PROPOSED REMEDIAL ACTION PLAN

Niagara Mohawk
Broadway – Schenectady MGP Site
Schenectady(C),Schenectady County, New York
Site No. 4 47 026

February 2008

Prepared by:

Division of Environmental Remediation
New York State Department of Environmental Conservation

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SECTION 1: SUMMARY AND PURPOSE OF THE PROPOSED PLAN

The New York State Department of Environmental Conservation (the Department), in consultation with the New York State Department of Health (NYSDOH), is proposing a remedy for the Niagara Mohawk Broadway – Schenectady MGP site. Note that the Department has chosen to retain the "Niagara Mohawk" name for this site (Niagara Mohawk now operates as a part of National Grid) to maintain consistency with the documentation of the 15 year investigation of the site. The presence of hazardous waste has created significant threats to human health and the environment that are addressed by this proposed remedy. As more fully described in Sections 3 and 5 of this document, past operation of the former manufactured gas plant (MGP) have resulted in the disposal of hazardous substances, including volatile organic chemicals and polycyclic aromatic hydrocarbons. These wastes have contaminated the soil, sediment and groundwater at the site, and have resulted in:

- a significant threat to human health associated with potential exposure to soil, sediment and groundwater.
- a significant environmental threat associated with the current and potential impacts of contaminants to soil, sediments and groundwater.

To eliminate or mitigate these threats, the Department proposes to construct a low permeability barrier around the site which would effectively isolate the majority of the contamination from the environment and potential human receptors. An inward hydraulic gradient would be maintained to ensure the effectiveness of the barrier. An asphaltic cover would cover the contained area, which would limit exposure to contaminated material and assist in establishing hydraulic control over the contained material. Non-aqueous phase liquid (NAPL) impacted soil adjacent to historic MGP structures, source areas which represent the most significant threat of exposure and future migration, would be excavated.

The proposed remedy, discussed in detail in Section 8, is intended to attain the remediation goals identified for this site in Section 6. The remedy must conform with officially promulgated standards and criteria that are directly applicable, or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, criteria and guidance are hereafter called SCGs.

This Proposed Remedial Action Plan (PRAP) identifies the preferred remedy, summarizes the other alternatives considered, and discusses the reasons for this preference. The Department will select a final remedy for the site only after careful consideration of all comments received during the public comment period.

The Department has issued this PRAP as a component of the Citizen Participation Plan developed pursuant to the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375. This document is a summary of the information that can be found in greater detail in the June 1993 Site Assessment Report, January 1999 Remedial Investigation Report, November 2005 Site Remedial Investigation Report, and December 2006

Feasibility Study, and other relevant documents. The public is encouraged to review the project documents, which are available at the following repositories:

Schenectady County Public Library
99 Clinton Street
Schenectady, NY
518-388-4500
Hours:
9 a.m. to 9 p.m. Monday through Thursday
9 a.m. to 5 p.m. Friday and Saturday
1 to 5 p.m. on Sundays

NYSDEC Region 4
1150 N. Westcott Road
Schenectady, NY 12306-2014
(518) 357-2068
By appointment 8 am - 4 pm daily
Contact: Rick Georgeson

NYSDEC Central Office
Attn: William Ottaway, Project Manager
625 Broadway
Albany, NY 12233-7017
By appointment 8 am - 4 pm daily

The Department seeks input from the community on all PRAPs. A public comment period has been set from February 15, 2008 until March 14, 2008 to provide an opportunity for public participation in the remedy selection process. A public meeting is scheduled for February 28, 2008 at Room 101 in the Stockade Building at Schectady County Community College, in downtown Schenectady at the corner of State Street (Route 5) and Washington Avenue beginning at 7:00.

At the meeting, the results of the RI/FS will be presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period will be held, during which verbal or written comments may be submitted on the PRAP. Written comments may also be sent to Mr. Ottaway at the above address through March 17, 2008.

The Department may modify the proposed remedy or select another of the alternatives presented in this PRAP, based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified here.

Comments will be summarized and addressed in the responsiveness summary section of the Record of Decision (ROD). The ROD is the Department's final selection of the remedy for this site.

SECTION 2: <u>SITE LOCATION AND DESCRIPTION</u>

The Niagara Mohawk Broadway – Schenectady MGP site is located on Broadway in the City of Schenectady, Schenectady County, New York (Figure 1). The 9 acre site is located west of Interstate Route 890, east of a Conrail railroad track and south of a Delaware and Hudson railroad track. The site is an active National Grid (NG) service center and is located in a commercial/industrial area. National Grid assumed liability for this site following acquisition of the Niagara Mohawk Power Corporation (NMPC) in 2002. The Class 2 General Electric Main Plant Site #4-47-004 is located to the north and west of this site, immediately across the railroad tracks. Other nearby remediation sites are also shown on Figure 1.

On a regional scale, the site lies at the boundary between two different types of glacial sediments: lacustrine (lake bottom) deposits of silt and clay, and deltaic sediments consisting of well sorted fine to coarse sand and gravel. Soil samples recovered from borings on the site show seven to fourteen feet of fill material mixed with unconsolidated glacial sediments, underlain by a layer of lacustrine silts and clays generally 5-10 feet thick. This is in turn underlain by deltaic fine to medium sand down to a depth of 40 to 70 feet. Below these depths, a glacial till unit extends to depths of 90 to 110 feet. The till is a dense, poorly sorted mixture of clay, silt, and boulders, which generally has a much lower hydraulic conductivity that the overlying sandy material. This till unit forms the bottom of the aquifer, since water and other liquids flow through it very slowly. Below the till, bedrock consists of sandstones, siltstones, and shales.

The site is located within the recharge area for the Schenectady Aquifer, which is a designated sole source aquifer under section 1427 of the Safe Drinking Water Act. However, no impacts from the site contaminants have been noted at production wells in the aquifer, and none are expected. The public water supply wells which produce from this aquifer (the Schenectady and Rotterdam well fields) are located approximately 2 miles northwest of the site and hydraulically up-gradient from the site. Since these wells are a significant distance away, and they are not located in the direction of the groundwater flow, they are not and will not be impacted by this site. A report prepared for the Schenectady Intermunicipal Watershed Rules and Regulations Board supports this conclusion.

Schermerhorn Creek flows through the site. This creek is culverted upstream and downstream from the site, and functions largely as a storm sewer. This unculverted portion of the Creek floods on a regular basis, in spite of the flood control structures upstream of the site.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

The MGP was constructed by the Mohawk Gas Company in 1903. Gas was manufactured at this site using the coal carbonization processes from 1903 until 1907. From 1907 until the 1940's, gas was manufactured using the carbureted water gas process. A series of consolidations of utility companies resulted in NMPC acquiring the site in 1950. Demolition of the MGP-related structures took place in 1961. A map showing the MGP related structures that were in place circa 1930 is included as Figure 2.

3.2: Remedial History

This site is a former MGP owned by National Grid. In December 1992, NMPC entered into a NYSDEC consent order requiring remediation of 21 Niagara Mohawk owned former MGP sites, including this one. National Grid assumed liability for this site following acquisition of the Niagara Mohawk Power Corporation (NMPC) in 2002.

A Preliminary Site Assessment (PSA) was performed during the spring and summer of 1992. This investigation consisted of an 82 point soil gas survey, excavation of 15 test pits, installation of 27 soil borings, installation of one monitoring well, and collection of 2 sediment samples. These efforts found MGP related contamination in the area of the historic gas production facilities and gas holders, as well as on the west side of the property near the Conrail railroad tracks. The final PSA Report was submitted by Niagara Mohawk in June 1993, recommending a full Remedial Investigation.

SECTION 4: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The NYSDEC and the Niagara Mohawk Power Corporation entered into a Consent Order on December 7, 1992. The Order obligates Niagara Mohawk Power Corporation to implement a full remedial program. This Order was superceded by a separate order dated November 7, 2003, signed by National Grid.

SECTION 5: SITE CONTAMINATION

A remedial investigation/feasibility study (RI/FS) has been conducted to evaluate the alternatives for addressing the significant threats to human health and the environment.

5.1: Summary of the Remedial Investigation

The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The RI was conducted in 3 phases. Most of the field work took place during the first phase, between July and October 1994. The second phase took place between April and August 1996, and the third phase took place in March 1997. Taken together, these investigations identified the location of historic MGP structures and the associated contamination in the soil, groundwater and sediment. A report entitled "Remedial Investigation Report for the Schenectady (Broadway) Site" dated January 1999 was prepared to describe the field activities and findings of the RI in detail.

Following the completion and approval of the RI, additional investigation of the site was deemed necessary. Investigation activities were carried out between November 2001 and May 2005 to more precisely locate the subsurface structures, more fully understand the distribution and migration of the MGP tars in the subsurface, and characterize the till material under the site. The findings of those investigations are described in the Site Remedial Investigation Report. These reports are available at the document repositories identified earlier in this report.

5.1.1: Standards, Criteria, and Guidance (SCGs)

To determine whether the soil, groundwater, and surface water and sediment contain contamination at levels of concern, data from the investigation were compared to the following SCGs:

- Groundwater, drinking water, and surface water SCGs are based on the Department's "Ambient Water Quality Standards and Guidance Values" and Part 5 of the New York State Sanitary Code.

- Soil SCGs are based on the Department's Cleanup Objectives ("Technical and Administrative Guidance Memorandum [TAGM] 4046; Determination of Soil Cleanup Objectives and Cleanup Levels." and 6 NYCRR Subpart 375-6 - Remedial Program Soil Cleanup Objectives).

- Sediment SCGs are based on the Department's "Technical Guidance for Screening Contaminated Sediments."

Based on the RI results, in comparison to the SCGs and potential public health and environmental exposure routes, certain media and areas of the site require remediation. These are summarized in Section 5.1.2. More complete information can be found in the RI report.

5.1.2: Nature and Extent of Contamination

This section describes the findings of the investigation for all environmental media that were investigated.

As described in the RI report, many soil, groundwater and sediment samples were collected to characterize the nature and extent of contamination. As seen in Figures 3 through 7 and summarized in Table 1, the main categories of contaminants that exceed their SCGs are volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). For comparison purposes, where applicable, SCGs are provided for each medium.

Cyanide was also detected in groundwater at levels above applicable SCGs. There are two potential sources of cyanide at MGP sites: purifier waste and tar from the coal carbonization process. At this site, there have been no observations of significant purifier waste deposits. The elevated cyanide levels in groundwater coincide with areas of MGP tar contamination. Therefore, since it appears to be related to the coal carbonization tar, cyanide in groundwater will not be addressed separately in the evaluation of alternatives.

Specific volatile organic compounds of concern are benzene, toluene, ethylbenzene and xylenes. These are referred to collectively as BTEX in this document.

The specific semivolatile organic compounds of concern in soil and groundwater are the following polycyclic aromatic hydrocarbons (PAHs):

acenaphthene	acenaphthylene	*dibenzo(a,h)anthracene*	*chrysene*
anthracene	*benzo(a)anthracene*	fluoranthene	fluorene
benzo(a)pyrene	*benzo(b)fluoranthene*	*indeno(1,2,3-cd) pyrene*	2-methylnaphthalene
benzo(g,h,i)perylene	*benzo(k)fluoranthene*	naphthalene	phenanthrene
pyrene			

PAH concentrations referred to in this plan are the summation of the individual PAHs listed above (i.e., total PAHs or tPAHs). The italicized PAHs are probable human carcinogens. The summation of the italicized PAHs are referred to in this document as cPAHs.

As described in more detail below, MGP tars are present at this site in the form of a dense oily liquid which does not readily dissolve in water. Materials such as this are typically found at MGP sites, and are referred to as non-aqueous phase liquids or NAPL. Since this NAPL is more dense than water, it is also referred to as a dense NAPL or DNAPL. Analysis of the NAPL reveals that it contains BTEX and PAHs several orders of magnitude greater than the SCGs for these compounds. The NAPL was found to saturate the unconsolidated deposits in some areas and to exist in scattered, discontinuous globules in others. Any of these conditions can serve as the source of high BTEX and PAH concentrations which have been found in soil and groundwater.

Figures 3 through 7 and Table 1 summarize the degree of contamination for the contaminants of concern in soil, groundwater and sediment and compare the data with the SCGs for the site. Chemical concentrations are reported in parts per billion (ppb) for water and parts per million (ppm) for waste, soil, and sediment. The following are the media which were investigated and a summary of the findings of the investigation.

