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Feasibility Study Report

Hornell Former Manufactured Gas Plant Site

Hornell, New York

NYSDEC Site # 8-51-032
AOC #A8-0634-02-10

Submitted to:
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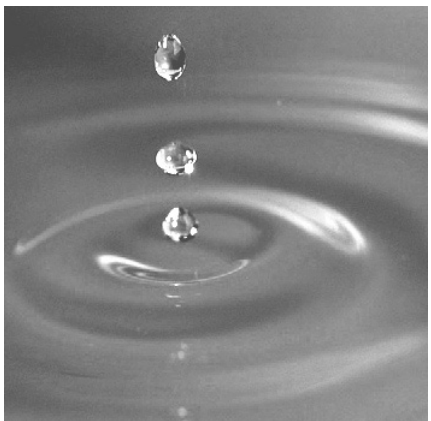

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Abbreviations and Acronyms

AOC	Adminstrative Order on Consent
AWQS	Ambient Water Quality Standards, Guidance Values, and Groundwater Effluent Limitations
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
COC	Constituents of Concern
CY	cubic yard
DEC Soil Cleanup Guidance	CP-51 Soil Cleanup Guidance Policy Memorandum
DER	Department of Environmental Remediation
DER-10	NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, May, 2010
DNAPL	Dense Non-Aqueous Phase Liquid
DPW	Department of Public Works
EPA	United States Environmental Protection Agency
FS	Feasibility Study
GAC	Granular Activated Carbon
GEI	GEI Consultants, Inc., P.C.
GRA	General Response Action
HASP	Health and Safety Plan
IC/ECs	Institutional Controls/Engineering Controls
ISCO	In-Situ Chemical Oxidation
ISS	In-Situ Solidification
LNAPL	Light Non-Aqueous Phase Liquid
LTTD	Low-Temperature Thermal Desorption
MGP	Manufactured Gas Plant
mg/kg	Milligrams per kilogram (equivalent to ppm)
MNA	Monitored Natural Attenuation
NAPL	Non-Aqueous Phase Liquid
NAVD88	North American Vertical Datum 1988
NCP	National Contingency Plan. 40CFR1J Part 300 – National Oil and Hazardous Substances Pollution Contingency Plan
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
NYSM	New York State Museum
OM&M	Operations, Maintenance and Monitoring
PAH	Polycyclic Aromatic Hydrocarbon
PDI	Pre-Design Investigation
POTW	Publically Owned Treatment Works
ppb	parts per billion

Abbreviations and Acronyms (cont.)

PPE	Personal protective equipment
ppm	parts per million (equivalent to mg/kg in soil)
PSC	New York State Public Service Commission
PRAP	Proposed Remedial Action Plan
RAO	Remedial Action Objective
RI	Remedial Investigation
RIR	Remedial Investigation Report
ROD	Record of Decision
ROW	Right-of-way
SCG	Standards, Criteria, and Guidance
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SVOC	Semi-Volatile Organic Compound
TBC	To Be Considered
TOGS	Technical and Operational Guidance Series
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound

Engineer's Certification

In accordance with NYSDEC DER-10 Section 1.5 (b) 2,

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

March 28, 2018

Engineer's Seal
GEI Consultants, Inc., P.C.

Date

It is a violation of New York State Education Law for any person, unless acting under the direction of a licensed professional engineer, to alter in any way plans, specifications, plates, and reports to which the seal of a professional engineer has been applied. If an item bearing the seal of an engineer or land surveyor is altered, the altering engineer shall seal the item and add the notation "altered by", sign and date such alteration, and provide a specific description of the alteration.

Executive Summary

Introduction and Purpose

This report describes the Feasibility Study (FS) undertaken for a site located on Franklin Street in Hornell, New York which formerly contained a manufactured gas plant (MGP). The location is shown in Figure 1. The FS was conducted pursuant to an Administrative Order on Consent (ACO) between National Fuel Gas and the New York State Department of Environmental Conservation (NYSDEC) and is based on an environmental investigation performed at the Site which is described in the Remedial Investigation Report (RIR) of June 2014. The FS describes options for remediation of the Site, as well as MGP-related impacts on a bordering parcel owned by National Fuel Gas and used for gas regulator equipment. The portions of bordering residential properties and of Franklin Street where MGP residuals may be present are also described in this FS.

The purpose of this FS is to: 1) identify and comparatively evaluate appropriate remedial alternatives for soil and groundwater, 2) recommend media-specific alternatives that adequately mitigate potential threats to human health and the environment due to the constituents of concern (COC) from former MGP operations, and 3) identify alternatives which are consistent with the remedial objectives for the future contemplated site use.

Site Description and History

The MGP was originally constructed sometime prior to 1873. In its original form it operated until 1899, producing coal gas. Gas production ended when it was replaced by gas from nearby oil fields. New facilities were constructed in the 1920's, with oil gas produced from 1926 to 1932. The Site was used for natural gas storage and distribution between the two gas production eras, and after the final end of gas production at the Site. Natural gas storage ended at the Site sometime between 1948 and 1954.

Soil Impacts and Subsurface Structures

The RI found that the majority of MGP impacts are related to coal tar and are within the western portion of the Site, associated with the first phase of gas production. The foundation for the original gas production and purification building contains MGP tar impacts, and tar is found beneath the gas holder associated with this phase of gas production (Gas Holder A). Migration has occurred of tar and associated impacts to the east (hydraulically downgradient) into the subsurface portion of the central area of the Site; however, nearly all of the soil impacts are confined to the Site. Off-Site migration of a narrow finger of non-aqueous phase liquid (NAPL) impacts into the residential area south of the site was found, but this impact ends upgradient of the homes. The downward migration of tar and associated impacts appears to be limited to the upper 30 feet of the soil unit, well above bedrock (approximately 100 feet below ground surface or bgs). Groundwater impacts are closely

associated with the impacted soils. Off-Site groundwater impacts are limited to the area immediately south of the Site boundary. Soil vapor impacts are present on site. Slightly elevated soil vapor volatile organic compound (VOC) concentrations were detected near one downgradient residence at a depth well below the foundation level of the house. No VOCs attributable to the MGP were found in the indoor air or crawl space beneath the residence.

Human Health Exposure

A small area where tar was observed at the ground surface was removed during the test pit investigation for the RI. No other visible surface impacts were found during the investigation, and there are no risks to most potential exposure groups associated with the Site. Surface soil in the vicinity of the gas regulator equipment on the National Fuel Gas parcel exceeds commercial Soil Cleanup Objectives (SCOs) and may present an exposure risk to utility workers. A potentially complete exposure pathway may also exist for utility workers in shallow utility excavations in the area of the 1800's gas production, or in deeper excavations within the western and central area of the Site. A subsurface utility worker or a construction worker who may perform excavation work on the Site may potentially be exposed to coal tar NAPL mixed in the soil matrix or groundwater that is impacted by coal tar.

General Response Actions (GRAs) and Remedial Technologies

To meet the remedial action objectives (RAOs) developed for the Site, the following GRAs and remedial technologies were identified:

1. **No Action.** This response action is listed for compliance with the NYSDEC Division of Environmental Remediation's guidance document DER-10 [NYSDEC, 2010a], but would not result in meeting the RAOs and is not contemplated for this site.
2. **Institutional Controls and Engineering Controls (IC/ECs) Pertaining to Soil or Groundwater.** These actions, also known as IC/ECs, involve restrictions of legal access to soil or groundwater, and engineering controls to limit physical access. This also includes the use of a Site Management Plan (SMP) to control site use.
3. **In-Situ Treatment of Soil and Groundwater.** These actions reduce the volume, toxicity, and/or mobility of the COC. Technologies reviewed here include in-situ solidification/stabilization (ISS), in-situ chemical oxidation (ISCO) of impacted soil, and monitored natural attenuation (MNA) of groundwater.
4. **Removal and Off-Site Treatment/Disposal of Soil and NAPL/Groundwater**. These actions include excavation of impacted soil and non-aqueous phase liquid (NAPL), and off-Site treatment/disposal of these wastes in properly permitted facilities.

Development and Analysis of Alternatives

A range of alternatives for additional remedial actions were developed based on the results of the RI, land use approaches, RAOs, and GRAs and the identified applicable remedial technologies. A total of six alternatives were developed for detailed analysis:

1. **Alternative 1** – No Action (required for comparison purposes by DER-10).
2. **Alternative 2** – Excavation up to 15 feet below ground surface (bgs) of soils exceeding Commercial SCOs on the Site. Excavation and replacement of 1-foot of soil on the gas regulator property MNA of groundwater.
3. **Alternative 3** – Excavation up to 15 feet bgs of soils exceeding Commercial Soil Cleanup Objectives (SCOs) on the Site. Excavation and replacement of 1 foot of soil on the gas regulator property. In-situ chemical oxidation (ISCO) of source material below 15 feet bgs on the Site, followed by MNA.
4. **Alternative 4** – Excavation of soils, foundations, and other obstructions on the Site followed by in-situ soil solidification (ISS) down to 26 feet. Excavation and replacement of the upper 1 foot of soil on the gas regulator parcel, followed by MNA.
5. **Alternative 5** – Excavation up to 15 feet bgs of soils exceeding Commercial SCOs on the Site, and of grossly impacted soils from 15 to 26 feet bgs on the Site. Excavation and replacement of 1 foot of soil on the gas regulator property. Installation of additional monitoring wells near SB24, and MNA.
6. **Alternative 6** – Soil removal on all parcels to Applicable NYSDEC Part 375 Unrestricted Use Criteria.

Estimated Costs for Each Alternative

The costs of each alternative evaluated are summarized as follows:

Alternative	Estimated Cost
Alternative 1	No Cost
Alternative 2	$4,330,000
Alternative 3	$5,650,000
Alternative 4	$4,210,000
Alternative 5	$7,050,000
Alternative 6	$8,080,000

FS Evaluation

Detailed comparative evaluation of the six alternatives was then performed using the following eight criteria as defined by DER-10. All of the alternatives would meet the requirements to protect human health and would allow for all current and reasonably anticipated future property uses, although

Alternative 2 would not meet the RAOs for groundwater remediation. Alternative 4 achieves the RAOs at a lower cost than Alternatives 3 and 5. Alternatives 2, 3, and 4 would be more implementable with less community disruption and short-term risks than Alternatives 5 and 6. Compared to the cost for Alternatives 3 and 4, the higher cost of Alternative 6 does not offer a commensurately higher value in additional environmental protection, nor does it increase the actual land use options.

Recommended Remedy

Alternative 4 is the recommended remedial alternative for the Site. This remedy was selected because:

1. The remedy meets the RAOs developed for the Site.
2. This alternative is readily implementable with moderate short-term impacts.
3. This alternative will allow for commercial development of the Site, and for the continued use of the adjacent National Fuel Gas property for natural gas regulation equipment.
4. This alternative is implementable using proven remedial technologies, and avoids the need for difficult shoring and deep excavation into a saturated gravel and sand soil unit.
5. This alternative is the most cost effective when compared with the other alternatives while offering a high-level of protection for human receptors by stabilization of the MGP-related source material at the Site.
6. Although less impacted material will be physically removed from the Site under Alternative 4, the ISS-treated material will not pose a threat for migration because the impacted soil will be solidified. Groundwater concentrations of COC are already near non-detect levels and would be anticipated to further decrease with the solidification of the source material and MNA.

In accordance with DER-31 Green Remediation, this alternative would have a moderate environmental footprint, primarily associated with the initial removal and disposal of impacted soil and debris, the ISS process, and the placement of the backfill material.

The next step will be for the NYSDEC to issue a Proposed Remedial Action Plan (PRAP) for public comment and then a Record of Decision (ROD) for the Site. A design for the remedy, including detailed drawings and specifications for remedial construction, will follow the issuance of the PRAP and ROD.

1. Introduction and Scope

This report describes the Feasibility Study (FS) undertaken for a site located on Franklin Street in the City of Hornell, Steuben County, New York. The Site is the location of a former manufactured gas plant (MGP) that operated at the Site in the late 19th and early 20th century. The location of the Site is shown on Figure 1.

The FS was conducted pursuant to an Administrative Order on Consent (AOC#A8-0634-02-10) between National Fuel Gas Distribution Corporation (National Fuel Gas) and the New York State Department of Environmental Conservation (NYSDEC). This report has been prepared in accordance with applicable regulations and guidance documents of the NYSDEC and the New York State Department of Health (NYSDOH) and will be submitted to these agencies for review and approval as a requirement of the AOC.

1.1 Purpose of Report

As requested by the NYSDEC, this FS Report has been prepared following the completion of the Remedial Investigation Report (RIR) for the Site [GEI, 2014]. The guidance document DER-10 [NYSDEC, 2010a] specifies that the FS Report should be prepared by the party responsible for performing remediation, and the report should be submitted to the NYSDEC Department of Environmental Remediation (DER) for approval prior to the implementation of the remedy. The FS develops and evaluates options for remedial action in accordance with CERCLA [40 CFR 300.430(e)] and 6NYSCRR Part 375 to address the impacted media at the Site or area of concern that is being addressed by cleanup actions. The purpose of this FS is summarized as follows:

- To identify the goal of the remedial program;
- To define the nature and extent of the MGP-related residuals to be addressed by the developed alternatives;
- To develop remedial action objectives (RAOs) for the Site;
- To develop a set of remedial action alternatives;
- To complete an initial screening and detailed analysis of the identified alternatives;
- To implement the specified decision process identified in DER-10 to identify and evaluate appropriate remedial options;
- To develop and provide a detailed description of the recommended site remedy; and
- To demonstrate that the recommended remedy can achieve the cleanup objectives for the Site.

1.2 Report Organization

The balance of this document is divided into the following sections, in accordance with NYSDEC's guidance document DER-10 [Section 4.4 (b) 4]:

- **Section 2.0 - Site Description and History**. This section provides a description of the current layout of the Site, and the history of the MGP.
- **Section 3.0 - Summary of the Remedial Investigation (RI) and Exposure Assessment**. This section describes the results of the environmental investigation, and evaluates the resulting potential for current or potential future site users to be exposed to MGP-related constituents of concern (COC).
- **Section 4.0 - Remedial Goals and Remedial Action Objectives**. This section introduces the documents that govern the FS evaluation, and presents the requirements which are applied to the MGP site.
- **Section 5.0 - General Response Actions (GRAs) and Volume Estimates**. This section describes the broad categories of remedies under consideration for this site and provides estimates of the volumes of the impacted media present at the Site.
- **Section 6.0 - Identification and Screening of Technologies**. This section names and describes the principal technologies which might be brought to bear for the remedy of the Site, and screens these technologies for applicability to the Hornell MGP site.
- **Section 7.0 - Development and Analysis of Alternatives**. In this section, a range of alternatives consisting of several technologies are described, evaluated in accordance with a standard set of criteria, and compared with one another.
- **Section 8.0 - Recommended Remedy**. This section presents the principal elements and sequence of implementation of the remedy.
- **Section 9.0 - References**. This section lists the references cited in this report.

Supporting information on the zoning for the Site is provided in Appendix A. Cost estimates for the remedial alternatives are provided in Appendix B.

2. Site Description and History

This section provides a summary of the Site history and description based on information presented in the RIR for the former Hornell MGP site.

2.1 Site Description

The former Hornell MGP site is located along the south side of Franklin Street, near the corner of Canisteo and Franklin Streets at the southwest side of the downtown area of Hornell (Figure 1). The Site is on the border between the modern and historic commercial/industrial area and a residential area. A modification to the AOC and Administrative Settlement between the NYSDEC and National Fuel Gas (dated October 21, 2010) defined boundaries for the Hornell site (Figure 2). These boundaries are shown on the figures presented in this report as the "site boundary".

The former MGP is located on a portion of property owned by Maple City Lodging Partnership (Maple City) and which is used for a hotel. The portion of this property that was previously used for gas production or storage extends across the entire northern portion of the lot, from the western property line to Canisteo Street to the east, with approximate dimensions of 375 by 125 feet. This portion of the Maple City property is defined as the former MGP site by the Consent Order between the NYSDEC and National Fuel Gas. The hotel is located along the eastern side of the Maple City property, with the northernmost portion within the boundaries of the former gas plant. The central and western portion of the Site is a grassy vacant lot. A line of trees is found along the southern property line which borders residential backyards. The Site is generally flat-lying and no surface water features are present.

The Site is bordered by a mix of commercial and residential properties.

- The parcel adjoining the western side of the Site is a small lot (30 feet wide by 120 feet deep) that is vacant except for gas regulating equipment owned by National Fuel Gas. The gas regulators are within two small fenced enclosures. There are no buildings on this lot. To the west of this lot are residential properties.
- To the south the Site is bordered by residential properties, a vacant portion of the hotel property, and by the hotel structure and its parking lot.
- To the east the Site is bordered by Canisteo Street. Across Canisteo Street to the east is a small structure that covers stairs leading to a pedestrian tunnel under an active Norfolk Southern rail line that bisects the city. The rail line is 120 feet to the northeast of the Site.
- To the north the Site is bounded by Franklin Street. Across Franking Street is a credit union building and parking lot, located on the former site of a brewery building.

The hotel property is zoned for commercial purposes (City of Hornell zone B-1 Local Business District). The city zoning map (Appendix A) shows the western boundary for the B-1 zoning to cut through the parcel, but the tax records list the entire lot with this classification.

To the north and east across Franklin and Canisteo Streets, respectively, the Site is bordered by commercially-zoned properties. North of Franklin Street, the properties are zoned "B-1", and the properties east of Canisteo Street are zoned "B-2". Single-family residential properties (zoned "R-2") are found to the northwest, and directly bordering the Site to the south.

The property containing gas regulating equipment along the west side of the Site is mapped within the R-2 residential area, although it has not had a residential structure on it and has been owned by the gas company since at least 1898, as shown on the Sanborn Maps provided in the RI. Current property records for this lot were not available from the City to verify its zoning status. National Fuel Gas property records indicate that they own this parcel; however, information obtained during the Site Characterization Study (SCS) implied that the City of Hornell may consider this to be city-owned property.

2.2 Site History and Former Structures

The RIR contains a chronology of the Site from the 1873 to 1976, which has been compiled from a number of sources, including records obtained from the New York Public Service Commission (PSC), the Browns Directory of American Gas Companies, the City of Hornell, National Fuel Gas, and the Sanborn Map Company. Some of the information is inconsistent with regards to the years and types of gas production for the MGP, but the overall history of the MGP can be constructed from the information. The historical features of the MGP are shown with dashed outlines on Figure 3.

Based on the date of construction, the configuration of the plant, and the original gas production was performed by coal carbonization, beginning some time prior to 1873. A single gas building was used along the west side of the Site, with a single gas holder (Gas Holder A). Later production appears to have been by a water gas process, and a second gas holder was constructed (Gas Holder B) in the mid to late 1890's). Gas production in this facility ended sometime around 1899, as natural gas became available and was piped into Hornell from oil wells to the southwest. A second generation gas plant was constructed in a newer building along Franklin Street using an oil-gas process. According to the Browns Directory records, MGP production shut down in 1932 with the Site continuing to be used for natural gas storage and distribution until the late 1940's or early 1950's.

2.2.1 Historical Site Features

The historical research identified former site features which may have been potential source areas for MGP-related residuals, and as such, those areas were targeted for investigation during the RI. The key features of the MGP, shown on Figure 3, are summarized below:

- **Gas Holder A** – This was the original gas holder, located in the center of the Site along the southern boundary of the property. This gas holder was constructed with a subgrade pit foundation. It is first shown on maps of the Site in 1873. Between 1893 and 1898 Gas Holder A was no longer being used for production. This appears to coincide with the construction of Gas Holder B.
- **Gas Holder B** – A second gas holder (Gas Holder B) was constructed to the northeast of Gas Holder A between 1893 and 1898. Gas Holder B was constructed with an above-ground tank on a 4-foot thick concrete slab foundation. This foundation slab is today buried beneath 4 feet of fill.
- **Gas Holder C** – A third gas holder (Gas Holder C) was constructed to the east of Gas Holder B. Gas Holder C was constructed with an above-ground tank on a 2-foot thick concrete slab foundation, and is buried under about half a foot of soil. Gas Holder C was used for natural gas distribution after the end of gas production at the Site, and was demolished sometime in the late 1940's or early 1950's.
- **Gas Production Buildings** – Two generations of gas production buildings are shown on Figure 3. The 1800's Gas Production Building is located on the western portion of the property; this building was subdivided into three areas. These areas were labeled "Retorts", "Purifiers", and "Storage" on the historical maps. In the 1920's a second Gas Production Building was constructed on the northern half of the property.
- **Gas/Oil Separators and Purifiers** – The 1800's purifiers are located west of Gas Holder A and are located south of the 1800's Gas Production Building, or in a portion of the Gas Production Building. Later, six gas/oil separators shown in a 1932 site photo consisted of six drum-shaped tanks in the northeast footprint of Gas Holder A; these tanks are referred to as 1920's Gas/Oil Separators on Figure 3. Additionally, a newer 1920's purifier structure is located along the southern property line in the footprint of Gas Holder A.
- **Oil Filter House** – A small building attached to the 1920's Gas Production Building, located between Gas Holders A and B.
- **Tin Shop** – A small structure located south of Gas Holder C at the southeastern corner of the property.

2.2.2 Other Site Uses

There is presently little information available regarding use of the Site after it was no longer used for gas storage as it remained generally vacant. In 1989 the City of Hornell began investigation of the eastern portion of the property for construction of a new hotel. At that time, it appeared that the City owned the former gas company property along Franklin Street, and the property along Canisteo Street between Franklin and Spruce Streets. The City acquired the Site in 1980 and the Quit Claim Deed was issued in 1989. The property was subsequently sold to the Hornell Industrial Development Agency in 1993 for development. The hotel was then constructed, using a portion of the eastern end of the Site, in the early 1990's.

2.3 Physical Setting and Local Land and Water Use

2.3.1 Topography

The data obtained from the Site survey was used to prepare a contour map of the ground surface of the Site (Figure 2). The Site is relatively flat with an overall change in elevation of only 3 feet. The ground surface of the Site is highest in the central and western site areas. The ground surface elevation in this area is approximately 1,158 feet NAVD88. To the south and east, the ground surface slopes very gently to 1,155 feet NAVD88.

2.3.2 Land Use

As described previously, the Site is used for several purposes. The eastern third of the Site is currently developed as part of the hotel, with a portion of the building and parking areas present on the property. West of the parking area is a concrete driveway providing access to a dumpster pad. The central and western portion of the Site is a grassy vacant lot. A line of trees is found along the southern property line which borders residential backyards. The Site is generally flat-lying and does not have any surface water features present.

The western side of the Site is bordered by a parcel used by National Fuel Gas for active gas regulating equipment. This parcel measures approximately 30 feet wide along Franklin Street, by 120 feet deep.

2.3.3 Zoning

The Steuben County tax records indicate that the Site is zone as commercial. The City of Hornell zoning map however shows the boundary for the B-1 commercial district cross-cutting the parcel, as well as numerous other parcels around the City. The City of Hornell zoning map is included in Appendix A. County tax assessment records for the gas regulator parcel along the west side of the Site were not available, and this parcel is shown within the R-2 residential area, though this parcel has been in continuous gas company ownership since the late 1800's.

2.3.4 Utilities and Infrastructure

Utilities at the Site include both underground and overhead utilities. Overhead electric lines run along Franklin Street. During the RI investigation, Dig Safely New York, Inc. located natural gas lines, underground electric lines, and a fiber-optic communication line. The natural gas lines located along Franklin Street service the gas regulators on the City of Hornell parcel adjacent to the MGP site. A National Fuel Gas crew performed excavations to positively identify the locations and depths of active gas lines. Underground electric lines run alongside the sanitary sewer in the vicinity of the concrete drive access for the dumpster present on Site. Marked out utilities were surveyed during the RI and are shown on Figure 3.

2.3.5 Water Supply in the Area

According to the City of Hornell, the City obtains its potable water supply from three upland reservoirs owned and operated by the Hornell City Department of Public Works. The first recorded reservoir was constructed on Seeley Creek in 1882 and was in use until 1936 when it was destroyed by a flood and replaced. A second reservoir was constructed on Trout Run in 1920 and in 1932 a third reservoir was constructed between the two aforementioned supplies.

2.4 Site Geology

The surficial geology has been described as recent alluvial deposits consisting of gravel, sand, silt and clay of Pleistocene and Recent ages [(USGS, 1954) and New York State Museum (NYSM, 1986)]. Locally, the surface of these alluvial deposits are highly disturbed by the history of site development by fill and reworking.

The soil units encountered during the RI are described as follows:

- **Fill** – A zone of fill and reworked soils 4 to 10 feet thick below a topsoil layer. The fill contains occasional brick, ash and cinders. The foundations of former MGP structures are located within this zone.
- **Silt-Clay** – Beneath the fill is a mixed silt unit with some amounts of clay and sand, approximately 5 to 8 feet thick. This is interpreted to be a post-glacial alluvial unit. The silt-clay unit was found everywhere to be above the water table. The permeability of this unit is lower than that of the fill soils above and the more granular soils below.
- **Gravel and Sand** – A gravel and sand unit is found at 7 to 14 feet bgs and extending to the base of all site borings (generally 30 feet). The sand and gravel unit is expected to extend to bedrock. This unit was deposited by glacial outwash filling the valley [USGS, 1954].

Bedrock is estimated to be present at a depth of 100 feet or more beneath the Site. Bedrock in the Site area is mapped as upper Devonian age Wiscoy sandstone, Hanover shale, and Pipe Creek shale member. The unit is described as greenish-gray sandstone and siltstone containing beds of buff sandstone and siltstone; dark gray shale, containing some buff siltstones; and black shale at the base of the Hanover shale [USGS, 1954].

2.5 Site Hydrogeology

2.5.1 Site Surface Water and Drainage

The Site is located approximately 2,100 feet northwest of the Canisteo River. There are no surface water connections between the Site and the river. The Canisteo River flows from north to south through the eastern side of the City of Hornell.

There are no storm water collection ditches or storm sewer lines within the Site. Any storm water runoff from the Site enters the municipal storm water system via catch basins along the City streets.

2.5.2 Groundwater

The RI found that the water table is present at approximately 9.56 (likely perched water at MW-5) to 15.92 feet bgs at MW-8. The water table is within the gravel and sand unit at 14 to 16 feet bgs, and isolated from the fill unit by the silt-clay layer. The silt-clay unit, where present, appears to act as a barrier to infiltration. No confining layers were observed to define groundwater units within the gravel and sand unit that was investigated by the investigation borings.

A complete round of depth-to-water measurements was taken on February 8, 2012 for all the Site wells. These data are presented in the RIR [GEI, 2014]. The data have been used to prepare a contour map of the surface of the water table and the inferred direction of groundwater flow (Figure 4).

Based on the measurements from the Site wells, the surface of the water table slopes to the south and east towards MW-3. This well had the lowest water level elevation measured (1,141.28 feet NAVD88). The horizontal gradient from Franklin Street (1,143.41 ft NAVD88), to MW-3 (1,141.28 ft NAVD88) is 0.002 feet/foot.

The horizontal hydraulic conductivity of the gravel and sand unit was estimated based on typical values for unconsolidated deposits [Freeze and Cherry, 1979]. To obtain an estimate of the horizontal groundwater seepage velocity, a porosity of 0.3 for the sand was assumed and a gradient of 0.002 feet/foot was used. The estimate of the horizontal groundwater seepage velocity within the silty sand is 650 feet per year. Vertical hydraulic gradients cannot be evaluated at this time as deep groundwater was not investigated.

3. Summary of the RI and Exposure Assessment

This section summarizes the results of the RI including the human health exposure assessment.

3.1 Site Condition Summary

The areas of concern for the Site are defined based on specific areas of impacts or by former MGP features. Information regarding conditions observed at the former MGP features, and the nature and extent of MGP-related residuals associated with the features, is summarized below. The locations of the test pits, soil borings, and monitoring wells are shown on Figure 5.

Six former MGP structures are identified and discussed in this FS. Their locations are labeled in Figure 3. Their outlines are also shown on Figure 5 with the locations of investigation.

Gas Holder A

The foundation for Gas Holder A is still present in the subsurface at the location shown on Figure 3. The foundation is now covered by approximately 6 feet of fill, which is comprised predominantly of silty sand, gravel, brick fragments, and coal fragments. The diameter of the foundation is 60 feet. The floor of the foundation is constructed of concrete, and is 2 feet thick. The outer (perimeter) edge of the floor consists of a mortared stone wall that was observed in TP5 but not TP6. Based on this field observation, it appears that the mortar had fully weathered along the western perimeter of the holder.

Visible evidence of coal tar-impacted soil was observed as tar staining from 9 to 22 feet in the center portion of the holder with tar saturation identified in soil boring logs for MW2 and MW5 from 10 to 14 feet. The horizontal extents of the impacts observed beneath the holder have not been identified.

Gas Holder B

Based on the soil boring advanced in the footprint of Gas Holder B, the foundation for the holder is still present in the subsurface of the Site. The foundation consists of a concrete slab that is 4 feet thick that is buried 4 feet bgs. The diameter of the foundation is 60 feet. The foundation is covered with fill material consisting of silt, gravel, sand, and brick fragments. MGP-like odors were observed beneath the foundation, but no visible evidence of coal tar-impacted fill or soil was detected except in the soils sampled at 16 to 18 feet bgs where a slight sheen was observed. Holder B is hydraulically downgradient of the other MGP structures and impacts, and from the subsurface impacts observed at SB15; therefore, it is likely that the sheen at the water table beneath the holder is from other upgradient former MGP structures and not from Gas Holder B.

Gas Holder C

The foundation for Gas Holder C is still present and can be observed by its influence on vegetation at the ground surface. Based on the soil boring advanced in the footprint of Gas Holder C, the foundation for the holder is present 6 inches from the ground surface. The foundation consists of a concrete slab that is 2.5 feet thick with a diameter of 80 feet. The soils above the foundation were described in boring SB6 as topsoil. Visible evidence of MGP-related residuals was not observed in the borings completed in or around the former holder location (SB6, MW3).

Gas Production Buildings

Two generations of gas production buildings were built at the Site, the 1800's building located north of the purifiers and west of Gas Holder A, and the 1920's building to the north of Gas Holder A (Figure 3). At test pit TP1, in-place bricks and a concrete foundation wall were observed along the north and west sides for the 1800's Gas Production Building. At test pit TP2, in-place bricks were seen along both the north and west walls of the excavation and large foundation stones were encountered at 4 feet bgs, along with some tar seams. A foundation floor for the retorts building was not encountered in SB12, MW1, or MW11A. Concrete was observed at SB1 from 2 to 4 feet bgs, but it is unclear if that foundation is from the retorts or the purifiers. Visible evidence of MGP-related residuals was observed at SB12 with tar-coated soil observed from 8 to 10, 18 to 20, and 22.5 to 22.6 feet bgs. Tar-coated soils were also encountered in MW11 from 6 to 8 feet. Tar staining was observed in SB13 and MW11A from 4 to 8 feet bgs and 6 to 8.5 feet bgs, respectively. In addition, some hardened tar was also seen from 0.5 to 1.5 feet bgs in the 1800's Gas Production Building area.

The newer 1920's Gas Production Building was also investigated to assess soil conditions. Foundations for the building were observed at SB4 with concrete from 2 to 6 feet bgs; however, no concrete was observed at SB14 or MW12. Tar staining or sheen was observed at SB4 from 16 to 18 feet bgs. No visible evidence of MGP-related residuals were observed in MW12 or SB14. Slight MGP-like odors were observed in MW12.

