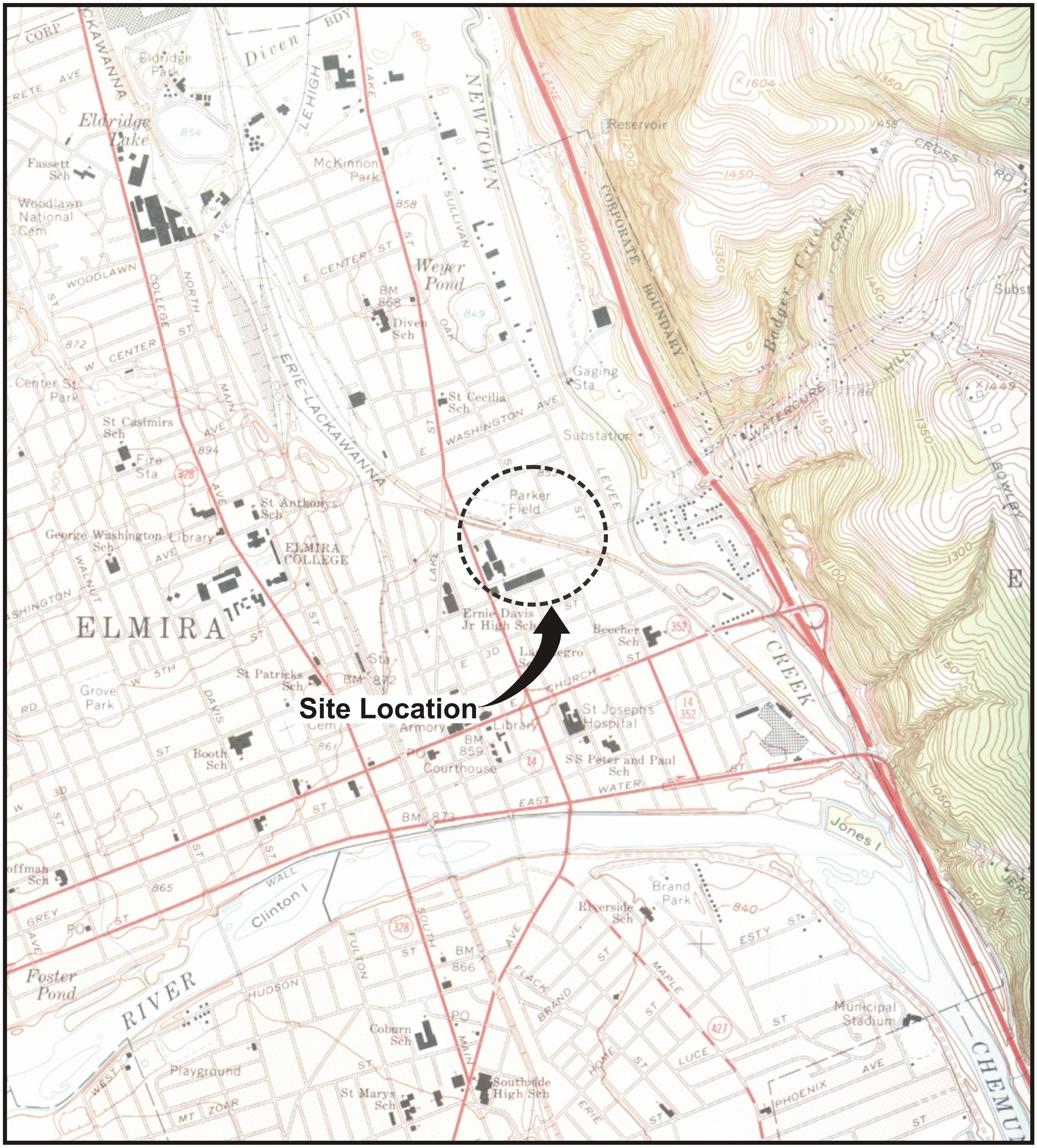
New York State Electric and Gas Corporation
Madison Avenue Former MGP Site
Elmira, New York

Alternative GW4 - NAPL Recovery and Oxygen Enhancement

16. Semi-annual groundwater monitoring cost estimate includes: all labor, equipment, travel, subsistence and materials necessary to conduct semi-annual groundwater monitoring for a 5-year period. Groundwater monitoring will consist of collecting groundwater samples from 20-24 existing monitoring wells using low-flow sampling methods. Cost assumes two project level personnel could complete the monitoring activities in 4 work days. Cost includes submitting groundwater samples to an analytical laboratory for analysis for chemical constituents of concern (BTEX compounds and PAHs) and natural attenuation indicator parameters (i.e., total biomass, PAH-degrading indicator compounds, geochemical parameters). Cost assumes standard analytical turnaround time. No costs have been included for data validation.
17. Annual groundwater monitoring cost estimate includes: all labor, equipment, travel, subsistence and materials necessary to conduct annual groundwater monitoring for a 25-year period. Groundwater monitoring will consist of collecting groundwater samples from select (approximately 10-15) existing monitoring wells using low-flow sampling methods. Cost includes submitting groundwater samples to an analytical laboratory for analysis for chemical constituents of concern (BTEX compounds and PAHs) and natural attenuation indicator parameters (i.e., total biomass, PAH-degrading indicator compounds, geochemical parameters). Cost assumes standard analytical turnaround time. No costs have been included for data validation.

ARCADIS

Figures



REFERENCE: BASE MAP USGS 7.5 MIN. QUAD., ELMIRA, N.Y.-PA., 1969.

2000' 0 2000'

Approximate Scale: 1" = 2000'

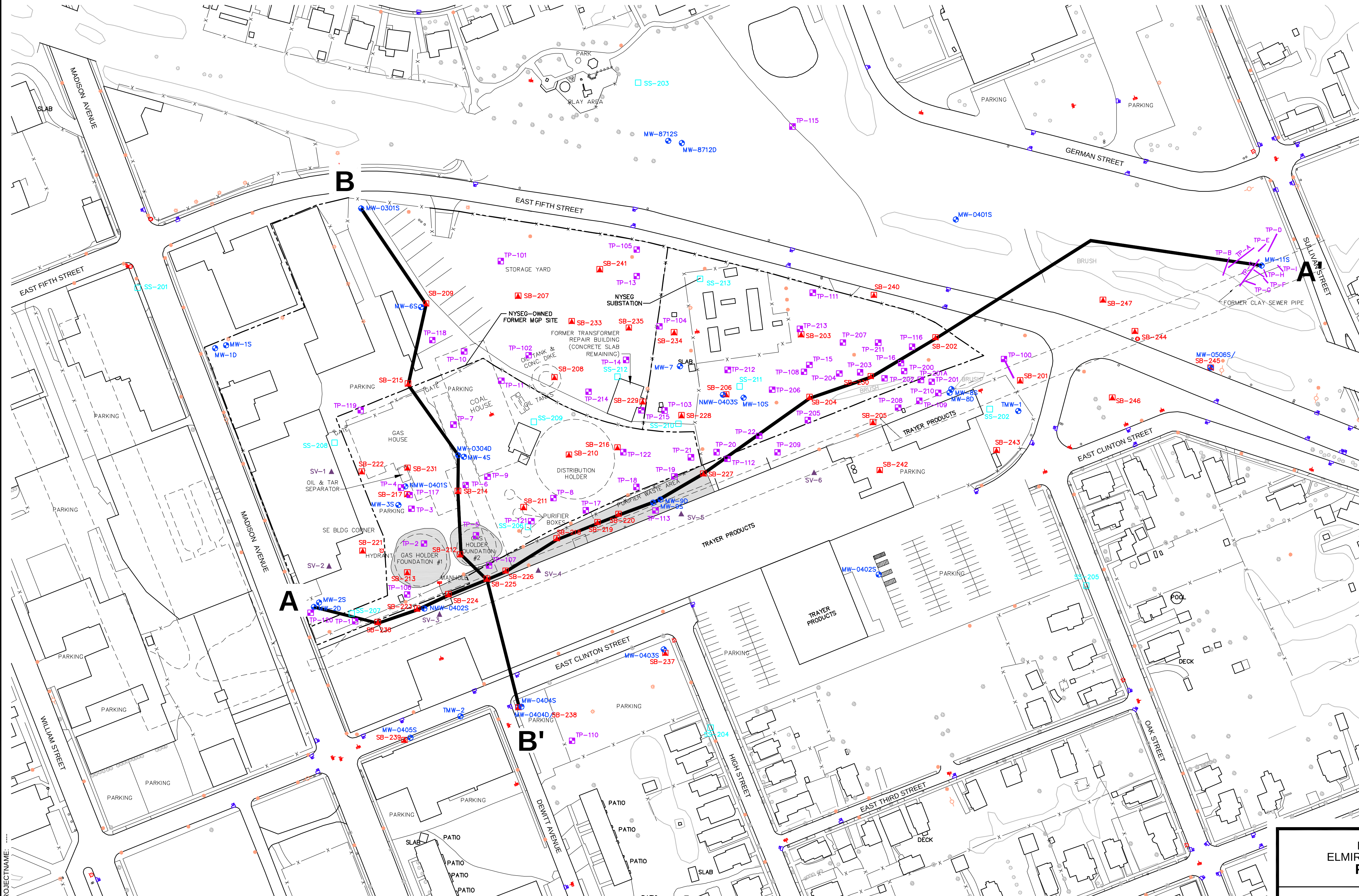
NEW YORK STATE ELECTRIC & GAS
ELMIRA MADISON AVENUE FORMER MGP SITE
FEASIBILITY STUDY REPORT