Waste Materials

The distribution of MGP tar is shown on Figure 3. MGP tar was found as a discrete substance - a non-aqueous phase liquid or NAPL - in the vicinity of most former MGP structures, including the gas production facilities between Schermerhorn Creek and the "open garage" and the gas holders located in the center of the site.

MGP tar was also found along the west side of the property, along the Conrail tracks. Since no MGP structures were historically located in this area, it appears that MGP tar either migrated to this location, or was dumped there. This area was the location of the former coal piles. There is some historical literature from other sites which refers to MGP tar being sprayed on coal piles. The tar-covered coal was then burned as fuel. There is no direct evidence or documentation of this practice at this site, but it is one possible explanation for the origin of this contamination.

Tar may have migrated beneath the adjacent elevated railroad tracks, but it has not been observed on the other side. Direct investigation beneath the tracks was not possible.

MGP tar was observed at a wide range of depths at this site. Tar was frequently observed at a depth of less than 4 feet, which makes human exposure more likely. Tar was also observed at depths of approximately 20 feet, and occasionally as deep as 30 feet. These greater depths complicate some treatment technologies, particularly excavation.

Waste identified during the RI/FS will be addressed in the remedy selection process.

Subsurface Soil

Subsurface soil in the vicinity of MGP structures, and in other source areas where tar was found, is impacted by PAHs and BTEX. Total PAH concentrations ranged from not detected (in 56 of 210 samples) to 9689 ppm in boring BBR41 at 4-5 feet bgs. The location of borings which had elevated PAH levels are shown on Figure 5. The highest PAH levels were in the area of the subsurface MGP tar deposits discussed above.

Total BTEX concentrations ranged from not detected (in 67 of 136 samples) to 3020 ppm in sample BB51 in the area of the former purifier house at a depth of 6-8 feet below grade surface (bgs). BTEX concentrations above SCGs were noted in each of the three areas where significant amounts of MGP tar are present. Samples with elevated BTEX concentrations are generally co-located with elevated PAHs.

Samples with elevated cyanide were co-located with samples having elevated PAH levels. Cyanide was not detected in any samples at levels which would be indicative of a "source" area.

The RI separately addressed the most shallow subsurface soil (0-2'). which on-site workers would be most likely to come into contact with on a regular basis. PAH concentrations in the 19 samples ranged 0.6 to 546 ppm. The highest concentrations were found in the northwest portion of the site. Total BTEX concentrations ranged from not detected (in 17 of 19 samples) to levels of .004 and .006 ppm on the far east of the site, adjacent to the Conrail track. One additional soil sample, collected at a depth of 0-2 feet from a location between the garage and the D&H tracks, contained 48.2 ppm BTEX. This one sample was located in this same area as the highest PAHs. Cyanide concentrations ranged from not detected (in 14 of 19 samples) to 80.5 ppm in the northwest portion of the site (co-located with PAHs > 500 ppm). Shallow subsurface soil results are shown on Figure 4.

Subsurface soil contamination identified during the RI/FS will be addressed in the remedy selection process.

Groundwater

Monitoring wells were constructed and groundwater samples were collected both on-site and off-site. MGP related chemicals were found at levels well above applicable SCGs in the groundwater in each of the three source areas where tar was found in the subsurface soil.

Total BTEX concentrations ranged from not detected (in 33 of 56 samples) to levels of 20,700 ppb in MW-18 (adjacent to the former 150,000 CF gas holder). Benzene was found at concentrations above groundwater quality standards more than the other BTEX compounds. The benzene levels in groundwater are shown in Figure 6.

Total PAH concentrations in on-site groundwater ranged from not detected (in 36 of 56 samples) to 5,890 ppb in MW-16 (in the gas production area). Wells with elevated levels of PAHs are generally co-located with wells showing high benzene levels.

Impacted groundwater has migrated off-site a short distance to the north and to the west. PAHs were detected in wells 8 and 9 at concentrations as high as 2,094 ppb, and BTEX were detected at concentrations as high as 1,435 ppb. Well locations and analytical results for benzene are provided in Figure 6.

Cyanide concentrations ranged from not detected (in 20 of 47 samples) to 830 ppb in MW-18 (adjacent to the former 150,000 CF gas holder). Wells with elevated cyanide levels were also generally co-located with elevated benzene levels.

Groundwater contamination identified during the RI/FS will be addressed in the remedy selection process.

Surface Water

BTEX and PAH compounds were not detected in any of the surface water samples from Schermerhorn Creek. Cyanide was detected (below SCGs) at a concentration of 17 ppb in one sample.

No site-related surface water contamination of concern was identified during the RI/FS. Therefore, no remedial alternatives need to be evaluated for surface water.

Sediments

Sediments in the Schermerhorn Creek were sampled on-site and off-site. MGP contamination was detected in samples immediately adjacent to and downstream from the gas production areea. Elsewhere, concentrations of MGP related chemicals were generally consistent with upstream levels. Sample locations and results are provided in Figure 7. Since no BTEX were detected in on-site sediments, only total PAH levels are provided in this figure.

Total PAH concentrations on-site ranged from not detected (in one of 23 samples) to 306 ppm. Concentrations off-site ranged from 4.47 to 17.6 ppm. Total BTEX concentrations ranged from not detected (in 31 of 32 samples) to levels of .004 ppm in one sample collected upstream from the site. Cyanide concentrations ranged from not detected (in 21 of 23 samples) to 1.44 ppm.

Sediment contamination identified during the RI/FS will be addressed in the remedy selection process.

Soil Vapor/Sub-Slab Vapor/Air

A vapor intrusion investigation has not yet been completed at this site. In 1992, a soil gas survey was completed with vadose zone soil gas being analyzed at 82 points by a field gas chromatograph (GC). This investigation did not produce quantitative results, but did suggest significant levels of soil gas contamination in areas where subsequent investigations showed MGP tar to be present above the groundwater.

Since there is a potential for soil gas to impact indoor air in on-site and off-site building, an investigation and evaluation of possible soil vapor intrusion will be required.

5.2: <u>Interim Remedial Measures</u>

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS. There were no IRMs performed at this site during the RI/FS.

5.3: Summary of Human Exposure Pathways:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the human exposure pathways can be found in Section 8.3 of the RI report. An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: [1] a contaminant source, [2] contaminant release and transport mechanisms, [3] a point of exposure, [4] a route of exposure, and [5] a receptor population.

The source of contamination is the location where contaminants were released to the environment (any waste disposal area or point of discharge). Contaminant release and transport mechanisms carry contaminants from the source to a point where people may be exposed. The exposure point is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (e.g., ingestion, inhalation, or direct contact). The receptor population is the people who are, or may be, exposed to contaminants at a point of exposure.

An exposure pathway is complete when all five elements of an exposure pathway exist. An exposure pathway is considered a potential pathway when one or more of the elements currently does not exist, but could in the future.

Under the current and future use scenarios, the following potential exposure pathways have been identified:

- On-site workers and construction workers may come in contact with MGP waste during sub-surface excavation and may be exposed to site related contamination through dermal contact, ingestion, or inhalation of vapors and airborne particulates.
- The potential for future exposures resulting from ingestion or dermal contact to contamination in on-site and off-site groundwater is unlikely due to the availability of a public water supply. However, potential exposure to contaminated groundwater could occur if a drinking water well were installed on-site.
- People in on-site and off-site buildings could be exposed via inhalation of MGP associated vapors accumulating in the indoor air. The investigations necessary to fully evaluate this pathway have not been completed, but are planned during the remedial design.
- There is the potential for on-site workers or trespassers to be exposed through direct contact or incidental ingestion with elevated PAHs in on-site sediment of Schemerhorn Creek.

5.4: Summary of Environmental Assessment

This section summarizes the assessment of existing and potential future environmental impacts presented by the site. Environmental impacts include existing and potential future exposure pathways to fish and wildlife receptors, as well as damage to natural resources such as aquifers and wetlands.

The Fish and Wildlife Impact Analysis, which is included in the RI report, presents a detailed discussion of the existing and potential impacts from the site to fish and wildlife receptors.

The following environmental exposure pathways and ecological risks have been identified:

- Sediments in the Schemerhorn Creek contain levels of PAHs at levels that are considered toxic to bottom-dwelling wildlife. This results in potential impacts to wildlife living and/or feeding in the

Creek. Sampling of the sediment biota at the site has shown a relatively healthy benthic community in the sediment, which demonstrates that there is some ecological value to this steam.

- Site contamination has also impacted the groundwater resource in a designated sole source aquifer which is locally used as a drinking water supply. However, no migration of contamination toward the existing drinking water supply wells has been detected and such migration is considered highly unlikely.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and/or the environment presented by the hazardous waste disposed at the site through the proper application of scientific and engineering principles.

The remediation goals for this site are to prevent, eliminate or reduce to the extent practicable:

- Ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Contact with, or inhalation of, volatiles from contaminated groundwater.
- Discharge of contaminants to surface water.
- The source of ground and/or surface water contamination.
- Ingestion/direct contact with contaminated soil.
- Inhalation of or exposure from contaminants volatilizing from contaminants in soil.
- Migration of contaminants that would result in groundwater or surface water contamination.
- Impacts to biota from ingestion/direct contact with contaminated soil and sediment.
- Migration of contaminated sediments.
- Impacts to biota from ingestion/direct contact with sediments causing toxicity to terrestrial or aquatic wildlife.

Further, the remediation goals for the site include attaining to the extent practicable:

- ambient groundwater quality standards and
- recommended soil cleanup objectives in the Department's Cleanup Objectives ("Technical and Administrative Guidance Memorandum [TAGM] 4046; Determination of Soil Cleanup Objectives and Cleanup Levels." and 6 NYCRR Subpart 375-6 - Remedial Program Soil Cleanup Objectives).

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for the Niagara

Mohawk Broadway – Schenectady MGP site were identified, screened and evaluated in the FS report which is available at the document repositories established for this site.

A summary of the remedial alternatives that were considered for this site appears below. Alternative 4 presented below is a modification to Alternative 3, and was not included in the FS. Cost estimates for Alternative 4 are provided in Table 3. FS Alternative 3, "In-Situ Solidification of potentially NAPL impacts soils" was not included in the PRAP. This technology was included in PRAP Alternative 6.

The estimated costs are presented as "present worth" which represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved.

7.1: Description of Remedial Alternatives

The following potential remedies were considered to address the contaminated soil, groundwater, and sediment at the site.

Alternative 1: No Action

Present Worth: $1,537,000
Capital Cost: $0
Annual Costs:
(Years 1-30): $100,000

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. It requires continued monitoring only, allowing the site to remain in an unremediated state. This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment. There would be some costs due to the need to regularly assess site conditions and to continue monitoring the contaminated groundwater.

Common Elements

Alternatives 2 through 6 evaluated below each include the following common elements:

- An asphalt pavement cover (or a Department approved alternate cover system) would be provided. The cover installed would be engineered to minimize infiltration of rainwater into the area of remaining contamination, and would also limit exposure to underlying contamination.
- Schemerhorn Creek: The channel of Schermerhorn Creek would be reconfigured to prevent the discharge of contaminated groundwater to the creek or the infiltration of creek water into the containment area. This would be accomplished by removing the sediments and underlying soils from the creek bed to a depth sufficient to accommodate the placement of an impermeable barrier (e.g. concrete or geomembrane) and then restoring the stream channel with at least 2 feet of clean soils suitable for re-establishment of a benthic community. During the remedial design, the portion of the stream downstream of the proposed containment barrier and downstream from known subsurface contamination would be evaluated to determine the extent of the stream barrier system. If the impermeable barrier is not necessary for the integrity of the remedy, the stream would be restored without the barrier. Restoration of the vegetation in the bed and banks of the stream would follow the remediation in either case.

- Imposition of an institutional control in the form of an environmental easement that would require (a) limiting the use and development of the property to commercial use, which would also permit industrial use; (b) compliance with the approved site management plan; (c) restricting the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by NYSDOH; and (d) the property owner to complete and submit to the Department a periodic certification of institutional and engineering controls.