Oil Filter House

A small, one-story structure attached to the 1920's Gas Production Building was identified as the Oil Filter House. Visible evidence of MGP-related residuals was observed at boring SB15 with sheen observed from 8 to 10 feet bgs and small amounts of tar observed from 16 to 18 feet bgs.

Gas/Oil Separators and Purifiers

Soil borings were advanced in the 1800's purifier area to assess soil conditions and to look for foundations for the purifiers. Foundations for the western purifier area were not observed at soil boring location SB2, but concrete was observed at SB1 from 2 to 4 feet bgs. Visible evidence of purifier wastes (such as wood chips or lime materials) was not observed in either of the borings. Visible evidence of MGP-related residuals was observed as tar staining or sheen at each location. Test pits TP3 and TP4 both encountered fill materials including bricks, concrete, glass and/or wood. A trace amount of hardened tar was also observed at TP4.

A 1932 photograph of the Site showed the existence of the newer purifier structure located along the southern property line. This photograph was not discovered until after the completion of the subsurface investigation, therefore, no test pits or borings were performed at this location. Surface soil sample SS4 obtained from the purifier location did not find any indications of impact related to the gas purifier. Borings SB8 and MW6 flanked the area immediately downgradient of this structure. Visible evidence of MGP-related residuals was not observed in the downgradient borings. A slight tar-like odor was observed in SB8 from 16 to 18 feet bgs. The existing well which was found at the Site is immediately downgradient of the former purifier box location. Although the well was not sampled, no odors or sheen were detected in this well.

The six drum-shaped tanks which are shown in the 1932 site photo are presumed to be some form of traps for separating gas and oil after gas leaves the generators. These structures were also not identified until after the completion of the subsurface investigation. Boring SB7 was advanced near the presumed location of this equipment. Tar-like odors were observed in soils above the water table, from 6 to10 feet bgs. Tar was encountered in the boring at 16 to 18 feet bgs, with staining and odors in the soils above and below this interval.

3.2 Off-Site Areas

RI sampling was performed at off-Site locations to assess the presence of MGP-related residuals in these areas. These parcels include the residential properties to the south and west of the Site and the commercial properties located to the west, southeast, east, and north of the Site.

Off-Site Residential

Residential areas (Figure 5) were investigated for potential off-Site migration. No MGP features are located in the residential areas. Six soil borings (SB22, SB23, SB24, SB25, SB26, and SB31), one monitoring well (MW14), and four soil vapor points (SV6, SV7, SV8, and SV9) were installed between the former MGP site and the residential dwellings. MGP-like odors were observed at SB25 (10 to 14 feet bgs), located just outside the Site boundary, and a thin (1-foot thick) zone with tar coatings on the soil grains was observed at 29 to 30 feet bgs at SB24. No other impacts were observed in any of the off-Site residential locations.

Off-Site Commercial

Commercial areas (Figure 5) were investigated for potential off-Site migration. The northern portion of the hotel is included within the Site boundary due to the location of the former gas holder and other site features. For the RI, four soil borings (SB27, SB28, SB29, and SB30), seven monitoring wells (MW4, MW6, MW7, MW8, MW9, MW10, and MW13), two soil vapor points (SV2 and SV3), and one surface soil sample (SS2) were installed. No impacts were observed in the locations to the south of the MGP site, elevated soil vapor concentrations were detected at SV2 (located east of the off-Site residential area). MGP-like odors were observed at SB28 (10 to 12 feet bgs), SB29

(4.4 to 12 feet bgs), and MW8 (0.3 to 9, 14 to 16, and 22 to 24 feet bgs). No other impacts were observed in the off-Site commercial locations.

Due to the presence of numerous utility lines under Franklin Street, a limited amount of investigation could be performed to the north of the Site. Borings along the center of Franklin Street found only MGP-like odors (SB28 and SB29), and wells installed on the north side of Franklin Street showed no impacts (MW9 and MW10).

Borings and wells on the gas regulator parcel to the west of the Site showed no significant impacts, though polycyclic aromatic hydrocarbons (PAHs) were present in some of the soil samples that exceeded SCOs. These impacts were associated with the shallow fill soils that were disturbed by the history of development and excavations for gas lines.

3.3 Nature and Extent of MGP-Related COC

The horizontal limits of observed MGP-related residuals are summarized as follows:

- The majority of the soil borings showing visible evidence of MGP-related residuals were in the vicinity of Gas Holder A, the 1800's Gas Production Building, and the western purifier area.
- The area with visible evidence of MGP-related residuals was delineated at the north side of the 1800's former MGP area by the borings and wells installed along Franklin Street. Visible evidence of MGP-related residuals was not observed in the line of borings and wells installed south of the Site area through the residential or commercial zones, and it does not appear that residuals are migrating through the subsurface soil north of Franklin Street.
- Visible evidence of MGP-related residuals was not observed at the eastern portion of the Site or at locations south of the Site area.

Within the impacted area described above, coal tar was not observed to be present at depths greater than 26 feet bgs. A thin lens of impacted soil was observed to be present at 29 to 30 feet bgs off site in the residential area at the southwest side of the Site.

Media investigated during the RI included surface soil, subsurface soil, soil gas vapors, and groundwater. Conclusions for each are summarized below.

3.3.1 Surface Soil

Fifteen surface soil samples were collected at the Site and at the adjacent gas regulator and residential properties west of the Site. Benzene, toluene, ethylbenzene, and xylenes (BTEX) were not detected in any of the surface soil samples. PAH compounds were detected in all surface samples, with three samples containing one or more PAHs that exceeded their Unrestricted Use SCOs; 12 samples containing PAHs exceeding their Commercial Use SCOs; and one sample

containing PAH concentrations meeting the Unrestricted Use SCOs. The highest concentration of PAHs in surface soil was detected in the vicinity of the gas regulator equipment west of the Site (SS2), with a total PAH concentration of 1,033 mg/kg.

Thirteen of the surface soil samples contained one or more of the metals copper, lead, mercury, and zinc at concentrations greater than the Unrestricted Use SCOs. Arsenic was detected at concentrations greater than the Commercial Use SCO in 10 of the 15 samples. Lead was measured above the Commercial Use SCO in one sample, SS15, on the residential property west of the Site. This isolated lead measurement exceeded all other results, and the implication is that the presence of lead is due to man-made material present in the shallow soils at that location.

Total cyanide was detected in six of the surface soil samples. The concentrations detected were well below the Unrestricted Use SCO of 27 mg/kg.

3.3.2 Subsurface Soil

Subsurface soil observations and analytical results are presented according to two different depth criteria. These intervals include: the interval from 0 to 15 feet bgs and the interval from 15 feet or deeper. The 0 to 15 foot bgs depth range corresponds to the NYSDEC's approach of managing soils down to 15 feet using Part 375-6 SCOs [NYSDEC, 2006]. Below 15 feet the focus is on the management of MGP "source material" as described by DER-10 [NYSDEC, 2010a] and by CP-51 – Soil Cleanup Guidance [NYSDEC, 2010b].

0 to 15 feet bgs

Forty-five subsurface soil samples were collected in the interval from 0 to 15 feet bgs. In this depth interval 37 samples were collected in non-residential areas and 8 samples were collected in residential areas.

BTEX compounds were detected in the subsurface samples, with 15 samples exceeding the Unrestricted Use SCOs for individual volatile organic compounds (VOCs). Five of the samples had VOC concentrations exceeding the Commercial Use SCOs. The highest concentration of total BTEX in this depth interval was detected near the former retorts and purifiers in SB1 with total BTEX concentrations up to 1,059 mg/kg.

Twenty-five of the 45 samples had individual PAH concentrations exceeding the Unrestricted Use SCOs. Twenty-five of the 45 samples also had individual PAH concentrations exceeding the Commercial Use SCOs. The exceedances of the SCOs were predominantly PAH compounds. Where detected, the total PAH concentrations ranged from 0.0082 mg/kg, to 39,420 mg/kg, in a sample of non-aqueous phase liquid (NAPL)-impacted soil from test pit TP4 which is located in the former purifier area.

Fifteen of the 45 samples had metals concentrations exceeding the Unrestricted Use SCOs. Two of the 45 samples, SB18 and TP6A, had metals concentrations exceeding the Commercial Use SCOs for arsenic and copper, respectively.

Six of the 45 samples analyzed for total cyanide had concentrations exceeding the Unrestricted Use SCOs (MW1, MW2, MW5, SB10, TP2, and TP4). Free cyanide was detected at trace or low concentrations at nine of the 17 samples where it was analyzed. Where detected, the highest concentration was 3.2 mg/kg at TP4 located adjacent to the former 1800's purifiers.

15 feet bgs and Deeper

Fifty-nine samples were collected from the interval of 15 feet to 30 feet bgs.

Twelve of the 59 samples analyzed had concentrations of individual VOCs exceeding the Unrestricted Use SCOs. None of the samples had concentrations greater than the Commercial Use SCOs. Similar to the 0 to 15 foot bgs interval, the exceedances of the SCOs were predominantly BTEX compounds. Where detected, the total BTEX concentrations ranged up to 69 mg/kg for a sample collected in the former storage area of the Site (SB19).

Sixteen of the 59 samples analyzed had concentrations of individual PAHs exceeding the Unrestricted SCOs. All but one of these samples also had concentrations of individual PAH compounds with concentrations greater than the Commercial Use SCOs. Where detected, the total PAH concentrations ranged up to 4,528 mg/kg, from the sample collected south of the former storage area of the Site, SB20.

One of the 25 samples analyzed had metals concentrations exceeding the Unrestricted Use SCOs. None of the samples had metals concentrations exceeding the Commercial Use SCOs.

Thirty-two of the 59 samples analyzed had total cyanide detected in concentrations greater than the method detection limits. The greatest concentration detected was 12.1 mg/kg. This concentration is below the Unrestricted Use SCO of 27 mg/kg. Free cyanide was detected at trace or low concentrations at four of the 23 samples where it was analyzed. Where detected, the highest concentration was an estimated concentration of 1.3 mg/kg at SB5.

3.3.3 Groundwater

Thirty-three groundwater samples were collected from 14 wells from February 2011 to February 2012. BTEX and PAH impacts were found to be generally confined to the Site, with some downgradient detections at MW6 on the undeveloped hotel property. Based on the sampling results, it is presumed that these COCs are also present on the northern portion portions of the residential properties to the south of the Site.

BTEX compounds were detected above the ambient water quality standards (AWQS) in 14 of the 33 samples collected from the wells. The highest concentration of total BTEX detected was 5,981

micrograms per liter (µg/L) at MW11A. This well is located in the western area of the Site within the former purifier area, to the west of former Gas Holder A (Figure 5). Other VOCs detected above the AWQS include isopropylbenzene and styrene within eight samples collected from MW1, MW5, and MW11A over one or more sampling events.

PAH compounds were detected above the AWQS in 12 of the 33 groundwater samples. These exceedances were found in six of the 14 wells in one or more sampling events: MW1, MW2C, MW5, MW6, MW11A, and MW12. Similar to the BTEX results, the greatest concentration of total PAHs was detected in the western area of the Site at MW11A (1,625 µg/L).

The majority of the samples from the wells contained iron, magnesium, manganese, and sodium in concentrations greater than the groundwater standards for metals. These metals are commonly found to be elevated in groundwater throughout New York State and the concentrations detected likely reflect ambient conditions.

Total cyanide was identified in concentrations exceeding the groundwater standard of 200 µg/L for two of the 14 wells installed at the Site. The wells include MW7 and MW8 which are located off-Site on the Commercial Use area properties. Free cyanide was occasionally detected in groundwater samples, usually at low levels below the quantitation limit. The highest concentration detected was an estimated 15 µg/L at MW7 in February 2012.

3.3.4 Soil Vapor and Air Results

Soil vapor, indoor air, and ambient air samples were collected at the Site. Ten soil vapor samples were collected, with eight of the ten samples being collected on off-Site residential and commercial properties. Two indoor air samples were collected at off-Site residential and commercial properties, and ambient air samples were collected during each indoor air sampling event. The locations of these samples are presented in Figure 5. All of the soil vapor samples were collected from below the silt layer at the Site. It was presumed that the silt layer would act as a semi-permeable barrier to the upward migration of COCs in soil vapor from subsurface sources, and as a barrier to dilution of COCs from ambient air above.

For comparison purposes, indoor air results are compared to the background indoor air 90th percentile concentrations [NYSDOH, 2006]. Indoor air sample IA1, collected from the hotel, had exceedances of the 90th percentile indoor values for chloroform and ethanol, neither of which are MGP-related compounds. The total BTEX concentration at IA1 was 9.2 micrograms per cubic meter (µg/m^3). At SV1, the elevated detections of n-Decane, n-Dodecane, and n-Octane are components of gasoline and are believed to be related to former underground storage tanks (USTs) that were present near this location.

All site samples contained concentrations of a variety of VOCs which are commonly found in ambient air, indoor air, and soil vapor samples. Soil vapor samples SV3 and SV4 contained relatively low concentrations of VOCs similar to those found in the suite of samples taken at the

hotel. Sample SV5, located near the southern property line of the Site, had a concentration of 1,665 $\mu g/m^3$. This concentration is consistent with the finding of soil and groundwater impact at this location. Soil vapor samples obtained near the north side of the residences at 19 and 23 Albion Street did not show significant concentrations of VOCs in the soil vapor. The results for the air sampling at 15 Albion Street showed that all analytes with a possible MGP origin were below the NYSDOH 90th percentile of the indoor air quality database. The total BTEX concentration at IA2 was 0.6 $\mu g/m^3$. The crawl space sample, SV10, shows very low concentrations for possible MGP-related compounds, indicating that MGP impacts in soil vapor are not migrating into the building structure. Soil vapor sample SV2 was obtained on the hotel property, near the residence at 15 Albion Street. This portion of the property is used by the residents at 15 Albion Street as a driveway for parking their motor vehicles. The BTEX total for this sample was reported as 910 $\mu g/m^3$. This result is anomalous, as no soil or groundwater contamination was found at this location. Note that the low concentration reported for SV4, where soil and groundwater contamination is present, suggests that these two samples may have been switched during the sampling or analysis process. However, a review of field and laboratory records could not find indication that this occurred.

In order to clarify these results, SV2 and SV4 were resampled on August 29, 2012. The results for SV2 showed decrease in total BTEX concentration from 910 $\mu g/m^3$ to 100.3 $\mu g/m^3$, while the concentration at SV4 increased from 14.71 $\mu g/m^3$ to 185.2 $\mu g/m^3$. These results appear to confirm the explanation that the samples were somehow switched. Sample SV9 had a BTEX concentration of 168.3 $\mu g/m^3$. This result was the highest of the samples obtained from the residential areas.

The results do not indicate a concern with regard to vapor intrusion of MGP-related compounds into the hotel or the residences. Although the soil vapor concentration for SV9 is elevated, this sample was obtained at 8 feet below the ground surface, well below the foundation for the adjacent house (this residence does not have a basement). Subsequently, the crawl space sample at this residence, SV10, had a very low BTEX concentration indicating lack of vapor intrusion of MGP-related compounds to the residence.

3.4 Fate and Transport Mechanisms

Conclusions for each media investigated during the RI are summarized below.

3.4.1 Surface Soil

Surface soil at the Site is generally covered by grass, with the hotel building, and parking lot covering the eastern portion of the Site. A small area with disturbed soils at the northwest side of the Site where tar was observed in 2010 was excavated and restored with topsoil to prevent exposure to underlying MGP residuals. The COCs identified in the surface soil samples were at generally low-level concentrations, which were only slightly elevated above the Commercial Use SCOs. A sample which exceeded the Commercial Use SCOs which was obtained from the west side of the Site, between the gas regulator structures, was found to be not representative of the surface soils in this

area. (It is likely that this soil was at the ground surface due to excavation for the gas line associated with the regulators.)

Based on the short duration of any work that would be performed in the grass-covered areas of the Site, the potential for an exposure to COCs in surface soil is considered to be low. It is unlikely that the migration of COCs in surface soil by wind or water erosion would result in impacts to surface water or sediment in the areas adjacent to the Site.

3.4.2 Subsurface Soil

Subsurface soil with visible coal tar NAPL mixed in the soil matrix, and/or COCs with concentrations greater than Commercial Use SCOs, is present in the central and western areas of the Site. The most visibly impacted interval was from 4 to 20 feet bgs. Coal tar NAPL in the soil matrix was not observed at depths deeper than 26 feet bgs on the Site. Borings located at the east side of the Site indicate that impacts are not present in the vicinity of the hotel. Coal tar NAPL identified in the subsurface appears to have migrated off site in the deeper subsurface soils in only one small location, south of the original gas works, from the area of SB20 to SB24. A zone 1-foot thick at a depth of 29 to 30 feet bgs was found to have tar coatings on sand and gravel grains. The impact at SB24 was not found to extend further south to borings immediately adjacent to the residences at 19 and 21 Albion Street.

3.4.3 Groundwater

Impacted groundwater is localized around the areas with observed coal tar NAPL-impacted soil. The greatest concentrations of COCs are in the central-western area of the Site. Groundwater impacts are likely to extend to the south of the Site boundary; however, groundwater impacts are not present near the residences along Albion Street. Total cyanide was detected in two wells in concentrations greater than the NYSDEC groundwater standard. Free cyanide at these locations was present at or slightly below the method quantitation limit. Light non-aqueous phase liquid (LNAPL) or dense non-aqueous phase liquid (DNAPL) has not been observed to accumulate in any of the 14 monitoring wells installed at the Site. Based on the wells installed during the RI, impacted groundwater is not migrating from the Site towards adjacent off-Site areas except in a small area along the south side of the Site. Groundwater is not extracted and/or used at the Site. The City of Hornell obtains its drinking water from upland reservoirs.

3.5 Exposure Pathways and Potential Receptors

The RIR contains an evaluation of exposure pathways and receptors for the area investigated during the RI. The evaluation examined the following media and potential release mechanisms, and examined how each potential human receptor group might come into contact with impacted media.

- **Fugitive Dust.** COCs in surface and subsurface soil could be a potential source for fugitive dust via physical disturbance.

- **Volatilization.** Volatile COCs may potentially be transported from subsurface soil by volatilizing into soil-pore space and eventually emanate into ambient or indoor air.
- **Leaching.** COCs in surface or subsurface soil could potentially leach to groundwater.

There are three mechanisms by which COCs in groundwater can be transported to other media. These migration pathways include the following:

- **Adsorption.** COCs in groundwater may be sorbed onto subsurface soils.
- **Volatilization to Ambient Air.** Volatile COCs in groundwater may potentially desorb into soil vapor and be transported through the vadose zone into ambient or indoor air.
- **Extraction or Migration.** COCs in groundwater may migrate to other media by extraction or migration and use of impacted groundwater.

Each of these potential release mechanisms was evaluated for each potential receptor group, both on site and off site. The receptor groups included:

- On-Site Outdoor Maintenance Workers
- On-Site Subsurface Utility or Construction Workers
- Site Visitors or Trespassers

A qualitative human health exposure assessment was performed for the Site. On-site maintenance workers are identified as hotel employees who may be exposed to COCs in surface soil via direct contact pathways (i.e., incidental ingestion, dermal contact, and inhalation of volatiles or particulates) while performing light maintenance activities such as mowing and weed or brush removal. For on-Site outdoor maintenance workers, the potential for an exposure to MGP-related residuals is considered to be low based on analytical results from samples collected from the hotel grassy area. For a subsurface utility worker or construction worker who may perform excavation work in the central area of the Site, the worker may potentially be exposed to coal tar NAPL-impacted soil and impacted groundwater. These areas include more shallow depths within the 1800's Gas Production Building area and deeper depths in the vicinity of Gas Holder A and the 1920's Gas/Oil Separators. Only properly trained and equipped personnel should perform the subsurface utility work in this area using methods specified in a site-specific health and safety plan (HASP). There is moderate exposure potential for site visitors or trespassers due to the presence of COCs in the surface soil and the absence of a perimeter fence at the Site.

Ecological Receptors

A high-value habitat is not present at the Site because the Site is largely a turf grass-covered field with a paved parking lot, located in an urban area. The potential for an exposure for an ecological receptor at the Site is therefore considered to be very low.

4. Remedial Goals and Remedial Action Objectives

4.1 Standards, Criteria, and Guidance (SCGs)

As defined in the DER-10, standards and criteria are the New York State regulations or statutes that dictate the cleanup standards, standards of control and other substantive environmental protection requirements, criteria, or limitations which are generally applicable, consistently applied, officially promulgated and are directly applicable to a remedial action.

The principal SCGs applicable to this site are:

- **6 NYCRR § 375-1**: General Remedial Program Requirements
- **6 NYCRR § 375-2**: Inactive Hazardous Waste Disposal Site Remedial Program
- **6 NYCRR § 375-6**: Remedial Program Soil Cleanup Objectives
- **DER-10** Technical Guidance for Site Investigation and Remediation
- **NYSDEC Policy Memorandum CP-51** on Soil Cleanup Guidance (Soil Cleanup Memo), October 21, 2010 [NYSDEC, 2010b]
- **NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1** Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations [NYSDEC, 1998]
- **Guidance for Evaluating Soil Vapor Intrusion in New York** [NYSDOH, 2006]
- **DER-31** Green Remediation [NYSDEC, 2011]

Detailed lists of the chemical-specific, action-specific, and location-specific SCGs are provided in Tables 4-1, 4-2 and 4-3, respectively.

The Site-specific cleanup levels for the MGP-related COC in soil and groundwater are the SCGs that will be used to define the RAOs and to develop the remedial alternatives. The topics of guidance listed in Table 4-1 are considered "to be considered" (TBC). These topics provide guidance for evaluating the media, constituents, actions or locations, but do not dictate specific requirements for addressing impacted areas. These TBC topics are used in conjunction with SCGs. For example, TBCs may serve to clarify the application of requirements or help ensure the developed alternatives will be acceptable to local stakeholders.

4.2 Soil Cleanup Levels

As stated in the NYSDEC Soil Cleanup Memo CP-51, Section 5, Paragraph A: *a soil cleanup level is the concentration of a given COC for a specific site that must be achieved under a remedial*

program for soil. The determination of soil cleanup levels is dependent on the following criteria (the criteria are provided in *italics*, below):

1. ***The applicable regulatory program***, which for this site is the Inactive Hazardous Waste Program.
2. ***Whether the groundwater beneath or down gradient of the Site is or may become impacted with site related COCs***, which for this site is confirmed by the RIR. This site exhibits plume morphology typical of former MGP sites, with dissolved BTEX and PAHs. The extents of the impacted groundwater plume appear to be stable and mostly within the boundaries of the Site.
3. ***Whether ecological resources constitute an important component of the environment at or adjacent to the Site, and which are, or may be, impacted by site-related COC.*** Ecological resource considerations do not apply for this FS, as established in the RIR, because the Site is a developed, urban area. Residences, a natural gas regulator station, maintained turf grass, and a hotel parking lot constitute the land uses.
4. ***Other impacted environmental media such as surface water, sediment, and soil vapor***. These considerations for surface water and sediment are not applicable, as these media are not present at the Site. The soil vapor investigation conducted and reported in the RIR concludes that intrusion into the surrounding hotel and residential structures is a potential concern. Additionally, the prevention of potential inhalation of soil vapor COC due to soil vapor intrusion into any potential future building at the Site property will be addressed by the management of source material.

After evaluating the nature and extent of the soil impacts on the Site, this FS presents alternatives based on NYSDEC's Soil Cleanup Guideline Approach 2: Restricted Use SCOs [NYSDEC, 2010b]. Within the Restricted Use approach, the Commercial Use SCOs are applicable for the Site soils within the Franklin Street right-of-way and the parcels owned by Maple City Lodging Partnership and National Fuel Gas. This applicability is based on the likely land use and continued ownership by these existing owners. The Residential Use SCOs are applicable for the soil in the off-Site area containing residences. The development of these SCOs is described in more detail below.

Protection of Groundwater. Protection of Groundwater SCOs (which are the Unrestricted Use SCOs for the PAHs and benzene, toluene, ethyl benzene, and xylene (BTEX) compounds at this site) may be deemed not applicable by the NYSDEC, allowing a Restricted Use approach, if the following conditions are met, as described in the NYSDEC Soil Cleanup Memo CP-51, Section V, Paragraph D2 (the Memo text is provided in *italics,* below):

- ***The groundwater standard contravention is the result of an on-Site source which is addressed by the remedial program***. In order for this condition to be met, the remedial alternatives in this FS that are based on the Restricted Use approach include technologies that address the on-Site source areas.

- ***An environmental easement or other institutional control will be put in place which provides for a groundwater use restriction.*** This provision has been included in the alternatives in this FS that are based on the Restricted Use approach.
- ***DEC determines that contaminated groundwater at the Site****:*
  a) ***Is not migrating, nor likely to migrate, off-Site***. As demonstrated by the RI, substantial off-Site migration of groundwater with MGP-related COC was not found to be occurring. *Or*
  b) ***Is migrating, or likely to migrate, off-Site; however, the remedy includes active groundwater management to address off-Site migration.*** Not applicable.
- ***DEC determines that groundwater quality will improve over time***. The subsurface soils and source material that impact the on-Site groundwater will be addressed by all alternatives (with the exception of the "no action" alternative).

4.3 Land Use and Cleanup Objectives

4.3.1 Soil Cleanup Levels – On Site

The SCOs as defined in 6 NYCRR Part 375-6 that apply to the Site are determined based on the Site use. The on-Site area is an undeveloped, grassed field. The future site ownership and use is projected to remain as it is today. The following SCOs have been selected for the Site:

- **Commercial Use Soil Standards – Applicable to Soil Less than 15 feet bgs:** This FS proposes to use a soil cleanup level for Total PAHs of 500 parts per million (ppm), applicable to a depth of 15 feet, as stated in CP-51 Paragraph H. The 500 ppm level will be used in lieu of achieving individual COC specific cleanup levels. For the purposes of this provision, subsurface soil will be defined as soil beneath at least 1 foot of soil cover or soil that meets the applicable SCOs.
- **Source Removal Below 15 feet bgs:** Source removal refers to the removal of a discrete source area, which is defined in DER-10 1.3 (b) 70 as containing "*COC in soil in sufficient concentrations to migrate in soil, or to release significant levels of COC to another environmental medium, which could result in a threat to public health and the environment. A source area typically includes, but is not limited to, a portion of a site where a substantial quantity of any of the following is present:*
  i. concentrated solid or semi-solid hazardous substances;
  ii. non-aqueous phase liquids; or
  iii. grossly impacted media. [see 6 NYCRR 375-1.2(au)]

4.3.2 Soil Cleanup Levels – Off Site

Two different SCOs will be applied to off-Site properties. The Commercial Use SCOs will apply to the soil above 15 feet bgs at the natural gas regulator parcel along the west side of the Site, and to soils beneath Franklin Street that have been impacted by the MGP.

The off-Site residential properties to the south of the Site will have Residential Use SCOs applied, based on the Site use and zoning. These areas are projected to remain in residential use.

4.3.3 Groundwater Cleanup Levels

The SCGs for groundwater quality are the Ambient Water Quality Standards, Guidance Values, and Groundwater Effluent Limitations (AWQS) identified in "*NYSDEC Technical and Operational Guidance Series 1.1.1"* (TOGS) [NYSDEC, 1998]. Based on this document, there is a single standard for groundwater in New York, based on the use of groundwater as drinking water.

4.4 Remedial Action Objectives (RAOs)

The RAOs are established as the overall goals for the Site remediation to provide protection of human health and the environment. The RAOs for this site were developed based on the applicable SCGs and the current and intended future land use. The RAOs are site-specific goals that address the media of concern, specific COC, and the exposure pathways for the Site. Specific COC to be addressed in this FS are PAHs, BTEX, and total cyanide.

Upon consideration of the SCGs, and the nature and extent of MGP impacts, as described in the RI, the following RAOs were developed for the Site. These RAOs are goals to be achieved to the extent practicable.

4.4.1 Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with soil with COC levels exceeding the applicable SCOs.
- Prevent inhalation of or exposure to COC volatilizing from soil.

RAOs for Environmental Protection

- Prevent migration of COC that would result in groundwater, surface water, or sediment impacts.
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity.

4.4.2 Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with COC levels exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles from impacted groundwater.

RAOs for Environmental Protection

- Prevent the discharge of COC to surface water or sediment.
- Remove the source of groundwater or surface water impacts, to the extent practicable.
- Restore groundwater aquifer to ambient groundwater quality criteria, to the extent practicable.

4.4.3 Surface Water

- **Not Applicable**. There are no surface water features at the Site.

4.4.4 Sediment

- **Not Applicable**. There are no sediments at the Site.

4.4.5 Soil Vapor

RAOs for Public Health Protection

- **Not Applicable**. As described in Section 3.3.4, the soil vapor investigation conducted for the RI show that soil vapor intrusion into the surrounding hotel and residential structures is a not a concern. The prevention of inhalation of soil vapor COC due to soil vapor intrusion into any potential future building at the Maple City Lodging Partnership property will be addressed by the management of source material and by Institutional Controls/Engineering Controls (IC/ECs).

5. General Response Actions and Estimated Volumes

In accordance with the guidance provided in DER-10 regarding the development and evaluation of remedial alternatives, this section describes the development of General Response Actions (GRAs) to address the RAOs identified in Section 4, and the estimated volumes of impacted media.

5.1 Potentially Site-Derived MGP Constituents of Concern

The potentially site-derived MGP COCs, as identified in the RI, are BTEX, PAHs, and total cyanide. The 17 PAH compounds included in the Total PAH concentrations (Total PAH17) discussed in this FS include the following:

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

5.2 Range of General Response Actions (GRAs)

GRAs are not specific to any single technology, but represent categories or approaches which may be combined and further defined to create remedial alternatives. To meet the RAOs developed for the Site, the following GRAs were identified:

1. **No Action.** This response action is listed for compliance with DER-10 FS guidance, but would not result in meeting the RAOs and is not contemplated for this site.
2. **Institutional Controls and Engineering Controls (IC/ECs) Pertaining to Soil or Groundwater.** These actions, also known as IC/ECs, involve restrictions of legal access to soil or groundwater and engineering controls to limit physical access.
3. **Containment of Soil and Groundwater.** Containment actions involve little or no treatment, but provide physical barriers to exposure, or otherwise remove pathways of exposure. These actions include vertical barriers and surface soil covers or impervious caps.
4. **In-Situ Treatment of Soil and Groundwater.** These actions include on-Site reduction in the volume, toxicity, and/or mobility of the COC. Technologies include in-situ solidification

(ISS) of impacted soil, in-situ groundwater treatment, active enhancement of natural attenuation, and monitored natural attenuation (MNA) of groundwater.

5. **Removal and Off-Site Treatment/Disposal of Soil and NAPL/Groundwater**. These actions include excavation of impacted soil and extraction of non-aqueous phase liquid (NAPL), and off-Site treatment/disposal of these in properly permitted facilities.

5.3 General Extent of Impacts

The nature and extent of impacts in surface soil, subsurface soil, and groundwater were described in Section 3. In accordance with the guidance provided in DER-10, this section presents the estimated extent of impacts on-Site and at the off-Site properties. The extent of impacts was determined with reference to the data presented in the RIR. Laboratory data from the RI were tabulated and compared to chemical-specific SCGs for surface soil, subsurface soil, and groundwater. The estimated areal extent of soil impacts, defined as exceedances of Part 375 Unrestricted Use SCOs, is shown in Figure 6. The estimated extent of groundwater impacts, defined as exceedances of NYSDEC Ambient Water Quality Standards, is shown in Figure 7.