SITE LOCATION MAP

ARCADIS

FIGURE
1

01/15/07 SYR-D85-KLS, DJH
B0013043/0000/00007/CDR/13043N02.CDR



LEGEND:

- PROPERTY LINE
- CHAIN-LINK FENCE
- BRUSH
- FORMER MGP STRUCTURES – REMOVED
- APPROXIMATE LOCATION OF SUB-SLAB VAPOR SAMPLING POINT
- MONITORING WELL; SHALLOW (S), DEEP (D), TRAYER WELL (TMW)
- SOIL BORING
- TEST PIT
- SURFACE SOIL SAMPLING LOCATION
- POWER POLE
- UTILITY POLE WITH GUY
- LIGHT POLE
- CATCHBASIN
- MANHOLE
- A—A' CROSS SECTION LOCATION
- APPROXIMATE MGP IRM REMOVAL AREAS (DEPTHS VARY)

NOTES:

1. BASE MAP SUPPLIED BY NYSEG, LATEST REVISION DATED APRIL 2004, AT A SCALE OF 1" = 60'.
2. ALL LOCATIONS ARE APPROXIMATE.

0 80' 160'
GRAPHIC SCALE

NEW YORK STATE ELECTRIC & GAS
ELMIRA MADISON AVENUE FORMER MGP SITE
FEASIBILITY STUDY REPORT

SITE MAP

ARCADIS

FIGURE
2

CITY: SYRACUSE DIV/GROUP: 85/CAD DB: LJP LD: AM: PD: TM: TR: LYR:ON=*;OFF=*REF*
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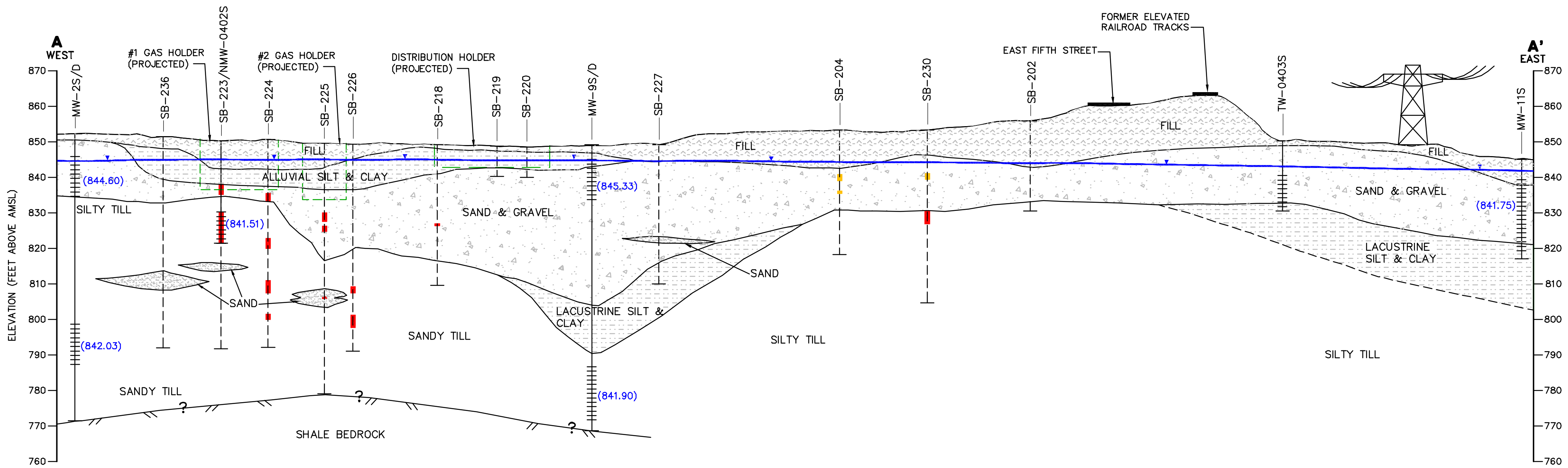
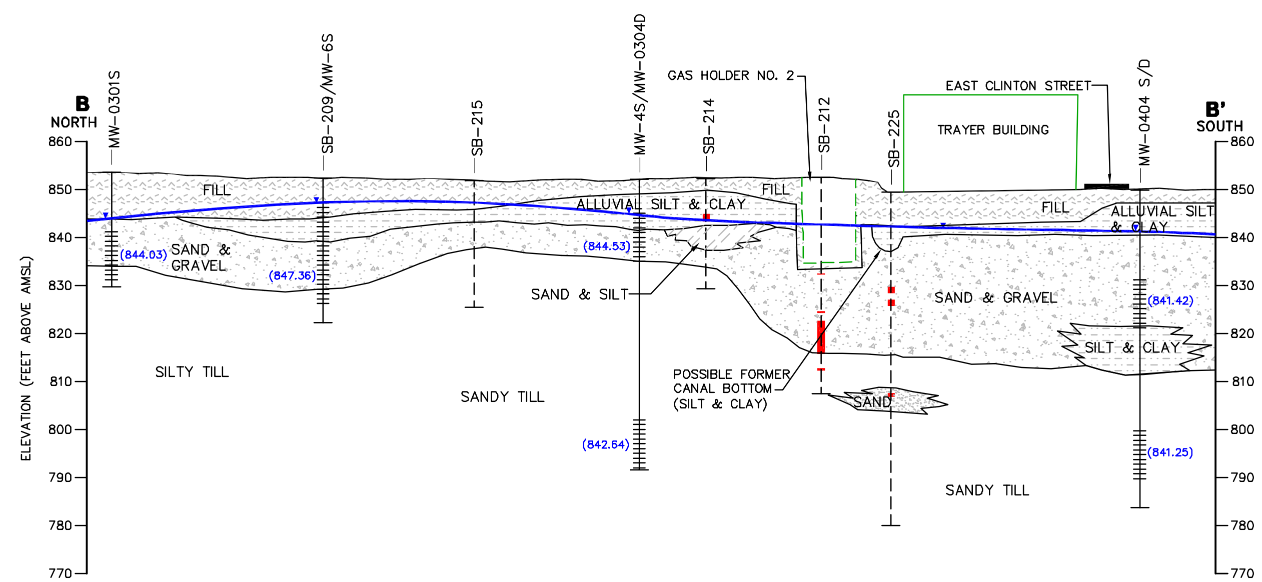
XREFS: 13043X00 13043X01 IMAGES: PROJECTNAME: ----





LEGEND:

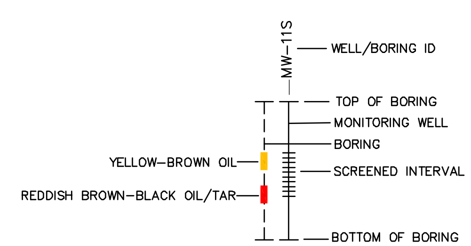
FILL

SILT AND CLAY

SAND AND GRAVEL

TILL (DENSE UNSORTED SAND AND GRAVEL WITH VARYING AMOUNT OF SAND AND SILT)

(841.71) GROUNDWATER ELEVATION (4/20/04)



HORIZONTAL SCALE 0 80' 160'