- Development of a site management plan which would include the following institutional and engineering controls: (a) management of the asphalt cover to restrict excavation below the pavement, or buildings. Excavated soil would be tested, properly handled to protect the health and safety of workers and the nearby community, and would be properly managed in a manner acceptable to the Department; (b) continued evaluation of the potential for vapor intrusion for any buildings developed on the site, including provision for mitigation of any impacts identified; (c) monitoring of groundwater and the tar under the tracks east of the containment; (d) restricting use of the property to commercial/industrial only; (e) maintenance and monitoring of the containment barrier, including provisions for maintaining an inward hydraulic gradient across the barrier and monitoring this gradient along its entire perimeter; (f) maintenance and monitoring of the barrier isolating Schermerhorn Creek and the stream restoration; and (g) provisions for the continued proper operation and maintenance of the components of the remedy.

- The property owner would provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to the Department, until the Department notifies the property owner in writing that this certification is no longer needed. This submittal would: (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous certification or are compliant with Department-approved modifications; (b) allow the Department access to the site; and (c) state that nothing has occurred that would impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the Department.

Alternative 2: Groundwater Extraction and Treatment

Present Worth: $12,981,000
Capital Cost: $9,178,000
Annual Costs:
(Years 1-30): $274,000

In this alternative, contaminated groundwater would be pumped from a series of wells and treated on-site. The objective would be to maintain an inward hydraulic gradient so that contaminated groundwater would not migrate to off site areas. Some mobile MGP tar would also be extracted in this process, but most would not be extracted or otherwise addressed by this alternative. An asphalt cover, institutional controls, and Schermerhorn Creek would be addressed as described above in the common elements.

Alternative 3: Containment with Tar Collection

Present Worth: $19,900,000
Capital Cost: $17,656,000
Annual Costs:
(Years 1-30): $176,000

This alternative (shown in Figure 8) would isolate the most heavily contaminated areas to prevent contact with groundwater and to prevent further migration of contamination. A physical subsurface barrier wall would be constructed to surround the contaminated areas. Groundwater levels within the contained area would be maintained at levels lower than the surrounding areas to eliminate the possibility for migration of liquids out of the containment area.

Mobile MGP tar within the contained area would be removed using collection wells, with the collected tar sent off site for proper treatment and disposal. In addition to the tar collection, some pumping of groundwater would be required to maintain an inward groundwater gradient. This pumping would be conducted in the most heavily contaminated portions of the site, to maximize the removal of contamination over the long term. Recovered groundwater would be treated to remove tar and dissolved contaminants, as needed to allow discharge to either Schermerhorn Creek or the local sanitary sewer system.

Several on-site utility lines (particularly natural gas pipes) are located in heavily contaminated soils north of Schermerhorn Creek. To lower the risk of worker exposure to this contamination during future repair and reconstruction work, this Alternative would remove contaminated soil within one foot of these utility lines.

An asphalt cover, institutional controls, and Schermerhorn Creek would be addressed as described above in the common elements. The required site management plan would also include Maintenance and monitoring of the containment barrier, including provisions for maintaining an inward hydraulic gradient.

Alternative 4: Containment with Shallow Soil Removal

Present Worth: $21,787,000
Capital Cost: $19,568,000
Annual Costs:
(Years 1-30): $176,000

This Alternative (shown in Figure 9) would be identical to Alternative 3, with one addition: shallow source material which is readily accessible for excavation and which would also represent the highest potential for human exposure would be excavated and shipped off-site for proper treatment and disposal. This excavation of approximately 12,000 cubic yards would include all MGP tar impacted soil above the water table. Between Schermerhorn Creek and the open garage, the excavation would be extended below the water table to a depth of up to 10 feet and would include removal of all historic MGP structures. A trace of oil-like material was noted above the water table inside the open garage. This contamination does not appear to represent a significant source area, and the above grade structure and very heavy sub-grade concrete would make excavation difficult. This area would be addressed by the institutional controls.

All of the containment measures proposed in Alternative 3 would remain, with the most heavily contaminated areas surrounded with a vertical barrier wall and covered with an asphaltic cover. MGP tar collection and groundwater pumping measures would remain the same. The basis for the cost estimate for the additional excavation proposed in this alternative, is provided in Table 3.

An asphalt cover, institutional controls, and Schermerhorn Creek would be addressed as described above in the common elements. The required site management plan would also include maintenance and monitoring of the containment barrier, including provisions for maintaining an inward hydraulic gradient.

Alternative 5: Containment with Chemical Oxidation

Present Worth: $23,531,000
Capital Cost: $21,439,000
Annual Costs:
(Years 1-30): $166,000

This Alternative would be identical to Alternative 3, with the addition of in-situ chemical oxidation to treat MGP contaminants within the contained area. This method would involve the injection of chemical oxidizing agents into the ground which react with and destroy the MGP tars and their dissolved constituents. The oxidation produces carbon dioxide and water as its end products. A treatability study would be required to confirm that oxidation would be effective and implementable.

As with Alternative 3, contamination within one foot of existing infrastructure (pipes and electric lines) would be removed and shipped off site for treatment and disposal. An asphaltic cover, institutional controls, and Schermerhorn Creek would be addressed as described above in the common elements. The required site management plan would also include Maintenance and monitoring of the containment barrier, including provisions for maintaining an inward hydraulic gradient.

Alternative 6: In-Situ Solidification (Total PAHs >500 ppm)

Present Worth: $45,956,000
Capital Cost: $44,281,000
Annual Costs:
(Years 1-30): $133,000

Under this Alternative (shown in Figure 10), MGP tar-contaminated soils would be treated with in-situ stabilization (ISS). This process would involve mixing the soil with pozzolanic agents (typically portland cement). Overlapping vertical columns of solidified soil would be created using large diameter augers, jet grouting, or other methods, resulting in a large monolith with greatly reduced permeability. Contaminants would not be destroyed, but they would be immobilized in place, and contact with groundwater is greatly reduced.

Some pre-excavation would be required. Any subsurface structures such as foundations and abandoned piping would interfere with the mixing process and thus would need to be removed. Since the addition of cement would result in a net volume increase, the ground surface would rise unless some soil were removed ahead of time. It is estimated that approximately 5 feet of soil would need to be removed to account for the volume increase resulting from the ISS. Some foundations would require deeper excavation beyond this depth. Soils removed would be sent off-site to an appropriately permitted treatment or disposal facility. An asphalt cover, institutional controls, and Schermerhorn Creek would be addressed as described above in the common elements.

Alternative 7: Soil Removal - Total PAHs >500 PPM

Present Worth: $79,327,000
Capital Cost: $78,582,000
Annual Costs:
(Years 1-30): $60,000

In this alternative (shown in Figure 11), all soil with visible MGP tar impacts or with total PAHs above the TAGM 4046 guidance value of 500 ppm total PAHs would be excavated. Removed material would be transported off site to appropriately permitted treatment and disposal facilities. The site would then be backfilled with clean fill material from off-site sources. Since this remedy would still result in contamination remaining in place (particularly under the tracks) which could represent a continuing source of groundwater contamination continued groundwater monitoring and institutional controls would be required.

Since this remedy would remove the contamination which could potentially enter the creek, isolation of the creek would not be needed. After removal of impacted sediment, the Creek would be restored as an unlined, open stream. The similar remedy in the Feasibility Study (FS) called for culverting the creek, which accounts for the difference in cost between the FS and this document.

Alternative 8: Soil Removal - Contamination above TAGM 4046 RSCO

Present Worth: $157,014,000
Capital Cost: $157,014,000
Annual Costs:
(Years 1-30): $0

This alternative (shown in Figure 12) would maximize removal of MGP Tar and contaminated soil from the site.

All MGP Tar-contaminated soil and soil exceeding the soil cleanup goals would be removed. Removed material would be transported off site to appropriately licensed treatment and disposal facilities. The site would then be backfilled with clean fill material. Since this remedy would result in contamination remaining in place under the tracks, continued groundwater monitoring and institutional controls would be required.

Since this remedy would remove the contamination which could potentially enter the creek, isolation of the creek would not be needed. After removal of impacted sediment, the Creek would be restored as an unlined, open stream. The similar remedy in the Feasibility Study (FS) called for culverting the creek, which accounts for the difference in cost between the FS and this document.

7.2 Evaluation of Remedial Alternatives

The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375, which governs the remediation of inactive hazardous waste disposal sites in New York A detailed discussion of the evaluation criteria is included in the FS report and a comparative analysis is provided in Section 8.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment. Alternative 4 would be protective of public health and the environment since the shallow coal tar impacted soil (source material) would be removed for off-site treatment/disposal and the source material at depth and remaining soil and groundwater contamination remaining on-site, would be physically isolated from human or environmental receptors.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the Department has determined to be applicable on a case-specific basis. Alternative 4 would comply with SCGs by removing or controlling the media impacted by the MGP contamination at levels exceeding SCGs.

The next five "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Short-term Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives. Alternative 4 would have some short term impacts during implementation, but these impacts could be mitigated using well established operating practices.

4. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks,

2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls. Alterative 4 would be effective in the long term since the shallow coal tar impacted soil (source material) would be removed for off-site treatment/disposal and the source material at depth and remaining soil and groundwater contamination remaining on-site, would be physically isolated from human or environmental receptors.

5. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site. Alternative 4 would be effective in reducing the toxicity, mobility and volume of contamination since the shallow coal tar impacted soil (source material) would be removed for off-site treatment/disposal. The mobility of the remaining soil and groundwater contamination remaining on-site would be controlled by the subsurface containment barrier

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth. Alternative 4 would be readily implementable.

7. Cost-Effectivness. Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision. The costs for each alternative are presented in Table 2. Alternative 4 would be cost effective.

8. Land Use - The current, intended, and reasonably anticipated future use of the site are considered where restoration to pre-disposal conditions is not feasible. Preference is given to alternatives which would allow the full range of planned or anticipated uses without unreasonable use restrictions. Alternative 4 would allow the site to be used for commercial/industrial purposes, which is the intended and reasonably anticipated use of the site. If residential use were proposed in the future, this change of use would have to be approved by the NYSDEC and NYSDOH. Additional soil cover would be required, and the potential for soil vapor intrusion would have to be addressed. The site management plan and environmental easement would also have to be modified.

This final criterion is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

9. Community Acceptance - Concerns of the community regarding the RI/FS reports and the PRAP are evaluated. A responsiveness summary will be prepared that describes public comments received and the manner in which the Department will address the concerns raised. If the selected remedy differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes. The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375, which governs the remediation of inactive hazardous waste disposal sites in New York State. For each criterion, a brief description is provided, followed by an evaluation of the alternatives against that criterion. The rationale for the remedy appears in Section 8.

SECTION 8: SUMMARY OF THE PROPOSED REMEDY

The Department is proposing Alternative 4: Containment with Shallow Soil Removal as the remedy for this site. The elements of this remedy are described at the end of this section.

The proposed remedy is based on the results of the RI, the evaluation of alternatives presented in the FS, and the analysis presented below. Alternative 4 is being proposed because, as described below, it satisfies the threshold criteria and provides the best balance of the primary balancing criteria described in Section 7.2. A detailed comparative analysis of each alternative to each criterion is provided below:

The No Action Alternative would not be protective of human health or the environment since it would not achieve the threshold criterion of protectiveness as described in Section 7. It is not considered further. Each of the remaining alternatives would be protective of human health and the environment, but would attain this protectiveness through different means.

The remediation of contaminated sites in New York State is carried out pursuant to a number of standards, criteria, and guidance (SCGs). The principal SCGs are contained in 6 NYCRR Part 375 (Part 375). Section 1.8.c of Part 375 provides a hierarchy of source removal and control measures which are to be used, ranked in order of preference. This hierarchy also guides the Department in comparing how different alternatives achieve the required protection of human health and the environment. The preferred option is removal and/or treatment of all source material. This is typically achieved through excavation of contaminated soils. Due to the depth to which the tar has sunk at this site, and the presence of active railroad lines along the site perimeter, complete excavation of source material would be extraordinarily difficult.

Alternatives 7 and 8 would permanently remove the majority of contamination from this site, while leaving some behind beneath the tracks, and would thus come closest to achieving the preference for source removal. Alternative 5 is intended to destroy the contamination through in-situ chemical oxidation, and would also achieve the objective of source removal if that technology could be applied effectively throughout the waste mass. If full removal is not feasible, source material is to be removed to the greatest extent feasible. As such, Alternatives 4 and 6 would be preferred over Alternative 3 since they call for physical removal of more contaminated material than Alternative 3 does. Alternative 2 would only remove small amounts of source material, and would only deal with groundwater which has already become contaminated by contact with source material. Alternative 1 would not provide any active source area remediation and thus would not satisfy this criterion.