RIR Table 13 (non-residential soils) and Table 14 (residential soils) [GEI 2014] presents a summary of the frequency of exceedances of the SCOs for subsurface soil for each land use. The table includes the number of subsurface soil samples collected, the range of each of the COC concentrations detected, and the number of exceedances of the Subpart 375 Unrestricted and Commercial Use SCOs (Table 13) or Unrestricted and Residential Use SCOs (Table 14) [GEI, 2014].

5.4 Volume Estimates

The volumes of impacted soil and groundwater present on site and off site were estimated for the purpose of providing a basis for the development and evaluation of remedial alternatives. Table 5-1 provides a summary of the volumes for each impacted medium.

Table 5-1 Estimated Volumes of Impacted Media

Area and Medium	Estimated Volume (cubic yard)
Area within Site Boundary	
Surface Soil exceeding Commercial Use SCOs (0-1 foot bgs)	905
Surface Soil exceeding Unrestricted Use SCOs (0-1 foot bgs)	1,120
Subsurface Soil exceeding 500 ppm Total PAH Commercial Use SCO (1-15 feet bgs)	12,670
Subsurface Soil Exceeding Unrestricted Use SCOs (1-15 feet bgs)	15,675
Deep Soil containing Source Material[1] (below 15 feet)[2]	269
Deep Soil exceeding Commercial Use SCOs (below 15 feet)	4,050
Deep Soil exceeding Unrestricted Use SCOs (below 15 feet)	4,239
Gas Regulator Parcel	
Surface Soil exceeding Commercial Use SCOs (0-1 foot bgs)	112
Surface Soil exceeding Unrestricted Use SCOs (0-1 foot bgs)	112
Subsurface Soil Exceeding Commercial Use SCOs (1-15 feet bgs)	112
Subsurface Soil Exceeding Unrestricted Use SCOs (1-15 feet bgs)	448
Residential Area	
Surface Soil exceeding Residential Use SCOs (0-2 feet bgs)	0
Surface Soil exceeding Unrestricted Use SCOs (0-2 feet bgs)	0
Subsurface Soil exceeding Residential Use SCOs (2-15 feet bgs)	0
Subsurface Soil exceeding Unrestricted Use SCOs (2-15 feet bgs)	0
Deep Soil containing Source Material[1] (below 15 feet)[2]	39
Deep Soil exceeding Residential Use SCOs (below 15 feet)[2]	39
Deep Soil exceeding Unrestricted Use SCOs (below 15 feet)[2]	39

Table Notes:
[1]Source Material is defined as coal tar lenses or deposits, or coal tar mixed in the fill or soil matrix as observed in RI borings or test pits.

[2]Source Material was not observed at depths deeper than 26 feet bgs on site, and 30 feet bgs off site during the RI.

5.4.1 Surface Soils

Surface soils for the MGP site itself will generally be addressed by any approaches that address subsurface impacts. Surface soils across the entire area that are remediated will be removed and restored so that a minimum of 1 foot of clean soil meeting Unrestricted SCOs is left at the surface. Based on the findings of the RI, this will exclude the eastern third of the Site where Gas Holders B and C were located. These gas holders were constructed on top of concrete slabs, and the soils covering the foundations were imported after MGP operations ceased.

For the gas regulator area, one surface sample exceeded the Commercial Use SCO for total PAH (SS2). For volume estimation purposes, we have assumed that the soils on this parcel do not meet the requirements for a 1-foot clean soil cover for commercial use or for unrestricted access (this area is not fenced except for the small enclosures around the above-ground piping). We have therefore

assumed that all of the shallow soil on this parcel will be removed and replaced, according to the description in each remedial alternative.

The surface soil sampling identified one location in a residential use area with surface soil with concentrations of COC exceeding the individual Residential Use SCOs (SS14). This off-Site sample was attributed to a non-site source, therefore no remediation is proposed for any soil west of the gas regulator parcel. Surface soils samples were not collected on the off-Site residential properties to the south of the Site. No surface soil remediation for these properties is included in the remedial alternatives in this report. Should pre-design sampling or sidewall confirmation sampling results indicate soils exceed the Residential Use SCOs then surface soil removal will be performed during the remedial action.

5.4.2 Subsurface Soils

The extents of subsurface soil exceedances of the applicable SCOs in the identified site and residential areas are shown on Figure 6. The footprint of these areas was estimated based on the observations of borings and test pits, as well as analytical laboratory results reported in the RIR and the exceedance criteria. The soil volumes were estimated as the product of the applicable areal extent and the applicable impacted depths. Although non-impacted soil may be present above deeper coal tar-impacted zones, this soil was included in the volume estimates because it would need to be excavated or pre-excavated (for ISS) to address the deeper impacted soil in most remedial scenarios.

The total volume of soil exceeding the Unrestricted Use SCOs was estimated to provide a maximum impacted soil volume, for comparison purposes. The horizontal extent of soil exceeding the Unrestricted Use SCOs is shown in Figure 6. The vertical extents of the impacted soil were based on the general depths of identified impacts for multiple borings advanced in the areas drawn.

As discussed in Sections 3 and 4, the parcel that was formerly used as the MGP is currently classified as Commercial Use based on the City of Hornell designation and on the current and planned future use for the foreseeable future. Therefore, Commercial Use SCOs provided the basis for soil volume estimates in accordance with NYS Part 375 and the NYSDEC CP-51 for this parcel. Commercial use SCOs are also applied to the off-Site gas regulator parcel to calculate soil volume estimates.

The soil volumes were estimated for total extent, without regard to accessibility. Table 5-1 provides these soil volumes for soils less than 15 feet in depth and exceeding 500 ppm Total PAHs. Included in this volume are observed source areas that may not have been sampled for laboratory analysis (source areas were assumed to exceed 500 ppm Total PAHs). Table 5-1 also provides estimates of source areas deeper than 15 feet with observed source areas from the RIR used to develop the areal extent and depth.

5.4.3 Groundwater

The estimated area of impacted groundwater is shown in Figure 7. As shown on the figure, the impacts are largely within the Site boundary, though the downgradient area of groundwater impact includes areas within residential parcels. The limits of groundwater impact are defined by the exceedance of the State Groundwater Quality Standard for benzene (1 ug/L) in the outer wells, and of the State Guidance Value for naphthalene of (10 ug/L). These compounds are the most soluble and mobile of the VOCs and the semi-volatile organic compounds (SVOCs) found at the Site. The area of exceedance is also presumed to include borings where sheen or NAPL was observed but no water samples were obtained. This includes the water table at SB5 where sheen was observed in soils at the water table, and SB24 where a narrow zone of NAPL was found at 29 to 30 feet bgs. The aerial extent of contamination delineated by these standards is approximately 32,175 square feet.

6. Identification and Screening of Technologies

Remediation technologies are the practical means used to address a specific environmental condition. The goal of the identification and screening of technologies is to enable the most effective and applicable technologies to be applied to meet the Site-specific conditions and remedial objectives. The individual technologies and approaches are then grouped to form alternatives, with each alternative addressing the Site as a whole.

The identification and screening of technologies was conducted in three stages, in accordance with DER-10 guidance. An initial screening process was first used to determine the most applicable technologies for the Site, using literature sources and GEI's experience at similar sites [FRTR, 2002; GRI, 1997; ITRC, 2002; NYSDEC, 1992]. For each of the GRAs identified in Section 5.2 (No action, Institutional Controls/Engineering Controls, Containment, In-Situ Treatment, and Removal) one or more technologies and process options were identified, described, and screened with respect to site-specific applicability. The general screening criteria used in the initial screening were with respect to effectiveness and, to a lesser extent, implementability and duration. The outcome of this initial screening is presented on Table 6-1 for surface soil, Table 6-2 for subsurface soil, and Table 6-3 for groundwater technologies.

Next, the technologies that were not eliminated from consideration due to site-specific applicability were further refined and evaluated. The evaluation at this stage used the criteria of effectiveness, implementability, and relative cost, in accordance with the DER-10 guidance. The outcome of this screening evaluation is presented on Table 6-4 for surface soil, Table 6-5 for subsurface soil, and Table 6-6 for groundwater technologies.

Finally, a more in-depth evaluation was conducted and technologies were then combined to form alternatives for analysis, as presented in Section 7.

The remainder of this section provides additional brief descriptions of the technologies and a discussion of the evaluation issues for surface soil, subsurface soil, and groundwater.

6.1 Surface Soil Technologies

6.1.1 IC/ECs

Institutional controls can provide an effective measure to limit or prevent direct contact exposure to soil. Applicable actions may include access control protocols, deed restrictions with an environmental easement, and the establishment for managing ground-intrusive activities through the implementation of a Site Management Plan (SMP). Because a SMP would be applicable as an

institutional control that would establish protocols for surface soil-disturbing activities at the Site, IC/ECs were retained for alternative development.

6.1.2 Surface Soil Barriers

Physical barriers may be used to limit the transport of COCs and to prevent potential exposures. Site covers or caps can be constructed of any combination of soil, gravel, asphalt, concrete, clay, or synthetic materials. The design and materials utilized to construct the cap or cover system depends upon the intended post-remedial use of the Site, the resistance to potential erosion required, and the desired permeability. Areas to be re-used for roadways and parking are typically gravel, asphalt, or concrete covered. Permeability will depend on the degree to which the cover/cap reduces infiltration of precipitation and the required resistance to erosion. Low permeability covers (e.g., asphalt, concrete, clay, or a synthetic material) are used to restrict infiltration and reduce the leaching of soil COCs in the vadose zone. Soil covers are more permeable and are used where infiltration and erosion are not major concerns.

A permeable or impermeable cover or cap could be used at the designated areas of the Site to prevent direct contact with soil and potential transport via water and wind erosion. In combination with the retained institutional controls (SMP), a cover or cap would attain the soil RAOs for the protection of public health. By preventing potential off-Site migration of impacted soil, a properly maintained cover would also meet the soil RAOs for environmental protection. Permeable and low permeability cover options are therefore retained for further consideration in the development of remedial alternatives.

6.1.3 Surface Soil Removal

Surface soil removal by conventional excavators and graders was retained as a possible technology for alternative development. Removal alone has limited effectiveness if the soil beneath the surface soil is also impacted. Therefore, this technology was retained for possible use as grading in combination with placement of soil cover materials.

6.2 Subsurface Soil Technologies

Impacted areas below the surface soil zone (1 or 2 feet below the ground surface, depending on the Site classification) and above the water table are addressed by subsurface soil technologies. Impacts below the water table are also generally addressed by groundwater technologies, but the descriptions in this section describe the subsurface soil technologies.

6.2.1 IC/ECs

IC/ECs for soils can be an important component during site remediation when combined with other response actions. An example would include the combination of an appropriate access restriction and soil management procedures with measures to control fugitive dust generation and provisions for long-term maintenance to achieve the soil RAOs for the protection of human health and the

environment. Site access protocols, soil management protocols, and site maintenance planning (as controlled in an environmental easement under a SMP) are therefore retained for alternative development.

6.2.2 Containment for Subsurface Soil

Subsurface vertical barrier walls have been used at MGP sites to prevent the migration of NAPL in subsurface soils. However, based on the sampling performed during the RI, active migration of impacts is not a concern; there does not appear to be significant mobile free-phase NAPL on the impacted parcels. Therefore, these technologies are not retained for alternative development.

6.2.3 In-Situ Treatment of Subsurface Soil

Subsurface soil treatment technologies include those that provide containment, immobilization, transformation, or recovery of contamination. Due to the limited mobility of the MGP impacts in soils and the strong sorption of the COCs to soils (recovery of NAPL would still leave impacted soils), technologies that enhance recovery were screened out in the first round of technology screening.

In Situ Chemical Oxidation (ISCO)

Application of ISCO technology has had a varied record of effectiveness at sites with contaminated soils. One of the obstacles to effective implementations is a heterogeneous subsurface and the presence of fine-grained soils that can limit the distribution. Additionally, the technology is generally not applicable for areas with NAPL or highly impacted soils. However, for highly conductive soils and areas without free product or high concentrations of contamination, the technology may be effective. As a technology that provides destruction of contamination, ISCO was retained for alternative development.

Enhanced In-Situ Bioremediation

Enhanced in-situ bioremediation involves the use of microorganisms to degrade the COCs present in soil and groundwater. It relies on changing the nutrient and oxidation or reduction characteristics in the subsurface by distribution of active agents throughout the affected saturated zone. However, similarly to the difficulties of effective ISCO, the presence of fine-grained soils, and highly impacted soils can limit the distribution of biologically active amendments and limit the enhancement of bioremediation beyond natural attenuation. With the effectiveness of this technology substantially limited by the presence of highly impacted soils, this technology was not retained for alternative development.

In Situ Solidification (ISS)

ISS has become a commonplace means of remediation at MGP sites, including MGP sites in New York State [New York Construction, 2007]. ISS of impacted soil involves the in-place mixing of cementitious reagents (such as Portland cement) with impacted soil with a vertical or horizontal-mounted auger or excavator bucket to create a solidified mass that substantially decreases the ability

of groundwater to come into contact with the impacted soil, and also effectively immobilizes COCs in the ISS-treated soil. The resulting material is typically a homogeneous mixture of soil and grout that hardens into a low permeability soil/cement material.

ISS results in the formation of a solid monolith of relatively impermeable material in the saturated zone. Groundwater is forced around and under the ISS monolith, thus preventing contact of groundwater with the COCs contained in the monolith. ISS results in an expansion of about 30% in the volume of treated soil, thus requiring either pre-excavation or post-excavation of soil to a depth such that the final ISS monolith does not exist in the frost zone. At this site, it is assumed that all of the source material can be reached by an ISS system. This technology was retained for alternative analysis development.

Jet Grouting

The jet grouting process involves the use of high pressure to inject and mix a liquid cement bentonite grout into a column or area of soil. The high pressure mixing accomplished with this method allows for a smaller diameter drill or auger hole to be used, which allows use of this method around obstructions such as utilities or foundations. An advantage of this method includes the ability to target specific depth intervals for treatment, including thin lenses of impacted media at depth or obstructions. However, uniform homogenization of the soil is difficult to accomplish for this method for larger applications. Jet or pressure grouting may be applicable to address some of the impacted areas of the Site beneath and around major obstructions. For this reason, it is retained for alternative development.

6.2.4 Subsurface Soil Removal

Excavation of soil is implementable and highly effective when coupled with an appropriate treatment or disposal option. Removal of impacted soils would achieve (in part or completely) the RAO for this media. Removal of soils containing coal tar in the matrix would remove a potential source of on-going groundwater impacts. Technologies for excavation include use of conventional trackhoe equipment for excavation to depths of 20 feet, extended arm trackhoe equipment for excavation to depths of 40 feet, and crane-mounted Kelly bar/clam shell equipment for excavation to depths of 100 feet or more [Hayward Baker, 2005]. At this site, excavation for removal of impacted soils could extend to a depth of 28 feet, to below the depth of the deepest observed soil impacts. A combination of conventional trackhoe and extended arm trackhoe technologies, and staged, shored excavations, would be used to accomplish the excavation work and are therefore carried forward for the development of the alternatives. The excavation of soils below the saturated zone is feasible but additional cost will be incurred due to measures needed to maintain a stable excavation area and to de-water both the excavation area, as needed, and the excavated soils prior to off-Site transport.

Control of odors and VOC emissions will be a critical aspect of all excavation scenarios. Excavation and loading activities could be conducted using a temporary fabric structure (if specified during the design phase of the project), odor-controlling foam, temporary plastic covering, fabric-covered

perimeter fencing, and direct load-out, as has been effectively done for odor control during recent remedial actions at other MGP sites.

6.2.5 Subsurface Soil Off-Site Treatment and Disposal

On-site soil treatment processes conducted on excavated soil include biological, chemical, or thermal treatment. The effectiveness of these processes is variable and each requires a site-specific demonstration to determine the degree of treatment, time, and land area required. These processes require a location with an appropriate distance from residential areas. These considerations resulted in on-Site treatment processes not being retained for alternative development.

Subsurface soil off-Site treatment and disposal technologies include conventional landfilling (Subtitle D landfill), low-temperature thermal desorption (LTTD), and disposal in waste-to-energy facilities. Each of these technologies has its place as a potentially applicable approach for certain soils or solid debris, and may be advantageous under particular conditions. Therefore, all were retained for alternative development.

6.3 Groundwater Technologies

6.3.1 Institutional Controls and Engineering Controls (IC/ECs)

The institutional controls for groundwater that may be applicable to alternatives for this site include an environmental easement for site and groundwater use, and a restriction on the construction and use of new groundwater wells.

6.3.2 Groundwater Containment Technologies

Groundwater containment technologies include soil cover, low permeability caps such as asphalt parking lots, subsurface vertical barriers such as steel sheet pile or soil/bentonite walls, and active process barriers such as biologically active zones which form treatment walls preventing off-Site migration of residuals.

For areas that have subsurface impacts in the vadose zone, soil covers and impermeable surface caps could decrease infiltration of precipitation through impacted soils in the vadose zone and therefore have a positive effect on groundwater quality.

Subsurface vertical barriers were not retained due to the localized impacts around the observed impacts in the subsurface soil and because the impacts are not likely to extend beyond the impacted parcels.

6.3.3 In-Situ Treatment

Monitored Natural Attenuation (MNA)

Groundwater MNA relies upon the natural degradation and mitigation processes which occur in the subsurface to remedy groundwater impacts over time. The natural attenuation processes include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of COCs in soil or groundwater. These processes include biodegradation, dispersion, dilution, sorption, volatilization, and chemical or biological stabilization, transformation, or destruction of COCs.

A recent study of MNA at an MGP site has shown its effectiveness following source removal and with favorable subsurface conditions [Neuhauser, et al, 2009]. Implementation is determined as a function of an evaluation of physical and chemical soil and groundwater characteristics including soil and groundwater chemistry, groundwater hydraulics, and biodegradation processes associated with microbial activity. Groundwater MNA was retained for alternative development because it is readily implementable, with low cost.

ISS

As described in Section 6.2.2, the technology of ISS creates a solidified mass that substantially decreases the ability of groundwater to come into contact with the impacted soil and effectively immobilizes COCs in the ISS-treated soil. This technology is retained for impacted media in the saturated zone due to its effectiveness and implementability.

ISCO

The use of ISCO involves the injection of Fenton's Reagent (a solution of hydrogen peroxide and an iron catalyst), or similar chemical oxidant, which is injected across the area of COC impacts, generally in a regular pattern whose spacing depends on the Site-specific radii of influence via temporary injection wells or modified direct push rods. ISCO is generally much more effective at COC destruction in the saturated zone than the vadose zone. Due to the depth below the ground surface of the groundwater impacts, this technology is retained for evaluation.

Enhanced In-Situ Bioremediation

Enhanced biological treatment of groundwater may use aerobic or anaerobic microbial degradation of COC. These are active management processes in which natural groundwater conditions are modified in order to facilitate bioremediation of the COCs to innocuous end-products. Engineered saturated zone bioremediation processes are designed to treat the dissolved constituents of the groundwater plume by ensuring the existence of a bioactive zone which is sufficient to degrade the constituents before they reach an environmental receptor. Aerobic biological treatment is the most applicable to MGP sites. In this process, oxygen-releasing compounds or direct air/oxygen injection is used in wells to deliver oxygen to the affected groundwater over the required time period to achieve the desired amount of oxygen. Enhancements such as increasing the dissolved oxygen

content in the subsurface have been shown to be effective at MGP sites [Levinson, 2009]. These technologies are used to treat dissolved COCs in groundwater.

This technology is potentially effective for groundwater with moderate concentrations of COCs. However, for the Hornell Former MGP site, impacted groundwater containing COCs are generally concentrated around soil containing coal tar or NAPL with high concentrations of COCs. Groundwater bioremediation will not address free-phase contamination effectively, so the technology is not retained.

Air Sparging

Air sparging/soil vapor extraction is the injection of pressurized air into the subsurface below the water table to induce volatilization of dissolved phase COC. The volatilized compounds are then removed by active vapor extraction wells. This technology is applicable to sites such as gasoline spills where VOCs are predominant. Because MGP-impacted groundwater contains PAHs which are not readily-volatilized by air sparging, this technology is not being retained for alternative development.

6.3.4 Removal and ex-situ Treatment Technologies for Addressing Groundwater

General technology types within the source removal GRA include excavation, NAPL recovery, and enhanced recovery technologies. Additionally, once the groundwater is extracted, a number of options exist for treatment of the impacted water.

Excavation/Extraction/Ex-situ Treatment

As discussed in Section 6.2.3, removal of soils containing coal tar in the soil matrix would remove a potential source of on-going groundwater impacts. Therefore, this technology applicable to soil is also applicable to groundwater. Generally, soil excavation below the water table requires dewatering, so the groundwater in the vicinity of the excavation is extracted and treated ex-situ in a temporary, on-Site water treatment facility.

It would be feasible to extract impacted groundwater for above-ground treatment at this site. On-site treatment technology options for extracted groundwater may include air stripping and/or granular activated carbon (GAC). Although the MGP COC are amenable to biological treatment, the concentrations in groundwater are typically too low for biological treatment to be effective without the addition of large amounts of co-substrate to maintain a viable biomass. Pumped groundwater would be appropriate for off-Site treatment at a publicly owned treatment works (POTW), though some pretreatment may be required by the City. Groundwater extraction with air stripping, GAC and/or discharge to the POTW is retained for further consideration in development of alternatives.

As discussed above, groundwater extraction would result in a very high volume with low concentrations of COC. Mass removal rates relative to the recovery effort would be very low. A more efficient means to extract the source material mass and reduce the on-going source of

groundwater impacts would be to remove coal tar from the subsurface. Groundwater extraction and treatment without excavation was not retained as a groundwater technology due to the long-term duration and energy and operations-intensive nature of this approach for the low-solubility COCs at the Site. However, since excavation-related dewatering during construction may be required, the ex-situ pre-treatment technologies were retained for further consideration in development of alternatives.

NAPL Recovery

NAPL recovery can reduce the mass of NAPL in the subsurface and also can, by recovering the flowable fraction, reduce the mobility of residual NAPL. Typical recovery systems include specially constructed wells and/or recovery trenches. Collection may be passive or may require an active pumping system. Several NAPL pumping systems are available, including low-flow NAPL pumps which, for many systems, allow for the greatest NAPL recovery [EPRI, 2000a]. Recovery of viscous and weathered NAPL may be difficult, and low rates of recovery may indicate that there is not a substantial flowable NAPL fraction.

At the Site, flowable NAPL has not been observed and therefore is not accumulating in the monitoring wells. Without treatment, coal tar residual will not flow as a separate phase and would be anticipated to be extremely difficult to mobilize. Because flowable NAPL has not been observed in the RI soil borings, wells, or test pits, and NAPL recovery using wells or trenches is not retained for alternative development.

Enhanced Recovery Technologies

As mentioned above, coal tar residual at the Site in groundwater is not expected to migrate without treatment designed to enhance its recovery. Adding heat to the subsurface through steam, hot water, or electro-resistive heating are technologies that may be used to enhance tar or NAPL recovery. However, these technologies are energy intensive and have a risk of mobilizing source materials in an uncontrolled fashion. This could spread contamination to previously unimpacted areas and make treatment more difficult, particularly if the impacts migrate downward in the aquifer.

Similarly, chemical enhancements such as surfactants or co-solvents or physical enhancements such as acoustic vibrations could also mobilize contamination, but recovery may be difficult and only partially effective. However, a substantial risk exists for uncontrolled migration of impacts to deeper within the aquifer. Therefore, the most efficient, safe and direct means to remove the coal tar is to physically excavate soils containing the coal tar material. For these reasons, enhanced recovery technologies were not retained for alternative development.

6.4 Secondary Technology Screening

The secondary technology screening step has retained technologies that are an appropriate and effective means to prevent exposure to site-related COCs. These technologies are retained for incorporation into the remedial alternatives. The use of a permeable cover (with appropriate soil

management provisions and drainage controls) would provide a reliable means to prevent direct contact exposures and transport via wind and water erosion on the Site, and is retained for incorporation into remedial alternatives.

ISCO was retained as a technology to target areas deeper (>15 feet bgs) that have been identified to have visible impacts of NAPL or sheen at a significant depth. ISS was retained as a technology to manage source material in the identified areas of concern for the Site. Jet or pressure grouting was retained as a method of in-situ solidification for potential consideration to address impacted soil around or beneath major obstructions. Excavation was also retained for these areas given the anticipated depth of excavation (up to 30 feet) is possible with proper stabilization and contingency measures. Off-Site LTTD and disposal would be feasible for the treatment of the highly-impacted excavated soils. Following ISS or excavation, MNA for the groundwater was retained for further consideration to address the limited impacts to groundwater. The retained technology options and media are summarized in the table below:

Technology Option	***Media***
No Action	All
Institutional Controls:	
▪ Site Management Plans	Soil and Groundwater
▪ Environmental Easements	Soil and Groundwater
▪ Groundwater Use Prohibitions	Groundwater
Barriers:	
▪ Soil Cover	Soil, Groundwater
▪ Low Permeability Surface Cover (pavement)	Soil, Groundwater
In-Situ Treatment:	
▪ Jet or Pressure Grouting	Soil, Groundwater
▪ In Situ Chemical Oxidation	Soil, Groundwater
▪ In Situ Solidification	Soil, Groundwater
▪ Monitored Natural Attenuation	Groundwater
Removal and Ex-Situ Treatment:	
▪ Excavation	Soil
▪ Landfilling	Soil
▪ Low Temperature Thermal Desorption	Soil
▪ Groundwater Organic COC Treatment	Groundwater (extracted during soil removal)

7. Development and Analysis of Alternatives

In this section, the remedial alternatives for the Site are developed and evaluated, based on the nature and extent of impacts and the applicable technologies. A comparison of alternatives is presented at the conclusion of this section. A summary of how the alternatives address the RAOs is provided in Table 7-1. A summary and comparison of the remedial alternatives is provided in Table 7-2. The recommended alternative is further described in Section 8.

7.1 Development of Alternatives for Additional Remedial Actions

A range of alternatives for additional remedial actions were developed for this site, based on the land use approaches, RAOs, and GRAs identified in Sections 3, 4 and 5, and the applicable technologies identified in Section 6. A total of six alternatives were developed and retained for detailed analysis. The six alternatives are summarized as follows:

Alternative 1: No Action

- No Action (required for comparison purposes by DER-10)

Alternative 2: Surface and Subsurface Soil Removal up to 15 feet, Soil Cover, MNA, and IC/ECs

The areas of the Site to be addressed by this alternative are shown, with the depths of excavation as well as the area of soil cover in Figure 8.

- Surface soil removal for all on-Site areas to be addressed by the subsurface soil removal.
- The upper 1-foot of soil on the gas regulator parcel would be removed and replaced. A demarcation material would be placed under areas with the 1-foot thick clean soil cover, over soils meeting the SCOs for Commercial Use.
- Subsurface soils would be excavated to a depth of 15 feet bgs exceeding Commercial SCOs (500 ppm total PAHs) and removed from the Site for treatment and/or disposal as shown in Figure 8.
- Relocation of overhead electrical distribution lines and communication lines, and underground natural gas and water lines along Franklin Street on the western side of the Site in the area to be remediated.
- Sheet piling would be used for excavation support surrounding the deeper excavation areas.
- Removal of pavement and road base into Franklin Street to near SB28 and 29.

- Demolition, excavation and removal of the original gas production building foundation and the foundation for Gas Holder A from the former MGP parcel. Portions of the foundation of the later production building would be removed only if necessary in order to remove impacted soils down to 15 feet bgs. The foundations for the former Gas Holders B and C would remain in place.
- Backfill of the excavation with soils meeting the SCOs specified in 6 NYCRR Part 375-6.7(d) and DER-10 Appendix 5.
- Restoration of Franklin Street and the currently grassed areas with vegetation at the surface for the excavated areas.
- MNA for groundwater.
- IC/ECs implemented site-wide by a SMP (including site and groundwater use restrictions and an environmental easement agreement).

A Monitoring Plan (included in the SMP and applied site-wide) would be developed to monitor the performance of the MNA. The soil cover area would be inspected annually and a Periodic Review Report prepared in accordance with Part 375-1.8(h)(3).

Alternative 3: Surface and Subsurface Soil Removal to 15 feet, Soil Cover, ISCO of Impacts Below 15 feet, MNA, and IC/ECs

The areas of the Site to be addressed by this alternative are shown, with the depths of excavation as well as the area of soil cover in Figure 9a. Figure 9b indicates the area of deeper subsurface impacts (below 15 feet bgs) that would be addressed by ISCO treatment. This alternative varies from Alternative 2 by the addition of ISCO for deeper impacts in subsurface soils and groundwater.

- Surface soil removal for all on-Site areas to be addressed by the subsurface soil removal.
- The upper 1-foot of soil on the gas regulator parcel would be removed and replaced. A demarcation material would be placed under areas the 1-foot thick clean soil cover, over soils meeting the SCOs for Commercial Use.
- Subsurface soils exceeding Commercial SCOs (500 ppm Total PAH) would be excavated to a depth of 15 feet bgs and removed from the Site for treatment and/or disposal as shown in Figure 9a.
- Relocation of overhead electrical distribution lines and communication lines, and underground natural gas and water lines along Franklin Street on the western side of the Site in the area to be remediated.
- Sheet piling would be used for excavation support surrounding the deeper excavation areas.
- Removal of pavement and road base into Franklin Street to near SB28 and 29.

- Demolition, excavation and removal of the original gas production building foundation and the foundation for Gas Holder A from the former MGP parcel. Portions of the foundation of the later production building would be removed only if necessary in order to remove impacted soils down to 15 feet bgs. The foundations for the former gas holders B and C would remain in place.
- Backfill of the excavation with soils meeting the SCOs specified in 6 NYCRR Part 375-6.7(d) and DER-10 Appendix 5.
- Restoration of Franklin Street and the currently grassed areas with vegetation at the surface for the excavated areas.
- ISCO followed by MNA for groundwater on the former MGP parcel. For costing purposes, it is assumed that two rounds of chemical injection would be performed as part of this remedy.
- MNA for deep off-Site impacts.
- IC/ECs implemented site-wide by a SMP (including site and groundwater use restrictions and an environmental easement agreement).

A Pre-Design Investigation (PDI) would be performed to further refine the horizontal and vertical limits of ISCO in the subsurface soil, particularly in the area of Gas Holder B.

A Monitoring Plan (included in the SMP and applied site-wide) would be developed to monitor the performance of the MNA. The soil cover area would be inspected annually and a Periodic Review Report prepared in accordance with Part 375-1.8(h)(3).

Alternative 4: ISS of Subsurface Soil with Pre-Excavation

This alternative addresses subsurface impacts using ISS. Excavation in the areas of ISS will be required so that the additional volume of material generated from the ISS (spoils) do not remain above the frost line. The frost line at the Site under strong winter conditions is estimated to extend up to 4 feet bgs. The footprints of these areas of excavation are the same as Alternatives 2 and 3 and are shown in Figure 10a. The exact areas for ISS would be determined during design. The total volume of impacted soils to be excavated and treated and/or disposed, however, is estimated to be at least 33 percent smaller in this alternative, with 60 percent less backfill needed. Due to the expansion of soils subjected to ISS, pre-excavation of soils to an average of 10 feet bgs is required, as shown on Figure 10a. The depths of treatment by ISS are shown on Figure 10b.