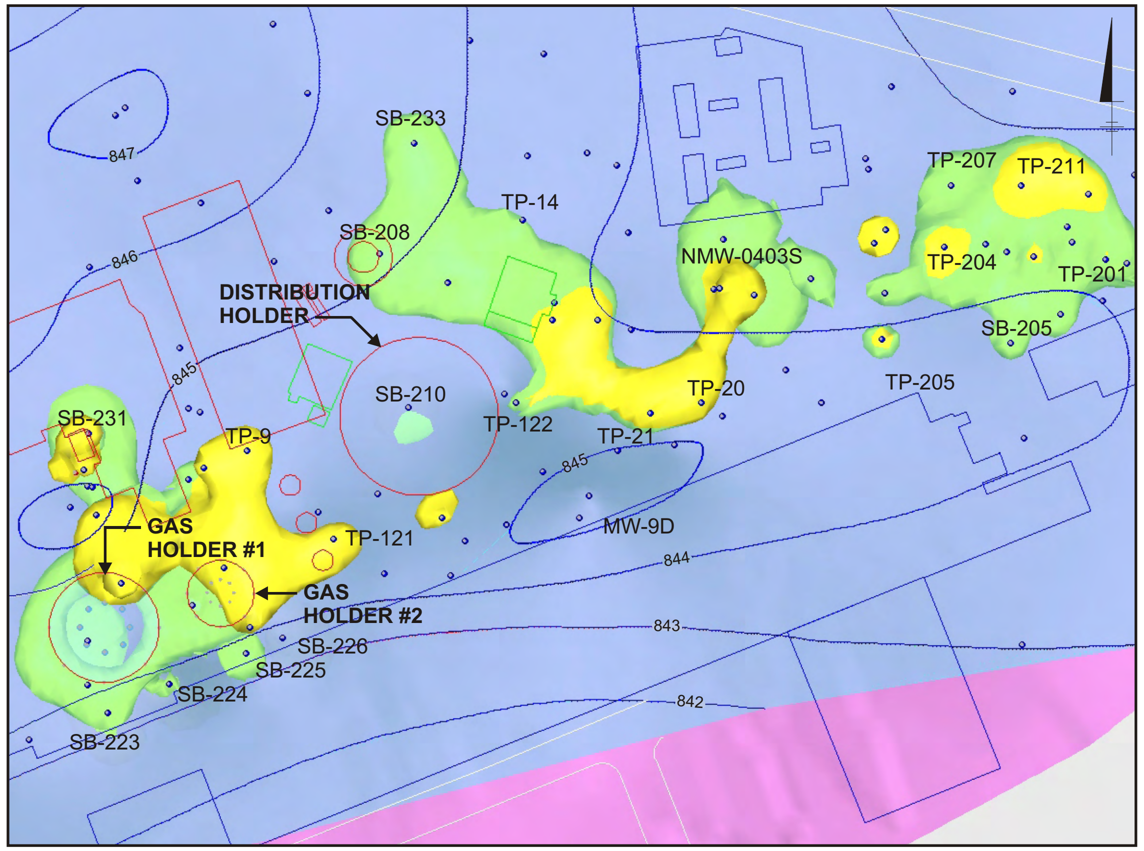
VERTICAL SCALE 0 20' 40'

NEW YORK STATE ELECTRIC & GAS
ELMIRA MADISON AVENUE FORMER MGP SITE
FEASIBILITY STUDY REPORT

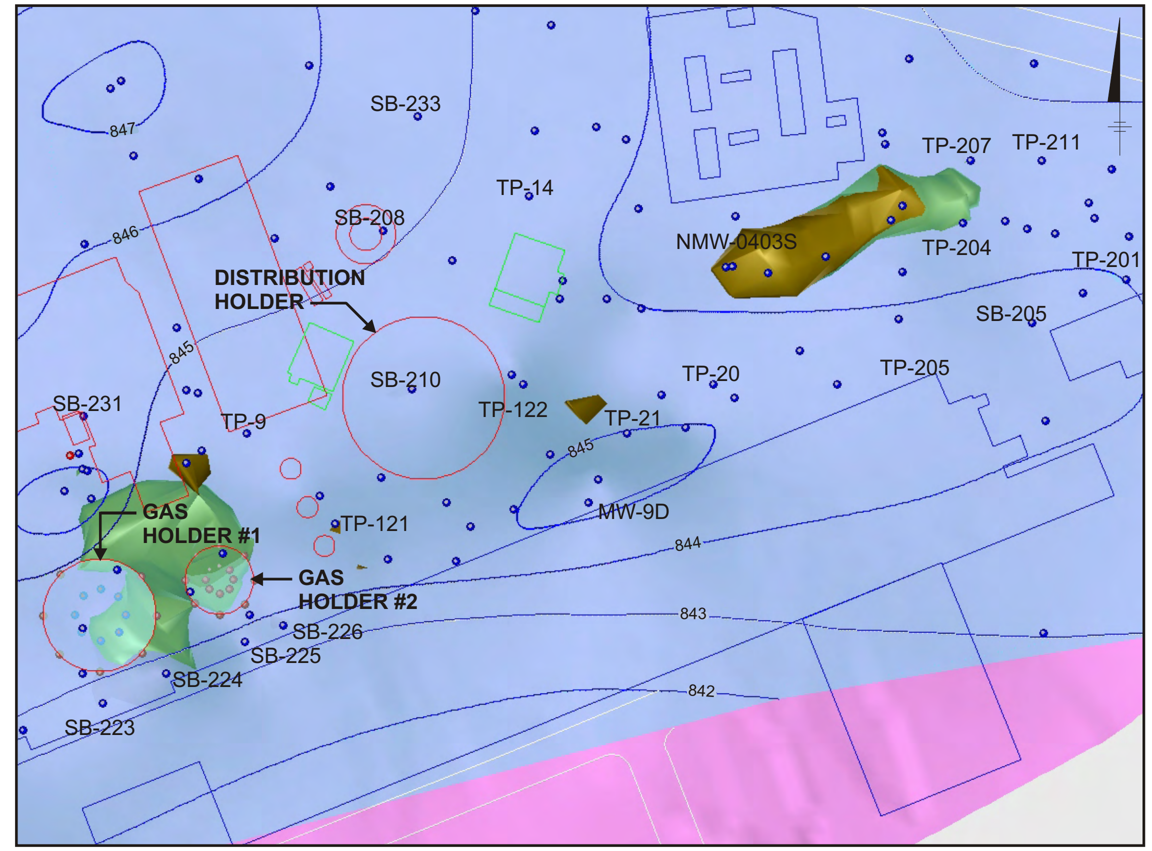
GEOLOGIC CROSS SECTIONS A-A' AND B-B'