If contamination is to remain on-site, the Department's preference is to physically isolate the contamination from human or environmental receptors. Alternative 8 would avoid the need for such isolation, since (with the exception of the inaccessible areas beneath the railroad tracks) it would leave no contamination at levels that could present a threat to human health and the environment. Alternative 7 would be nearly as protective, since most contamination would be removed and what remains would be at considerable depth below the ground surface. Alternative 5 would have the potential to destroy a large amount of contamination and eliminate the need for isolation, but may be difficult to implement at this site (see discussion below). Of the three containment remedies, Alternative 4 would remove the most shallow contamination, which is the contamination most likely to result in exposure to the on-site workers identified in section 5.3. Alternatives 4 and 3 would both physically isolate the contamination from contact with groundwater, but Alternative 3 would not remove significant amounts of it, and some of the remaining contamination would be left in a position where direct contact could occur in the future. Alternative 6 would achieve isolation through solidification of the contaminated soil, thus greatly reducing the impact of the contamination on groundwater and limiting the potential for direct exposures. Alternative 2 would rely on the continued operation of the extraction system to maintain the isolation, and would (like Alternative 3) leave significant amounts of contamination in a position where direct contact could occur in the future.

Where contamination can not be adequately isolated, then institutional controls would be needed to manage the site in a way that will minimize exposures.

Section 1.8.d of Part 375 provides the basis for considering groundwater contamination associated with contaminated sites. The first measure to be taken would be source removal and control as noted above. The second would be to evaluate restoration of groundwater quality to meet applicable standards guidance. Alternatives 6, 7, and 8 would be expected to allow groundwater to meet applicable standards except for the area directly below the railroad tracks. Alternative 5 would also be expected to meet standards if that technology could be applied effectively. If groundwater restoration is not feasible, plume containment/stabilization is called for. Alternatives 2, 3, and 4 would provide containment or stabilization of the plume. Alternative 1 would not provide any active remediation and not address this criterion.

In addition to 6 NYCRR Subpart 375, applicable SCGs for this site include a)groundwater SCGs based on the Department's "Ambient Water Quality Standards and Guidance Values"; b) Soil SCGs based on the Department's "Technical and Administrative Guidance Memorandum [TAGM] 4046; Determination of Soil Cleanup Objectives and Cleanup Levels." and 6 NYCRR Subpart 375-6 - Remedial Program Soil Cleanup Objectives; and c) Sediment SCGs based on the Department's "Technical Guidance for Screening Contaminated Sediments."

With the exception of Alternative 1 (No Action), all of the remaining alternatives would comply with applicable SCGs. Alternative 8 would comply by removing all soil and sediment which contain contaminants at levels above SCGs (except under the tracks). Groundwater would be expected to meet SCGs shortly after remediation. The other six alternatives would all leave soil containing contamination at levels above SCGs. As such, they would employ other means to achieve SCG compliance. The contamination left in place following removal in Alternative 7 would not be accessible to environmental or human receptors, and would not be expected to significantly impact groundwater quality. Alternative 6 would isolate the remaining soil contamination from groundwater and human or environmental receptors by solidifying the soil and greatly reducing potential contact with contaminants in the solidified mass. Groundwater would be expected to meet SCGs following remediation. Alternatives 2 - 5 would leave contamination in contact with groundwater, but would physically and/or hydraulically control movement of the contaminated groundwater into off site areas.

As outlined in Section 7, balancing criteria are used to compare the positive and negative aspects of each alternative which meets the threshold criteria of protectiveness and SCG compliance.

Alternatives 7 and 8 would have the greatest potential for short term impacts because they would involve the excavation and handling of very large volumes of impacted soil. The potential to generate organic vapors and fugitive dust could be mitigated using well-established operating practices. However, the two alternatives would also be extremely disruptive to on-site operations, and would likely result in the relocation of these business activities. These alternatives would also entail a large amount of truck traffic, which would also impact the community through increased truck traffic, noise, air pollution and potential for spills or accidents. Smaller volumes of soil would be excavated and handled in Alternatives 4 and 6. These alternatives would include impacts similar to Alternatives 7 and 8 (truck traffic, dust, vapors, business disruption), but to a far lesser degree. Alternative 6 would also involve handling ISS spoils or "fluff." Alternative 6 would be extremely disruptive to on-site operations, and would likely require the relocation of these business activities.

The chemical oxidation called for in Alternative 5 would involve transporting and using strong oxidants, which can present safety risks. These risks can be mitigated using well established operating practices. Alternative 2 would have relatively low short term impacts, but these impacts would continue for the foreseeable future. Alternative 3 would have less short term impact than the other containment alternatives (4 and 5), since the other 2 alternatives involve additional, active remediation.

The long term effectiveness of Alternatives 2-8 is assessed largely on the basis of how they meet the source removal hierarchy in Part 375 as discussed above. Alternatives 7 and 8 would be the most effective and permanent, since they would remove the greatest amount of contamination. Alternative 5 could potentially destroy the contamination and achieve the same degree of permanence, but may be difficult to implement. The remaining alternatives all leave varying amounts of contamination on-site, which would need to be managed over the long term through engineering controls and/or institutional controls. Of these remedies, Alternative 6 would rely the least on institutional controls and would thus be the most reliable. Alternative 4 would be preferred over Alternative 3 because shallow contamination would be removed instead of relying on an institutional control to prevent exposure to near-surface contamination. The reliability of the containment wall proposed in alternatives 3 and 4 would need to be monitored over the long term to ensure that an inward hydraulic gradient is maintained across the barrier wall. Alternative 2 would leave contamination in place, and would relay on the continued operation and maintenance of the pumping system to maintain an inward gradient, and would thus be less reliable that Alternatives 3 and 4 over the long term.

Reduction of mobility, toxicity, and volume for Alternatives 2-8 is also assessed in light of the source removal hierarchy presented in Part 375. Alternatives 7 and 8 would permanently reduce all three by removing the majority of contamination from this site. Alternative 5 would also meet this criterion in full by permanently destroying the contamination through in-situ chemical oxidation (assuming that the technology could be applied effectively). Alternative 6 would greatly reduce mobility and marginally reduce toxicity with little reliance on institutional controls. The volume of waste, however, would actually increase due to the "fluff" effect involved in the addition of cement to the contaminated soil. Alternative 2 would slightly reduce volume by extracting some groundwater contamination, but the reduction in mobility would rely on the continued operation of the extraction system to maintain hydraulic control. Alternative 3 would remove very little contamination, and would rely almost entirely on the containment barrier to reduce mobility. Alternative 4 would build on Alternative 3 by removing some contamination near the ground surface, which would otherwise have the potential to be remobilized during future flooding or excavation work. Alternative 4 thus reduces mobility, toxicity, and volume of the contaminated material more effectively that Alternative 3 or 2.

Alternatives 2, 3, 4 and 6 all employ tested technologies and are all considered readily implementable. Subsurface conditions and the complex distribution of MGP tar at this site would make Alternative 5 difficult to implement. Although oxidizing agents have been shown to destroy tar contamination quite readily, the chemical reactions involved can only take place if the oxidizing agents are mixed thoroughly with the contaminants. Mixing of the water-based oxidizing solutions with oily tar contained in the subsurface soils would be difficult to achieve, and incomplete mixing would result in incomplete treatment of the contamination. Alternatives 7 and 8 would involve very extensive excavation and would involve relocating current site activities as well as requiring a large fleet of trucks and significant off-site treatment and disposal capacity, both of which can be limiting factors. Excavation below the water table would require extensive dewatering, and the large volumes of water would need to be treated prior to discharge. It is expected that the excavation would be limited by the presence of the adjoining rail lines. Both lines are heavily used, and relocating them is considered infeasible.

Aside from the No-action alternative, Alternative 2 has the lowest cost. The next lowest cost would be for Alternative 3. However, both of these alternatives are less effective in preventing exposure to contaminated soils, since both allow highly contaminated soil to remain at shallow depths where future direct contact is possible. Alternatives 4 and 5 would more effectively address source material, and the costs involved are similar. However, if mixing of the oxidizing solutions and the tar proves difficult to achieve, repeated applications of in-situ chemical oxidation would be required to meet performance criteria, and the cost of Alternative 5 would rise significantly. The costs of alternatives 6-8 are significantly higher than the other alternatives, and these alternatives do not offer a proportional increase in protection.

At this site, the current and intended use of this site is commercial-industrial. The site management plan and environmental easement would be written with this intended use in mind. While there is no anticipation that this site would be used for residential purposes in the future, all alternatives could reasonably accommodate restricted residential use. If residential use were proposed in the future, this change of use would have to be approved by the NYSDEC and NYSDOH. Additional soil cover would be required, and the potential for soil vapor intrusion would have to be addressed. The site management plan and environmental easement would also have to be modified.

Alternative 4 is being proposed because it satisfies the threshold criteria and provides the best balance of the primary balancing criteria. Alternative 4 would be preferred over Alternatives 7 and 8 because these excavation-based alternatives would be extremely disruptive to on-site operations and to the surrounding community without a proportional benefit to human health or the environment.

In-situ solidification (ISS), described in Alternative 6, appears to be more feasible than excavation at this site, since it would produce far less truck traffic and would largely avoid the need for extensive dewatering of a large excavation. However, the disruption of current site use would be essentially the same as in the excavation alternatives. Alternative 4 would not require relocation of the operations currently conducted at the site and is preferred largely for this reason.

Alternative 4 would be preferred over Alternative 5 because the Department recognizes significant difficulties and complications in conducting in-situ treatment at this site. Although oxidation of MGP tar contamination has shown some promise in limited applications at MGP sites across the state, the nature of the contamination and the subsurface geology indicates this site would not be a good candidate for application of this technology. The heterogeneous nature of the subsurface geology has resulted in this MGP tar being distributed unevenly throughout the contaminated area. This would present significant technical challenges in mixing the oxidant with the MGP tar sufficiently to destroy the tar.

Alternative 3 would leave grossly contaminated material at shallow depths on-site. This contamination presents a potential for future exposures to utility workers and other personnel at the service center, and this potential could be cost-effectively removed by excavation. The Department has not identified any compelling reason to leave this material in place, untreated, given the statutory requirements and hierarchy of actions related to sources of contamination discussed at the beginning of this section. The additional removal proposed in Alternative 4 would address those areas of source contamination which could be most economically and practically removed. Therefore, Alternative 4 would be preferred over Alternative 3.

Alternative 2 (groundwater extraction and treatment) would leave the largest volume of contaminated soil in place on the site. Consequently, the comparison between Alternatives 3 and 4 presented above also apply to the comparison of Alternatives 2 and 4. In addition, Alternative 2 would require constant, long-term operation and maintenance of a large-scale pumping and treatment system in order to control groundwater impacts.

Alternatives 2 through 6 would leave MGP tar and MGP tar contaminated soils in close proximity to the Schermerhorn Creek. A barrier would be required to ensure that this contamination does not enter the creek, and to keep water from the stream from contacting the contaminated soils as well. The design of this barrier would have to consider the overall storm water management at this site as well as in the surrounding neighborhood. Management of storm water in this neighborhood has been a significant issue in the past, and some reworking of the drainage system may be proposed by municipal authorities in the future. The proposed remedy can be modified to match any reasonable alternative selected to deal with the drainage issues in the future.

The barrier described in the proposed remedy would create an open channel with a minimum of two feet of soft sediment provided above the barrier to provided a benthic habitat. This would amount to a restoration of current drainage conditions. However, a culvert would be consistent with the selected remedy. If considerations beyond the scope of this remedy dictate that the stream is to be culverted, then appropriate permits must be obtained from the Army Corps of Engineers, with input from the NYSDEC. The final condition of the stream would be addressed in a comprehensive Storm water Pollution Prevention Plan (SWPPP) consistent with NYSDEC guidelines.

The estimated present worth cost to implement the remedy is $22,657,000. The cost to construct the proposed remedy is estimated to be $20,295,000 and the estimated average annual costs for 30 years is $2,219,000.

The elements of the proposed remedy are as follows:

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program. The design would include a comprehensive stormwater pollution prevention plan to address stormwater run-off control systems needed during the remedial construction phase and during site management, prepared in accordance with the New York Standards and Specifications for Erosion and Sediment Control, dated August 2005; and the New York State Stormwater Management Design Manual, dated August 2003. If alternate erosion and sediment controls or stormwater management practices are proposed, the owner must demonstrate equivalence to these technical standards.