- Surface soil removal for all on-Site areas to be addressed by the subsurface soil removal.
- The upper 1-foot of soil on the gas regulator parcel would be removed and replaced. A demarcation material would be placed under areas with the 1-foot thick clean soil cover, over soils meeting the SCOs for Commercial Use.

- Relocation of overhead electrical distribution lines and communication lines, and underground natural gas and water lines along Franklin Street on the western side of the Site in the area to be remediated.
- Removal of pavement and road base into Franklin Street to near SB28 and 29.
- Demolition, excavation and removal of the original gas production building foundation and the foundation for Gas Holder A from the former MGP parcel. Portions of the foundation of the later production building will be removed only if necessary in order to ISS impacted soils down to 15 feet bgs. The foundations for the former Gas Holders B and C would remain in place
- Pre-excavation of on-Site soil exceeding 500 ppm Total PAHs to allow for a utility corridor and to ensure that the ISS mass is below the frost line. Subsurface soils would be excavated and removed from the Site to depths as shown in Figure 10a. The average depth of removal would be 10 feet bgs, with the most impacted soils in this area targeted for removal.
- Off-Site disposal of debris and soil or off-Site treatment of soil at an LTTD facility.
- ISS for soil exceeding the Commercial Use SCOs above 15 feet bgs, and with source material below 15 feet, as shown on Figure 10b.
- Jet or pressure grouting may be utilized to address impacted soil around or beneath major obstructions.
- Site re-grading to accommodate a 1-foot thick clean soil cover meeting the SCOs specified in 6 NYCRR Part 375-6.7(d) and DER-10 Appendix 5 for Commercial Use.
- A demarcation material will be placed under areas where a 1-foot thick clean soil cover meeting the SCOs specified for Commercial Use is placed.
- Backfill of the excavation with soils meeting the SCOs specified in 6 NYCRR Part 375-6.7(d) and DER-10 Appendix 5.
- Restoration of Franklin Street and the currently grassed areas with vegetation at the surface for the excavated areas.
- MNA for groundwater.
- IC/ECs implemented site-wide by a SMP (including site and groundwater use restrictions and an environmental easement agreement).

A PDI would be performed to further refine the horizontal and vertical limits of ISS in the subsurface soil, particularly in the area of Gas Holder B.

A Monitoring Plan (included in the SMP) would be developed for the Site to assess the performance of the remedy. Soil cover areas would be inspected annually and a Periodic Review Report prepared in accordance with Part 375-1.8(h)(3).

Alternative 5: Excavation of Impacted Soils <15 feet Exceeding SCOs, Deep Source Removal

Alternative 5 has the same approach for subsurface soils to 15 feet bgs as Alternative 3. Figure 11a indicates these extents. This alternative additionally includes the excavation and off-Site disposal or treatment of soil below 15 feet bgs containing source material. Figure 11b presents these areas and depths of removal. Since the water table is at approximately 14 to 16 feet bgs, areas excavated below this depth would require dewatering. This water will require pretreatment using activated carbon before discharging to a sanitary sewer.

- Surface soil removal for all on-Site areas to be addressed by the subsurface soil removal.
- The upper 1-foot of soil on the gas regulator parcel would be removed and replaced. A demarcation material would be placed under areas with the 1-foot thick clean soil cover, over soils meeting the SCOs for Commercial Use.
- Subsurface soils would be excavated to a depth of 15 feet bgs and removed from the Site for treatment and/or disposal as shown in Figure 11a.
- Relocation of overhead electrical distribution lines and communication lines, and underground natural gas and water lines along Franklin Street on the western side of the Site in the area to be remediated.
- Sheet piling would be used for excavation support surrounding the deeper excavation areas.
- Removal of pavement and road base into Franklin Street to near SB28 and 29.
- Demolition, excavation and removal of the original gas production building foundation and the foundation for Gas Holder A from the former MGP parcel. Portions of the foundation of the later production building would be removed only if necessary in order to remove impacted soils down to 15 feet bgs. The foundations for the former Gas Holders B and C would remain in place.
- Subsurface soils up to 15 feet bgs would be excavated and removed from the Site for disposal or treatment as shown in Figure 11a (soil exceeding 500 ppm Total PAHs).
- Removal of soil with source material below a depth of 15 feet. This will require excavation down to as much as 26 feet in localized hot-spots.
- Off-Site disposal or treatment of soil and debris at an LTTD or landfill.
- Restoration of Franklin Street and the currently grassed areas with vegetation at the surface for the excavated areas.
- Backfill of the excavation with soils meeting the SCOs specified in 6 NYCRR Part 375-6.7(d) and DER-10 Appendix 5.
- Restoration of Franklin Street and the currently grassed areas with vegetation at the surface for the excavated areas.

- Installation of additional monitoring wells in the vicinity of SB24, with MNA for groundwater.
- IC/ECs implemented site-wide by a SMP (including site and groundwater use restrictions and an environmental easement agreement). An SMP or use restrictions would not be needed for the off-Site residential properties as this remedy would remove all impacted soils exceeding the Residential SCOs.

A Monitoring Plan (included in the SMP) would be developed for the Site to assess the performance of the remedy. Soil cover areas would be inspected annually and a Periodic Review Report prepared in accordance with Part 375-1.8(h)(3).

Alternative 6 (required for comparison purposes by DER-10)

This alternative, similarly to Alternative 5 uses excavation and off-Site treatment/disposal to address impacts at the Site. However, this alternative would remove soils for all areas of the Site and the neighboring affected properties with impacts above Unrestricted Use SCOs, as shown on Figures 12a and 12b. For this alternative, the gas regulator parcel would have all soils exceeding the Unrestricted Use SCOs removed (with soil removed to an average of 5 feet bgs) and replaced by clean fill. This will require relocation of the gas lines and the gas regulator equipment. In addition to the remainder of the actions described for Alternative 5, a small area at the southeastern edge of the former Gas Holder C would be removed to remediate the soil that exceeds the Unrestricted Use SCOs for PAHs and mercury identified in the fill soil at this location.

7.2 Detailed Analysis of Alternatives

The following sections present descriptions of each of the remedial alternatives and the results of the evaluation of the alternatives with regard to the following eight criteria defined by DER-10:

1. Overall protection of human health and the environment
2. Conformance with SCGs
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, or volume of COC through treatment
5. Short-term impacts and effectiveness of controls
6. Implementability
7. Cost effectiveness
8. Land Use

When performing this evaluation, the first two evaluation criteria are threshold criteria and must be met for an alternative to be considered for selection. The next six evaluation criteria are balancing

criteria which are used to compare the positive and negative aspects of each of the remedial alternatives, contingent on whether the alternative satisfies the threshold criteria.

A ninth criterion, Community Acceptance, is considered after a decision document has been subject to public comment. This modifying criterion is evaluated after any public comments on the remedy have been received, prior to NYSDEC's final approval of the remedy.

In accordance with the NYSDEC Guidance Document DER-31 – Green Remediation, aspects of environmental sustainability were evaluated as part of the detailed analysis of alternatives. These aspects were included in the considerations of the short-term impacts of each alternative.

Estimated costs are presented for the proposed remedies. These include capital and operations, maintenance, and monitoring (OM&M) costs. OM&M costs are associated with groundwater monitoring for this site and are presented as present worth costs calculated based on a maximum period of 30 years with a discount rate of 5 percent. This value was selected based on recommendations by the NYSDEC. Costs have been prepared to present a range that may vary between +50 % and -30 % from actual costs.

7.2.1 Alternative 1: No Action

The No Action Alternative is used as a baseline condition for comparison to other alternatives. It involves no monitoring, active remediation, or IC/ECs. There is no cost associated with this baseline alternative. Because it would not address the surface or subsurface impacts present at the Site, the No Action Alternative would not achieve the threshold criterion of conformance with SCGs required by DER-10. It would have low long-term effectiveness and permanence, and would not reduce mobility, toxicity, or volume. The overall protection of human health and the environment would not be achieved under the No Action Alternative, particularly for a future construction worker risk scenario. While No Action would have no negative short-term impacts, and would be implementable and cost effective, it would not meet the RAOs for subsurface soil to the extent practicable and is therefore not a viable alternative.

7.2.2 Alternative 2: Surface and Subsurface Soil Removal up to 15 feet, Isolation and Implementation of IC/ECs and an MNA Program

Description

This alternative consists of the establishment and maintenance of a clean soil cover for the gas regulator parcel and excavation of impacts in soils to a depth of 15 feet for the Site. This alternative also establishes the IC/ECs implemented by a SMP, including site and groundwater use restrictions and an environmental easement to prevent human contact with media containing COCs above relevant SCOs. An MNA program would be implemented to document and report the levels of COC impacts to groundwater. It is recognized, however, that MNA alone will not address the impacts to groundwater of source material below 15 feet. This Alternative is included in the FS for comparison with other alternatives that provide an active remedy for this zone.

This alternative provides for protection of human health and the environment while having lower short-term impacts and remedial action cost by addressing contamination down to the depths where human activity could encounter impacts. The remedy would allow the current commercial land use as a natural gas regulator station and vacant field adjacent to the hotel and a parking lot, provided a SMP is in place to address control of any future excavation within the impacted areas. No groundwater use takes place at the Site, therefore long-term groundwater impacts will not affect human health. This remedial alternative is depicted in Figure 8.

Deed restrictions and an environmental easement would be established between National Fuel Gas and Maple City Lodging Partnership. Likewise, the residential properties containing deep MGP-related impacts would also have established deed restrictions and environmental easements, in accordance with DER-33 [NYSDEC, 2010c]. An SMP would be established such that any future excavation in the impacted areas would be conducted under a National Fuel Gas-approved work plan. There are currently no wells for groundwater use on the Site, and future installation of wells and groundwater use on the properties would be restricted by the environmental easement established under this alternative.

The soil cover would be inspected annually and a Periodic Review Report would be prepared in accordance with Part 375-1.8(h)(3). Groundwater monitoring would be performed for 5 years and the results re-evaluated with the NYSDEC. For the estimate of costs for this FS, it is assumed that the monitoring would be performed for 30 years.

Overall Protection of Human Health and the Environment

The potential for contact with COCs in surface soils will be mitigated by the removal of surface and subsurface soils exceeding the Commercial Use SCOs across the production areas of the former MGPs. The presence of deep impacts in the soil matrix in the subsurface poses little threat, but it is a continued concern for any deep utility or other subsurface work that may be needed at the Site, as well as for any future construction. These potential risks will be managed through the use of a SMP and deed restriction. Groundwater is deep (approximately 15 feet bgs) at this site, and impacted groundwater does not appear to be migrating. There is no current or anticipated future use of groundwater at the Site or in the vicinity of the Site. Table 7-1 provides a summary of how this alternative addresses the RAOs.

Conformance with SCGs

This alternative does not conform to the applicable SCGs for subsurface soil below 15 feet. Sources of COC in soil which may contribute to exceedances of the NYSDEC Ambient Groundwater Water Quality Standards will be present at the identified areas of concern. However, it appears that the extents of any groundwater impacts are stable within the currently impacted parcels. Table 7-1 provides a summary of how this alternative addresses the RAOs.

Long-Term Effectiveness and Permanence

Alternative 2 includes removal soils down to 15 feet below the surface, resulting in a permanent and effective remediation of all of the soils within this zone. This would remove all of the sub-surface MGP structures and their contents, as well as the majority of the grossly impacted soils. Soils below 15 feet would not be actively remediated, and would be addressed by long-term MNA and site controls, including a SMP to provide appropriate procedures for handling and managing impacted soil encountered during future invasive activities, and methods to address potential future soil vapor intrusion, should construction be undertaken at the Site. The COCs which remain in groundwater pose minimal risk to human health under current site use conditions and are not likely to increase in concentration over time. Remaining impacted soils which may act as a source of COC impacts to groundwater will remain; however, the extent of the impacts would not increase past their current extents, and some reduction of the footprint of groundwater impact may occur as the soil and groundwater re-establish equilibrium conditions.

Reduction of Mobility, Toxicity, or Volume Through Treatment

This remedial alternative will reduce the volume of COCs in surface and subsurface soil by removal and transport of impacted media from soils at the Site (down to 15 feet bgs) and destroying it through LTTD and/or transferring the COCs to be isolated in an off-Site disposal facility. Impacts in soils below this depth will remain in place. Partial removal of source material will reduce the loading of dissolved COCs to groundwater, and will reduce the footprint of the area where groundwater exceeds water quality standards. MNA is anticipated to further reduce the volume of COCs, albeit very slowly, in groundwater at the Site over time.

Short-Term Impacts and Effectiveness of Controls

Implementation of this alternative poses relatively low short-term risks in the excavation and exposure of impacted materials during removal, management, and transport. This alternative is effective in the short-term; however, groundwater monitoring may be required for a very long period of time because source material in the subsurface would remain on site.

- **Protection of Community.** During the implementation of this alternative, measures would be taken to monitor and reduce the potential for air emissions during the soil and subsurface structure removal actions. Truck traffic for this alternative is moderate, compared with the other alternatives.
- **Protection of Workers.** Workers involved in the remedial and OM&M activities would wear the appropriate personal protective equipment (PPE) and work should be completed under an appropriate health and safety plan and site controls. However, even with these controls, construction work poses risks to workers by its nature.
- **Environmental Impacts.** The potential for negative environmental impacts from this alternative would be low. Particulate and greenhouse gas emissions from truck traffic and excavation equipment are proportional to the quantity of soil excavated, transported off-Site, and treated by LTTD. Similarly, importing and placing backfill results in particulate and

greenhouse gas emissions. Landfill space and borrow source soils are also resources consumed by this alternative.

- **Time Until Response Objectives are Achieved.** The timeframe for this alternative following excavation of the top 15 feet would be an assumed 30-year monitoring period for groundwater. With tar impacts left below the water table, the impacts within subsurface soils and groundwater will remain above SCOs for the foreseeable future. It is unknown, however, what the relative contribution of COCs to groundwater is from NAPL in the vadose zone versus that in the saturated zone. The low-permeability silt/clay layer found across much of the Site isolates the shallow impacts from direct impact to the underlying sand and gravel soils. NAPL at and below the water table is expected to have undergone leaching of some COCs due to the constant movement of water through the highly permeable soils. For the purposes of this FS cost estimate, it is assumed that a 30-year monitoring period for MNA, and an assumed 30-year OM&M period would be applicable.
- **Green Remediation Considerations**. This alternative would require use of fossil fuels and disposal facilities for the excavation, transportation, LTTD and/or disposal, and cover placement actions. Other resource utilization would include the clean soils brought onto the Site for cover. Table 7-2 provides a summary of the relevant metrics for Alternative 2, as well as the other alternatives and provides a picture of the energy/emissions/transportation impacts, since the volumes managed are generally proportional to the environmental footprint.

Implementability

- **Technical Feasibility.** This action is readily implementable from a technical standpoint. The technologies are available from several specialized construction companies.
- **Administrative Feasibility.** This alternative should be administratively feasible. The property owners have historically been supportive of site activities.
- **Availability of Services and Materials.** The services and materials required for this alternative are readily available.

Cost Effectiveness

This alternative has a moderate cost effectiveness because some of the remedial objectives are addressed over a long-time period.

The projected costs for this alternative are as follows:

Capital and Engineering Cost	$3.35 million
OM&M Cost	$0.25 million
Contingency	$0.72 million (20% for undefined costs and conditions)
Rounded Total	$4.33 million

Details of the cost estimate are provided in Appendix B.

Land Use

The current land uses for the Site as for a hotel, parking lot, and a natural gas regulator station would be allowed to continue under this alternative. Future development of the property for Commercial Use would also be allowed under this alternative. There are no future development plans for the gas regulator parcel, which will remain in use as such under the control of National Fuel Gas. There would be restrictions/environmental easements on the parcels to prevent contact with deep subsurface impacts.

7.2.3 Alternative 3: Surface and Subsurface Soil Removal up to 15 feet, ISCO below 15 feet, Isolation and Implementation of IC/ECs, and an MNA Program

Description

This alternative consists of the re-routing of subsurface and overhead utilities, establishment and maintenance of a soil cover for the gas regulator parcel, and excavation of impacts in soils to a depth of 15 feet similar to Alternative 2. This alternative also implements the use of ISCO for grossly impacted soils below 15 feet bgs. This alternative establishes the IC/ECs implemented by a SMP, including site and groundwater use restrictions and an environmental easement to prevent human contact with media containing residual COCs above relevant SCOs. An MNA program would be implemented to document and report the progress of COC attenuation in groundwater. This alternative provides for protection of human health and the environment while having lower short-term impacts and remedial action cost by addressing contamination down to the depths where human activity could encounter impacts. The remedy would allow the current commercial land use as a natural gas regulator station and vacant field adjacent to the hotel and a parking lot, provided a SMP is in place to address control of any future excavation within the impacted areas. This remedial alternative is depicted in Figures 9a and 9b.

Deed restrictions and an environmental easement would be established between National Fuel Gas and Maple City Lodging Partnership as the Commercial Use property owners of the Site. Likewise, the residential properties containing deep MGP-related impacts would also have established deed restrictions and environmental easements, in accordance with DER-33. An SMP would be established such that any future excavation in the impacted areas would be conducted under a National Fuel Gas-approved work plan. There are currently no wells for groundwater use on the Site, and future installation of wells and groundwater use on the properties would be restricted by the environmental easement established under this alternative.

The soil cover would be inspected annually and a Periodic Review Report would be prepared in accordance with Part 375-1.8(h)(3). Groundwater monitoring would be performed for 5 years and the results re-evaluated with the NYSDEC. For the estimate of costs for this FS, it is assumed that the monitoring would be performed for 30 years.

Overall Protection of Human Health and the Environment

Alternative 3 will be effective in meeting RAOs and will be protective of human health and the environment. The potential for contact with COCs in surface soils will be mitigated by the removal of surface soils where subsurface soils will also be excavated or treated with ISCO, as well as the construction of a soil cover and by the IC/ECs. The presence of deep impacts in the soil matrix (below 15 feet bgs) poses little threat, but would be a continued concern for any deep utility or other subsurface work that may be needed at the Site, as well as for any future construction. Groundwater is deep (15 feet) at this site, and impacted groundwater does not appear to be migrating very far outside of the ISCO area. Any potential on-going groundwater impacts would be addressed by MNA or additional ISCO treatment, if necessary. There is no current or anticipated future use of groundwater at the Site or in the vicinity of the Site. Table 7-1 provides a summary of how this alternative addresses the RAOs.

Conformance with SCGs

This alternative conforms to the applicable soil SCGs through the implementation of excavation and ISCO. The SCGs for groundwater would also be addressed through the ISCO injections, and it appears that the extents of any groundwater impacts are stable within the currently impacted parcels. Any potential sources of COC in groundwater would be anticipated to be reduced by MNA over time to below the NYSDEC Ambient Groundwater Water Quality Standards. Table 7-1 provides a summary of how this alternative addresses the RAOs.

Long-Term Effectiveness and Permanence

Alternative 3 would be effective because the coal-tar and COC-impacted soil would be removed down to 15 feet below the surface with ISCO treatment being implemented at depths below 15 feet. Some level of concern would remain for permanence of this alternative due to the strength of sorption between coal tar and COC impacts and soil particles; however, the concern would be low since the potential for the leaching of COC to groundwater would be greatly reduced. The COC that would remain in the subsurface would be addressed by additional ISCO injections and institutional controls. Site controls include a SMP to provide appropriate procedures for handling and managing impacted soil encountered during future invasive activities, and methods to address potential future soil vapor intrusion, should construction be undertaken at the Site. Potential remaining COCs in groundwater pose minimal risk to human health under current site use conditions and would be expected to decrease in concentration over time with the management of source material removed and MNA. Significant off-Site migration of COCs is not presently occurring and would not be anticipated in the future.

Reduction of Mobility, Toxicity, or Volume Through Treatment

This remedial alternative will reduce the volume of COC in surface and subsurface soil by removal and transport of impacted media from soils at the Site (down to 15 feet bgs) and destroying it through LTTD and/or transferring the COC to be isolated in an off-Site disposal facility. Impacts in soils and groundwater below this depth will be reduced through ISCO treatment. Natural attenuation

is anticipated to further reduce the volume of COC, albeit very slowly, in groundwater at the Site over time. Post-remedial reduction through MNA of groundwater would be monitored.

Short-Term Impacts and Effectiveness of Controls

Implementation of this alternative poses relatively low short-term risks in the excavation and exposure of impacted materials during removal, management, and transport. This alternative is effective in the short-term; however, groundwater monitoring may be required to monitor for potential impacts that may require additional ISCO treatment on site.

- **Protection of Community.** During the implementation of this alternative, measures would be taken to monitor and reduce the potential for air emissions during the soil and subsurface structure removal actions. Truck traffic for this alternative is moderate, compared with the other alternatives.
- **Protection of Workers.** The use of chemical oxidants increases the risks to workers over the hazards associated with basic remedial excavation tasks. Workers involved in the remedial and OM&M activities would wear the appropriate personal protective equipment (PPE) and work should be completed under an appropriate health and safety plan and site controls. However, even with these controls, construction work poses risks to workers by its nature.
- **Environmental Impacts.** The potential for negative environmental impacts from this alternative would be low. Particulate and greenhouse gas emissions from truck traffic and excavation equipment are proportional to the quantity of soil excavated, transported off-Site, and treated by LTTD. Importing and placing backfill results in particulate and greenhouse gas emissions, and ISCO involves the addition of chemicals into the subsurface. Landfill space, borrow source soils, and chemical additives are also resources consumed by this alternative.
- **Time Until Response Objectives are Achieved.** The timeframe for this alternative following ISCO would be an assumed 5-year monitoring period for groundwater with the results reviewed with the NYSDEC. For the purposes of this FS cost estimate, it is assumed that a 30-year monitoring period for MNA, and an assumed 30-year OM&M period would be applicable.
- **Green Remediation Considerations**: This alternative would require use of fossil fuels and disposal facilities for the excavation, transportation, LTTD and/or disposal, and cover placement actions. Other resource utilization would include the clean soils brought onto the Site for cover. Table 7-2 provides a summary of the relevant metrics for Alternative 3, as well as the other alternatives and provides a picture of the energy/emissions/transportation impacts, since the volumes managed are generally proportional to the environmental footprint.

Implementability

- **Technical Feasibility.** This action is readily implementable from a technical standpoint. The technologies are available from several specialized construction companies, and the existing overhead and subsurface utilities can be re-routed at the Site. ISCO is a newer technology, but requires the subsurface to be in the saturated zone for optimal treatment. MNA has been demonstrated as a technically feasible approach at similar MGP sites, and off-Site migration of groundwater is currently minimal. Institutional controls such as site management plans are commonly adopted and are considered readily implementable.
- **Administrative Feasibility**. This alternative should be administratively feasible.
- **Availability of Services and Materials.** The services and materials required for this alternative are available. The ISCO treatment is available from a limited number of vendors, therefore contractor scheduling will be an important logistical consideration.

Cost Effectiveness

This alternative has a moderate cost effectiveness because some of the remedial objectives are addressed over a long time period.

The projected costs for this alternative are as follows:

Capital and Engineering Cost	$4.54 million
OM&M Cost	$0.17 million
Contingency	$0.94 million (20% for undefined costs and conditions)
Rounded Total	$5.65 million

Details of the cost estimate are provided in Appendix B.

Land Use

The current and planned future land uses for the Site as a potential commercial building, hotel, parking lot and a natural gas regulator station would be allowed to continue under this alternative. The future land use would be restricted to Commercial Use in accordance with the institutional controls and site zoning.

7.2.4 Alternative 4: Excavation to Accommodate ISS and Jet Grouting to Bottom of Impacts, Isolation and Implementation of IC/ECs, and an MNA Program

Description

This alternative consists of the re-routing of subsurface and overhead utilities, establishment and maintenance of a clean soil cover for the gas regulator parcel, and ISS for that exceed Commercial Use SCOs above 15 feet bgs, and that contain source material below 15 feet bgs. Excavation of soil to an average of 10 feet bgs would be performed to remove foundations within the area to be

remediated, to allow for the volume expansion that occurs in ISS, and to keep the top of the ISS zone below the frost line. ISS for soil with source material and observed impacts (sheen and staining) will be implemented below 15 feet. Jet grouting will be used where obstructions prevent the use of ISS mixing equipment. Upon completion of ISS, the Site will be backfilled in the areas above the ISS mass, the soil cover installed, and IC/ECs established. A small batch plant would be set-up on the property for the ISS. This alternative establishes the IC/ECs implemented by a SMP, including site and groundwater use restrictions and an environmental easement to prevent human contact with media containing COCs above relevant SCOs. An MNA program would be implemented to document and report the progress of COC attenuation in groundwater. This alternative provides for protection of human health and the environment while having lower short-term impacts and remedial action cost by addressing contamination down to the depths where human activity could encounter impacts. The remedy would allow the current commercial land use as a natural gas regulator station and vacant field adjacent to the hotel and a parking lot, provided a SMP is in place to address control of any future excavation within the impacted areas. This remedial alternative is depicted in Figures 10a and 10b.

Groundwater monitoring wells would be recommended for sampling outside of the solidified soils following ISS; the number and location of groundwater monitoring wells would be established during the development of the SMP. Groundwater monitoring over the course of several years on the Site (5 year initial period) would indicate any trends in concentrations of COC and track the progress of MNA. The details of the monitoring program, including the number and location of the wells and frequency of sampling, will be described in a Monitoring Plan in a NYSDEC-approved SMP prepared during the Remedial Design. For the purposes of the cost estimate in this FS, it was assumed that groundwater sampling would occur twice per year for a period of 30 years.

The soil cover addresses PAH exceedances in surface soil in an area adjacent to the existing gas regulator station. These areas are shown on Figure10a. The actual areas to be covered would be determined during the design of the remedy, which may include additional sampling for delineation of these areas.

Estimated excavation of debris and soil, and soil addressed by ISS volumes, are summarized as follows:

Alternative 4				
Excavation Area[1]	***Total Excavated (CY)***	***Total Transported to Facility (CY)***	***Facility Option (CY)***	
			Landfill	***LTTD***
Surface Soil (two areas)	1,020	510	510	0
Subsurface Soil and Debris	5,310	5,310	3,980	1,330
ISS	***ISS Soil (CY)***	***Total Transported to Facility (CY)***	***Facility Option (CY)***	
			Landfill	***LTTD***
ISS	9,360	0	NA	NA
TOTAL	**15,690**	**5,820**	**4,490**	**1,330**

CY – Cubic Yards

(1) Excavation necessary to clear debris from ISS area.
(2) Volumes are "in-place" and do not include bulking, once excavated and handled.

Overall Protection of Human Health and the Environment

Alternative 4 will be effective at meeting RAOs and will be protective of human health and the environment. The potential for direct contact with COCs in surface soils would be mitigated by the establishment and maintenance of a soil cover in the areas outside of area subjected to ISS. The ISS and IC/ECs would prevent potential direct contact with COCs in subsurface soil. However, some level of concern would remain for the continued presence of coal tar in the ISS solidified mass. Potential on-going groundwater impacts would be addressed by the solidification of the COCs in the ISS mass. Impacts to groundwater (already at near non-detect levels) would be addressed by MNA.

Conformance with SCGs

This alternative conforms to the applicable soil SCGs through the implementation of ISS. The SCGs for groundwater would be addressed through the ISS of the source material. Groundwater concentrations of COC outside of the ISS mass would be anticipated to be reduced by MNA over time to concentrations below the groundwater standards or guidance values. Table 7-1 provides a summary of how this alternative addresses the RAOs.

Long-Term Effectiveness and Permanence

This alternative would be effective because the coal tar-impacted soil and COC would be solidified by the ISS. Some level of concern would remain for permanence for this alternative due to the continued presence of coal tar and COCs in the ISS solidified mass; however, the concern would be low since the potential for the leaching of COCs in the ISS mass to groundwater would be greatly

reduced. The COCs that would remain in the subsurface in the ISS mass would be addressed by institutional controls. These institutional controls can be maintained indefinitely. The COCs, which would be present in groundwater after remediation poses minimal risk to human health. These impacts would be anticipated to decrease in concentration over time by MNA due to the removal and solidification of source material. Significant off-Site migration of COCs is not presently occurring and would not be anticipated in the future.

Reduction of Mobility, Toxicity, or Volume Through Treatment

Direct reduction of mobility, and toxicity of the coal tar and COCs would occur by the physical stabilization of the soil by ISS. The volume of COCs would be reduced partially by excavation for the ISS expansion; however, the COCs would also remain in the ISS solidified mass. Natural attenuation is anticipated to further reduce concentrations of COCs in groundwater to non-detect levels. Post-remedial reduction through natural attenuation of groundwater would be monitored.

Short-Term Impacts and Effectiveness of Controls

Implementation of this alternative poses minimal short-term risks from the loading and grading of the additional soil cover, the removal of the original gas plant building and the foundation for Gas Holder A, and associated debris and soil, and the implementation of the ISS.

- **Protection of Community.** During the implementation of this alternative, measures would be taken to monitor and reduce the potential for air emissions during the soil, subsurface structure removal, and ISS actions. Truck traffic for this alternative is moderate, compared with the other alternatives.
- **Protection of Workers.** Workers involved in the remedial and OM&M activities would wear the appropriate personal protective equipment (PPE) and work should be completed under an appropriate health and safety plan and site controls. However, even with these controls, construction work poses risks to workers by its nature.
- **Environmental Impacts.** The potential for negative environmental impacts from this alternative would be low. Particulate and greenhouse gas emissions from truck traffic and excavation equipment are proportional to the quantity of soil excavated, transported off-Site, and treated by LTTD. Importing and placing backfill results in particulate and greenhouse gas emissions. Landfill space and borrow source soils are also resources consumed by this alternative, but due to ISS monolith swelling, the volume of borrow source soils imported to the Site will be reduced.
- **Time Until Response Objectives are Achieved.** The timeframe for this alternative following ISS would be an assumed 5-year monitoring period for groundwater with the results reviewed with the NYSDEC. For the purposes of this FS cost estimate, it is assumed that a 30-year monitoring period for MNA, and an assumed 30-year OM&M period would be applicable.

- **Green Remediation Considerations**: This alternative would require use of fossil fuels and disposal facilities for the excavation, transportation, LTTD and/or disposal, ISS implementation, and cover placement actions. Other resource utilization would include the clean soils brought onto the Site for cover and the solidification additives for the ISS. Table 7-2 provides a summary of the relevant metrics for Alternative 4, as well as the other alternatives and provides a picture of the energy/emissions/transportation impacts, since the volumes managed are generally proportional to the environmental footprint.

Implementability

- **Technical Feasibility.** It is technically feasible to re-route the existing overhead and subsurface utilities to the Site. ISS is a newer technology but has been proven to be implementable and is gaining wider acceptance for application at MGP sites by the NYSDEC. Subsurface foundations will impede this remedy. Foundations above soils to be remediated would need to be removed by excavation prior to initiation of ISS. MNA has been demonstrated as a technically feasible approach at similar MGP sites, and groundwater is currently only minimally impacted. ISS would allow work to be conducted more safely and efficiently adjacent to the residential properties. Institutional controls following ISS such as an environmental easement are commonly adopted and are considered readily implementable.
- **Administrative Feasibility.** This alternative should be administratively feasible. The property owners have historically been supportive of site activities.
- **Availability of Services and Materials.** The services and materials required for this alternative are available. Specialized ISS equipment may not be readily available, thus scheduling its time at the Site will be an important logistical consideration.