ARCADIS

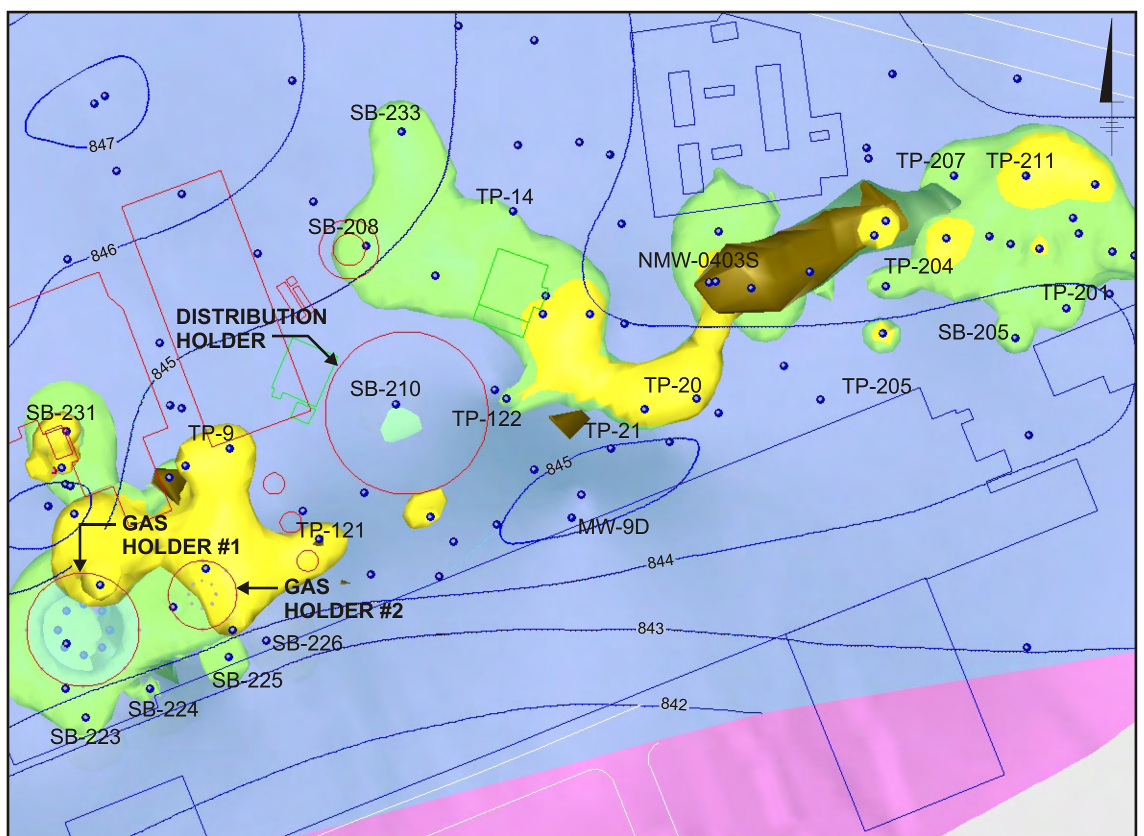
FIGURE **3**



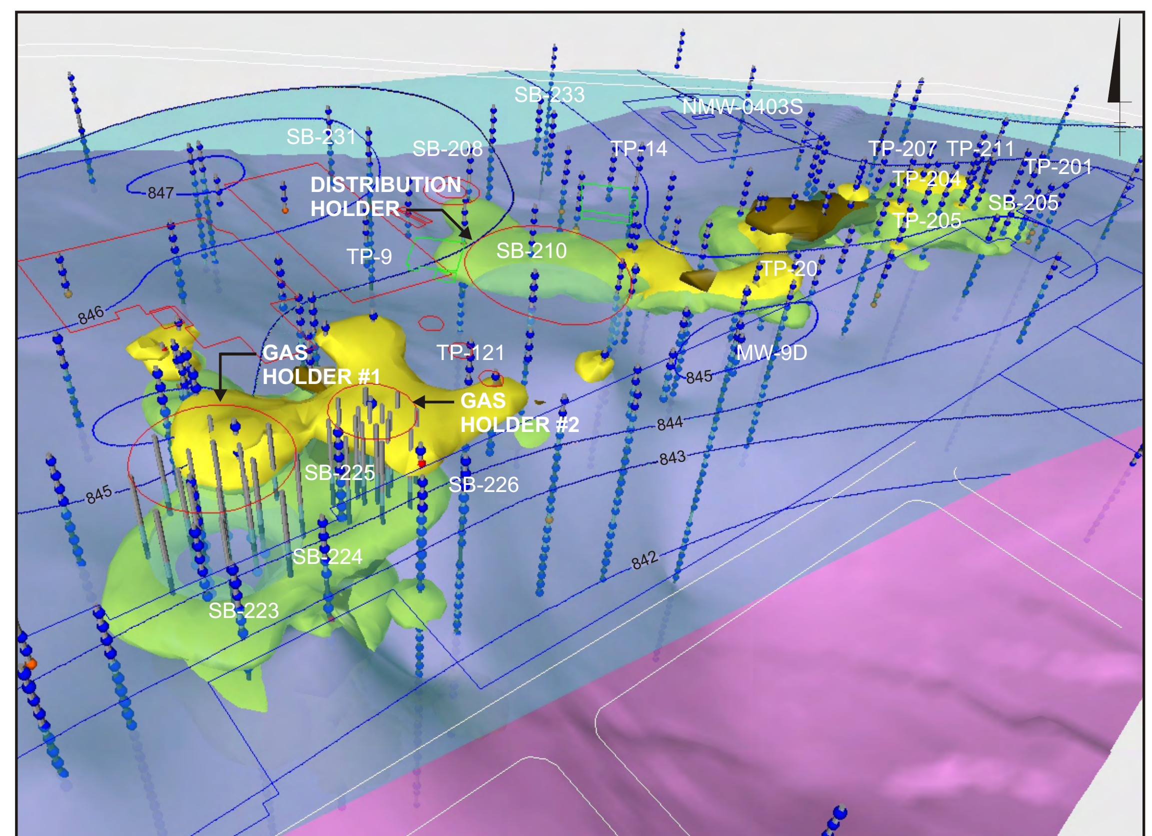
MODELED NAPL DISTRIBUTION (INCLUDING SHEENS) - PLAN VIEW



MODELED PAH DISTRIBUTION (≥ 500 MG/KG) - PLAN VIEW



COMBINATION OF MODELED NAPL AND PAH DISTRIBUTIONS - PLAN VIEW



COMBINATION OF MODELED NAPL AND PAH DISTRIBUTIONS - OBLIQUE VIEW

LEGEND:

- PAHs (≥ 500 PPM) ABOVE THE WATER TABLE
- PAHs (≥ 500 PPM) BELOW THE WATER TABLE
- NAPL ABOVE WATER TABLE
- NAPL BELOW WATER TABLE
- WATER TABLE
- WATER LEVEL ELEVATION CONTOUR (APRIL 2004)
- BOREHOLE TRACE
- SAMPLE LOCATION

NOTE:
THE MAJORITY OF DATA POINTS USED TO GENERATE THE REGION OF PAHS SHOWN ARE LOCATED INSIDE THE REGION ITSELF AND ARE THEREFORE NOT VISIBLE. ALL AVAILABLE SOIL PAH DATA WERE USED TO GENERATE THE REGION.

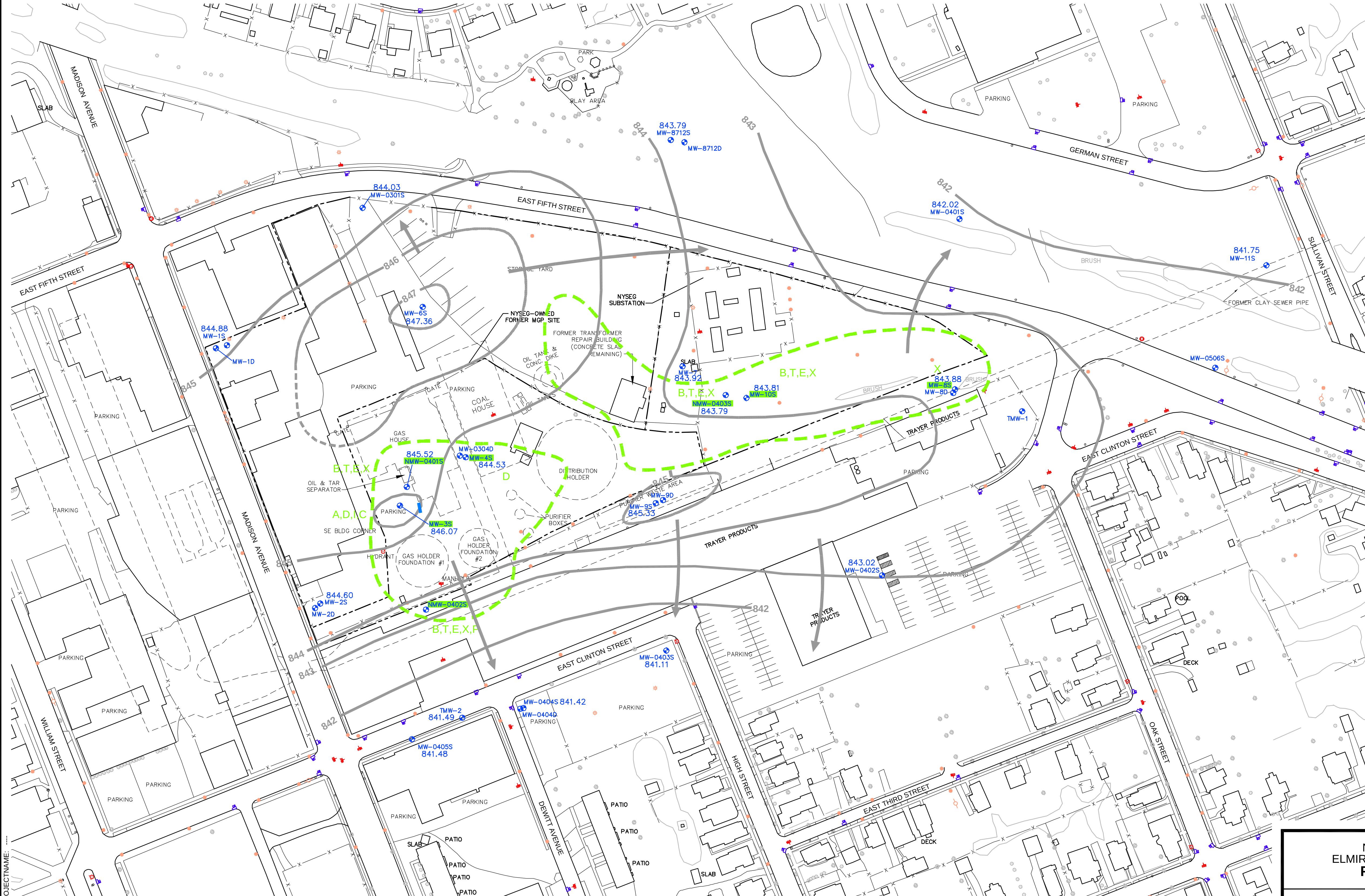
NEW YORK STATE ELECTRIC & GAS
ELMIRA MADISON AVENUE FORMER MGP SITE
FEASIBILITY STUDY REPORT