2. All areas above the water table where MGP Tar is present would be excavated and transported off-site for treatment or disposal at an appropriately permitted facility. See Figure 9.

3. Soils containing visible MGP tar in the gas production area between the creek and the open garage would be excavated to a depth of up to 10 feet. This excavation would extend below the bottom of the adjacent creek, and would include removal of all MGP structures in this area. See Figure 9.

4. An area south of Schermerhorn Creek identified as potentially MGP Tar impacted would be excavated to a maximum depth of approximately 15 feet. See Figure 9.

5. Schermerhorn Creek would be isolated from the underlying groundwater with a low permeability barrier (e.g. concrete or geomembrane). Soils and sediment removed to facilitate the construction of an impermeable barrier would be taken off-site to an appropriately licenced treatment or disposal facility. The creek bed would be restored with a minimum 2 feet of clean soils conducive to re-establishing a benthic community. Vegetation in the bed and banks of the stream would be restored following the remediation.

6. A vertical physical containment barrier would be constructed. This barrier would extend to the underlying till layer and would have a low coefficient of permeability, 10^{-7} cm/sec or less, which is similar to a liner at a landfill. This barrier would extend horizontally to contain most of the MGP tar and heavily contaminated soils on site. The proposed alignment of the barrier is shown on Figure 9. Some MGP tar would remain outside the barrier wall west of the site under the railroad embankment. The barrier would also not include the 2 million cubic foot holder or the gas regulator station. The contamination in these two areas is isolated and relatively minor.

7. Along Schermerhorn Creek, it is intended that the vertical barrier wall would surround the most grossly impacted material. If, during installation of the wall, significant amounts of MGP Tar are encountered outside the barrier, the extent of contamination would be determined and appropriate measures would taken to address this contamination. These actions could include either rerouting of the containment barrier or additional excavation. Additional delineation of MGP Tar would be part of the remedial design.

8. An asphalt pavement cover (or a Department approved alternate cover system) would be provided. The cover installed would be engineered to minimize infiltration into the area of remaining contamination, and would also limit exposure to underlying contamination.

9. Mobile MGP tar within the contained area would be removed to the extent possible using collection wells, with the collected tar sent off site for proper treatment and disposal. In addition to the tar collection, some pumping of groundwater would be required to maintain an inward groundwater gradient. This pumping would be conducted in the most heavily contaminated portions of the site, to maximize the removal of contamination over the long term. Monitoring wells would verify the effectiveness of the system.

10. Soil vapor near the on-site office building and west of the railroad tracks (off-site) would be investigated to evaluate the potential for contaminated soil vapor entering occupied buildings both

prior to the start of design and post-remedy. Mitigation systems, if determined to be necessary, would be installed.

11. Imposition of an institutional control in the form of an environmental easement that would require (a) limiting the use and development of the property to commercial use, which would also permit industrial use; (b) compliance with the approved site management plan; (c) restricting the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by NYSDOH; and (d) the property owner to complete and submit to the Department a periodic certification of institutional and engineering controls.

12. Development of a site management plan which would include the following institutional and engineering controls: (a) management of the asphalt cover to restrict excavation below the pavement, or buildings. Excavated soil would be tested, properly handled to protect the health and safety of workers and the nearby community, and would be properly managed in a manner acceptable to the Department; (b) continued evaluation of the potential for vapor intrusion for any buildings developed on the site, including provision for mitigation of any impacts identified; (c) monitoring of groundwater and the MGP tar under the tracks east of the containment; (d) restricting use of the property to commercial/industrial only; (e) maintenance and monitoring of the containment barrier, including provisions for maintaining an inward hydraulic gradient across the barrier and monitoring this gradient along its entire perimeter; (f) maintenance and monitoring of the barrier isolating Schermerhorn Creek and the stream restoration; and (g) provisions for the continued proper operation and maintenance of the components of the remedy; (h) maintenance of any mitigation systems required as a result of planned investigation described above in item 10.

13. The property owner would provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to the Department, until the Department notifies the property owner in writing that this certification is no longer needed. This submittal would: (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous certification or are compliant with Department-approved modifications; (b) allow the Department access to the site; and (c) state that nothing has occurred that would impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the Department.

TABLE 1
Nature and Extent of Contamination
June 1994 - May 2005

SHALLOW SUBSURFACE SOIL (0-2')	Contaminants of Concern	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)[a]	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	Benzene	ND - .006	0.06	0 of 18
	Toluene	ND - .002	1.5	0 of 18
	Ethylbenzene	ND	5.5	0 of 18
	Xyene (Total)	ND	1.2	0 of 18
Semivolatile Organic Compounds (SVOCs)	Total PAHs	0.6 -546	500	1 of 18

SUBSURFACE SOIL	Contaminants of Concern	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)[a]	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	Benzene	ND - 430	0.06	40 of 143
	Toluene	ND - 1,100	1.5	16 of 143
	Ethylbenzene	ND - 570	5.5	20 of 143
	Xyene (Total)	ND - 2,600	1.2	18 of 143
Semivolatile Organic Compounds (SVOCs)	Total PAHs	ND - 9,689	500	19 of 188

SEDIMENTS	Contaminants of Concern	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)[a]	Frequency of Exceeding SCG
Semivolatile Organic Compounds (SVOCs)	Total PAHs	ND - 306	4	26 of 34
	Exceed SCG for at least one PAH	NA	NA	31 of 34

GROUNDWATER	Contaminants of Concern	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)[a]	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	Benzene	ND - 8,000	1	51 of 124
	Toluene	ND - 3,100	5	20 of 124
	Ethylbenzene	ND - 2,100	5	33 of 124
	Xyene (Total)	ND - 8,300	5	33 of 124
Semivolatile Organic Compounds (SVOCs)	Naphthalene	ND - 5,900	10	27 of 122
	Total PAHs	ND - 6,280	NA	
	Exceeds GW Standards for at least one PAH.	NA	NA	36 of 122
Inorganic Chemicals	Cyanide	ND - 1,100	200	5 of 28

SURFACE WATER	Contaminants of Concern	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)[a]	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	Benzene	ND	1	0 of 4
	Toluene	ND	5	0 of 4
	Ethylbenzene	ND	5	0 of 4
	Xyene (Total)	ND	5	0 of 4
Semivolatile Organic Compounds (SVOCs)	Naphthalene	ND	13	0 of 4
	Total PAHs	ND	NA	0 of 4

[a] ppb = parts per billion, which is equivalent to micrograms per liter, ug/L, in water;
ppm = parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil;
ug/m^3 = micrograms per cubic meter

[b] SCG = standards, criteria, and guidance values;

- Groundwater, drinking water, and surface water SCGs are based on the Department's "Ambient Water Quality Standards and Guidance Values" and Part 5 of the New York State Sanitary Code.
- Soil SCGs are based on the Department's Cleanup Objectives ("Technical and Administrative Guidance Memorandum [TAGM] 4046;
- Sediment SCGs are based on the Department's "Technical Guidance for Screening Contaminated Sediments."

[c] LEL = Lowest Effects Level and SEL = Severe Effects Level. A sediment is considered to be contaminated if either of these criteria is exceeded. If both criteria are exceeded, the sediment is severely impacted. If only the LEL is exceeded, the impact is considered to be moderate.

For marine and estuarine sediments, change LEL to ER-L and SEL to ER-M in Table 1 and replace the above footnote with:
[c] ER-L = EffectRange - Low and ER-M = Effect Range - Moderate. A sediment is considered to be contaminated if either of these criteria is exceeded. If both criteria are exceeded, the sediment is severely impacted. If only the ER-L is exceeded, the impact is considered to be moderate.

NA = No SCG available for the compounds and environmental medium indicated.

Table 2
Remedial Alternative Costs

Remedial Alternative	Capital Cost ($)	Annual Costs ($)	Total Present Worth ($)
1. No Action	$0	$0	$0
2. Pump and Treat	$9,178,000	$274,000	$12,981,000
3. Containment	$17,656,000	$176,000	$19,875,000
4. Containment with Soil Removal	$20,295,000	$176,000	$22,657,000
5. Containment with In-Situ Oxidation	$21,440,000	$166,000	$23,532,000
6. In-Situ Solidification	$44,281,000	$133,000	$45,956,000
7. Excavation (PAHs >500 ppm)	$78,582,000	$60,000	$79,327,000
8. Excavation (TAGM 4046)	$157,014,000	$0	$157,014,000

Table 3
Excavation Cost Estimate for Alternative 4

Unit Costs

	Capital Cost	O&M Cost (Annual)	O&M (30 Yr. Total)	Total
Asphaltic Cap	$1,203,750	$10,000	$148,920	$1,352,670
Containment Barrier	$7,963,125	$63,000	$789,276	$8,752,401
ISS (NAPL)	$20,773,500	$63,000	$781,830	$21,555,330
ISS (PAHs>500 PPM)	$36,192,000	$63,000	$781,830	$36,973,830
Soil Removal (Utilities)	$143,288	$0	$0	$143,288
Soil Removal (PAHs >500 ppm)	$76,999,500	$0	$0	$76,999,500
Soil Removal (TAGM)	$155,695,500	$0	$0	$155,695,500
GW Monitoring	$264,000	$60,000	$744,600	$1,008,600
NAPL Collection	$142,500	$43,200	$536,112	$678,612
ISCO	$5,244,000	$33,000	$409,530	$5,653,530
GW Extraction and Treatment	$1,353,000	$264,000	$3,653,934	$5,006,934
Sediment Removal	$2,034,525	$0	$0	$2,034,525
Culvert	$6,621,375	$0	$0	$6,621,375
Soil removal - South of Creek	$1,318,425	$0	$0	$1,318,425
Soil Removal (Shallow Areas)	$679,175	$0	$0	$679,175
Soil Removal (Deeper Areas)	$2,102,239	$0	$0	$2,102,239

Cost Summary

Alt 1 No Action	$0	$0	$0	$0
Alt 5 Pump and Treat	$9,178,125	$274,000	$3,802,854	$12,980,979
Alt 2 Containment	$17,656,463	$176,200	$2,218,908	$19,875,371
Alt 4 Containment and Excavation	$20,294,589	$176,200	$2,218,908	$22,656,785
Alt 3 Contain and ISCO	$21,439,538	$166,000	$2,092,326	$23,531,864
Alt 6 ISS	$44,281,125	$133,000	$1,675,350	$45,956,475
Alt 7 Excavate (PAHs>500)	$78,581,925	$60,000	$744,600	$79,326,525
Alt 8 Excavate (TAGM)	$157,013,925	$0	$0	$157,013,925

Description of Alternatives

Alt 1	No Action
Alt 2	Asphaltic Cap, GW Extraction and Treatment, Culvert
Alt 3	Asphaltic Cap, Containment Barrier, Soil Removal (Utilities), GW Monitoring, Culvert, Soil removal - South of Creek, NAPL Collection
Alt 4 (Proposed)	Asphaltic Cap, Containment Barrier, Soil Removal (Utilities), GW Monitoring, Culvert, Soil removal - South of Creek, NAPL Collection, Shallow Excavation
Alt 5	Asphaltic Cap, Containment Barrier, Soil Removal (Utilities), GW Monitoring, Culvert, ISCO
Alt 6	Asphaltic Cap, ISS (PAHs>500 PPM), GW Monitoring, Culvert
Alt 7	Soil Removal (PAHs >500 ppm), GW Monitoring, Culvert
Alt 8	Soil Removal (TAGM), Sediment Removal

Table 3

Excavation Cost Estimate for Alternative 4

Shallow Soil Removal

Item	Quanity	Unit	Unit Price	Amount
Temporary Fencing	0	LF	$20	$0
Asphalt Removal	14,472	SF	$1	$14,472
Temporary Sheet Piling	0	LF	$56	$0
Soil Excavation	3,216	CY	$37	$118,992
Dewatering	0	LS	$50,000	$0
GW Treatement	0	LS	$50,000	$0
Odor Control	1	LS	$25,000	$25,000
Backfill	3,216	CY	$35	$112,560
Asphalt Installation (4" , 4")	547	ton	$85	$46,471
Waste Characterization	20	EA	$1,200	$24,000
Soil Disposal	4,502	ton	$75	$337,680
				$679,175