Cost Effectiveness

This alternative has a moderate cost effectiveness because some of the remedial objectives are addressed over a long time period. The projected costs for this alternative are as follows:

Capital and Engineering Cost	$3.34 million
OM&M Cost	$0.17 million
Contingency	$0.70 million (20% for undefined costs and conditions)
Rounded Total	$4.21 million

Land Use

The current and planned future land uses for the Site as a potential commercial building, hotel, parking lot and a natural gas regulator station would be allowed to continue under this alternative. The future land use would be restricted in accordance with the institutional controls.

7.2.5 Alternative 5: Surface and Subsurface Soil Removal up to 15 feet, Removal of Grossly Impacted Soil below 15 feet, Isolation and Implementation of IC/ECs, and an MNA Program

Description

This alternative is similar to Alternative 3, except for the method used to address the deep source material. This alternative consists of removing all soils that exceed the applicable SCOs for all on-Site and off-Site areas of impact above 15 feet, with removal of grossly impacted soils containing NAPL below 15 feet. This remedial alternative is depicted in Figures 11a and 11b. It requires the relocation of overhead and underground utilities, the removal of the original MGP Building foundation and the foundation of Gas Holder A, the removal of soil exceeding 500 ppm for Total PAHs (0-15 feet), removal of soil with source material below 15 feet, the installation of a soil cover, MNA for overburden groundwater, and IC/ECs. Excavated soils would be transported to an off-Site facility for low LTTD and disposal or another acceptable method. Debris would be transported to a local land fill, or if impacted, potentially to a waste-to-energy facility for disposal. Soil meeting DER-10 Appendix 5 would be used to backfill the excavated areas.

Note that this alternative relies on MNA for the small, deep lens of impacted soil between 29 and 30 feet bgs that is found at SB24. It is impracticable to excavate 29 feet of clean overburden to remove a 1-foot thick layer of soils. The effects of the soil impacts will be monitored by the installation of deep monitoring wells within and downgradient of the impacted soils. Due to the highly permeable soils at SB24, it is likely that the concentrations of COC in groundwater have been attenuated over time by leaching and MNA.

Estimated excavation and disposal volumes are as follows:

Alternative 5				
Excavation Area	***Total Excavated (CY)***	***Total Transported to Facility (CY)***	***Facility Option (CY)***	
			Landfill	***LTTD***
Surface Soil	1,020	510	510	0
Subsurface 1-15 ft	16,830	16,830	12,620	4,210
Subsurface > 15 ft-	4,280	4,280	3,180	1,060
TOTAL	**22,130**	**21,620**	**16,310**	**5,270**

Overall Protection of Human Health and the Environment

This remedial alternative is protective of human health and the environment. The potential for contact with COCs in surface soils and subsurface soils would be mitigated by the removal of

impacted surface soils and of subsurface soils that contain grossly impacted material. Because groundwater is not in use at the Site and is well below the depth of typical utility line or building construction, any residual impacts to groundwater would have little potential for risk to human health. Groundwater does not discharge near the Site, therefore residual groundwater impacts would have no risk to the environment.

Conformance with SCGs

This alternative conforms to the applicable soil SCGs through the removal of the soil. Groundwater concentrations of COC following the removal of the source material would be further reduced by MNA over time to concentrations below the groundwater standards or guidance values. Table 7-1 provides a summary of how this alternative addresses the RAOs.

Long-Term Effectiveness and Permanence

This alternative would be effective and permanent because the source material would be removed and disposed of off Site, and additional impacts to groundwater would be anticipated to be minimal. The COCs which would remain in soil would have minimal effects on groundwater and pose minimal risk to human health. Concentrations of COCs in groundwater would be anticipated to quickly decrease in concentration over time. The potential for off-Site migration of COCs would be very low as significant migration is not presently occurring.

Reduction of Mobility, Toxicity, or Volume Through Treatment

This remedial alternative will result in a reduction of the volume of COCs present at the Site by the removal of impacted soil and source material. The excavated soil would be treated and disposed of at off-Site facilities. This alternative would greatly reduce the potential for contact between groundwater and impacted soil.

Short-Term Impacts and Effectiveness of Controls

The primary short-term impacts of this alternative are associated with the relocation of the utilities, the grading and cover installation for surface soil, the excavation of the soil, and the backfilling and site restoration activities. There is potential for exposure to dust and odor by the construction workers and the community members during excavation activities; however, measures would be taken to manage these potential exposures.

- **Protection of Community.** Truck traffic from the operations would have a moderate to severe short-term impact. Truck traffic would include mobilization and demobilization of heavy construction equipment, trucking of impacted material from the Site, and trucking of backfill material onto the Site. During the implementation of this alternative, measures would be taken to monitor and reduce the potential for air emissions during the excavation and well installation actions. Excavation activities may be performed inside of a temporary fabric structure.

- **Protection of Workers.** Workers would be protected during implementation of this alternative as direct contact with impacted material will be minimized by use of heavy equipment to perform the excavation and loading activities. Workers involved in the remedial activities would wear the appropriate PPE. Workers involved in the remedial and OM&M activities would wear the appropriate PPE.
- **Environmental Impacts.** The potential for negative environmental impacts from this alternative would be low. Impacts during the soil and debris removal operations will be addressed by use of spill prevention and control measures.
- **Time Until Response Objectives are Achieved.** The objectives for this remedy would be met upon completion of the soil excavation, and the period for MNA to address the remaining COCs in groundwater. The trends would be reviewed after the first 5-year period and the sampling program would be re-evaluated at that time. The removal of all soils exceeding SCOs would eliminate all significant sources of impact to groundwater. Therefore it is anticipated that groundwater monitoring will continue for a period of 10 years for the purposes of cost estimating and comparison to other alternatives, and an assumed 10-year OM&M period.
- **Green Remediation Considerations**: This alternative would require use of fossil fuels and disposal facilities for the excavation and cover placement actions, and the installation of groundwater treatment and monitoring wells.

Implementability

- **Technical Feasibility.** It is technically feasible to re-route the existing overhead utilities to the Site. Soil excavation is technically feasible using conventional equipment and construction methods. However, significant technical challenges would be encountered with the excavation of deeper soil at SB24 in close proximity to the residences along Albion Street. MNA for groundwater has been demonstrated as a technically feasible approach at similar MGP sites.
- **Administrative Feasibility.** This alternative is administratively feasible provided that access agreements are obtained from the owner of the Site, the private residences to the south of the Site, and the City of Hornell.
- **Availability of Services and Materials.** The services and materials required for this alternative are readily available.

Cost Effectiveness

This alternative has a moderate cost effectiveness because some of the remedial objectives are addressed over a long time period. The projected costs for this alternative are as follows:

Capital and Engineering Cost	$5.77 million
OM&M Cost	$0.10 million

Contingency	$1.17 million (20% for undefined costs and conditions)
Rounded Total	$7.05 million

Land Use

The current and planned future land uses for the Site as a potential commercial building, hotel, parking lot and a natural gas regulator station would be allowed to continue under this alternative. The future land use would be restricted in accordance with the institutional controls.

7.2.6 Alternative 6: Excavation of Soils Exceeding Unrestricted Use SCOs

Description

This alternative consists of the removal of all soils on the Site and adjoining parcels that exceed the SCOs for Unrestricted use. This alternative requires the removal of the MGP foundations, the natural gas regulator station, a portion of the Franklin Street, followed by the removal of soil to Unrestricted Use SCOs. This alternative provides for protection of human health and the environment, but because of the regulator station removal and reconstruction, and the widespread removal of buried concrete foundation structures and soil excavation, it has extremely high short-term impacts and remedial action costs.

This remedial alternative is depicted in Figure 12. The highlighted remedial actions consist of removal and replacement of approximately 23,530 CY of soil. This alternative includes removal and reconstruction of new gas regulator equipment, and portions of the sidewalk and roadway along Franklin Street.

Analytical results from a soil sample collected from 2 to 4 feet in MW3 encountered concentrations of benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene above NYSDEC Commercial Soil Cleanup Objectives (SCOs). These impacts are likely to be associated with urban fill along Canisteo Street; however, the fill soils at this location are included as part of the soil excavation on the Site under this alternative.

Because of the completeness of the removal, MNA for groundwater would not be applicable to this alternative. Groundwater monitoring would be performed for a short period of time however to verify the effectiveness of the remedy.

After excavation is completed, confirmatory groundwater monitoring would be recommended for a period of up to 5 years, with the results reviewed with the NYSDEC.

The estimated excavation and disposal volumes are as follows:

Alternative 6				
Excavation Area	***Total Excavated (CY)***	***Total Transported to Facility (CY)***	***Facility Option (CY)***	
			Landfill	***LTTD***
TOTAL	**21,630**	**21,630**	**16,220**	**5,410**

Overall Protection of Human Health and the Environment

Alternative 6 meets all RAOs. This remedial alternative is protective of human health and the environment. A high level of overall protection would be achieved by the complete removal action defined by this alternative. Over an anticipated short time, the RAOs for groundwater would be met by the MNA as all potential source materials for impact to groundwater would be removed.

Conformance with SCGs

SCGs for soils will be achieved by the removal of soils exceeding Part 375 Unrestricted levels. It is anticipated that this complete removal action would also result in achieving groundwater RAOs within a short time period. Table 7-1 provides a summary of how this alternative addresses the RAOs.

Long-Term Effectiveness and Permanence

This remedy relies primarily on removal actions which will be effective and permanent, and will eliminate direct exposure potential upon removal.

Reduction of Mobility, Toxicity, or Volume Through Treatment

This remedial alternative will result in rapid substantial reduction of mobility, toxicity, and volume of COCs through the removal action.

Short-Term Impacts and Effectiveness

The primary short-term impacts of this alternative are associated with the relocation of the utilities, the grading and cover installation for surface soil, the excavation of the soil, and the backfilling and site restoration activities. There is potential for exposure to dust and odor by the construction workers and the community members during excavation activities; however, measures would be taken to manage these potential exposures.

- **Protection of Community.** Truck traffic from the operations would have a moderate to severe short-term impact. Truck traffic would include mobilization and demobilization of heavy construction equipment, trucking of impacted material from the Site, and trucking of backfill material onto the Site. During the implementation of this alternative, measures would be taken to monitor and reduce the potential for air emissions during the excavation

and well installation actions. Excavation activities may be performed inside of a temporary fabric structure.

- **Protection of Workers.** Workers would be protected during implementation of this alternative as direct contact with impacted material will be minimized by use of heavy equipment to perform the excavation and loading activities. Workers involved in the remedial activities would wear the appropriate PPE. Workers involved in the remedial and OM&M activities would wear the appropriate PPE.
- **Environmental Impacts.** The potential for negative environmental impacts for this alternative would be high due to impacts from trucking and LTTD treatment of soil will include the generation of greenhouse gasses.
- **Time Until Response Objectives are Achieved.** The SCOs would be met upon completion of the removal, which is estimated to take about a year to complete, including the reconstruction of the natural gas regulator station and the re-routing gas, electric, stormwater lines in Franklin Street. Groundwater objectives would be met after a final attenuation period, estimated to have a duration of 1-5 years.
- **Green Remediation Considerations**: This alternative would have the highest required use of fossil fuels and disposal facilities for the excavation and cover placement actions. Other resource utilization would include the clean soils brought onto the Site for backfill and cover.

Implementability

- **Technical Feasibility.** Although costly, it is technically feasible to implement this alternative using conventional equipment. Soil removal by excavation is technically feasible using conventional excavation equipment. Excavation, transportation, and disposal of impacted soils are conventional remedial methods. The feasibility may be hindered by lack of an alternative for distribution of natural gas from the regulator station facility.
- **Administrative Feasibility.** This alternative is administratively feasible provided that access agreements are obtained from the owner of the Site, the private residences to the south of the Site, and the City of Hornell.
- **Availability of Services and Materials.** The services and materials required for this alternative are readily available. Multiple facilities may need to be identified for both treatment of excavated soil and provision of clean backfill material, acceptable to the NYSDEC, due to the significant quantities of material involved. Excavation uses conventional construction equipment that is readily available.

Cost Effectiveness

This remedy would not be cost effective, as the extremely high costs would not have a commensurately high value in additional environmental protection or increase in actual land use. All of the other alternatives would allow both current and potential future land uses (gas regulator station and commercial development).

The projected costs for this alternative are as follows:

Capital and Engineering Cost	$6.64 million
OM&M Cost	$0.10 million
Contingency	$1.35 million (20% for undefined costs and conditions)
Rounded Total	$8.08 million

Details of the cost estimate are provided in Appendix B.

Land Use

This alternative would remediate the Site to allow for unrestricted use. However, the only planned or reasonable use of the gas regulator parcel, owned by National Fuel Gas, is its continued use for gas regulation equipment. Although the zoning status of this parcel is unclear, the width of the lot is such that other structures could not be built that comply with set-back requirements. There are no current plans for the development of the former MGP site itself. This alternative would allow for any potential use of the Site, though the property is limited to commercial zoning use.

7.3 Comparison of Alternatives

A comparative analysis was conducted in which the alternatives were compared to one another with regard to each of the eight analysis criteria. A summary of the comparative analysis is presented in Table 7-2. The following discussion provides a comparison of the five substantive alternatives, without the No Action Alternative, which is not considered a viable alternative.

Overall Protection of Human Health and the Environment

All five of the substantive alternatives include common elements that would result in overall protection of human health and the environment. All five alternatives would be protective of human health and the environment by eliminating potential exposure pathways or maintaining barriers to potential exposure pathways, either by removal or IC/ECs. For all but Alternative 2, SCGs for groundwater would be anticipated to be met in an acceptable period of time.

With respect to this criterion, the alternatives are ranked as follows:

1. **Alternative 6** would be the most protective, because it would involve the complete removal of COCs to Unrestricted Use SCOs at all locations and at all depths.
2. **Alternative~~s~~ 4** would be the next most protective, as removal of impacted soil in the identified areas of concern combined with ISS and placement of the soil cover would provide a similar level of protection, and would address the groundwater impacts. It would also decrease potential for accidental exposure from uncontrolled future excavation activities.

3. **Alternative 3 and 5** would be the next most protective, as excavation of soil above 15 feet would provide a similar level of protection to Alternative 4. However, both of these alternatives would not directly address deeper impacts and would rely on MNA to address the groundwater impacts. It would also decrease potential for accidental exposure from uncontrolled future excavation activities by use of IC/ECs.
4. **Alternative 2** would be less protective because, while the IC/ECs would be in place (including the existing soil cover), it would only minimally address the subsurface soil and groundwater impacts, and would not meet the RAOs for these media.

Conformance with SCGs

Alternatives 5 and 6 would provide substantial conformance with the SCGs appropriate for the current and future land uses for each alternative, to the extent practicable, in accordance with the RAOs. Alternative 5 would provide additional conformance to SCGs. Additional comparisons of the alternatives with regard to the RAOs are provided in Table 7-1.

Long-Term Effectiveness and Permanence

All of the alternatives provide long-term effectiveness for prevention of risk to receptors. They differ principally in how effective they are in addressing groundwater impacts.

Alternatives 3 and 5 would provide substantial long-term effectiveness and permanence. Alternative 4 would provide a similar level of permanence with the solidification of the COCs by ISS. SCGs for groundwater would likely immediately be achieved for the limited area of groundwater impacts on site based on the current concentrations of COCs detected (near non-detect levels). With MNA the concentrations of COCs would be anticipated to further decrease to concentrations below the groundwater standards over a short period of time.

With respect to this criterion, the alternatives are ranked as follows:

1. **Alternative 6** would be the most effective and permanent, because it would involve the complete removal of impacted materials.
2. **Alternative 5** would rank as the next most effective and permanent option due to the extensive removal of soils exceeding applicable SCOs and the deep source material using excavation.
3. **Alternatives 3 and 4** would rank as the next most effective and permanent options. Both would leave COCs in the subsurface soil. Alternative 4 would leave the COCs solidified in the ISS mass. Alternative 3 would remove more mass of COCs from the Site, but a residual amount of PAHs would be present in the subsurface even following repeated ISCO treatment. The removal of impacted soils down to 15 feet bgs would effectively remove the threat of contact with receptors, but the ISCO process would likely leave residual groundwater impacts. The solidification of deep soils with source material would be more

effective at reducing groundwater impacts, but the COCs would remain at the Site in the solidified soil mass at up to 4 feet bgs.

4. **Alternative 2** would be ranked as the least effective and permanent. Removal of soil down to 15 feet bgs would prevent nearly all potential contact with human receptors, but the natural attenuation of groundwater impacts would be slowed by the presence of deep source material. The IC/ECs, soil cover, and MNA would not be as effective or permanent as the other alternatives.

Reduction of Toxicity, Mobility, or Volume

Based on the findings of the RI, it appears that the impacts at the Site are currently stable and mostly confined to the area of the former MGP. Toxicity, mobility, and the volume of impacts in the shallow site soils and of tar within the foundation of the original gas plant building would be addressed by excavation and removal under all of these remedial alternatives. How the alternatives address these factors outside of the shallow excavations are ranked as follows:

1. **Alternative 6** would result in complete removal of all contaminants, therefore it would have complete reduction of toxicity, mobility, and volume of contamination.
2. **Alternative 5** would result in the next greatest reduction by soil removal, followed by MNA.
3. **Alternative 3** would result in the next most reduction because all of the impacts exceeding the SCOs above 15 feet will be removed from the Site. The volume, toxicity, and mobility below 15 feet will be reduced by the ISCO process.
4. **Alternative 4** will use the combination of soil removal, solidification, and MNA. COCs would remain in the soil; however, the COCs would be solidified in the ISS mass, and would not likely pose a threat for ongoing groundwater impacts.
5. **Alternative 2** would effectively eliminate toxicity, mobility, and full volume of impacts above 15 feet bgs, leaving the soil acceptable for commercial use. However, all material below 15 feet and in the groundwater would be allowed to remain, resulting in an ongoing source of dissolved groundwater impact.

Short-Term Impacts and Effectiveness of Controls

With respect to this criterion, the alternatives are ranked as follows:

1. **Alternative 2** would have the least short-term impact as it requires the smallest volume of soil to be removed from the Site and no additional work below 15 feet. However, this alternative would be the least effective in controlling long-term groundwater impacts.
2. **Alternative 3** ranks next because ISCO injection would require only the advancement of borings into the restored site to remediate deep soils. Most of the short-term impacts will result from the removal of the upper 15 feet of soils and site restoration. The methods available to control these impacts would be reliable and effective.

3. **Alternatives 4 and 5** would have similar degrees of impact. The ISS mixing equipment will require more heavy construction equipment and support facilities. However, ISS requires the least amount of excavation and truck traffic. It is also requires the least shoring. Deep excavation of source areas would require more robust deep shoring equipment.
4. **Alternative 6** would involve the greatest excavation quantities and depths, resulting in the greatest negative short-term impacts, with a high-level of disruption due to the removal and replacement of the existing natural gas regulator station and roadway. This alternative would require the largest truck traffic volume.

Implementability

All of the remedial alternatives evaluated here can be implemented. There are no site, land-use, or equipment limitations that would prevent them from being conducted. That said, the degree of implementability for the alternatives are ranked as follows:

1. **Alternative 2** would be most implementable, because all work would be conducted at or above the water table, minimizing the need for water management. It can also be conducted with little uncertainty with regard to means and methods.
2. **Alternative 3** would rank as next most implementable, because ISCO poses a lower level of difficulty for implementation below the water table and in the deep residential area.
3. **Alternative 4** would be less implementable, because of the use of deep mixing equipment combined with deep soil excavation, though it does require the least shoring.
4. **Alternative 5** would rank fourth due to the need for deep soil retaining methods to allow for excavation of source materials from 15 to 30 feet bgs.
5. **Alternative 6** could be implemented, but would have the greatest disruption to the Site. The gas regulator equipment would need to be decommissioned and replaced to allow for full removal of soils containing man-made impacts. The foundations for the second generation gas production building and Gas Holder B would also need to be removed.

Cost Effectiveness

The alternatives are ranked as follows with respect to cost effectiveness:

1. **Alternative 4** is the most cost-effective option as it provides for the current and future land use, addresses potential exposure issues for surface soil, addresses source areas at all depths, and reduces future groundwater impacts. This Alternative has the lowest cost at approximately $4.21 million.
2. **Alternative 2** is the next most cost-effective option as it provides for the current and future land use, addresses potential exposure issues for surface soil, and addresses all soils above 15 feet bgs. Although it does allow long-term groundwater impacts to remain at the Site, there are no current or foreseeable uses for on-Site groundwater or impacts that would be

associated with impacted groundwater. This alternative has an estimated cost of approximately $4.33 million, exceeding Alternative 4 by $120,000.

3. **Alternative 3** is the next most cost-effective option. Like Alternative 4, it provides for current and future land use, addresses potential exposure issues for surface soil, addresses source areas at all depths, and reduces future groundwater impacts. The estimated cost for this alternative is $5.65 million. It should be noted, however, that ISCO at MGP sites can require additional rounds of treatment. We have assumed that two rounds of treatment are necessary. Additional treatment would result in incremental cost increases.
4. **Alternative 5** is the next most cost-effective option. Although it has a relatively moderate total cost of approximately $7.05 million, it does not address the source material at the Site which will result in a very long groundwater monitoring period and implementation of IC/ECs.
5. **Alternative 6** is the least cost effective as its extremely high costs of $8.08 million would not have a commensurately high value in additional environmental protection or increase in actual land use additional to the current and future planned land use.

Land Use

The alternatives are ranked as follows with respect to land use:

1. **Alternative 6** would allow for unrestricted land use, though it would have the most disruption to the gas regulator equipment and might require full removal and replacement of the lines and equipment in order to reach all of the impacted soils. It would also disrupt areas on and adjacent to the Site due to the deep excavation that would be required to remove all material above Unrestricted Use SCOs, and to remove material exceeding SCOs not related to the MGP in historic urban fill.
2. **Alternatives 3 and 5** would all allow for similar land use. Both would remediate the upper 15 feet by excavation to the same depth to meet Commercial land use SCOs. An SMP and environmental easement would be required for management of impacted soils below 15 feet, whether they have been treated by ISCO or are untreated, and to prevent groundwater use. Since these alternatives treat or remove source of groundwater impacts below 15 feet, it is likely that groundwater quality will meet standard and guidance values once equilibrium conditions are re-established through MNA.
3. **Alternative 4** would be similar to Alternatives 3 and 5 and allow full Commercial Use of the Site. However, the presence of the ISS mass below 4 feet could increase the cost for site redevelopment for soil handling or disposal. An SMP and EE would be required, as well as a restriction on groundwater use.
4. **Alternative 2** would be supportive of any future commercial land uses, but with additional concern regarding soils or groundwater below 15 feet due to the COCs remaining at the Site below that depth. An environmental easement and groundwater restriction would be required indefinitely.

8. Recommended Remedy

Upon consideration of the results of the RI, and on the evaluated alternatives and their respective attributes and limitations, the elements detailed in Alternative 4 emerged as the recommended remedy for the Site. Alternative 4 is comprised of the following elements:

MGP Site

- Pre-Design Investigation to assess the horizontal limits of impacted soil for excavation, and to confirm the depth of impact in deep borings SB12, 18, and 19.
- Relocation of underground and above-ground utilities along Franklin Street to allow for excavation and to facilitate site remediation. This will include the natural gas lines under adjacent sidewalk, the overhead electric lines, and possibly water and sewer lines.
- Remove and re-grade surface soils to accommodate a 1-foot thickness of clean soil cover. The soil will meet the SCOs specified in 6 NYCRR Part 375-6.7(d) and DER-10 Appendix 5 for Commercial Use. A demarcation material will be placed over soils not meeting Unrestricted SCOs.
- Excavation and removal of the foundation for the original former MGP Building, and the foundation for Gas Holder A, along with all of the contents of the foundations.
- Removal and off-Site disposal of any underground process piping associated with the former MGP as it is encountered.
- Removal and off-Site disposal of any other foundations or debris that would inhibit the mixing of soils for ISS.
- Pre-excavation of soil for off-Site treatment or disposal to create sufficient space at the Site such that soils that undergo ISS are below the frost line.
- ISS of fill and soil exceeding 500 ppm for Total PAHs to 15 feet bgs.
- ISS of grossly impacted soil with source material below 15 feet.
- Jet or pressure grouting may be utilized to address impacted soil beneath or around major obstructions.
- Backfill of the ISS area above the solidified mass with clean soil which meets the SCOs specified in 6 NYCRR Part 375-6.7(d) and DER-10 Appendix 5.
- Site re-grading to accommodate a 1-foot thickness of clean imported cover soil meeting the SCOs specified in 6 NYCRR Part 375-6.7(d) for Commercial Use.
- Groundwater monitoring (applied site-wide).

- IC/ECs implemented site-wide by a SMP (including site and groundwater use restrictions and an environmental easement)

Gas Regulator Parcel

- Removal of the upper 1-foot of soil across the parcel, replaced by clean soil which meets the SCOs specified in 6 NYCRR Part 375-6.7(d) and DER-10 Appendix 5.
- Implementation of a SMP address any residual impacts in soil that exceed Unrestricted SCOs.

Franklin Street

- Removal of the sidewalk and a portion of the pavement along the south side of the street to allow for excavation of soils.
- Relocation of underground utilities, as necessary to allow for removal of MGP-impacted soils exceeding 500 Total PAH.
- Backfill and reconstruction of the roadway and sidewalk.

Residential Parcels

- Implementation of a SMP for parcels where deep impacts are present significantly below the water table, and an EE to prohibit groundwater use.

The remedy for the Site will include the implementation of an institutional control in the form of an environmental easement for the Site which will require: the submittal of a periodic certification of institutional and engineering controls to the NYSDEC in accordance with Part 375-1.8 (h)(3); will allow the use and development of the Site for Commercial Use as defined by Part 375-1.8(h)(3); and will restrict the use of groundwater as a source of potable or process water.

A NYSDEC-approved Site Management Plan will be developed which will include an Institutional and Engineering Control Plan that will identify all use restrictions and engineering controls for the Site, and will detail the steps and media-specific requirements necessary to ensure the engineering controls remain in place and are effective. The SMP will include an Excavation Plan which will detail the provisions for management of any potential future excavations at the Site, a provision for the evaluation of the potential for soil vapor for any buildings developed on the Site, and provisions for the management and inspection of the identified engineering controls. The plan will also have provisions for maintaining site access controls and procedures for NYSDEC notification.

A Monitoring Plan, also included in the SMP, will be developed to assess the performance and effectiveness for the MNA. The plan will include a schedule of monitoring and frequency of

submittals to the NYSDEC. The duration of the groundwater monitoring program is anticipated to be for 5 years. Following this period, the results of the monitoring and any trends identified will be reviewed with the NYSDEC, and revisions to the program will be made as needed.

The estimated cost for implementation of Alternative 4 is $4.21 million.

The recommended remedy represents a balanced and appropriate approach to address the MGP-related COCs present on the Site, given the current and future planned uses of the property. The remedy must be designed and implemented in coordination with the operations of the National Fuel Gas natural gas regulator station and activities in the neighborhood and at the hotel so that scheduling of the on-Site activities, traffic flows, parking areas, equipment staging, and other aspects of the work may be coordinated with the maximum efficiency and least short-term impacts. It is recommended that the work be performed during winter in order to minimize the effects of construction activities to the neighborhood. Green remediation principles and techniques will be implemented to the extent feasible in the Remedial Design, site remediation, and site management of the remedy in accordance with the specifications provided in DER-31.

The next step is a NYSDEC issuance of a Proposed Remedial Action Plan (PRAP) for public comment followed by a Record of Decision (ROD). A design for the remedy including detailed drawings and specifications for remedial construction will follow the issuance of the PRAP and ROD. A Pre-Design Investigation will be implemented to define the basis for design.

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Tables

Table 4-1
Chemical-Specific Standards, Criteria, and Guidance
Hornell Former MGP Site

Media	Requirements	Citation	Description	SCG or TBC	Comment
Soil	NYSDEC Remedial Program SCOs	6 NYCRR Part 375 Subpart 375-6	Establishes SCOs based on residential, commercial, and industrial land use; protection of ecological resources; and protection of groundwater quality.	SCG	Specified screening-level goals may be applicable in determining site-specific soil objectives.
	NYSDEC Soil Cleanup Objectives (SCOs) for Inactive Hazardous Waste Sites	NYSDEC DER-10, May 2010	Establishes recommended soil cleanup objectives (SCOs), SCOs for protection of groundwater quality, and groundwater standards/criteria.	SCG	Specified screening-level goals may be applicable in determining site-specific soil objectives.
	NYSDEC Guidance for implementing SCOs	NYSDEC Policy Memorandum on Soil Cleanup Guidance CP-51, October 2010	Provides guidance on use of SCOs.	TBC	Guidance may be applicable to site-specific soil cleanup alternatives. Provides modification to SCOs for MGP sites.
Groundwater	NYSDEC Groundwater Objectives	6 NYCRR Part 700-706 NYSDEC, Division of Water, TOGS (1.1.1) - 6 NYCRR 703.5	Establishes guidance or standard values for groundwater quality objectives.	SCG	May be applicable in determining site-specific groundwater objectives.
Surface water	NYSDEC Surface Water Objectives	6 NYCRR Part 700-706 NYSDEC, Division of Water, TOGS (1.1.1) - 6 NYCRR 703.5	Establishes guidance or standard values for surface water quality objectives.	SCG	Not applicable to this site. There are no surface water features at the site.
Sediment	NYSDEC Sediment Quality Criteria Development Process	Technical Guidance for Screening Contaminated Sediments (NYSDEC, 1999). Evaluating Ecological Risk to Invertebrate Receptors From PAHs in Sediments at Hazardous Waste Sites (USEPA, 2009)	Describes process for developing sediment quality criteria in the State of New York.	TBC	Not applicable to this site. There are no sediments at the site.
	Bioavailability Methods	ASTM D-7363-07 Standard Test Method for Solid-Phase Micro Extraction and PAH Analysis	Describes an updated process for developing sediment quality criteria.	TBC	Not applicable to this site. There are no sediments at the site.
Soil Vapor	Indoor Air Quality Objectives	NYSDOH Soil Vapor Intrusion Guidance October 2006	Establishes methods and guidance regarding data acquisition, interpretation, and mitigation.	TBC	Buildings adjacent to the site were evaluated for soil vapor concentrations during the RI. Sample results do not indicate a concern with regard to vapor intrusion. [GEI 2014]

Notes:

SCG = Standards, Criteria, and Guidance
TBC = Other Criteria To Be Considered

Table 4-2
Action-Specific Standards, Criteria, and Guidance
Hornell Former MGP Site

Action	Requirements	Citation	Description	SCG or TBC	Comment
Water Treatment Discharge	NYSDEC Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations	Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1	Compilation of ambient water quality standards and guidance values for toxic and non-conventional pollutants for use in NYSDEC programs (i.e., SPDES).	TBC	These standards and guidance values are applicable in establishing discharge limitations to surface waters.
	NYSDEC Industrial SPDES Permit Drafting Strategy for Surface Waters	TOGS 1.2.1	Guidance for developing effluent and monitoring limits for point source releases to surface water.	TBC	These standards and guidance values are applicable in establishing discharge limitations to surface waters.
	Clean Water Act	Section 401	Water Quality Certification.	SCG	Potentially applicable.
	SPDES	6 NYCRR Parts 750-01, 750-02	Requirements for obtaining a SPDES permit and requirements for operating in accordance with a SPDES permit.	SCG	Potentially applicable to constructing and operating a water treatment system for discharge to surface water.
	Wastewater Treatment Plant	TOGS 1.3.8	Limits on new or changed discharges to Publicly Owned Treatment Works (POTWs), strict requirements regarding bioaccumulative and persistent substances, plus other considerations.	TBC	Potentially applicable to constructing and operating a temporary water treatment system for discharge to POTWs.
Construction Stormwater	SPDES Permit Requirements	NYSDEC SPDES General Permit for Stormwater Discharge	Requirements to protect stormwater from construction impacts including preparation of a Stormwater Pollution Prevention Plan (SWPPP).	SCG	Potentially applicable. A permit itself is not needed, only that the substantive requirements are fulfilled.
In-Situ Treatment of Soils and Groundwater	Underground Injection Control Program	40 CFR Part 144	Includes requirements for injection of chemicals.	SCG	Potentially applicable for In Situ Chemical Oxidation.
	NYSDEC Ambient Water Quality Standards and Guidance Values	Division of Water Technical and Operational Guidance Series (TOGS) 2.1.2	Applicability of SPDES permits and groundwater effluent standards to the use of underground injection/recirculation as a remediation measure.	SCG	Potentially applicable.
Indoor Air	NYSDOH Background Air Levels	Guidance for Evaluating Soil Vapor Intrusion in the State of New York	Includes a database of background indoor air concentrations and description of decision-making process for remediation of indoor air impacts.	TBC	Not applicable. No buildings are present at the site.
Waste Management	Solid Waste Management Facility	6 NYCRR 360	Includes solid waste management facility requirements.	SCG	Applicable if soil or NAPL are removed.
	Waste Transporter Permits	6 NYCRR 364	Regulates collection, transport, and delivery of regulated waste. Requires that wastes be transported by permitted waste haulers.	SCG	Applicable if soil or NAPL are removed.
		DER-10 3.3(e)	Disposal of drill cuttings.	SCG	Potentially applicable during the installation of new monitoring wells.
MGP-Impacted Soil and Sediment	Management of Soil and Sediment Impacted with Coal Tar from Manufactured Gas Plant Sites	NYSDEC TAGM 4060 and NYSDEC DER-4	This guidance outlines the criteria for MGP coal tar waste. Soils and sediment only exhibiting the toxicity characteristic for benzene (D018) may be conditionally excluded from the requirements of 6 NYCRR Parts 370-374 and 376 when they are destined for permanent thermal treatment.	SCG	Applicable for off-site treatment and disposal of soil.