MODELED DISTRIBUTION OF MGP-RELATED IMPACTS

ARCADIS

FIGURE
4

01/15/07 SYR-D85-KLS, DJH
B0013043/0000/00007/CDR/13043N03.CDR



LEGEND:

- PROPERTY LINE
- CHAIN-LINK FENCE
- BRUSH
- FORMER MGP STRUCTURES – REMOVED
- MONITORING WELL; SHALLOW (S), DEEP (D), TRAYER WELL (TMW)
- POWER POLE
- UTILITY POLE WITH GUY
- LIGHT POLE
- CATCHBASIN
- MANHOLE
- 841.75 GROUNDWATER ELEVATION
- 842 INFERRED GROUNDWATER ELEVATION CONTOUR (APRIL 2004)
- GROUNDWATER FLOW DIRECTION
- INFERRED EXTENT OF SHALLOW GROUNDWATER CONCENTRATIONS ABOVE NYSDEC CLASS GA GROUNDWATER STANDARDS
- B,T,E,X,C APRIL 2004 GROUNDWATER SAMPLE CONTAINED ONE OR MORE CONSTITUENTS OF CONCERN (BTEX AND PAHs) AT A CONCENTRATION GREATER THAN THE NYSDEC CLASS GA GROUNDWATER STANDARD (TOGS 1,1,1, JUNE 1995). THE LETTER GIVEN REPRESENTS THE COMPOUNDS THAT EXCEED THEIR RESPECTIVE STANDARD, AS FOLLOWS:

A = 1,1,1,–TRICHLOROETHANE
D = 1,1–DICHLOROETHANE
I = 1,1–DICHLOROETHENE
C = CHLOROETHANE
X = XYLENES
B = BENZENE
E = ETHYLBENZENE
T = TOLUENE
P = BENZO(A)PYRENE

NOTES:

1. BASE MAP SUPPLIED BY NYSEG, LATEST REVISION DATED APRIL 2004, AT A SCALE OF 1" = 60'.
2. ALL LOCATIONS ARE APPROXIMATE.

0 80' 160'
GRAPHIC SCALE

NEW YORK STATE ELECTRIC & GAS
ELMIRA MADISON AVENUE FORMER MGP SITE
FEASIBILITY STUDY REPORT

ESTIMATED EXTENT OF COCs EXCEEDING CLASS GA GROUNDWATER STANDARDS

ARCADIS

FIGURE
5

CITY: SYRACUSE DIV/GROUP: 85/CAD DB: LJP LD: AM: PD: TM: TR: LYR:ON=*;OFF=*REF* ...PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 1/16/2008 8:56 AM BY: POSENAUER, LISA
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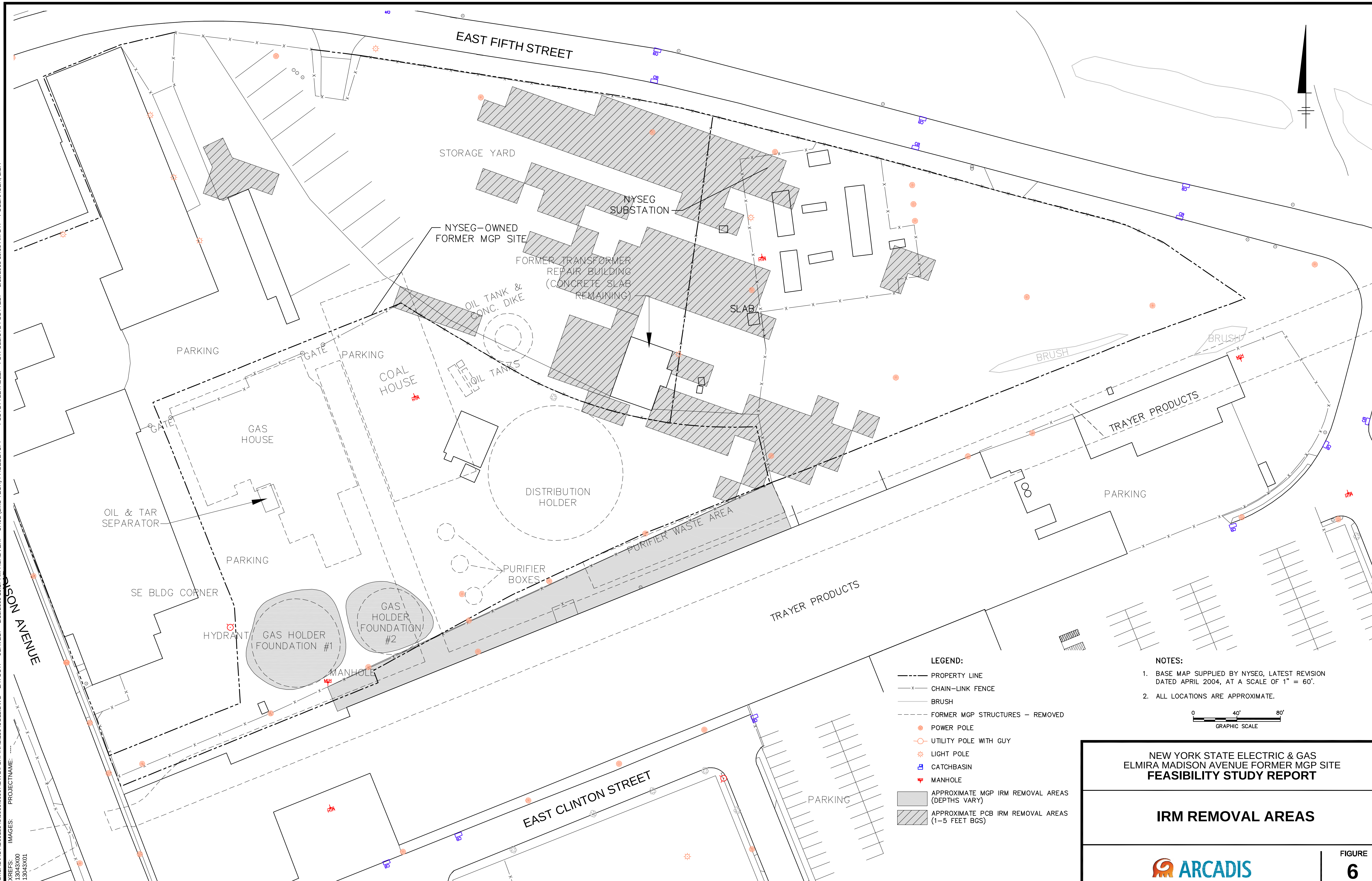
XREFS: 13043X00 13043X01 IMAGES: PROJECTNAME: ----



LEGEND:

- PROPERTY LINE
- CHAIN-LINK FENCE
- BRUSH
- FORMER MGP STRUCTURES – REMOVED
- POWER POLE
- UTILITY POLE WITH GUY
- LIGHT POLE
- CATCHBASIN
- MANHOLE
- APPROXIMATE MGP IRM REMOVAL AREAS (DEPTHS VARY)
- APPROXIMATE PCB IRM REMOVAL AREAS (1–5 FEET BGS)

NOTES:

1. BASE MAP SUPPLIED BY NYSEG, LATEST REVISION DATED APRIL 2004, AT A SCALE OF 1" = 60'.
2. ALL LOCATIONS ARE APPROXIMATE.