Deeper Soil Removal

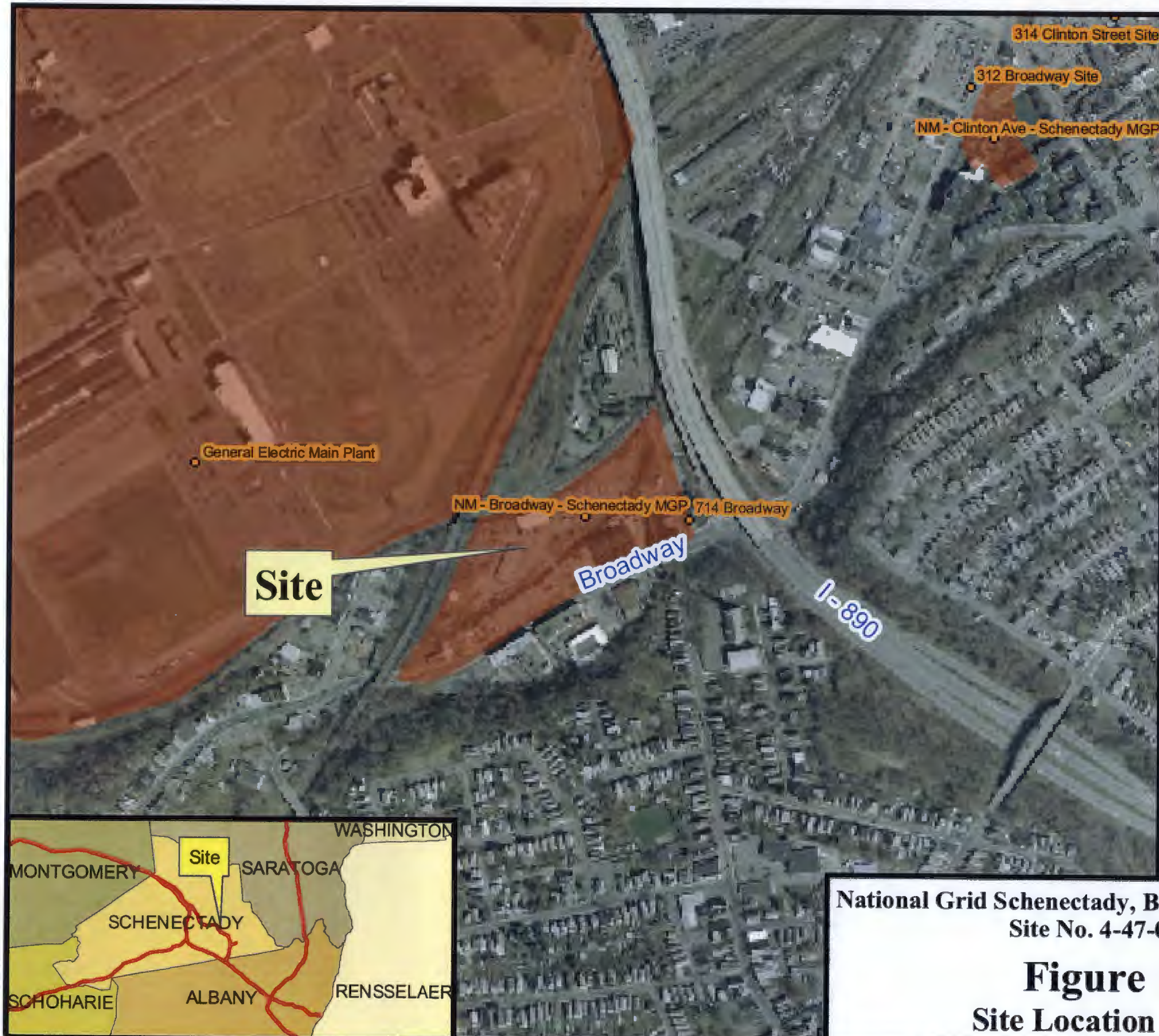
Item	Quanity	Unit	Unit Price	Amount
Temporary Fencing	1000	LF	$20	$20,000
Asphalt Removal	24,451	SF	$1	$24,451
Temporary Sheet Piling	935	LF	$56	$52,360
Soil Excavation	9,056	CY	$37	$335,072
Dewatering	1	LS	$150,000	$150,000
GW Treatement	1	LS	$100,000	$100,000
Odor Control	1	LS	$50,000	$50,000
Backfill	9,056	CY	$35	$316,960
Asphalt Installation (4" , 4")	924	ton	$85	$78,516
Waste Characterization	20	EA	$1,200	$24,000
Soil Disposal	12,678	ton	$75	$950,880
				$2,102,239

Shallow Areas (6')

Excavation Volume	Volume (CY)	Tons	Area (SF)
West of 150,000 CF Holder	941	1,317	4,235
West of Retort	929	1,301	4,181
North of 800,000 CF Holder	772	1,081	3,474
South of 800,000 CF Holder	190	266	855
By Tracks	189	265	851
2 Mil CF Holder	125	175	563
Near GRS	70	98	315
	3,216	4,502	14,472

Deeper Area (10')

Excavation Volume	Volume (CY)	Tons	Area (SF)
North of Creek (West)	3,803	5,324	10,268
North of Creek (East)	5,253	7,354	14,183
	9,056	12,678	24,451