Table 4-2
Action-Specific Standards, Criteria, and Guidance
Hornell Former MGP Site

Action	Requirements	Citation	Description	SCG or TBC	Comment
Hazardous Waste	**Federal:** *Resource Conservation and Recovery Act (RCRA) Subtitle C – Hazardous Waste Management*				
	Generation, Management, and Treatment of Hazardous Waste	40 CFR Parts 261-265	Outlines criteria for determining if a solid waste is a hazardous waste and establishes requirements for hazardous waste management.	SCG	Because of New York State policy for management of wastes from MGP sites, hazardous waste will not be generated as part of implementation of the remedial actions, except possibly NAPL. Potentially applicable.
	State: NYSDEC Division of Hazardous Substances Regulation				
	New York State Hazardous Waste Management Regulations	6 NYCRR Parts 370-376	Outlines criteria for determining if a solid waste is a hazardous waste and establishes a hazardous waste management program.	SCG	Because of New York State policy for management of wastes from MGP sites, hazardous waste will not be generated as part of implementation of the remedial actions, except possibly NAPL. Potentially applicable.
Off-Site Management of Non-Hazardous Waste	RCRA Subtitle D	42 U S C Section 6901 *et seq.*	State and local governments, in accordance with USEPA's guidance, are the primary planning, regulating, and implementing entities for the management of non-hazardous solid waste, such as household garbage and non-hazardous industrial solid waste.	SCG	Applicable if soil or NAPL are removed from site.
Air Emissions	*Clean Air Act (CAA)*				
	New Source Review (NSR) and Prevention of Significant Deterioration (PSD) Requirements	40 CFR Part 52	New sources or modifications which emit greater than the defined threshold for listed pollutants must perform ambient impact analysis and install controls which meet best available control technology (BACT).	SCG	Not applicable. No new sources will be generated.
	National Emission Standards for Hazardous Air Pollutants (NESHAPs)	40 CFR Part 61; 40 CFR Part 63	Source-specific regulations which establish emissions standards for hazardous air pollutants (HAPs).	SCG	Not applicable.
	New York State Air Pollution Control Regulations	6 NYCRR Parts 120, 200-203, 207, 211, 212, 219, Air Guide-1	Establishes emissions standards and permitting requirements for new sources of air pollutants and specific contaminants.	SCG	Requirements would be applicable to remediation alternatives that result in emissions of air contaminants, including particulate matter and volatile or semi-volatile COCs.
	New York State Ambient Air Quality Standards	6 NYCRR Part 257	Establishes state ambient air quality standards and guidelines for protection of public health.	SCG	May be applicable in evaluating air impacts during remediation activities. Establishes short-term exposure action limits for occupational exposure.
	Fugitive Dust Suppression and Particulate Monitoring	NYSDEC - DER-10, Appendix 1B	Fugitive dust suppression and particulate monitoring during source area remedial activities.	SCG	For implementation under a site health and safety plan and CAMP during remedial activities. Applicable to site disturbance activities.
Construction-Related Air Emissions	Community Air Monitoring Plan (CAMP)	NYSDEC - DER-10, Appendix 1A	Air Quality Requirements	SCG	Applicable to remedial site construction activities, well installation activities, or future construction.
Work Near Overhead Power Lines	Safety and Health Regulations for Construction	Occupational Safety and Health Administration (OSHA) 29 CFR Part 1926, Subpart K; Part 1926.550(a)(15)	Establishes minimum clearances and grounding requirements for work near electrical equipment and for the operation of cranes and derricks in the vicinity of electrical distribution and transmission lines.	SCG	The minimum required clearances will be maintained and equipment grounding will be established when work is performed in the vicinity of overhead power lines.
	Worker Protection - Safety and Health	New York State Department of Labor (NYSDOL) High-Voltage Proximity Act, Code Rule 57, Section 202-h	Establishes minimum clearances and grounding requirements for work near high-voltage power lines.	SCG	The minimum required clearances will be maintained and equipment grounding will be established when work is performed in the vicinity of overhead power lines.

Table 4-2
Action-Specific Standards, Criteria, and Guidance
Hornell Former MGP Site

Action	Requirements	Citation	Description	SCG or TBC	Comment
Institutional Controls	Institution of an Environmental Easement	NYSDEC Policy on Environmental Easements: Environmental Conservation Law (ECL) Article 71, Title 36 NYSDEC August 2015 update to policy and forms	NYSDEC has developed a standard form and procedure for establishing environmental easements.	SCG	Institutional controls will be established in accordance with NYSDEC policy.
Monitored Natural Attenuation (MNA)	Provides Specific Requirement for Implementation of MNA	*Use of MNA at Superfund, RCRA Corrective Action and UST Sites* (USEPA, 1997)	This guidance document establishes the technical basis for implementing MNA.	TBC	MNA will be implemented in accordance with USEPA guidance.
Site Management Plan (SMP)	Template document intended to expedite development and approval of a site-specific SMP by providing format and general content guidelines.	*Site Management Plan Template* (NYSDEC, August 2015)	NYSDEC has developed an SMP template for remedial projects performed under the management of the NYSDEC Division of Environmental Remediation.	SCG	An SMP will be utilized following remedial action, to address the means for implementing the Institutional Controls and Engineering Controls that will be required by an Environmental Easement for the site.
Land Disturbing Activities	Excavation of Impacted Soil	DER-10; Technical Guidance for Site Investigation and Remediation	Requirements for collection and analysis of compliance and documentation samples.	TBC	Applicable.
			Requirements for CAMP implementation.	TBC	Applicable.
	Backfill	DER-10; Technical Guidance for Site Investigation and Remediation	Requirements for procedures to document that imported backfill is not impacted by COC.	TBC	Applicable.

Table 4-3
Location-Specific Standards, Criteria, and Guidance
Hornell Former MGP Site

Location	Requirements	Citation	Description	SCG or TBC	Comment
Entire Site	Steuben County	General Regulations	County transportation and site use regulations.	TBC	Requirements of County, Town, and Village would be applicable to all remediation alternatives, especially those requiring transportation.
	City of Hornell	Redevelopment Plans	Zoning regulations	SCG	Any zoning or master plan for redevelopment would be considered when planning future land use at the site.
	Village of Hornellsville	General Ordinances	Village regulations regarding transportation, noise, zoning, building permits, etc.	TBC	Requirements of County, Town, and Village would be applicable to all remediation alternatives, especially those requiring transportation.
	New York State Department of Transportation	General Regulations	NYSDOT regulations regarding transport of materials	TBC	Requirements of NYSDOT would be applicable to most remediation alternatives.
Floodplains	Executive Order 11988 - Floodplain Management	40 CFR Part 6, Subpart A; 40 CFR Part 6.302	Activities taking place within floodplains must be done to avoid adverse impacts and preserve the beneficial values in floodplains.	SCG	Not applicable. The site is in Zone B of the FEMA Flood Insurance Map which indicates it is located in an area of minimal flooding.
	Floodplain Management Regulations	6 NYCRR Part 500	Establishes floodplain management requirements.	SCG	Not applicable. The site is in Zone B of the FEMA Flood Insurance Map which indicates it is located in an area of minimal flooding.
	100-year floodplain regulations	Federal Emergency Management Agency	Administers floodplain management requirements.	SCG	Not applicable. The site is in Zone B of the FEMA Flood Insurance Map which indicates it is located in an area of minimal flooding.
Wetlands/Waters of the U.S.	Executive Order 11990 - Protection of Wetlands	40 CFR Part 6, Subpart A	Activities taking place within wetlands must be done to avoid adverse impacts.	SCG	Not applicable. Wetlands are not present at the site.
	Dredging and Filling regulations	Clean Water Act, Section 404; Rivers and Harbors Act	Regulates the discharge of dredged or fill material into waters of the United States. Requires a permit from the ACOE.	SCG	Not applicable. Sediments are not present at the site.
	Wetlands Regulations	NYSDEC Freshwater Wetlands Act	Regulates use and development of freshwater wetlands.	SCG	Not applicable. Wetlands are not present at the site.
	Protection of Water Regulations	6 NYCRR Part 608	Protection of Water Permit/ Water Quality Certification.	SCG	Not applicable.
Critical Habitat	Endangered Species Act and Fish and Wildlife Coordination Act	16 USC 661; 16 USC 1531	Actions must be taken to conserve critical habitat in areas where there are endangered or threatened species.	SCG	Not applicable. A high-value habitat for wildlife is not present at the site.
Historic Preservation	New York State Department of Parks, Recreation, and Historic Preservation	Historic Preservation Act	Establishes requirements for the identification and preservation of historic and cultural resources.	SCG	Applicable to the management of historic or archeological artifacts identified on the site. A "No Findings" determination is required prior to excavation.

Notes:
SCG = Standards, Criteria, and Guidance
TBC = Other Criteria To Be Considered

Table 6-1
Initial Technology Screening for Surface Soil
Hornell Former MGP Site

General Response Action	Remedial Technology Type	Technology Process Option	Description	Site-Specific Screening Evaluation
No Action	No Action	No Action	No additional remedial action.	No Action is included for comparison purposes in accordance with NYSDEC DER-10.
Institutional Controls/ Engineering Controls (IC/ECs)	Institutional Controls	Environmental Easement / Deed Restriction	Legal agreement or notice restricting site use in accordance with NYSDEC DER-10.	The impacted parcels are owned by multiple parties for varying uses including the Maple City Lodging Partnership, the City of Hornell and multiple single family homeowners. Retained for further evaluation.
		Site Management Plan	Contingency plans for property owner actions, such as procedures for excavation and handling of surface soil. They are administered through environmental easements, deed restrictions or third-party property agreements.	The impacted parcels are owned by multiple parties for varying uses including the Maple City Lodging Partnership, the City of Hornell and multiple single family homeowners. Retained for further evaluation.
	Engineering Controls	Fencing	Fencing or other physical barriers prevent potential receptors from exposures. For surface soil, this would include impacted parcels perimeter fencing.	Not consistent with the current functions of the impacted parcels. Not retained.
		Signage	Signs, which deter potential receptors from exposures, such as trespassing on surface soil.	Not consistent with the current functions of the impacted parcels. Not retained.
Containment	Surface Barriers	Soil Covers	One foot clean soil cover, for Commercial Site use, with impacted parcels grading for drainage.	Eliminates exposure pathway to surface soils. Retained for further evaluation.
		Low Permeability Surface Caps	Includes low permeability covers including pavement and concrete building pads.	Eliminates exposure pathway to surface soils. Retained for further evaluation.
Removal	Excavation	Conventional excavators and graders	Excavation of the top one-foot of soil (for Commercial site use) or placement of one-foot of clean soil. Addition of a soil cover is necessary if soil below surface soil is impacted.	Eliminates exposure pathway to surface soils. Retained for further evaluation.
Treatment and Disposal	Off-Site Disposal or Treatment	Landfill	Disposal at a permitted off-site landfill.	A widely used conventional technology. Retained for further evaluation.
		Low-Temperature Thermal Desorption (LTTD)	Treatment at a permitted thermal desorption facility. The soil is heated in order to volatilize COCs, which are then destroyed in an afterburner.	A widely used conventional technology for MGP-impacted soils. Retained for further evaluation.
		Waste-to-Energy/ Management of NAPL-impacted large debris	Co-fired boiler or other waste-to-energy facilities, resulting in destruction of COCs and energy production.	Potentially applicable for impacted parcels debris that is too large for LTTD. Capacity of facilities is limited and may not be applicable for bulk soil. Retained for further evaluation.
		Soil Washing/ Chemical Treatment	Soil washing and/or chemical treatment by addition of oxidants.	Not applicable for MGP-impacted soils. Not retained.
		Biological Treatment	Landfarming or soil windrow tilling to enhance biological treatment of COCs in soil.	No active facilities are available for MGP-impacted soils. Not retained.
	On-Site Disposal or Treatment	Landfill	Disposal at an on-site location constructed as a permitted landfill.	Insufficient land area available. Not retained.
		Low-Temperature Thermal Desorption	Treatment on site with a mobile permitted thermal desorption facility. The soil is heated in order to volatilize COCs which are then destroyed in an afterburner.	Insufficient land area available. Not likely to be acceptable to surrounding community. Not retained.
		Incineration	High temperature burning on site with a mobile permitted incinerator.	Insufficient land area available. Not likely to be acceptable to surrounding community. Not retained.
		Soil Washing/ Chemical Treatment	Soil washing and chemical treatment by addition of oxidants.	Not applicable to MGP-impacted soils. Not retained.
		Biological Treatment	Landfarming or soil windrow tilling to enhance biological treatment of contaminants in soil.	Insufficient land area available. Not retained.

Table 6-2
Initial Technology Screening for Subsurface Soil
Hornell Former MGP Site

General Response Action	Remedial Technology Type	Technology Process Option	Description	Site-Specific Screening Evaluation
No Action	No Action	No Action	No additional remedial action.	No Action is included for comparison purposes in accordance with NYSDEC DER-10.
Institutional Controls/ Engineering Controls (IC/ECs)	Institutional Controls	Environmental Easement / Deed Restriction	Legal agreement or notice restricting site use in accordance with NYSDEC DER-10.	The impacted parcels are owned by multiple parties for varying uses including the Maple City Lodging Partnership, the City of Hornell and multiple single family homeowners. Retained for further evaluation.
		Site Management Plan	Contingency plans for property owner actions, such as procedures for handling subsurface soil during excavations for underground utilities or basements. They are administered through environmental easements, deed restrictions or third-party property agreements.	The impacted parcels are owned by multiple parties for varying uses including the Maple City Lodging Partnership, the City of Hornell and multiple single family homeowners. Retained for further evaluation.
	Engineering Controls	Temporary Fencing	Temporary fencing during excavation in which subsurface soil is encountered.	Applicable for on-site construction activities. Retained for further evaluation.
		Temporary Signage	Temporary signs which deter potential receptors from exposures during excavation in which subsurface soil is encountered.	Applicable for on-site construction activities. Retained for further evaluation.
Containment	Subsurface Vertical Barriers	Steel Sheet Piling Bentonite/Cement Slurry Walls HDPE Sheeting Walls Drilled Grout and Solidified Earth Column Walls Jet Grout Column Walls	Subsurface vertical barrier walls have been used at MGP sites to prevent the migration of NAPL in subsurface soil.	Based on the sampling performed during the RI, it does not appear that there is a significant amount of mobile free-phase NAPL on the impacted parcels. Not retained.
In-Situ Treatment	Immobilization	In-Situ Solidification (ISS) using Auger Mixing method	Overlapping columns are augered as a grout/soil mixture to form a solid monolith of low permeability. Most effective to a depth of approximately 40 feet but constructible to a depth of approximately 50 feet. Physically binds or encloses a COC mass and/or induces a chemical reaction between the stabilizing agent and the COCs to reduce their mobility within the subsurface and to decrease permeability of the mass so that groundwater does not contact the COCs.	Effective for meeting soil-related RAOs. Retained for further evaluation.
		In-Situ Solidification (ISS) using Jet Grouting method	High pressure jet grouting displaces soil to form a grout column. Overlapping grout columns form a solid monolith of low permeability. Most effective to a depth of approximately 40 feet.	Effective for meeting soil-related RAOs. Retained for further evaluation.
		In-Situ Solidification (ISS) using Excavator Bucket Mixing method	Bulk soil is mixed into a grout/soil mixture to form a solid monolith of low permeability. Constructible to a depth of approximately 20 feet (deeper if larger excavator with extended long reach boom is utilized).	Effective for meeting soil-related RAOs. Retained for further evaluation.
	Chemical Treatment	In-Situ Chemical Oxidation (ISCO)	Treatment by a field of wells in the impacted area, which are used to chemically degrade the COCs, usually by addition of an oxidant such as ozone, hydrogen peroxide, or potassium permanganate.	Potentially effective for meeting soil-related RAOs. Retained for further evaluation.

Table 6-2
Initial Technology Screening for Subsurface Soil
Hornell Former MGP Site

General Response Action	Remedial Technology Type	Technology Process Option	Description	Site-Specific Screening Evaluation
In-Situ Treatment (cont.)	Biological Treatment	Enhanced In-Situ Bioremediation: Aerobic Biodegradation	Air sparging, oxygen injection and addition of oxygen releasing compounds (ORC).	Potentially effective for subsurface soil with moderate concentrations of COCs. Soils containing COCs are generally concentrated around soil containing coal tar or coal tar NAPL with high concentrations of COCs. Not retained.
		Enhanced In-Situ Bioremediation: Anaerobic Biodegradation	Addition of a carbon substrate or electron acceptor as a reducing agent to maintain anaerobic conditions.	Potentially effective for subsurface soil with moderate concentrations of COCs. Soils containing COCs are generally concentrated around soil containing coal tar or coal tar NAPL with high concentrations of COCs. Not retained.
	Air Sparging/Soil Vapor Extraction	Air Sparging/Soil Vapor Extraction	This technology is the injection of pressurized air into the subsurface below the water table to induce volatilization of dissolved phase COCs.	Effective for VOCs in groundwater and soil vapor. Not effective for meeting soil-related RAOs. Not retained.
	Enhanced Recovery technologies	Steam	Uses injected steam to heat subsurface soil and groundwater and enhance mobility to allow for more effective treatment or extraction. This technology is in the experimental phase. Substantial risk of uncontrolled migration of contaminants.	Experimental technologies with a substantial risk for uncontrolled migration. Not retained.
		Electro-Thermal	Uses electrical current to heat subsurface soil and groundwater and enhance mobility to allow for more effective treatment or extraction. This technology is in the experimental phase. Substantial risk of uncontrolled migration of COCs.	Experimental technologies with a substantial risk for uncontrolled migration. Not retained.
		Surfactants	Uses surfactant chemicals (soap formulations) injected in the subsurface to enhance mobility to allow for more effective treatment or extraction. This technology is in the experimental phase. Substantial risk of uncontrolled migration of COCs.	Experimental technologies with a substantial risk for uncontrolled migration. Not retained.
		Acoustic Vibrations	Uses sound to vibrate subsurface soil and groundwater and enhance mobility to allow for more effective treatment or extraction. This technology is in the experimental phase. Substantial risk of uncontrolled migration of COCs.	Experimental technologies with a substantial risk for uncontrolled migration. Not retained.
Removal	Excavation	Conventional and Long-Stick Excavators/ Shoring	For excavations to approximately 20 feet (slightly deeper for long-stick excavators). Shoring and benching required for deeper excavations.	A widely used conventional technology. Will allow for the removal of the remaining concrete gas holder and gas building foundation. Retained for further evaluation.
		Slurry Trench Excavation	Excavations deeper than the typical reach of an excavator, with flowing sand and artesian conditions. A slurry is used to maintain sidewall support. Requires additional equipment and more extensive dewatering and earth support structures.	During the RI, MGP impacts were not observed to be deeper than 30 feet. Subsurface soils containing COCs are within the typical reach of conventional and long-stick excavators but unsupported excavations below the water table may experience sidewall stability issues. Retained.

Table 6-2
Initial Technology Screening for Subsurface Soil
Hornell Former MGP Site

General Response Action	Remedial Technology Type	Technology Process Option	Description	Site-Specific Screening Evaluation
Treatment and Disposal	Off-Site Treatment and Disposal	Off-site Landfill	Transportation to and disposal at a permitted off-site landfill.	A widely used conventional technology for the management of MGP-impacted soils. Retained for further evaluation.
		Low-Temperature Thermal Desorption (LTTD)	Treatment at a permitted thermal desorption facility. The soil is heated in order to volatilize COCs, which are then destroyed in an afterburner.	A widely used conventional technology for the management of MGP-impacted soils. Retained for further evaluation.
		Waste-to-Energy	Co-fired boiler or other waste-to-energy facilities, resulting in destruction of COCs and energy production.	Potentially applicable for impacted site debris that is too large for LTTD. Capacity of facilities is limited and may not be applicable for bulk soil. Retained for further evaluation.
		Soil Washing/ Chemical Treatment	Soil washing and chemical treatment by addition of oxidants.	Not applicable for MGP-impacted soils. Not retained.
		Biological Treatment	Landfarming or soil windrow tilling to enhance biological treatment of COCs in soil.	No active facilities are available for MGP-impacted soils. Not retained.
	On-Site Treatment and Disposal	On-site Landfill	Disposal at an on-site location constructed as a permitted landfill.	Insufficient land area available. Not retained.
		Low-Temperature Thermal Desorption	Treatment on site with a mobile permitted thermal desorption facility. The soil is heated in order to volatilize COCs, which are then destroyed in an afterburner.	Insufficient land area available. Not likely to be acceptable to surrounding community. Not retained.
		Incineration	High temperature burning on site with a mobile permitted incinerator.	Insufficient land area available. Not likely to be acceptable to surrounding community. Not retained.
		Soil Washing/ Chemical Treatment	Soil washing and chemical treatment by addition of oxidants.	Not applicable to MGP-impacted soils. Not retained.
		Biological Treatment	Landfarming or soil windrow tilling to enhance biological treatment of COCs in soil.	Insufficient land area available. Not likely to be acceptable to surrounding community. Not retained.

Note: Shading indicates the technology was retained for further evaluation.

Table 6-3
Initial Technology Screening for Groundwater
Hornell Former MGP Site

General Response Action	Remedial Technology Type	Technology Process Option	Description	Site-Specific Screening Evaluation
No Action	No Action	No Action	No remedial action.	No Action is included for comparison purposes in accordance with NYSDEC DER-10.
Institutional Controls/ Engineering Controls (IC/ECs)	Institutional Controls	Environmental Easement/ Deed Restriction	Legal agreement or notice restricting site use in accordance with NYSDEC DER-10.	The impacted parcels are owned by multiple parties for varying uses including the Maple City Lodging Partnership, the City of Hornell and multiple single family homeowners. Retained for further evaluation, particularly as a common element of alternatives that combine technologies.
		Local Groundwater Use Ordinance	Legal restriction placed by the local municipality preventing installation of new wells or use of existing wells.	Can prevent potential contact with COCs in impacted groundwater. Retained for further evaluation, particularly as a common element of alternatives that combine technologies.
		Site Management Plan	Contingency plans for property owner actions. They are administered through environmental easements, deed restrictions, or third-party property agreements.	Can prevent potential contact with COCs in impacted groundwater. Retained for further evaluation, particularly as a common element of alternatives that combine technologies.
Containment	Surface Barriers: Cover Soil and Caps	Soil Covers	Clean, low permeability soil cover, with site grading for surface drainage.	Can decrease infiltration of precipitation through impacted soils in the vadose zone and therefore have a positive effect on groundwater quality. Retained for further evaluation for commercial zoned parcels.
		Low Permeability Surface Caps	Includes low permeability covers including pavement and concrete building pads.	Surface barriers minimize infiltration of precipitation through vadose zone source areas, reducing migration of dissolved COCs. Retained for further evaluation.
	Subsurface Vertical Barriers	Steel Sheet Piling	Interlocking steel sheets are driven by vibration or hammer to pre-determined depths to provide a physical, hydraulic barrier to groundwater flow.	The RI sampling has demonstrated that groundwater impact is localized around areas with observed coal tar NAPL-impacted subsurface soil and not likely to extend beyond the impacted parcels. Would require an associated and sophisticated hydraulic control (such as groundwater extraction) to prevent uncontrolled mounding or run-around. Very long duration. Not retained.
		Bentonite/Cement Slurry Walls	Slurry walls involve excavation of a 1.5 to 5 foot wide trench followed by immediate placement of slurry which hardens to form the barrier.	The RI sampling has demonstrated that groundwater impact is localized around areas with observed coal tar NAPL-impacted soil and not likely to extend beyond the impacted parcels. Would require an associated hydraulic release. Not retained.
		HDPE Sheeting Walls	HDPE interlocking sheeting is installed through a slurry-supported trench.	The RI sampling has demonstrated that groundwater impact is localized around areas with observed coal tar NAPL-impacted soil and not likely to extend beyond the impacted parcels. Would require an associated hydraulic release. Not retained.
		Drilled Grout and Solidified Earth Column Walls	Overlapping columns are drilled and filled with grout or grout/soil mixture to form a barrier wall with low permeability.	The RI sampling has demonstrated that groundwater impact is localized around areas with observed coal tar NAPL-impacted soil and not likely to extend beyond the impacted parcels. Would require an associated hydraulic release. Not retained.
		Jet Grout Column Walls	High pressure jet grouting displaces soil to form a grout column. Overlapping grout columns form a barrier wall.	The RI sampling has demonstrated that groundwater impact is localized around areas with observed coal tar NAPL-impacted soil and not likely to extend beyond the impacted parcels. Would require an associated hydraulic release. Not retained.

Table 6-3
Initial Technology Screening for Groundwater
Hornell Former MGP Site

General Response Action	Remedial Technology Type	Technology Process Option	Description	Site-Specific Screening Evaluation
Containment (Cont'd.)	Process Barriers	Biological Containment	Containment by a line of wells downgradient of the impacted area, which are used to stimulate microbial activity, usually by air injection at low pressures ("biosparging"). The groundwater is treated in-situ before it migrates off site.	The RI sampling has demonstrated that groundwater impact is localized around areas with observed coal tar NAPL-impacted soil and not likely to extend beyond the impacted parcels. Would be more applicable if groundwater impacts were migrating beyond impacted parcels. Not retained.
		Chemical Containment	Containment by a line of wells downgradient of the impacted area, which are used to chemically degrade the COCs, usually by addition of an oxidant such as ozone, hydrogen peroxide, or potassium permanganate. The groundwater is treated in-situ before it migrates off site.	The RI sampling has demonstrated that groundwater impact is localized around areas with observed coal tar NAPL-impacted soil and not likely to extend beyond the impacted parcels. Not highly effective for dilute plumes. Difficult to implement due to multiple events required. Not retained.
		Permeable Reactive Barrier	Containment by construction of a vertical treatment zone downgradient of the impacted area, which is used to chemically and biologically degrade the COCs, usually by the placement of a reactive material such as iron filings or activated carbon. This can also be combined with NAPL capture, biological and chemical in-situ treatment. The groundwater is treated in-situ before it migrates off site.	The RI sampling has demonstrated that groundwater impact is localized around areas with observed coal tar NAPL-impacted soil and not likely to extend beyond the impacted parcels. Expensive and difficult to implement, since reactive media may need to be replaced. Not retained.
		Hydraulic Containment	Containment by extracting groundwater by wells or trenches around the impacted area. Just enough groundwater is captured so that an inward hydraulic gradient is maintained and off-site migration does not occur. The captured groundwater is treated prior to discharge to surface water or the local sewage treatment system.	The RI sampling has demonstrated that groundwater impact is localized around areas with observed coal tar NAPL-impacted soil and not likely to extend beyond the impacted parcels. Expensive and would require very long duration to implement, especially due to the highly transmissive saturated soils (sand and gravel). Not retained.
In-Situ Treatment	Natural Attenuation	Monitored Natural Attenuation (MNA)	MNA refers to the reliance on natural treatment processes to achieve site-specific remedial objectives. The natural attenuation processes include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of COCs in soil or groundwater. These processes include biodegradation, dispersion, dilution, sorption, volatilization, and chemical or biological stabilization, transformation, or destruction of COCs.	The RI sampling has demonstrated that groundwater impact is localized around areas with observed coal tar NAPL-impacted soil and not likely to extend off-site. Source removal will assist in meeting groundwater-related RAOs over time. Retained for further evaluation, especially for combination with removal or solidification strategies for subsurface soil impacts.
	Immobilization	In-Situ Solidification (ISS) using Auger Mixing method	Overlapping columns are augered as a grout/soil mixture to form a solid monolith of low permeability. Most effective to a depth of approximately 40 feet but constructible to a depth of approximately 50 feet.	Effective for meeting groundwater and soil-related RAOs. Retained for further evaluation.
		In-Situ Solidification (ISS) using Pressure Grouting method	High pressure jet grouting displaces and mixes with soil to form a soil-grout column. Overlapping grout columns form a solid monolith of low permeability. Constructible to a depth of approximately 40 feet.	Effective for meeting groundwater and soil-related RAOs. Retained for further evaluation.
		In-Situ Solidification (ISS) using Excavator Bucket Mixing method	Bulk soil is mixed into a grout/soil mixture to form a solid monolith of low permeability. Constructible to a depth of approximately 20 feet (deeper if larger excavator with extended long reach boom is utilized).	Effective for meeting groundwater and soil-related RAOs. Retained for further evaluation.
	Chemical Treatment	In-Situ Chemical Oxidation (ISCO)	Treatment by a field of wells in the impacted area, which are used to chemically degrade the COCs, usually by addition of an oxidant such as ozone, hydrogen peroxide, or potassium permanganate.	Potentially effective for meeting groundwater and soil-related RAOs. Retained for further evaluation.
	Biological Treatment	Enhanced In-Situ Bioremediation: Aerobic Biodegradation	Air sparging, oxygen injection or addition of oxygen releasing compounds (ORC) in source areas of subsurface soil impacts (as opposed to "barrier" configuration as a containment technology).	Potentially effective for groundwater with moderate concentrations of COCs. Impacted groundwater containing COCs are generally concentrated around soil containing coal tar

Table 6-3
Initial Technology Screening for Groundwater
Hornell Former MGP Site

General Response Action	Remedial Technology Type	Technology Process Option	Description	Site-Specific Screening Evaluation
In-Situ Treatment (Cont'd.)				or coal tar NAPL with high concentrations of COCs and will interfere with groundwater treatment. Not retained.
		Enhanced In-Situ Bioremediation: Anaerobic Biodegradation	Addition of a biologically-active substrate or electron acceptor as a reducing agent to maintain anaerobic conditions in source areas.	Technology potentially effective for groundwater with moderate concentrations of oxidized COCs (such as halogenated compounds). The organic COCs at the site are more amenable to aerobic biodegradation. Not retained.
		Phytoremediation	Trees or other plants are placed to remove groundwater and immobilize or treat COCs.	Not consistent with the current functions of the properties. Not retained.
	Air Sparging/Soil Vapor Extraction	Air Sparging/Soil Vapor Extraction	This technology is the injection of pressurized air into the subsurface below the water table to induce volatilization of dissolved phase COCs.	Effective for VOCs in groundwater and soil vapor. Impacted soils containing COCs are generally concentrated around soil containing coal tar or coal tar NAPL with high concentrations of COCs and will interfere with groundwater treatment. Not retained.
Source Material Removal	Excavation	Excavation and Removal of Soil Containing Source Material	Removal of soil using a hydraulic excavator or other excavation equipment. For deeper excavations, it is likely that shoring and dewatering operations will be required as part of excavation.	Effective for meeting soil-related RAOs and for meeting groundwater-related RAOs over time. Retained for further evaluation.
	Groundwater Extraction	Groundwater Pump and Treat	An extraction well system is used to withdraw water from impacted zones. The water is treated by ex-situ treatment or discharged to a publically operated treatment works (POTW) for treatment.	Historically, this technology was used heavily to control and attempt to remediate groundwater impacts. However, low-solubility COCs such as those at MGP sites provide very long-term duration sources. The approach is energy and cost-intensive. Not retained.
	NAPL Recovery	Recovery Wells and Trenches	This technology involves the extraction of free-phase NAPL from wells or trenches. The NAPL accumulates in the well, and is then pumped into a holding tank prior to off-site disposal or recycling at an appropriate facility. Partially addresses source material and aids in meeting groundwater and soil-related RAOs. Effective at removing free-phase NAPL from the subsurface; and therefore reducing the COC flux into the groundwater. Pilot tests are typically required to determine recovery rates, NAPL recoverability, well or trench design, pumping and control equipment.	Based on the sampling performed during the RI, it does not appear that there is a significant amount of free-phase or mobile NAPL on the impacted parcels; NAPL was observed in the soil samples collected from soil borings, but has not accumulated in any wells installed on the impacted parcels. The NAPL does not appear to be migrating and it is unlikely to be recoverable. Not retained.
	Enhanced Recovery Technologies	Steam/Hot Water	Uses injected steam and/or hot water to heat subsurface soil and groundwater and enhance mobility to allow for more effective treatment or extraction. This technology is in the experimental phase. Substantial risk of uncontrolled migration of COCs.	Experimental technologies with a substantial risk for uncontrolled migration of COCs to off-site areas. High cost and expected to be ineffective. Not retained.
		Electro-Thermal	Uses electrical current to heat subsurface soil and groundwater and enhance mobility to allow for more effective treatment or extraction. This technology is in the experimental phase. Substantial risk of uncontrolled migration of steam and COCs.	Experimental technologies with a substantial risk for uncontrolled migration of COCs to off-site areas. High cost and expected to be ineffective. Not retained.
		Surfactants	Uses surfactant chemicals (soap formulations) injected in the subsurface to enhance mobility to allow for more effective treatment or extraction. This technology is in the experimental phase. Substantial risk of uncontrolled migration of COCs.	Experimental technologies with a substantial risk for uncontrolled migration of COCs to off-site areas and expected to be ineffective. Not retained.
		Acoustic Vibrations	Uses sound to vibrate subsurface soil and groundwater and enhance mobility to allow for more effective treatment or extraction. This	Experimental technologies with a substantial risk for uncontrolled migration of COCs to off-site areas and expected to be ineffective. Not retained.