0 40' 80'
GRAPHIC SCALE

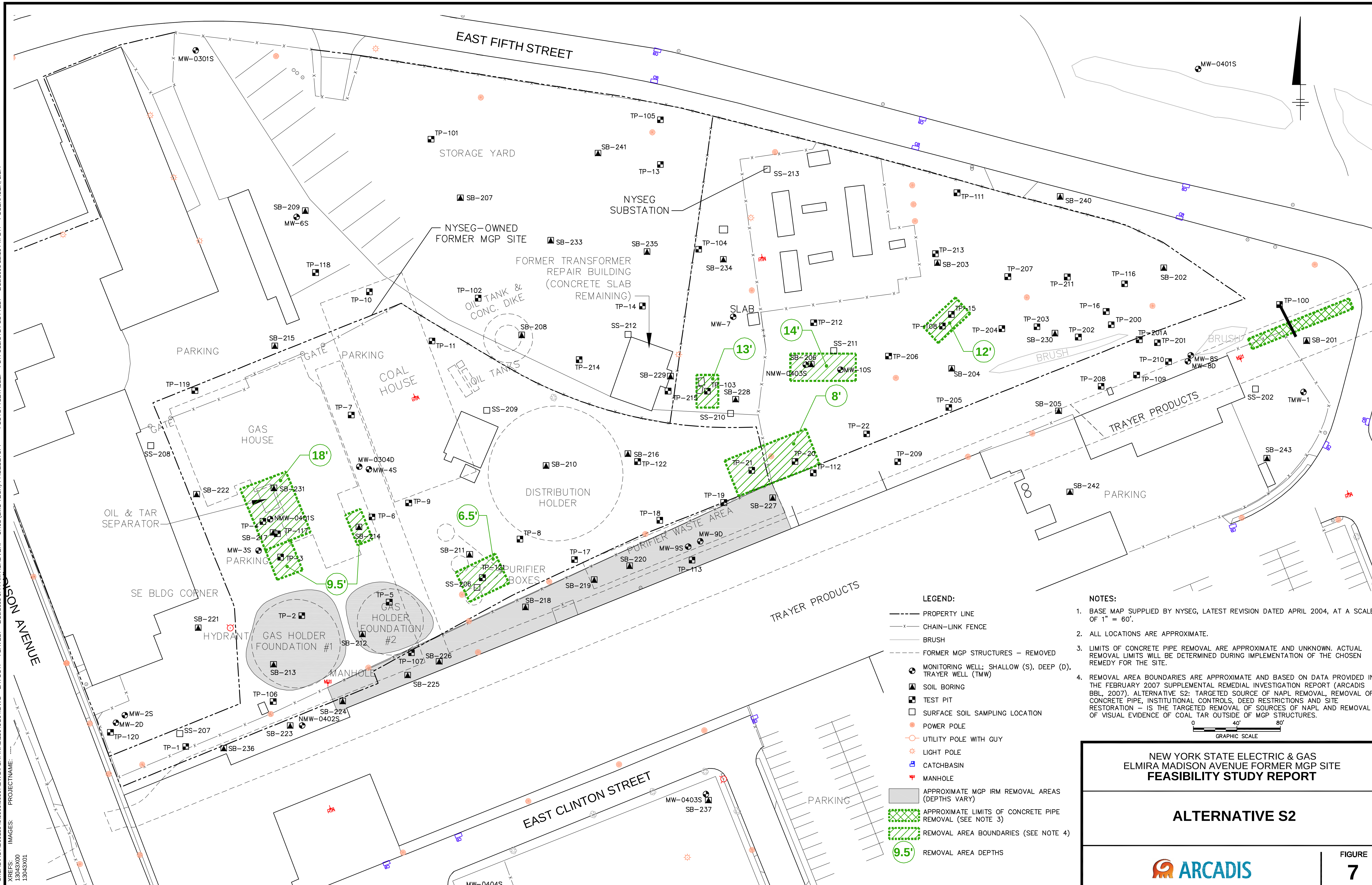
NEW YORK STATE ELECTRIC & GAS
ELMIRA MADISON AVENUE FORMER MGP SITE
FEASIBILITY STUDY REPORT

IRM REMOVAL AREAS

ARCADIS

FIGURE
6

CITY: SYRACUSE DIV/GROUP: 85/CAD DB: LJP LD: AM: PD: TM: TR: LYR:ON=*;OFF=*REF* G:\CAD\ACTB0013043\0000\00007\DWG\FSRFINAL\13043G12.DWG LAYOUT: 6SAVED: 1/15/2008 10:17 AM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 1/15/2008 10:58 AM BY: POSENAUER, LISA
XREFS: 13043X00 13043X01 IMAGES: PROJECTNAME: ---



LEGEND:

- PROPERTY LINE
- CHAIN-LINK FENCE
- BRUSH
- FORMER MGP STRUCTURES – REMOVED
- MONITORING WELL; SHALLOW (S), DEEP (D), TRAYER WELL (TMW)
- SOIL BORING
- TEST PIT
- SURFACE SOIL SAMPLING LOCATION
- POWER POLE
- UTILITY POLE WITH GUY
- LIGHT POLE
- CATCHBASIN
- MANHOLE
- APPROXIMATE MGP IRM REMOVAL AREAS (DEPTHS VARY)
- APPROXIMATE LIMITS OF CONCRETE PIPE REMOVAL (SEE NOTE 3)
- REMOVAL AREA BOUNDARIES (SEE NOTE 4)
- 9.5' REMOVAL AREA DEPTHS

NOTES:

1. BASE MAP SUPPLIED BY NYSEG, LATEST REVISION DATED APRIL 2004, AT A SCALE OF 1" = 60'.
2. ALL LOCATIONS ARE APPROXIMATE.
3. LIMITS OF CONCRETE PIPE REMOVAL ARE APPROXIMATE AND UNKNOWN. ACTUAL REMOVAL LIMITS WILL BE DETERMINED DURING IMPLEMENTATION OF THE CHOSEN REMEDY FOR THE SITE.
4. REMOVAL AREA BOUNDARIES ARE APPROXIMATE AND BASED ON DATA PROVIDED IN THE FEBRUARY 2007 SUPPLEMENTAL REMEDIAL INVESTIGATION REPORT (ARCADIS BBL, 2007). ALTERNATIVE S2: TARGETED SOURCE OF NAPL REMOVAL, REMOVAL OF CONCRETE PIPE, INSTITUTIONAL CONTROLS, DEED RESTRICTIONS AND SITE RESTORATION – IS THE TARGETED REMOVAL OF SOURCES OF NAPL AND REMOVAL OF VISUAL EVIDENCE OF COAL TAR OUTSIDE OF MGP STRUCTURES.

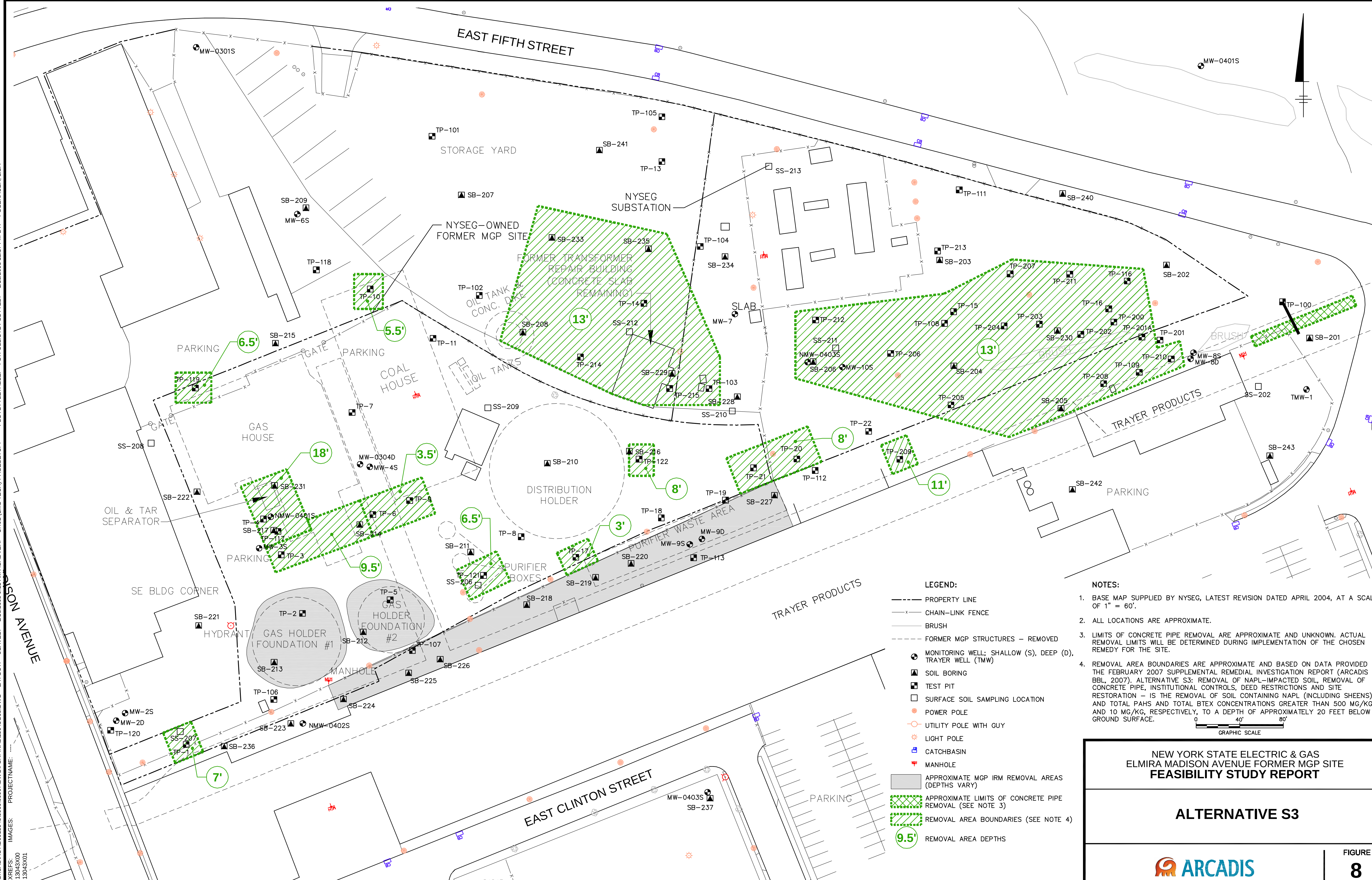
0 40' 80'
GRAPHIC SCALE

NEW YORK STATE ELECTRIC & GAS
ELMIRA MADISON AVENUE FORMER MGP SITE
FEASIBILITY STUDY REPORT

ALTERNATIVE S2

ARCADIS

FIGURE
7



LEGEND:

- PROPERTY LINE
- CHAIN–LINK FENCE
- BRUSH
- FORMER MGP STRUCTURES – REMOVED
- MONITORING WELL; SHALLOW (S), DEEP (D), TRAYER WELL (TMW)
- SOIL BORING
- TEST PIT
- SURFACE SOIL SAMPLING LOCATION
- POWER POLE
- UTILITY POLE WITH GUY
- LIGHT POLE
- CATCHBASIN
- MANHOLE
- APPROXIMATE MGP IRM REMOVAL AREAS (DEPTHS VARY)
- APPROXIMATE LIMITS OF CONCRETE PIPE REMOVAL (SEE NOTE 3)
- REMOVAL AREA BOUNDARIES (SEE NOTE 4)
- 9.5' REMOVAL AREA DEPTHS

NOTES:

1. BASE MAP SUPPLIED BY NYSEG, LATEST REVISION DATED APRIL 2004, AT A SCALE OF 1" = 60'.
2. ALL LOCATIONS ARE APPROXIMATE.
3. LIMITS OF CONCRETE PIPE REMOVAL ARE APPROXIMATE AND UNKNOWN. ACTUAL REMOVAL LIMITS WILL BE DETERMINED DURING IMPLEMENTATION OF THE CHOSEN REMEDY FOR THE SITE.
4. REMOVAL AREA BOUNDARIES ARE APPROXIMATE AND BASED ON DATA PROVIDED IN THE FEBRUARY 2007 SUPPLEMENTAL REMEDIAL INVESTIGATION REPORT (ARCADIS BBL, 2007). ALTERNATIVE S3: REMOVAL OF NAPL–IMPACTED SOIL, REMOVAL OF CONCRETE PIPE, INSTITUTIONAL CONTROLS, DEED RESTRICTIONS AND SITE RESTORATION – IS THE REMOVAL OF SOIL CONTAINING NAPL (INCLUDING SHEENS) AND TOTAL PAHS AND TOTAL BTEX CONCENTRATIONS GREATER THAN 500 MG/KG AND 10 MG/KG, RESPECTIVELY, TO A DEPTH OF APPROXIMATELY 20 FEET BELOW GROUND SURFACE.

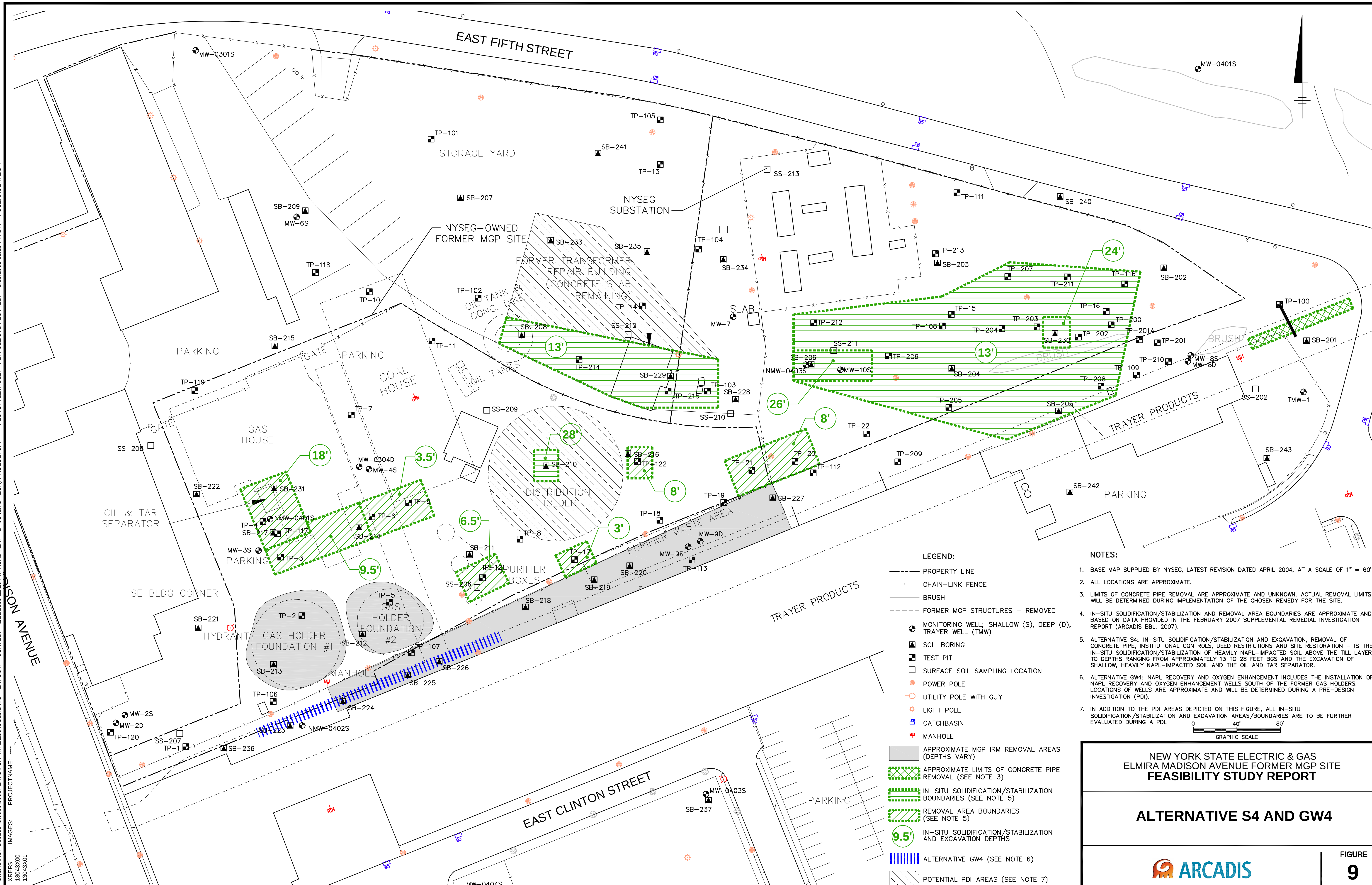
0 40' 80'
GRAPHIC SCALE

NEW YORK STATE ELECTRIC & GAS
ELMIRA MADISON AVENUE FORMER MGP SITE
FEASIBILITY STUDY REPORT

ALTERNATIVE S3

ARCADIS

FIGURE
8



LEGEND:

- PROPERTY LINE
- CHAIN–LINK FENCE
- BRUSH
- FORMER MGP STRUCTURES – REMOVED
- MONITORING WELL; SHALLOW (S), DEEP (D), TRAYER WELL (TMW)
- SOIL BORING
- TEST PIT
- SURFACE SOIL SAMPLING LOCATION
- POWER POLE
- UTILITY POLE WITH GUY
- LIGHT POLE
- CATCHBASIN
- MANHOLE
- APPROXIMATE MGP IRM REMOVAL AREAS (DEPTHS VARY)
- APPROXIMATE LIMITS OF CONCRETE PIPE REMOVAL (SEE NOTE 3)
- IN–SITU SOLIDIFICATION/STABILIZATION BOUNDARIES (SEE NOTE 5)
- REMOVAL AREA BOUNDARIES (SEE NOTE 5)
- 9.5' IN–SITU SOLIDIFICATION/STABILIZATION AND EXCAVATION DEPTHS
- ALTERNATIVE GW4 (SEE NOTE 6)
- POTENTIAL PDI AREAS (SEE NOTE 7)

NOTES:

1. BASE MAP SUPPLIED BY NYSEG, LATEST REVISION DATED APRIL 2004, AT A SCALE OF 1" = 60'.
2. ALL LOCATIONS ARE APPROXIMATE.
3. LIMITS OF CONCRETE PIPE REMOVAL ARE APPROXIMATE AND UNKNOWN. ACTUAL REMOVAL LIMITS WILL BE DETERMINED DURING IMPLEMENTATION OF THE CHOSEN REMEDY FOR THE SITE.
4. IN–SITU SOLIDIFICATION/STABILIZATION AND REMOVAL AREA BOUNDARIES ARE APPROXIMATE AND BASED ON DATA PROVIDED IN THE FEBRUARY 2007 SUPPLEMENTAL REMEDIAL INVESTIGATION REPORT (ARCADIS BBL, 2007).
5. ALTERNATIVE S4: IN–SITU SOLIDIFICATION/STABILIZATION AND EXCAVATION, REMOVAL OF CONCRETE PIPE, INSTITUTIONAL CONTROLS, DEED RESTRICTIONS AND SITE RESTORATION – IS THE IN–SITU SOLIDIFICATION/STABILIZATION OF HEAVILY NAPL–IMPACTED SOIL ABOVE THE TILL LAYER TO DEPTHS RANGING FROM APPROXIMATELY 13 TO 28 FEET BGS AND THE EXCAVATION OF SHALLOW, HEAVILY NAPL–IMPACTED SOIL AND THE OIL AND TAR SEPARATOR.
6. ALTERNATIVE GW4: NAPL RECOVERY AND OXYGEN ENHANCEMENT INCLUDES THE INSTALLATION OF NAPL RECOVERY AND OXYGEN ENHANCEMENT WELLS SOUTH OF THE FORMER GAS HOLDERS. LOCATIONS OF WELLS ARE APPROXIMATE AND WILL BE DETERMINED DURING A PRE–DESIGN INVESTIGATION (PDI).
7. IN ADDITION TO THE PDI AREAS DEPICTED ON THIS FIGURE, ALL IN–SITU SOLIDIFICATION/STABILIZATION AND EXCAVATION AREAS/BOUNDARIES ARE TO BE FURTHER EVALUATED DURING A PDI.

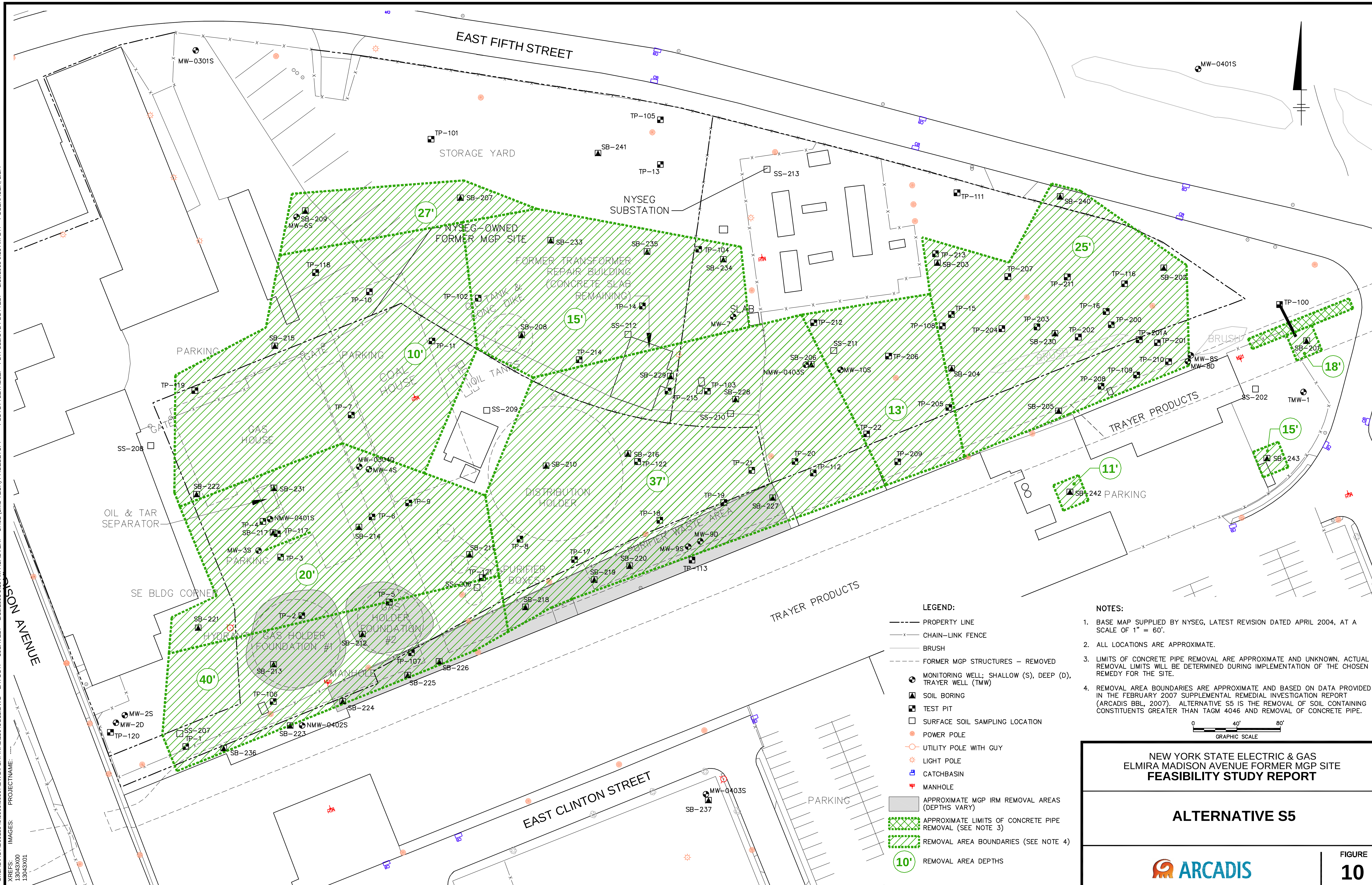
0 40' 80'
GRAPHIC SCALE

NEW YORK STATE ELECTRIC & GAS
ELMIRA MADISON AVENUE FORMER MGP SITE
FEASIBILITY STUDY REPORT

ALTERNATIVE S4 AND GW4

ARCADIS

FIGURE
9



LEGEND:

- PROPERTY LINE
- CHAIN-LINK FENCE
- BRUSH
- FORMER MGP STRUCTURES – REMOVED
- MONITORING WELL; SHALLOW (S), DEEP (D), TRAYER WELL (TMW)
- SOIL BORING
- TEST PIT
- SURFACE SOIL SAMPLING LOCATION
- POWER POLE
- UTILITY POLE WITH GUY
- LIGHT POLE
- CATCHBASIN
- MANHOLE
- APPROXIMATE MGP IRM REMOVAL AREAS (DEPTHS VARY)
- APPROXIMATE LIMITS OF CONCRETE PIPE REMOVAL (SEE NOTE 3)
- REMOVAL AREA BOUNDARIES (SEE NOTE 4)
- 10' REMOVAL AREA DEPTHS

NOTES:

1. BASE MAP SUPPLIED BY NYSEG, LATEST REVISION DATED APRIL 2004, AT A SCALE OF 1" = 60'.
2. ALL LOCATIONS ARE APPROXIMATE.
3. LIMITS OF CONCRETE PIPE REMOVAL ARE APPROXIMATE AND UNKNOWN. ACTUAL REMOVAL LIMITS WILL BE DETERMINED DURING IMPLEMENTATION OF THE CHOSEN REMEDY FOR THE SITE.
4. REMOVAL AREA BOUNDARIES ARE APPROXIMATE AND BASED ON DATA PROVIDED IN THE FEBRUARY 2007 SUPPLEMENTAL REMEDIAL INVESTIGATION REPORT (ARCADIS BBL, 2007). ALTERNATIVE S5 IS THE REMOVAL OF SOIL CONTAINING CONSTITUENTS GREATER THAN TAGM 4046 AND REMOVAL OF CONCRETE PIPE.

0 40' 80'
GRAPHIC SCALE

NEW YORK STATE ELECTRIC & GAS
ELMIRA MADISON AVENUE FORMER MGP SITE
FEASIBILITY STUDY REPORT

ALTERNATIVE S5

ARCADIS

FIGURE
10

CITY: SYRACUSE DIV/GROUP: 85/CAD DB: LJP LD: AM: PD: TR: LYR:ON=*;OFF=*REF*
G:\CAD\ACTB0013043\0000\00007\DWG\FS\FINAL\13043G11.DWG LAYOUT: 10 SAVED: 1/16/2008 9:10 AM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 1/16/2008 9:13 AM BY: POSENAUER, LISA
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