National Grid Schenectady, Broadway MGP Site
Site No. 4-47-026

Figure 1
Site Location Map

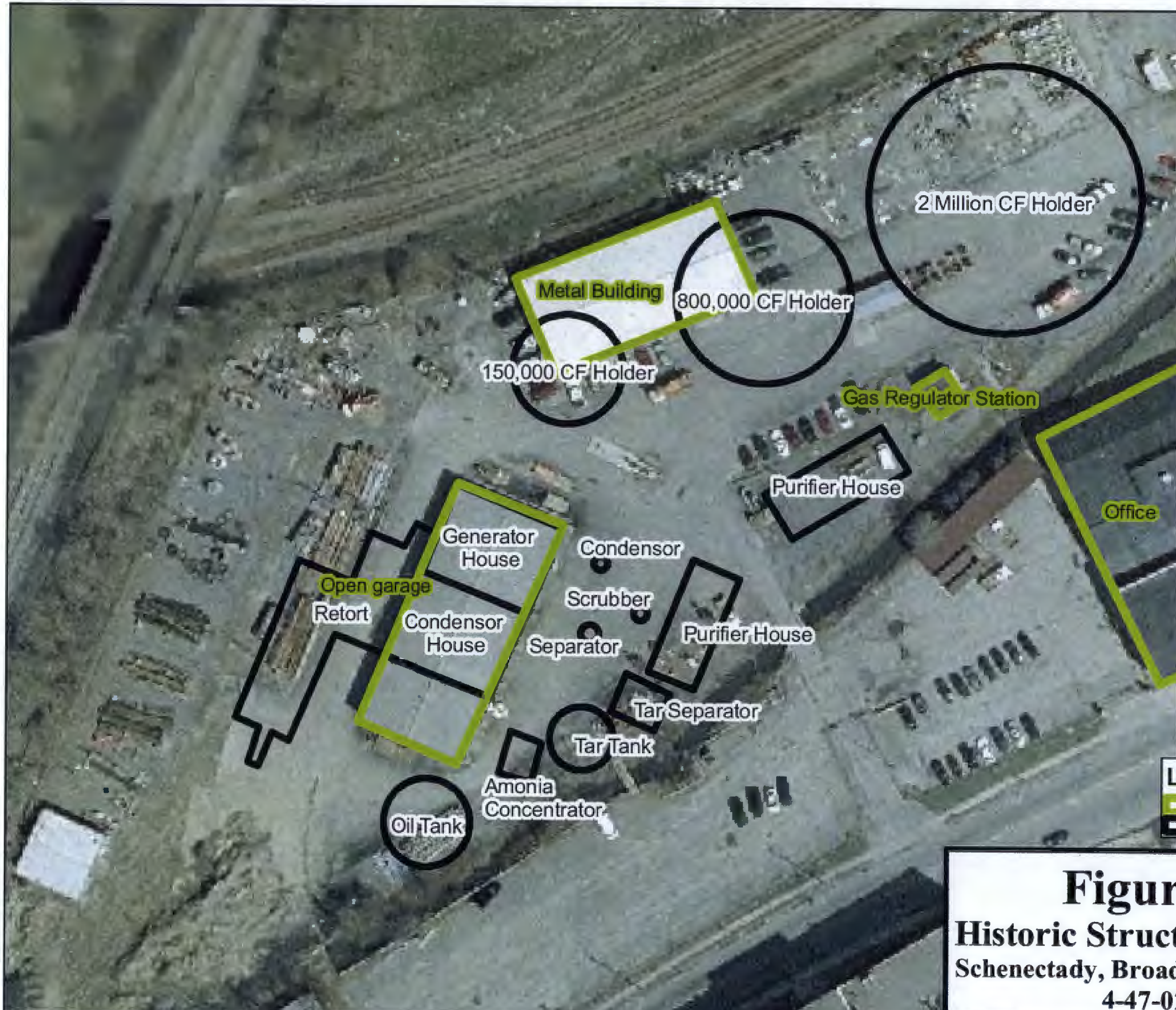


Figure 2
Historic Structures - 1914
Schenectady, Broadway MGP Site
4-47-026

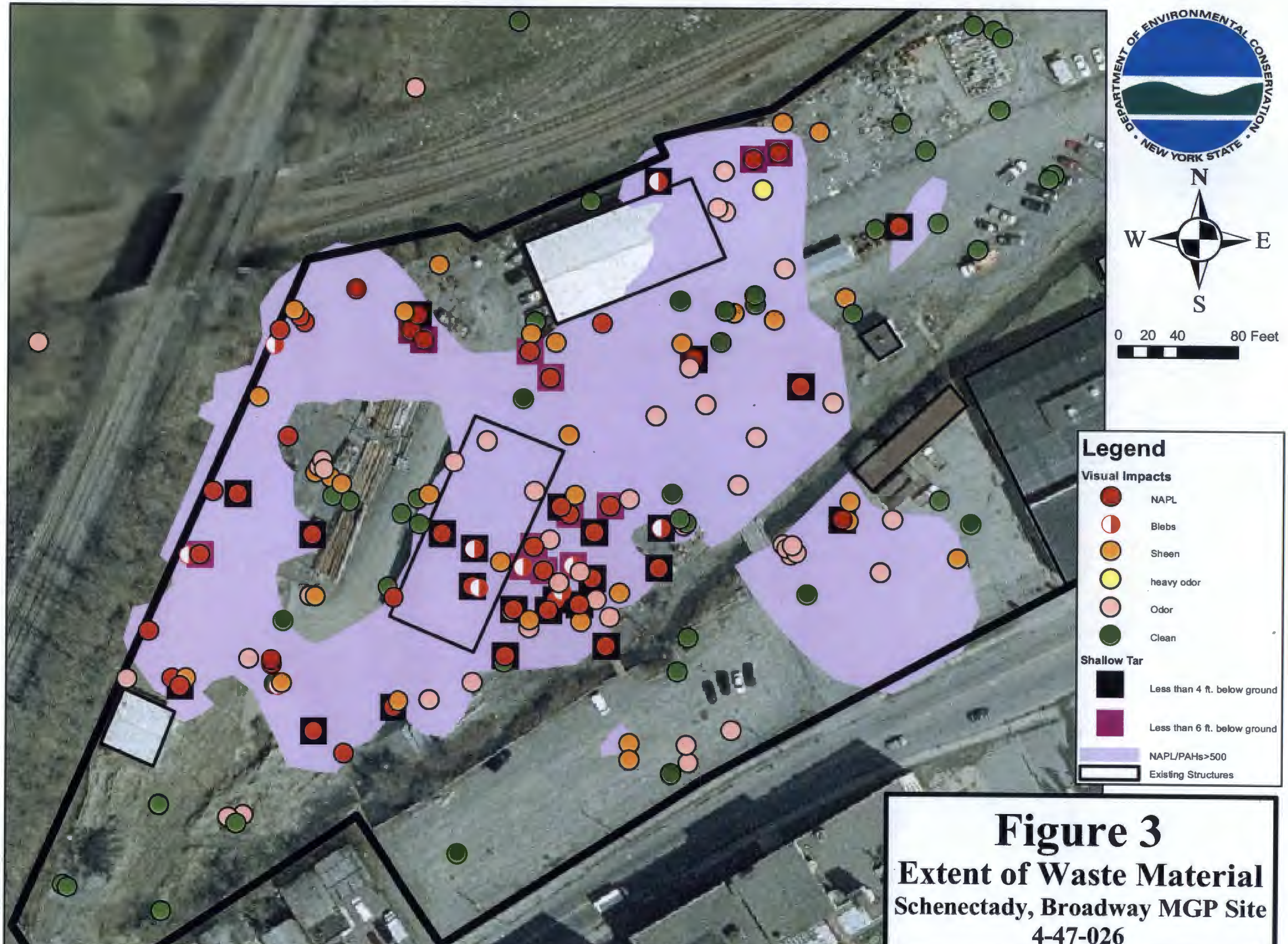


Figure 3
Extent of Waste Material
Schenectady, Broadway MGP Site
4-47-026

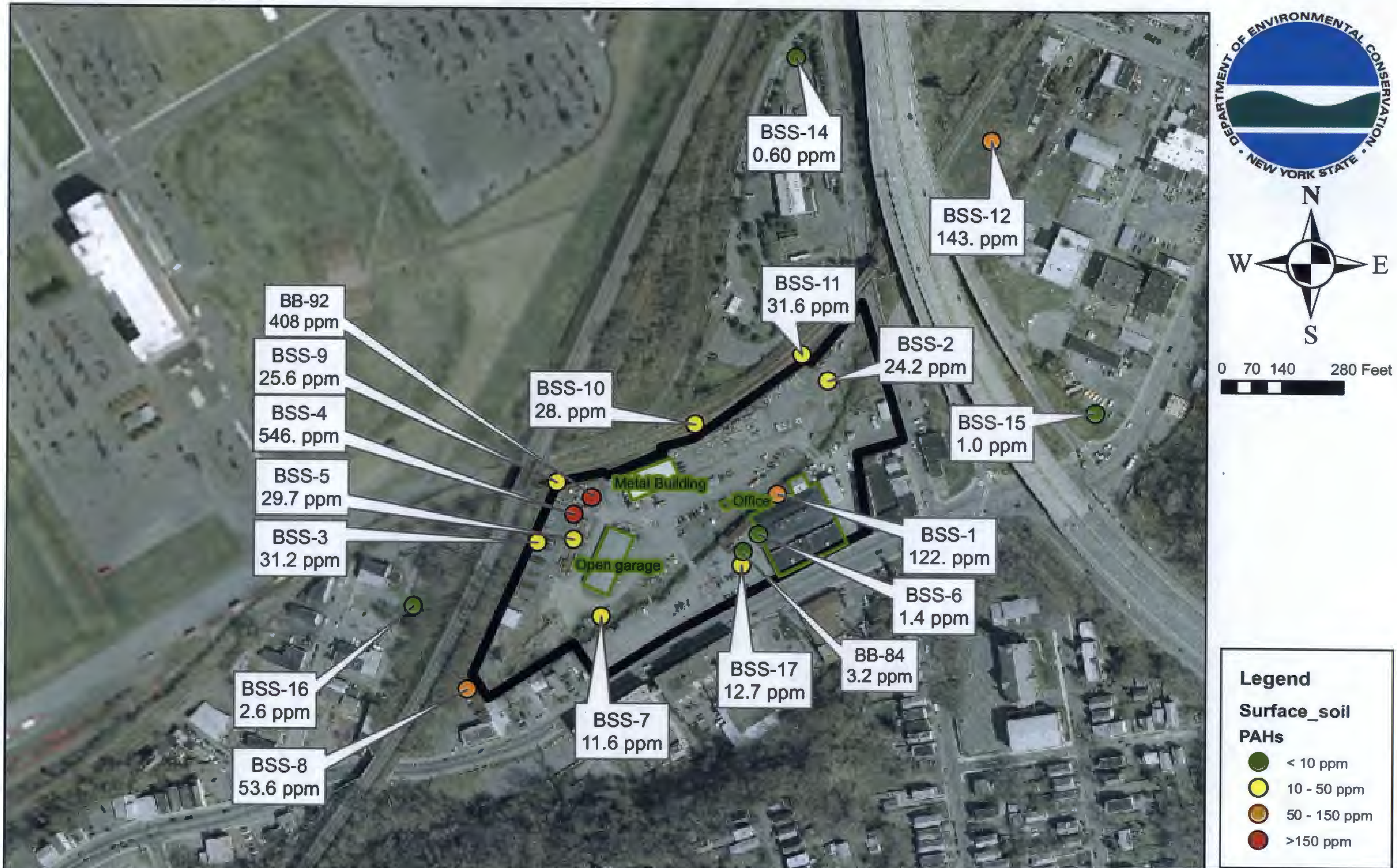


Figure 4
Shallow Soil PAHs
Schenectady, Broadway MGP Site
4-47-026

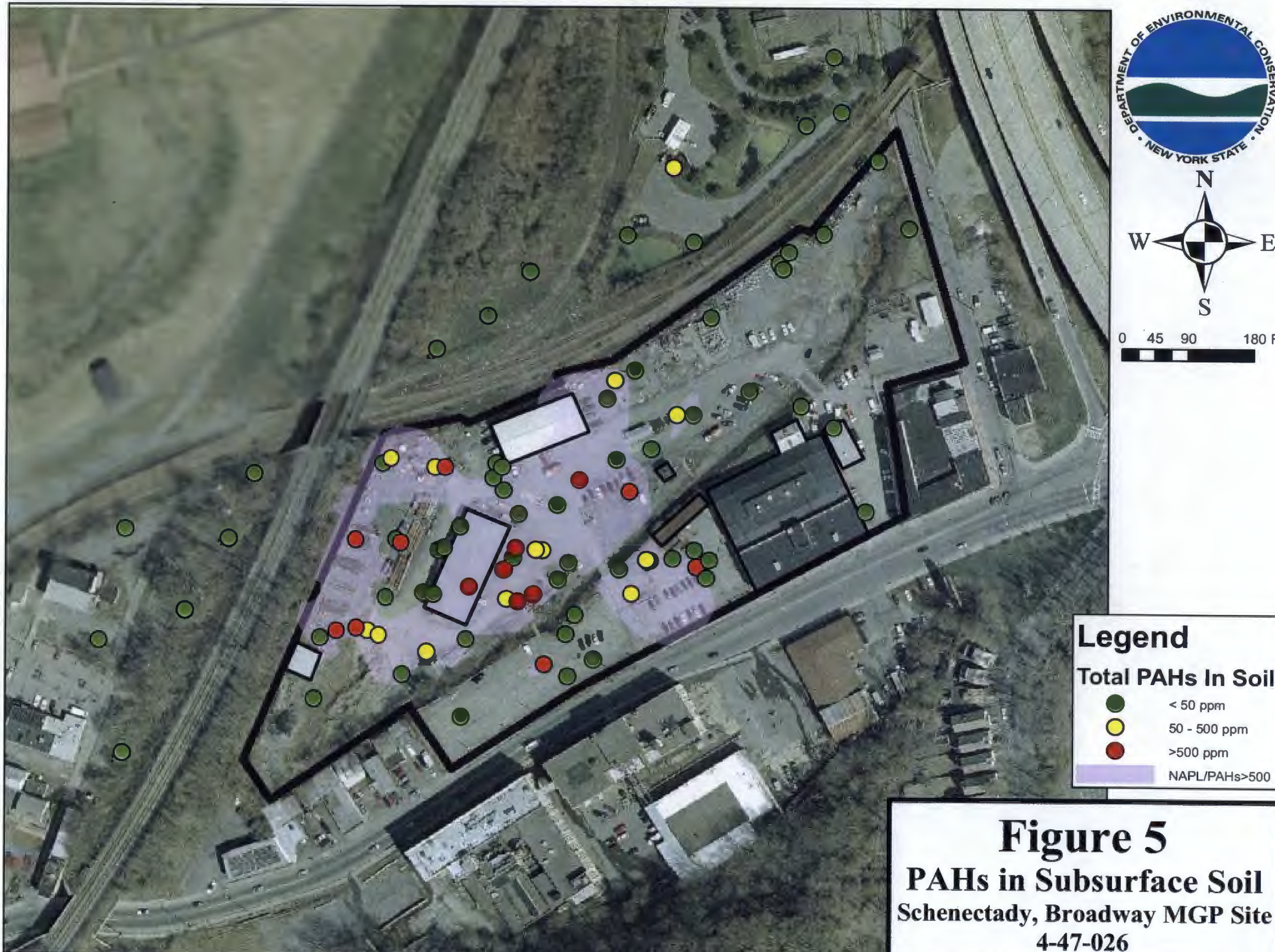


Figure 5
PAHs in Subsurface Soil
Schenectady, Broadway MGP Site
4-47-026

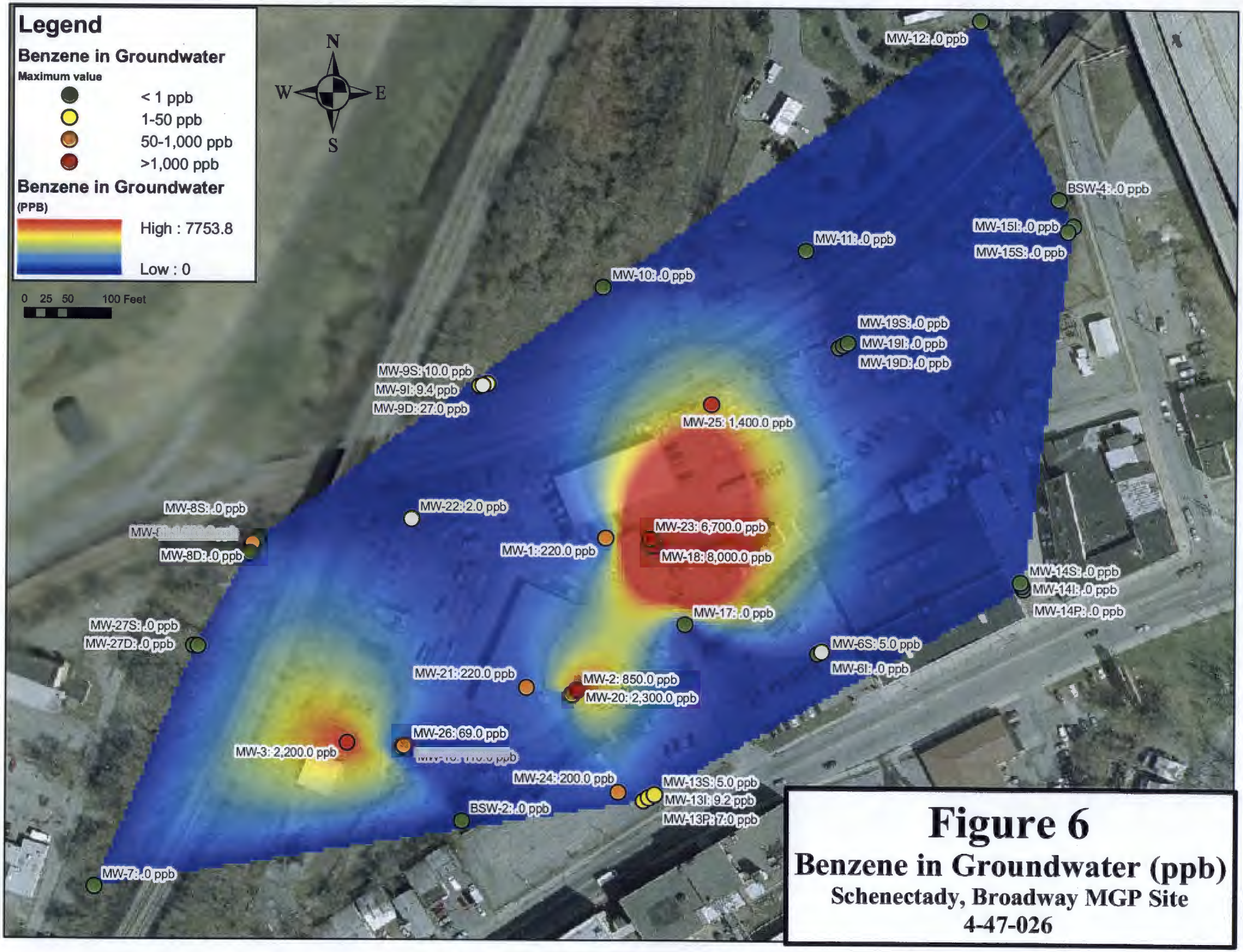


Figure 6

Benzene in Groundwater (ppb)