Table 6-3
Initial Technology Screening for Groundwater
Hornell Former MGP Site

General Response Action	Remedial Technology Type	Technology Process Option	Description	Site-Specific Screening Evaluation
			technology is in the experimental phase. Substantial risk of uncontrolled migration of COCs.	
Ex-Situ Treatment	Organic COC Treatment	Air Stripping	Air is used to volatilize VOCs in groundwater so that they can be removed, collected, and treated. Applicable to extracted groundwater.	Potentially feasible for use in excavation water treatment at the impacted parcels. Specific unit processes for treatment of organic COCs in groundwater will be evaluated during design. Generic organic water treatment is retained for further evaluation.
		Granular Activated Carbon	Treatment by adsorption of COCs on carbon. Applicable to extracted groundwater.	Potentially feasible for use in treating excavation-related extraction of water at the impacted parcels. Specific unit processes for treatment of organic COCs in groundwater will be evaluated during design. Generic organic water treatment is retained for further evaluation.
		Oil/Water Separation	Removal of NAPL from extracted water using gravity separation. Applicable to extracted groundwater.	Potentially feasible for use in treating excavation-related extraction of water at the impacted parcels. Specific unit processes for treatment of organic COCs in groundwater will be evaluated during design. Generic organic water treatment is retained for further evaluation.
		Chemical/UV Oxidation	Groundwater treatment using oxidizers, enhanced by UV radiation for destruction of dissolved, organic COCs. Applicable to extracted groundwater.	Potentially feasible for use in treating excavation-related extraction of water at the impacted parcels. Specific unit processes for treatment of organic COCs in groundwater will be evaluated during design. Generic organic water treatment is retained for further evaluation.
	Inorganic COC Treatment	Chemical Precipitation	pH adjustment and potentially flocculation of extracted water to promote precipitation of inorganic COCs. Applicable to extracted groundwater.	Potentially feasible for use in excavation water treatment at the impacted parcels, if inorganic impacts were found to be problematic at the site. However, the RI found that inorganic COCs were not present at concentrations that would require treatment. Therefore, no inorganic water treatment is retained for further evaluation. However, these technologies could be added to a treatment train, if pre-design investigation indicates that it is needed for extracted groundwater.
		Ion Exchange/Adsorption	Use of equipment to remove and treat COC in groundwater.	
		Filtration	Use of a filter to remove COC absorbed to particulates.	
		Peroxide Oxidation	Addition of hydrogen peroxide to water to treat inorganic COCs, particularly cyanide.	

Note:
Shading indicates the technology was retained for further evaluation.

Table 6-4
Remedial Technology Evaluation for Surface Soil
Hornell Former MGP Site

General Response Action	Remedial Technology Type	Technology Process Option	Effectiveness	Implementability	Relative Cost	Site-Specific Applicability and Screening Evaluation
No Action	No Action	No Action	Not effective for achieving RAOs for surface soil in an acceptable timeframe.	Readily implemented.	No Cost	No Action is included for comparison purposes in accordance with NYSDEC DER-10. Retained for alternative development.
Institutional Controls/ Engineering Controls (IC/ECs)	Institutional Controls	Environmental Easement / Deed Restriction	Effective in preventing exposures to construction/utility workers and residents.	Readily implemented.	Low	The Site is owned by multiple owners. Retained for alternative development.
		Site Management Plan	Effective in preventing exposures to construction/utility workers and residents.	Readily implemented.	Low	The Site is owned by multiple owners. Retained for alternative development.
Containment	Surface Barriers	Soil Cover	Effective in preventing exposures for construction/utility workers and residents.	Technology proven and readily implemented.	Moderate	Retained for alternative development.
		Low Permeability Surface Cap	Effective in preventing exposures for construction/utility workers and residents.	Technology proven and readily implemented.	Moderate	Retained for alternative development.
Removal	Excavation	Conventional Excavators and Graders	Effective at meeting surface soil RAOs.	Technology proven and readily implemented.	Moderate	Retained for alternative development.
Treatment and Disposal	Off-Site Disposal or Treatment	Landfill	Effective and widely used technologies.	Readily implemented.	Moderate	Retained for alternative development.
		Low-Temperature Thermal Desorption	Effective and widely used technologies.	Readily implemented.	High	Retained for alternative development.
		Waste-to-Energy	Effective and widely used technologies.	Readily implemented.	High	Retained for alternative development.

Table 6-5
Remedial Technology Evaluation for Subsurface Soil
Hornell Former MGP Site

General Response Action	Remedial Technology Type	Technology Process Option	Effectiveness	Implementability	Relative Cost	Site-Specific Applicability and Screening Evaluation
No Action	No Action	No Action	Not effective for achieving RAOs for subsurface soil in an acceptable timeframe.	Readily implemented.	No Cost	No Action is included for comparison purposes in accordance with NYSDEC DER-10. Retained for alternative development.
Institutional Controls/ Engineering Controls (IC/ECs)	Institutional Controls	Environmental Easement Site Management Plan (SMP)	Effective in preventing exposures to construction/utility workers. Not effective in limiting subsurface migration of COCs, volume reduction, or treatment.	Readily implemented.	Low	Retained for alternative development.
	Engineering Controls	Temporary Fencing and Signage	Effective in preventing exposures for construction/utility workers. Not effective in limiting subsurface migration of COCs, volume reduction, or treatment.	Readily implemented.	Low	Retained for alternative development.
In-Situ Treatment	Immobilization	In-Situ Solidification (ISS): Auger Mixing, Excavator Bucket Mixing, and Pressure/Jet Grouting	The ISS monolith physically prevents exposures to impacted subsurface soils. Physically binds or encloses a COC mass and/or induces a chemical reaction between the stabilizing agent and the COCs to reduce their mobility within the subsurface and to decrease permeability of the mass so that groundwater does not contact the COCs. Pressure/Jet Grouting method may be less effective due to unpredictability in extent of ISS monolith.	Technology proven and implementable under some conditions.	High mobilization costs. Costs of ISS for saturated soils can be less than excavation/off-site disposal.	Auger mixing and excavator bucket mixing method retained for alternative development. Pressure/Jet grouting method not retained due to unpredictability in effective implementation, except in locations where mixing cannot be performed.
Removal	Excavation	Conventional and Long-Stick Excavators/ Shored Excavation	Effective at meeting soil RAOs and addressing groundwater RAOs.	Technology is proven and readily implemented for accessible soils. Excavations deeper than the typical reach of an excavator, approximately 20 feet, would require additional equipment and more extensive dewatering and earth support structures.	High	Retained for alternative development.
Treatment and Disposal	Off-Site Treatment and Disposal	Landfill LTTD Waste-to-Energy	Effective and widely used technologies.	Readily implemented.	Moderate	All Retained for alternative development.

Table 6-6
Remedial Technology Evaluation for Groundwater
Hornell Former MGP Site

General Response Action	Remedial Technology Type	Technology Process Option	Effectiveness	Implementability	Relative Cost	Site-Specific Applicability and Screening Evaluation
No Action	No Action	No Action	Not effective for achieving RAOs for groundwater in an acceptable timeframe.	Readily implemented.	No Cost	No Action is included for comparison purposes in accordance with NYSDEC DER-10. Retained for alternative development.
Institutional Controls/ Engineering Controls (IC/ECs)	Institutional Controls	Environmental Easement/ Deed Restriction Local Groundwater Use Ordinance Site Management Plan	Effective in preventing exposures to construction/utility workers. Not effective in limiting subsurface migration of COCs, volume reduction, or treatment.	Relatively readily implemented. The property owners have generally been accepting of site work.	Low	Retained for alternative development.
Containment	Surface Barriers	Soil Cover Low permeability surface cover	Effective for decreasing infiltration of precipitation with site grading and draining.	Readily implemented.	Low	Retained for alternative development.
In-Situ Treatment	Natural Attenuation	Monitored Natural Attenuation (MNA)	Effective over time for meeting groundwater RAOs once sources of groundwater impacts have been addressed. If sources cannot be fully addressed, MNA is marginally effective to ineffective in providing a decreasing trend of groundwater COCs.	Implementable.	Low capital costs, Moderate OM&M costs.	Retained for alternative development.
	Immobilization	In-Situ Solidification (ISS): Auger Mixing Excavator Bucket Mixing Pressure/Jet Grouting	Effective for meeting groundwater RAOs. Physically binds or encloses a COC mass and/or induces a chemical reaction between the stabilizing agent and the COCs to reduce their mobility within the subsurface and to decrease permeability of the mass so that groundwater does not contact the COCs. Pressure/Jet Grouting method may be less effective due to unpredictability in extent of ISS monolith.	Technology proven and implementable.	High mobilization costs. Costs of ISS for saturated soils can be less than excavation/off-site disposal.	Auger mixing and excavator bucket mixing method retained for alternative development. Pressure/Jet grouting method not retained due to unpredictability in effective implementation.
Source Material Removal	Excavation (Refer to Table 6-5 for Treatment Technology Evaluation)	Excavation and removal of soil containing source material or COCs.	Effective at meeting soil RAOs and addressing groundwater RAOs through the removal of source material.	Technology is proven and readily implemented for accessible soils. Excavations deeper than the typical reach of an excavator, approximately 20 feet, would require additional equipment and more extensive dewatering and earth support structures.	Moderate	Retained for alternative development.
Treatment	Organic Treatment	Air Stripping Granular Activated Carbon Oil/Water Separation Chemical/UV Oxidation	These technology would be effective at meeting the RAOs for prevention of exposure to COCs in extracted groundwater (through treatment). Processes would potentially be used as part of a treatment train to treat groundwater removed from excavation areas. Has potential to be used as part of a treatment system to meet the RAOs.	The technology is implementable.	Moderate capital costs, Moderate to High OM&M costs	Activated carbon is retained for treatment of groundwater removed during on-site excavation. Other technologies are less applicable.

Table 7-1
Proposed Remedial Alternatives and RAOs
Hornell Former MGP Site

Former MGP Parcel & Hotel Parcel						
Applicable Medium	**Remedial Alternative**					
	Alternative 1 No Action	**Alternative 2 Excavation to 15 feet**	**Alternative 3 Excavation to 15 feet, ISCO to 26-30 feet**	**Alternative 4 Pre-Excavation & ISS to 26-30 feet**	**Alternative 5 Excavation of all grossly impacted soils to 26-30 feet**	**Alternative 6 Excavation to Unrestricted SCOs to 26-30 feet**
Surface Soil	Not addressed	Addressed by this action	Addressed by this action	Addressed by this action	Addressed by this action	Addressed by complete removal
Subsurface Soil <15 feet deep	Not addressed	Excavation of all soils above Commercial SCOs	Excavation of all soils above Commercial SCOs	Excavation or ISS of all soils above Commercial SCOs	Addressed by this action	Addressed by complete removal
Subsurface Soil >15 feet deep	Not addressed	Not addressed	ISCO targeted to soils with NAPL or sheens	ISS by bucket or auger mixing of soils with NAPL or sheens	Addressed by this action	Addressed by complete removal
Groundwater / NAPL	Not addressed	Addressed by SMP with groundwater use restrictions	Addressed by SMP with groundwater use restrictions. COC mass will be reduced by oxidant injection.	Addressed by SMP with groundwater use restrictions. Unimpacted groundwater prevented from contacting soil impacts.	Addressed by this action	Addressed by complete removal

Gas Regulator Parcel						
Applicable Medium	**Remedial Alternative**					
	Alternative 1 No Action	**Alternative 2 Replace 1 ft soil cover and demarcation fabric**	**Alternative 3 Replace 1 ft soil cover and demarcation fabric**	**Alternative 4 Replace 1 ft soil cover and demarcation fabric**	**Alternative 5 Replace 1 ft soil cover and demarcation fabric**	**Alternative 6 Excavation of all soil to 5 feet**
Surface/Subsurface Soil	Not addressed	Meets commercial / industrial cleanup requirements	Meets commercial / industrial cleanup requirements	Meets commercial / industrial cleanup requirements	All needs addressed by complete removal	All needs addressed by complete removal

Sidewalk / Franklin Street						
Applicable Medium	**Remedial Alternative**					
	Alternative 1 No Action	**Alternative 2 Excavation to 15 feet**	**Alternative 3 Excavation to 15 feet**	**Alternative 4 Excavation to 15 feet**	**Alternative 5 Excavation to 15 feet**	**Alternative 6 Excavation to Unrestricted SCOs (to 15 feet this area)**
Surface/Subsurface Soil	Meets surface exposure requirements	All needs addressed by complete removal	All needs addressed by complete removal	Meets residential and commercial / industrial surface cleanup requirements and prevents potential utility worker exposure	All needs addressed by complete removal	All needs addressed by complete removal

Table 7-1
Proposed Remedial Alternatives and RAOs
Hornell Former MGP Site

Vacant Hotel Parcel						
Applicable Medium	**Remedial Alternative**					
	Alternative 1 No Action	**Alternative 2 Excavation to 15 feet**	**Alternative 3 Excavation to 15 feet; ISCO bordering area**	**Alternative 4 Excavation to 8.5 feet, ISS of bordering area**	**Alternative 5 Excavation of all grossly impacted soils to 26-30 feet**	**Alternative 6 Excavation to Unrestricted SCOs (to 26-30 feet)**
Groundwater / NAPL	Not addressed	Addressed by SMP with groundwater use restrictions	Addressed by MNA and SMP with groundwater use restrictions	Addressed by MNA and SMP with groundwater use restrictions	Addressed by this action	All needs addressed by complete removal

Adjacent Downgradient Residential Parcels						
Applicable Medium	**Remedial Alternative**					
	Alternative 1 No Action	**Alternative 2 Excavation to 15 feet**	**Alternative 3 Excavation to 15 feet, ISCO to 26-30 feet**	**Alternative 4 Excavation to 15 feet, ISS to 26-30 feet**	**Alternative 5 Excavation of all grossly impacted soils to 26-30 feet**	**Alternative 6 Excavation to Unrestricted SCOs to 26-30 feet**
Subsurface Soil	Not addressed	Addressed by SMP and environmental easement	Addressed by SMP and environmental easement	Addressed by SMP and envirionmental easement	Addressed by SMP and envirionmental easement	Addressed by complete removal
Groundwater / NAPL	Not addressed	Addressed by SMP with groundwater use restrictions	Addressed by MNA and SMP with groundwater use restrictions	Addressed by MNA and SMP with groundwater use restrictions	Addressed by this action	Addressed by complete removal

Table 7-2
Metrics Relevant to Short-Term Impacts for All Alternatives
Hornell Former MGP Site

Alternative	Description	Descriptors of Short Term Impacts and Effectiveness of Controls				
		Duration of Construction	Volume Soil Excavated (CY)	Volume of Soils Treated by LTTD (CY)	Volume Backfilled (CY)	Total Truck Trips Required
1	No Action	None	None	None	None	None
2	Remove impacted surface and subsurface soil to 15' bgs, soil cover, MNA for groundwater, IC/ECs	3.5 months	13,690	3,720	13,690	1900
3	Remove impacted surface and subsurface soil to 15' bgs, ISCO of impacts below 15', soil cover, MNA and IC/Ecs	4.5 months (initial injection)	13,690	3,720	13,690	1900
4	Remove impacted surface soil, soil cover, remove foundations, excavate soil above ISS, ISS of subsurface soil exceeding 500 mg/kg for Total PAHs (0-15 ft), ISS of source material below 15 feet bgs, backfill and re-grade, MNA, IC/ECs	5 months	7,770	1,950	3,730	830
5	Remove impacted surface soil, soil cover, remove foundations, excavation of subsurface soil exceeding 500 mg/kg for Total PAHs (0-15 feet bgs), excavation of source material below 15 feet bgs, excavation backfill, MNA, IC/ECs	7 months	17,737	3,720	17,737	2590
6	Remove subsurface foundations, remove soil to Unrestricted Use SCOs	7 months	20,792	3,720	20,792	3040

Note: Low Temperature Thermal Desorption (LTTD)

CY - in-place cubic yards

Table 7-2
Metrics Relevant to Short-Term Impacts for All Alternatives
Hornell Former MGP Site

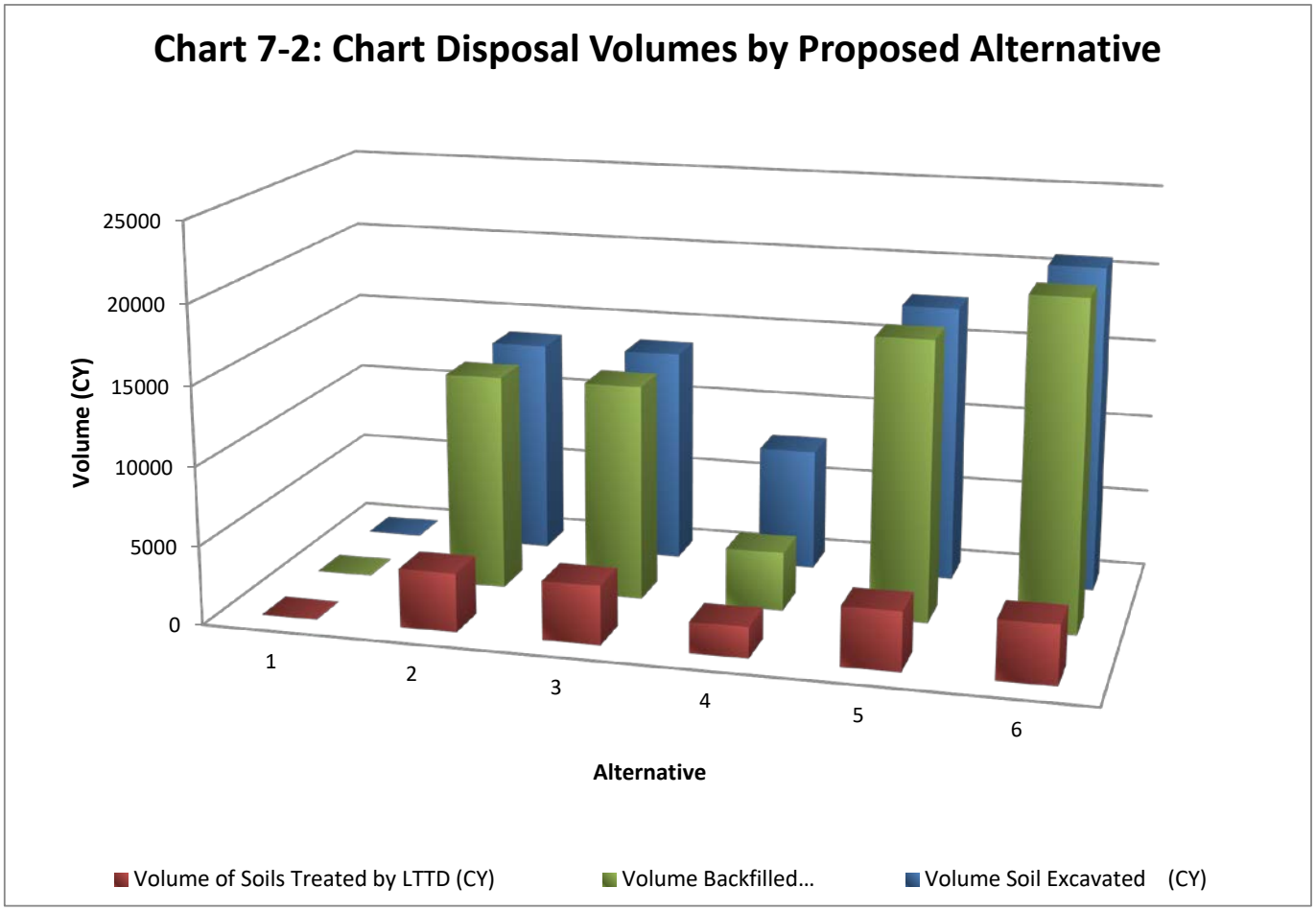


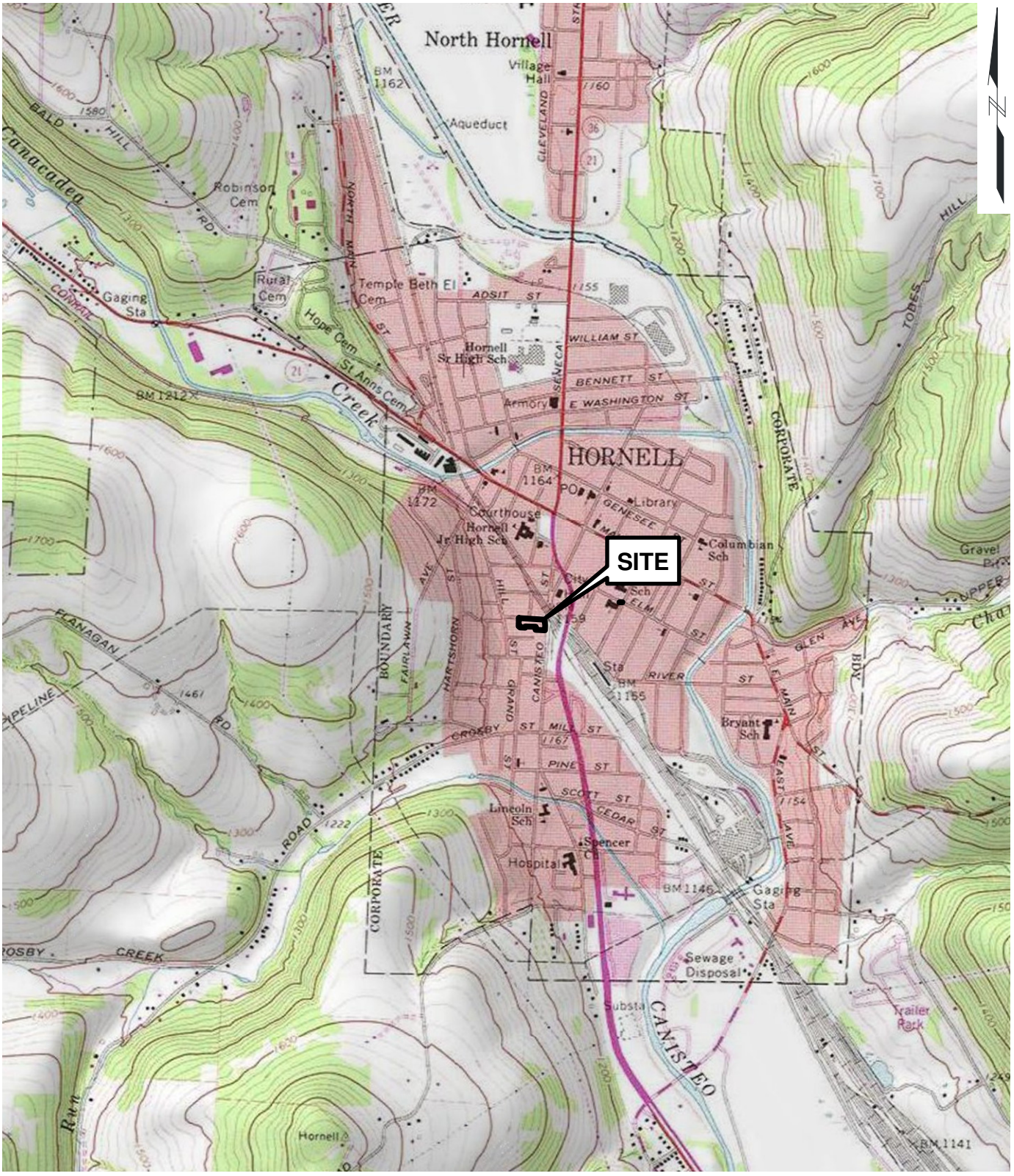
Table 7-3
Comparative Ranking of Alternatives
Hornell Former MGP Site

Alternative	Description	Threshold Criteria		Balancing Criteria						
		Overall Protection of Human Health and the Environment	Compliance with SCGs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, & Volume Through Treatment	Short-Term Effectiveness	Implementability	Total Cost (FS accuracy +50% / - 30%)	Cost Effectiveness	Land Use
1	No Action	Not Protective	Not Compliant	5th	5th	1st	1st	No Cost	No Cost	Not Supportive
2	Remove impacted surface and subsurface soil to 15' bgs, soil cover, MNA for groundwater, IC/ECs	4th	3rd	4th	4th	2nd	2nd	$4,330,000	1st	5th
3	Remove impacted surface and subsurface soil to 15' bgs, ISCO of impacts below 15', soil cover, MNA and IC/ECs	3rd	2nd	3rd	3rd	3rd	3rd	$5,650,000	3rd	4th
4	Remove impacted surface soil, soil cover, remove foundations, excavate soil above ISS, ISS of subsurface soil exceeding 500 mg/kg for Total PAHs (0-15 ft), ISS of source material below 15 feet bgs, backfill and re-grade, MNA, IC/ECs	3rd	2nd	2nd	3rd	3rd	3rd	$4,210,000	2nd	3rd
5	Remove impacted surface soil, soil cover, remove foundations, excavation of subsurface soil exceeding 500 mg/kg for Total PAHs (0-15 feet bgs), excavation of source material below 15 feet bgs, excavation backfill, MNA, IC/ECs	2nd	2nd	2nd	2nd	4th	4th	$6,800,000	4th	2nd
6	Remove subsurface foundations, remove soil to Unrestricted Use SCOs	1st	1st	1st	1st	5th	4th	$8,080,000	5th	1st

Comparative Ranking:

1st - Ranked First, Best
2nd - Ranked Second
3rd - Ranked Third
4th - Ranked Fourth
5th - Ranked Fifth, Last
Duplicate ranks indicate equivalent ranking.

Figures



SOURCE:
Copyright:© 2013 National Geographic Society, i-cubed

0 2,000 4,000
SCALE: 1" = 2000'

Feasibility Study Report Hornell Former MGP Site Hornell, New York	GEI Consultants	SITE LOCATION MAP
National Fuel Gas Distribution Company	Project 1412830	February 2018 Fig. 1

J:\Projects\National Fuel Gas\Hornell Former MGP\FS\HORNELL_FS_LOC.mxd

CREDIT UNION

BENCH MARK
RR SPIKE EAST FACE OF POLE
APPROX. 1' ABOVE GROUND
ELEVATION: 1157.82

GAS MARKER

FRANKLIN STREET

SIDEWALK

UNDERGROUND WALKWAY ENTRANCE

GAS REGULATORS

CONCRETE DRIVE

PAVED PARKING LOT

DUMPSTER

WOOD FENCE

CONCRETE

ABOVE GROUND POOL

GARAGE

DECK

RETAINING WALLS

STONE PARKING LOT

25

23

21

19

15

GRAVEL DRIVE

PAVED DRIVE

SIDEWALK

ALBION STREET

COMFORT INN

CANISTEO STREET

CLEANOUT

LEGEND

- APPROXIMATE SITE BOUNDARY (FROM NYSDEC)
- APPROXIMATE PROPERTY BOUNDARIES
- CHAIN-LINK FENCE
- 15 — EXISTING STRUCTURE & HOUSE NUMBER
- 1156 — GROUND SURFACE ELEVATION (NAVD 88)
- ELECTRIC OVERHEAD WIRE
- E — UNDERGROUND ELECTRIC LINE
- G — UNDERGROUND GAS LINE
- T — TELEPHONE LINE
- BENCHMARK
- UTILITY POLE
- GAS METER
- WATER VALVE
- MANHOLE
- SANITARY SEWER
- FIRE HYDRANT
- CATCH BASIN
- CLEANOUT — CLEANOUT

NOTE:

1. ALL UTILITY LINE LOCATIONS ARE APPROXIMATE AND SHOULD BE CONFIRMED IN THE FIELD.

0 50' 100'

SCALE: 1" = 50'

SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
2. City of Hornell, Steuben County, NY Tax Map No. 166.06 dated Oct. 18, 2008.
3. *Modification to Order on Consent and Administrative Settlement, Attachment 1* between New York State Department of Environmental Conservation, Office of General Counsel, and National Fuel Gas dated Oct. 21, 2010.