Schenectady, Broadway MGP Site

4-47-026

National Grid Schenectady, Broadway MGP Site
Site No. 4-47-026

Figure 7
PAH Levels in Stream Sediments

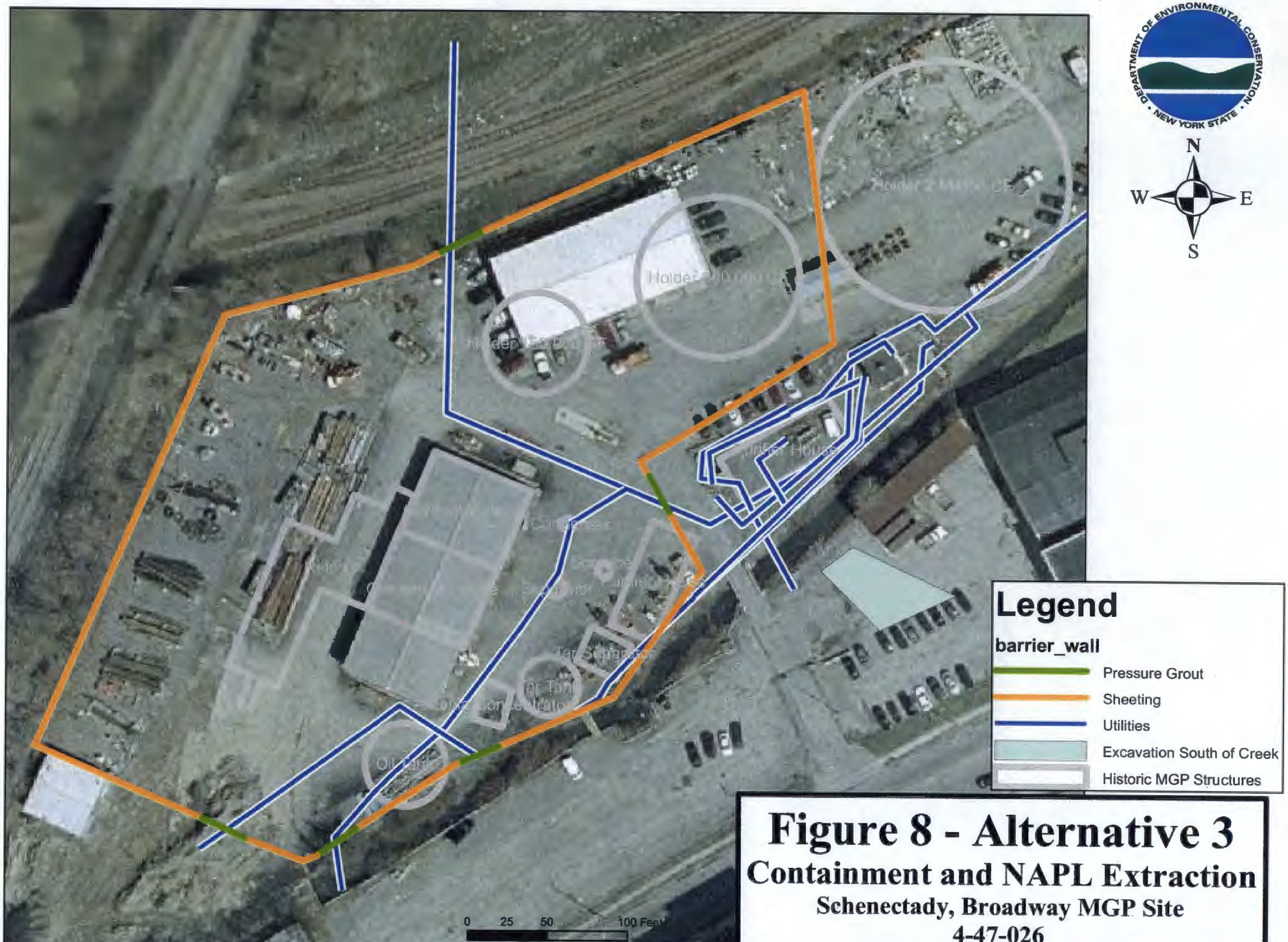


Figure 8 - Alternative 3
Containment and NAPL Extraction
Schenectady, Broadway MGP Site
4-47-026

Figure 9 - Alternative 4

Containment Barrier With Excavation

Schenectady, Broadway MGP Site

4-47-026

Figure 10 - Alternative 6

In-Situ Solidification

PAHs > 500 ppm

Schenectady, Broadway MGP Site

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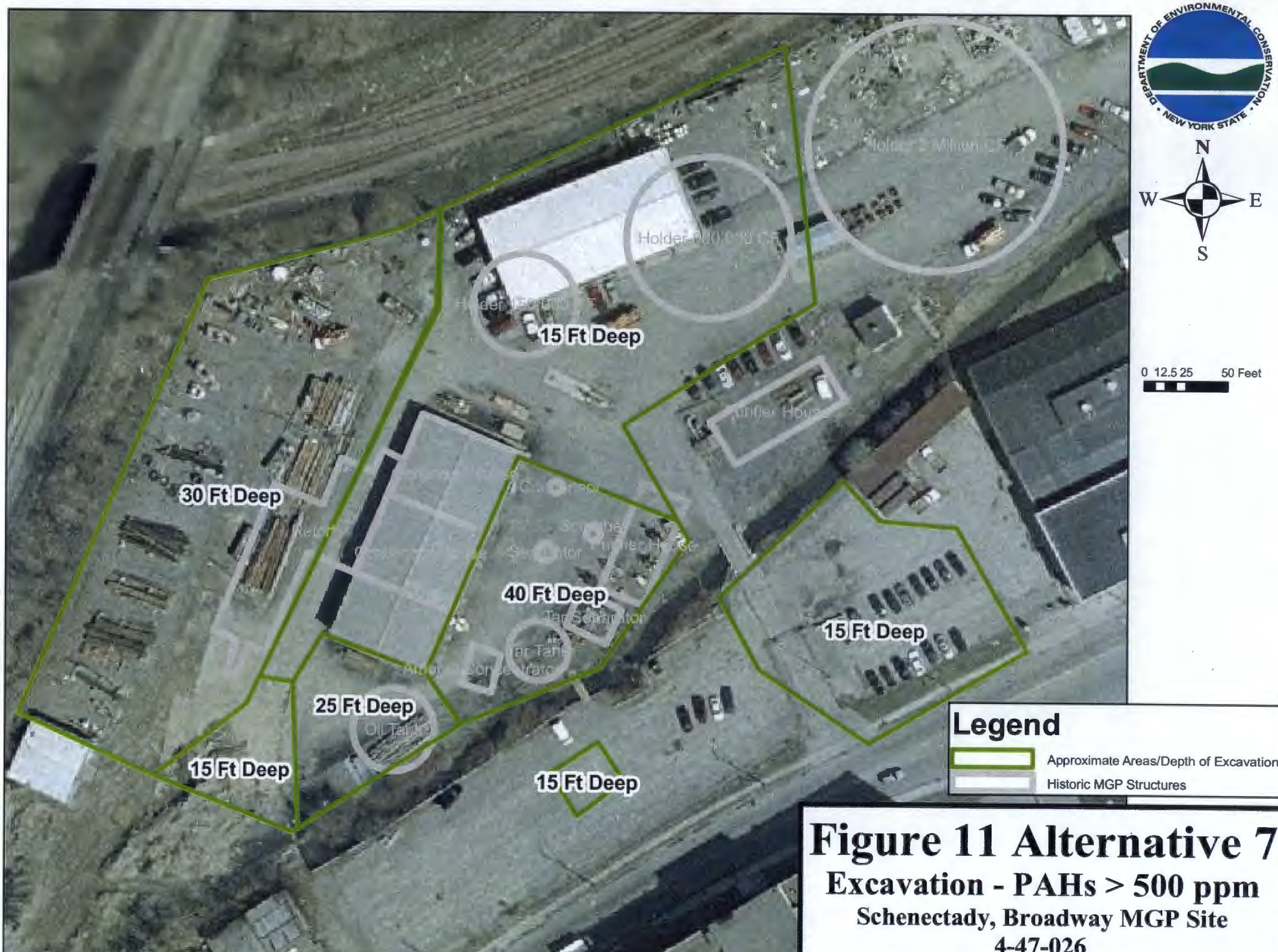

Figure 11 Alternative 7

Excavation - PAHs > 500 ppm

Schenectady, Broadway MGP Site

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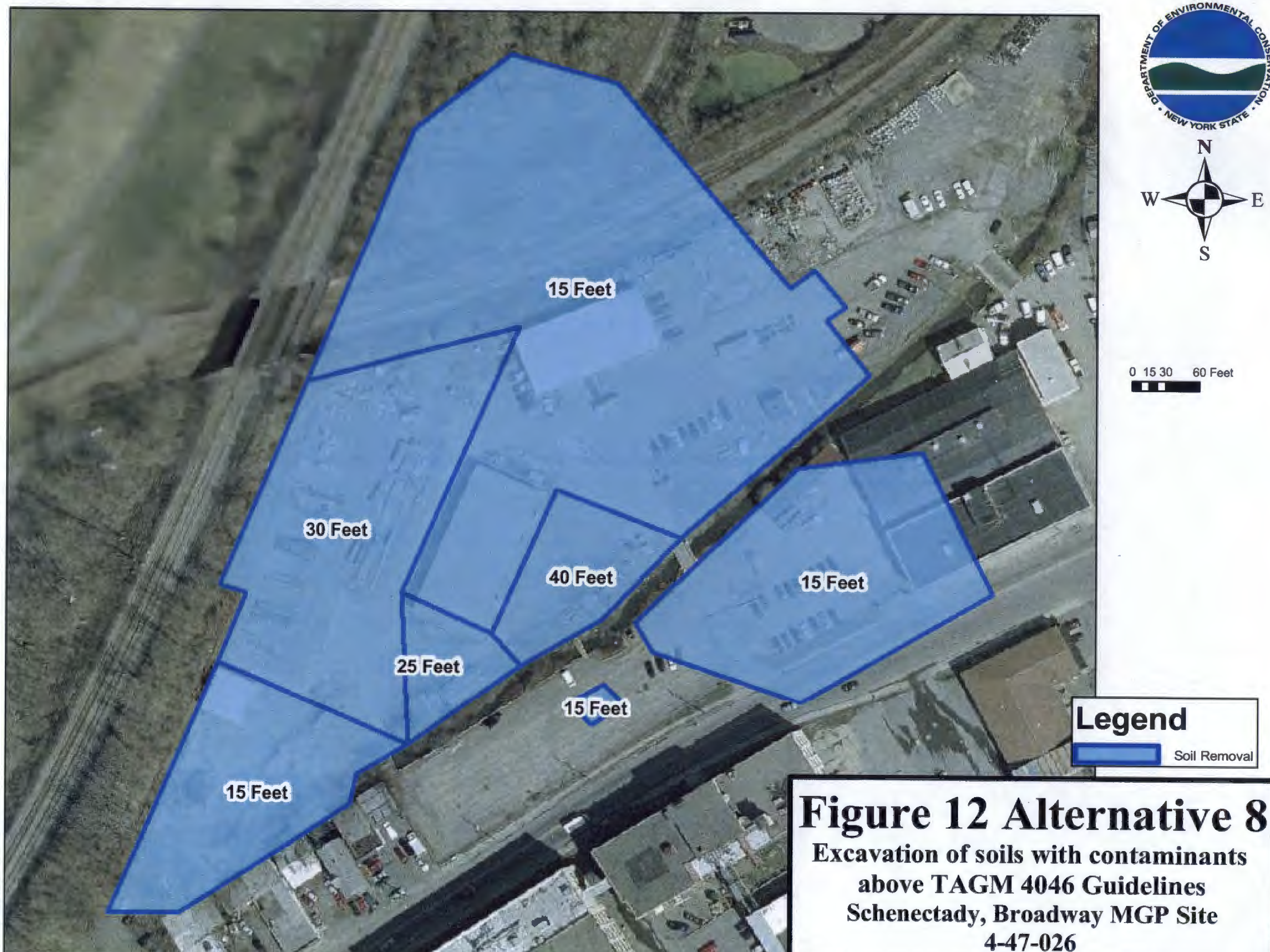

Figure 12 Alternative 8
Excavation of soils with contaminants above TAGM 4046 Guidelines
Schenectady, Broadway MGP Site
4-47-026