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Hornell Former MGP Site
Hornell, New York

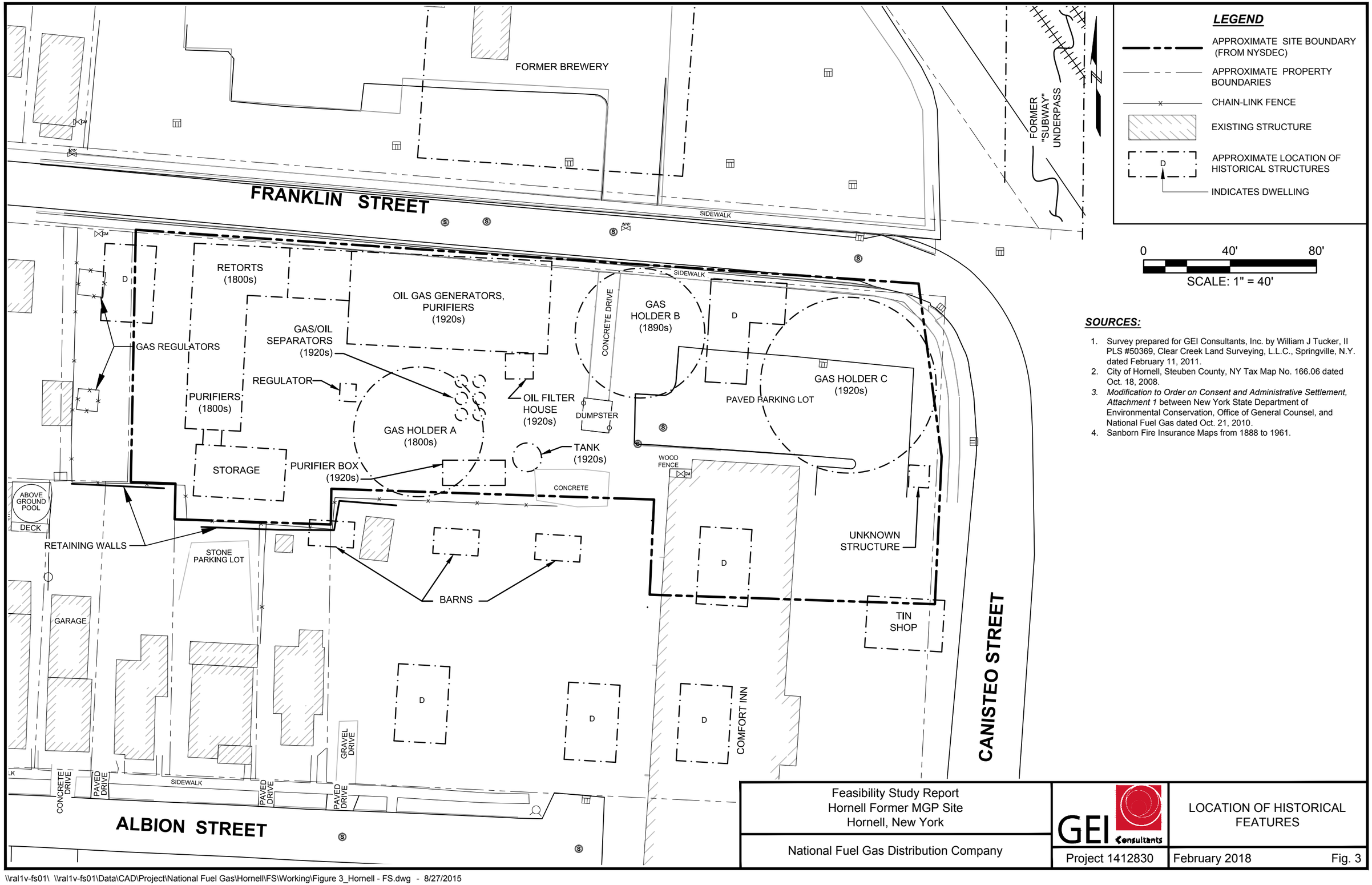
National Fuel Gas Distribution Company

GEI Consultants

CURRENT SITE CONDITIONS

Project 1412830 | February 2018 | Fig. 2

\\ral1v-fs01\ \\ral1v-fs01\Data\CAD\Project\National Fuel Gas\Hornell\FS\Working\Figure 2_Hornell - FS.dwg - 8/27/2015



SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
2. City of Hornell, Steuben County, NY Tax Map No. 166.06 dated Oct. 18, 2008.
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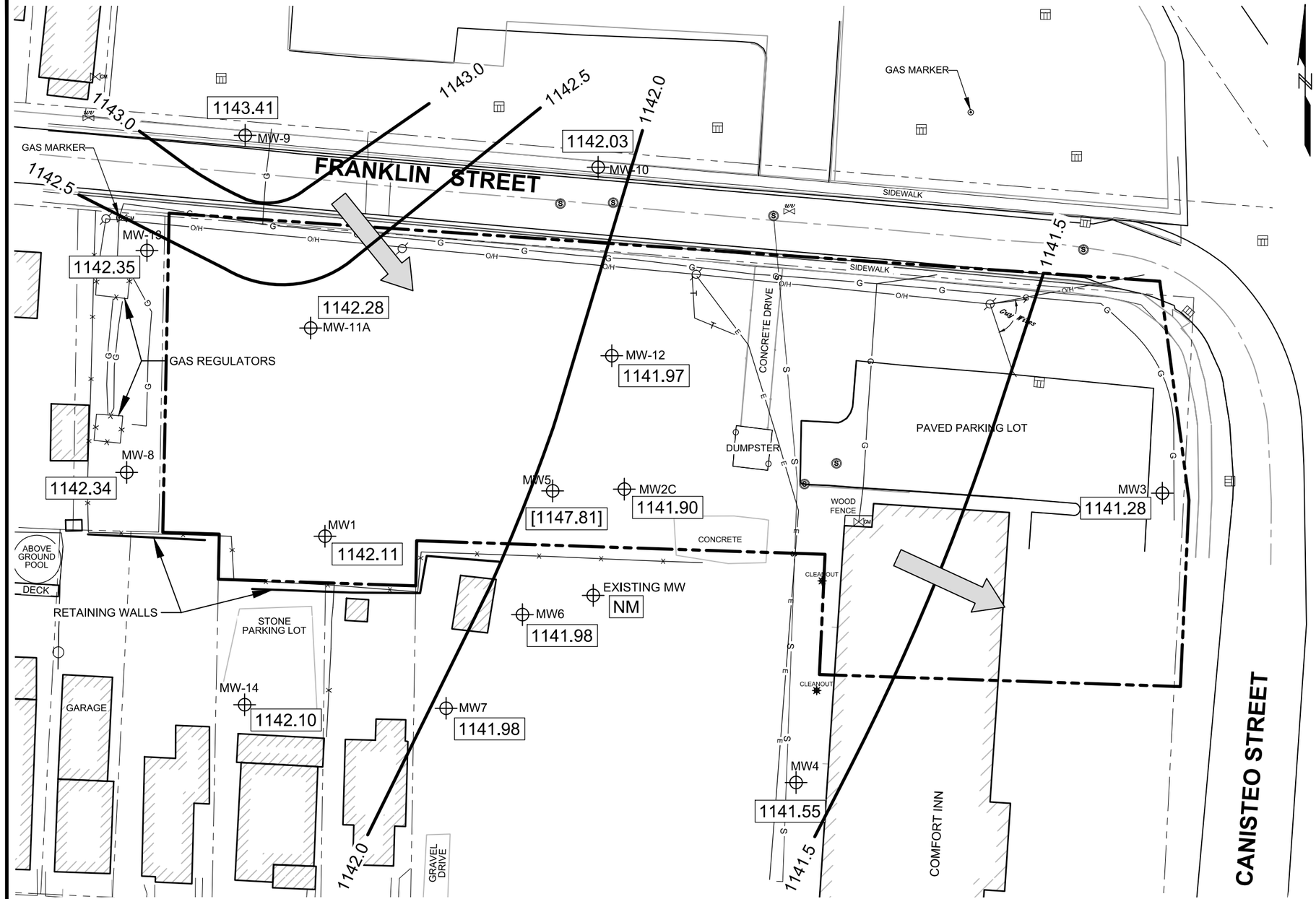
LOCATION OF HISTORICAL FEATURES

Project 1412830 | February 2018 | Fig. 3

\\ral1v-fs01\ \\ral1v-fs01\Data\CAD\Project\National Fuel Gas\Hornell\FS\Working\Figure 3_Hornell - FS.dwg - 8/27/2015



LEGEND

- APPROXIMATE SITE BOUNDARY (FROM NYSDEC)
- APPROXIMATE PROPERTY BOUNDARIES
- CHAIN-LINK FENCE
- EXISTING STRUCTURE

REMEDIAL INVESTIGATION SAMPLE LOCATIONS

- MW1 — MONITORING WELL
- 1140.88 — GROUNDWATER ELEVATION (FEET NAVD 88) FEBRUARY 8, 2012
- [1147.81] — GROUNDWATER ELEVATION NOT USED IN GENERATION OF CONTOURS
- NM — NOT MEASURED
- 1141.0 — GROUNDWATER CONTOUR (FEET NAVD 88)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
2. City of Hornell, Steuben County, NY Tax Map No. 166.06 dated Oct. 18, 2008.
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0 40' 80'

SCALE: 1" = 40'

Feasibility Study Report
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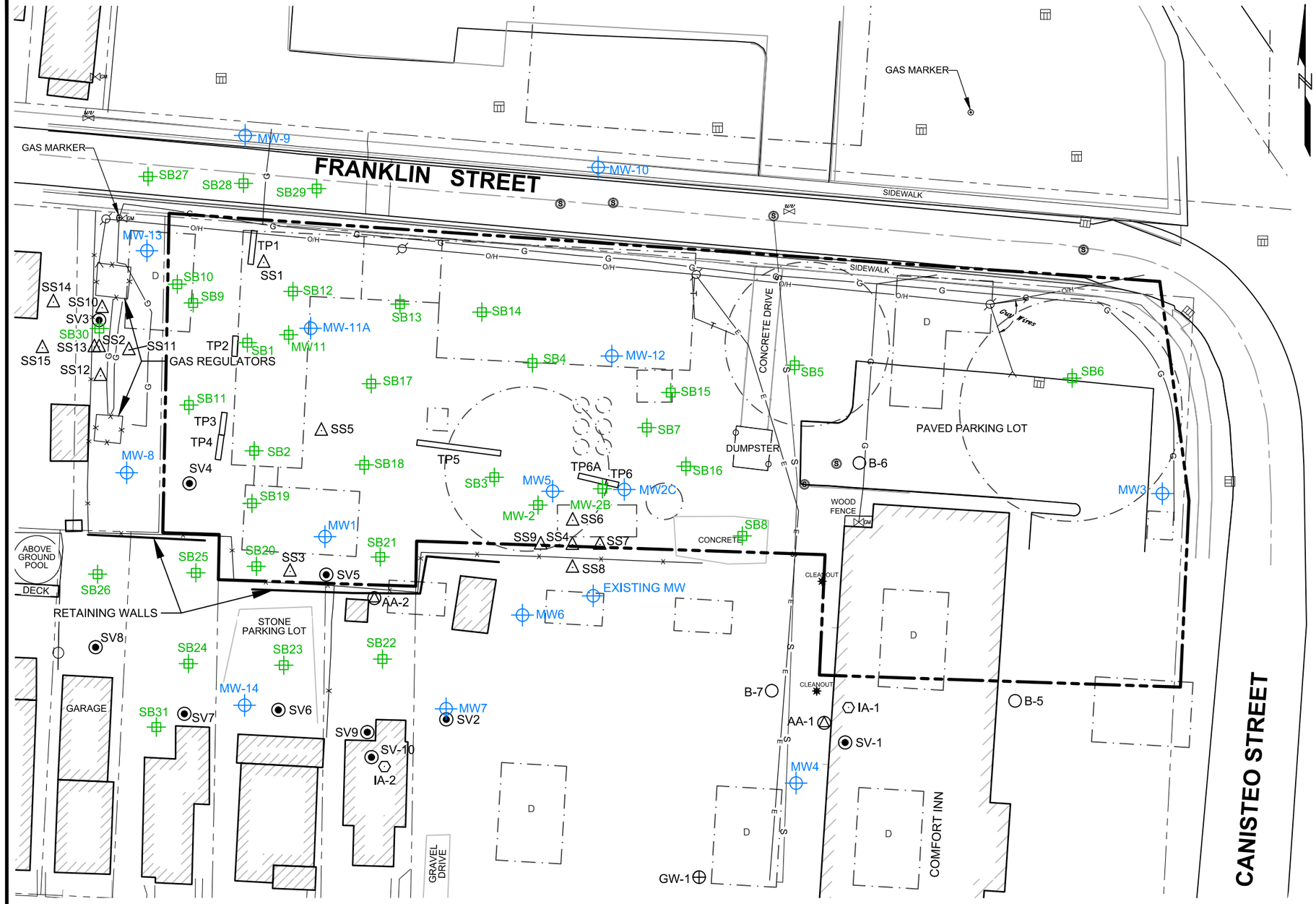
GROUNDWATER SURFACE CONTOURS

February 2018 Fig. 4

\\ral1v-fs01\ \\ral1v-fs01\Data\CAD\Project\National Fuel Gas\Hornell\FS\Working\Figure 4_Hornell - FS.dwg - 8/27/2015



LEGEND

- APPROXIMATE SITE BOUNDARY (FROM NYSDEC)
- APPROXIMATE PROPERTY BOUNDARIES
- CHAIN-LINK FENCE
- EXISTING STRUCTURE
- APPROXIMATE LOCATION OF HISTORICAL STRUCTURES
- D — INDICATES DWELLING
- CATCH BASIN

REMEDIAL INVESTIGATION SAMPLE LOCATIONS

MW1	MONITORING WELL
B1	SOIL BORING
TP1	TEST PIT
IA-1	INDOOR AIR SAMPLE
AA-1	AMBIENT AIR SAMPLE
SV-1	SOIL VAPOR SAMPLE
SS1	SURFACE SOIL SAMPLE
GW-1	FORMER MONITORING WELL (NOT FOUND)
B-1	FORMER GEOTECHNICAL SOIL BORING

SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
2. City of Hornell, Steuben County, NY Tax Map No. 166.06 dated Oct. 18, 2008.
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0 40' 80'

SCALE: 1" = 40'

Feasibility Study Report
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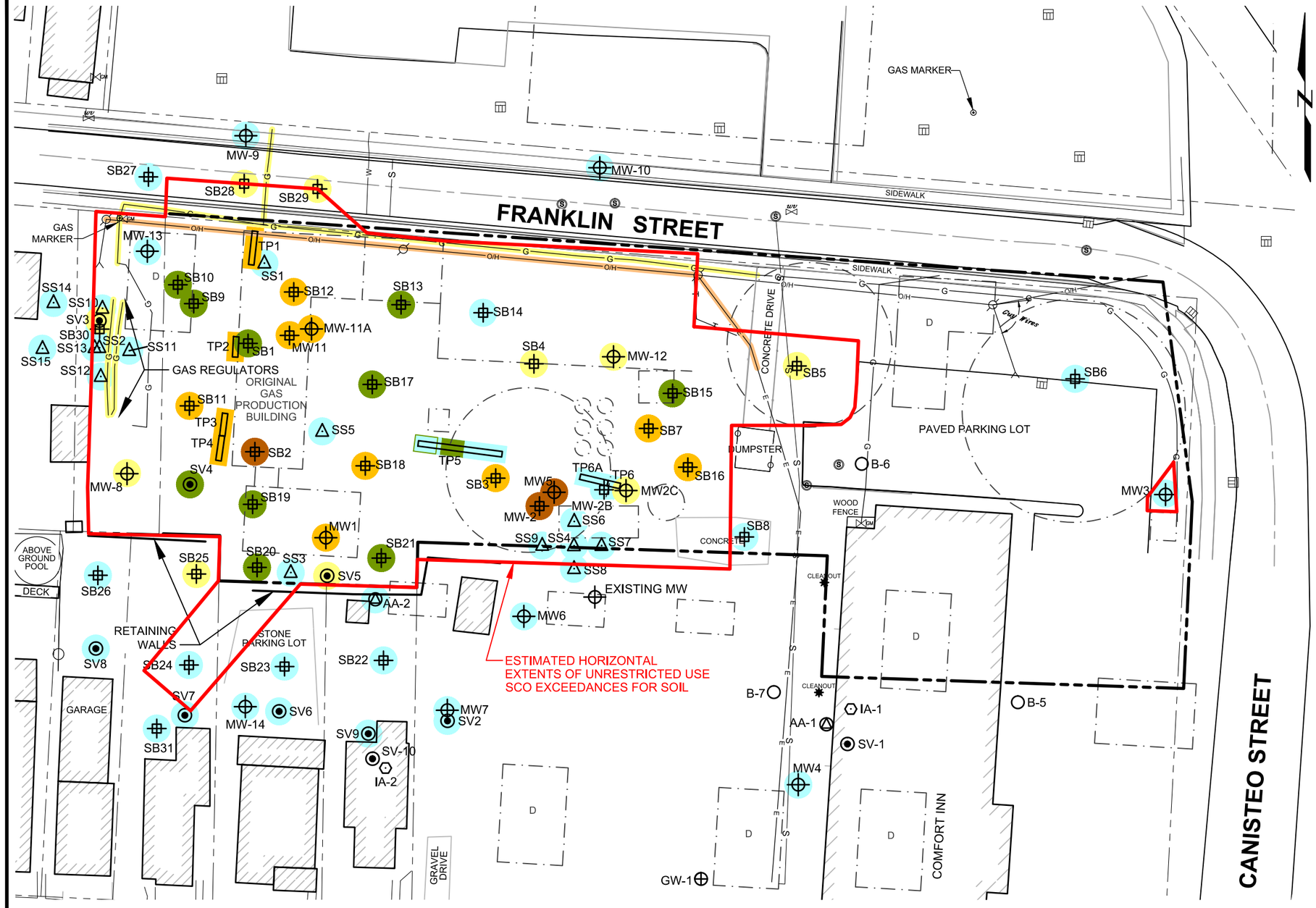
Project 1412830

SAMPLING AND INSPECTION LOCATIONS

February 2018 Fig. 5

\\ral1v-fs01\ \\ral1v-fs01\Data\CAD\Project\National Fuel Gas\Hornell\FS\Working\Figure 5_Hornell - FS.dwg - 8/27/2015



LEGEND

- APPROXIMATE SITE BOUNDARY (FROM NYSDEC)
- APPROXIMATE PROPERTY BOUNDARIES
- CHAIN-LINK FENCE
- EXISTING STRUCTURE
- D — APPROXIMATE LOCATION OF HISTORICAL STRUCTURES
- INDICATES DWELLING
- O/H — ELECTRIC OVERHEAD WIRE
- E — UNDERGROUND ELECTRIC LINE
- G — UNDERGROUND GAS LINE
- T — TELEPHONE LINE
- S — SANITARY SEWER LINE
- UTILITY POLE
- LIGHT POLE
- GAS METER
- WATER VALVE
- MANHOLE
- FIRE HYDRANT
- DROP INLET

REMEDIAL INVESTIGATION SAMPLE LOCATIONS

- MW1 — MONITORING WELL LOCATION
- SB1 — SOIL BORING LOCATION
- TP1 — TEST PIT LOCATION
- IA-1 — INDOOR AIR SAMPLE LOCATION
- AA-1 — AMBIENT AIR SAMPLE LOCATION
- SV-1 — SOIL VAPOR SAMPLE LOCATION
- GW-1 — FORMER MONITORING WELL LOCATION
- B-1 — FORMER SOIL BORING LOCATION
- SS1 — SURFACE SOIL SAMPLE LOCATION

VISUAL IMPACTS

- NO IMPACTS
- MGP-LIKE ODORS
- TAR STAINING OR SHEEN
- TAR BLEBS, GLOBS, LENSES, STRINGERS, COATINGS
- TAR SATURATED

ALTERNATIVE 2:

- Relocate gas and electric lines
- Excavate soil exceeding 500 ppm TPAH on Former MGP Parcel, Gas Regulator Parcel and Franklin Street.
- Excavate soil exceeding Residential Use SCOs on Adjacent Downgradient Residences.
- 1-ft soil on MPG Parcel and Gas Regulator Parcel
- Groundwater Monitoring
- IC/ECs

SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
2. City of Hornell, Steuben County, NY Tax Map No. 166.06 dated Oct. 18, 2008.
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0 40' 80'

SCALE: 1" = 40'

Feasibility Study Report
Hornell Former MGP Site
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National Fuel Gas Distribution Company

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ESTIMATED HORIZONTAL EXTENTS OF UNRESTRICTED USE SCO EXCEEDANCES FOR SOIL

Project 1412830 | February 2018 | Fig. 6

\\ral1v-fs01\ \\ral1v-fs01\Data\CAD\Project\National Fuel Gas\Hornell\FS\Working\Figure 6_Hornell - FS.dwg - 8/27/2015

Location Name	MW-13
Sample Date	2/10/2012
Total PAHs	ND
Total BTEX	ND

Location Name	MW-9	
Sample Date	10/26/2011	2/9/2012
Total PAHs	ND	ND
Total BTEX	**1.09**	**0.47**

Location Name	MW-11A	
Sample Date	10/26/2011	2/10/2012
Total PAHs	**1625.21**	**1283.54**
Total BTEX	**5981**	**4914**

Location Name	MW-1			
Sample Date	2/23/2011	2/23/2011 DUP	10/25/2011	2/10/2012
Total PAHs	ND	ND	**815.7**	**1270.29**
Total BTEX	ND	ND	**1590**	**3220**

Location Name	MW-10	
Sample Date	10/25/2011	2/9/2012
Total PAHs	ND	ND
Total BTEX	**0.79**	ND

Location Name	MW-12	
Sample Date	10/24/2011	2/10/2012
Total PAHs	**34.54**	**11.31**
Total BTEX	**7.82**	**2.24**

Location Name	MW-3		
Sample Date	2/23/2011	10/24/2011	2/10/2012
Total PAHs	ND	ND	ND
Total BTEX	ND	ND	ND

Location Name	MW-2C		
Sample Date	2/23/2011	10/25/2011	2/9/2012
Total PAHs	**0.47**	**27.68**	**61.25**
Total BTEX	ND	**31.8**	**65.8**

Location Name	MW-5			
Sample Date	2/10/2012	2/10/2012 DUP	10/25/2011	10/25/2011 DUP
Total PAHs	**580.19**	**682.6**	**556.9**	**508.2**
Total BTEX	**259**	**249**	**304**	**326**

Location Name	MW-8	
Sample Date	10/25/2011	2/10/2012
Total PAHs	ND	ND
Total BTEX	ND	ND

Location Name	MW-14
Sample Date	2/9/2012
Total PAHs	ND
Total BTEX	ND

Location Name	MW-7	
Sample Date	10/25/2011	2/9/2012
Total PAHs	ND	ND
Total BTEX	**0.62**	ND

Location Name	MW-6	
Sample Date	10/25/2011	2/9/2012
Total PAHs	**41.9**	**13.67**
Total BTEX	**76.72**	**28.24**

Location Name	MW-4		
Sample Date	2/23/2011	10/24/2011	2/9/2012
Total PAHs	ND	ND	**0.71**
Total BTEX	ND	ND	ND

LEGEND

- APPROXIMATE SITE BOUNDARY (FROM NYSDEC)
- APPROXIMATE PROPERTY BOUNDARIES
- CHAIN-LINK FENCE
- 15 — EXISTING STRUCTURE & HOUSE NUMBER
- D — APPROXIMATE LOCATION OF HISTORICAL STRUCTURES
- INDICATES DWELLING

REMEDIAL INVESTIGATION SAMPLE LOCATIONS

- MW1 — MONITORING WELL LOCATION

ANALYTICAL DATA BOX LEGEND

- PAHs — POLYCYCLIC AROMATIC HYDROCARBONS
- BTEX — BENZENE, TOLUENE, ETHYLBENZENE, XYLENES
- ND — NOT DETECTED
- **11.802** — INDICATES DETECTED COMPOUND IN MICROGRAMS PER LITER (µg/L)
- 34.54 / 7.82 — ONE OR MORE INDIVIDUAL COMPOUND(S) EXCEED WATER QUALITY STANDARD OR GUIDANCE VALUES
- PAH ISOPLETH FOR 2/2012 DATA
- BTEX ISOPLETH FOR 2/2012 DATA
- ESTIMATED EXTENT OF GROUNDWATER EXCEEDING WATER QUALITY STANDARDS OR GUIDANCE VALUES

SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
2. City of Hornell, Steuben County, NY Tax Map No. 166.06 dated Oct. 18, 2008.
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0 40' 80'

SCALE: 1" = 40'

Feasibility Study Report
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Hornell, New York

National Fuel Gas Distribution Company

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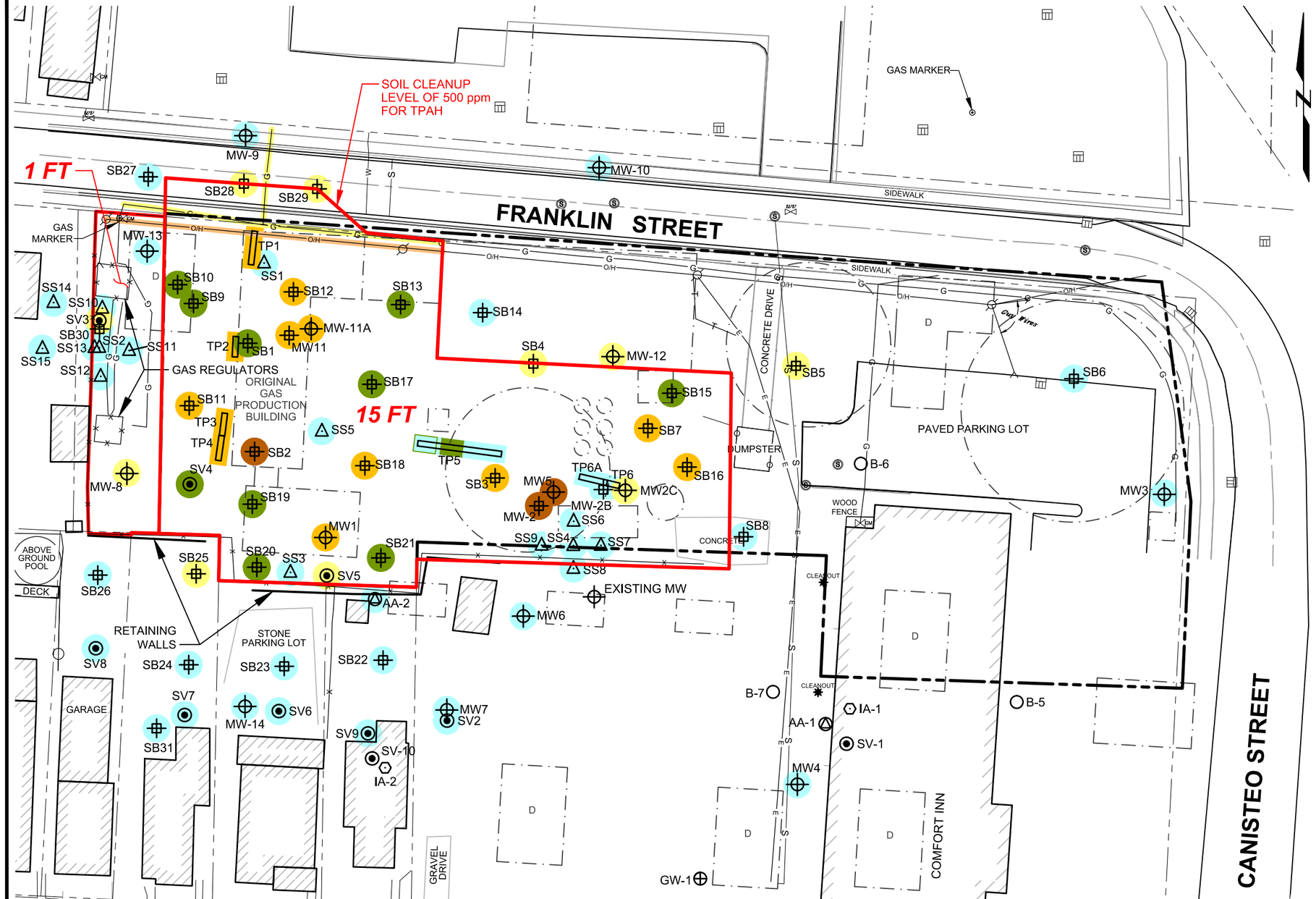
ESTIMATED EXTENTS OF AMBIENT WATER QUALITY STANDARDS IN GROUNDWATER

February 2018 Fig. 7

\\ral1v-fs01\ \\ral1v-fs01\Data\CAD\Project\National Fuel Gas\Hornell\FS\Working\Figure 7_Hornell - FS.dwg - 8/27/2015



LEGEND

- APPROXIMATE SITE BOUNDARY (FROM NYSDEC)
- APPROXIMATE PROPERTY BOUNDARIES
- CHAIN-LINK FENCE
- EXISTING STRUCTURE
- APPROXIMATE LOCATION OF HISTORICAL STRUCTURES
- INDICATES DWELLING
- ELECTRIC OVERHEAD WIRE TO BE RELOCATED
- UNDERGROUND ELECTRIC LINE TO BE RELOCATED
- UNDERGROUND GAS LINE TO BE RELOCATED
- TELEPHONE LINE
- SANITARY SEWER LINE
- UTILITY POLE
- LIGHT POLE
- GAS METER
- WATER VALVE
- MANHOLE
- FIRE HYDRANT
- DROP INLET

REMEDIAL INVESTIGATION SAMPLE LOCATIONS

- MW1 — MONITORING WELL LOCATION
- SB1 — SOIL BORING LOCATION
- TP1 — TEST PIT LOCATION
- IA-1 — INDOOR AIR SAMPLE LOCATION
- AA-1 — AMBIENT AIR SAMPLE LOCATION
- SV-1 — SOIL VAPOR SAMPLE LOCATION
- GW-1 — FORMER MONITORING WELL LOCATION
- B-1 — FORMER SOIL BORING LOCATION
- SS1 — SURFACE SOIL SAMPLE LOCATION

VISUAL IMPACTS

- NO IMPACTS
- MGP-LIKE ODORS
- TAR STAINING OR SHEEN
- TAR BLEBS, GLOBS, LENSES, STRINGERS, COATINGS
- TAR SATURATED

ALTERNATIVE 2:

- Relocate gas and electric lines
- Excavate soil exceeding 500 ppm TPAH on Former MGP Parcel, Gas Regulator Parcel and Franklin Street.
- 1-ft soil on MPG Parcel and Gas Regulator Parcel
- Groundwater Monitoring and MNA
- IC/ECs

SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
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Feasibility Study Report
Hornell Former MGP Site
Hornell, New York

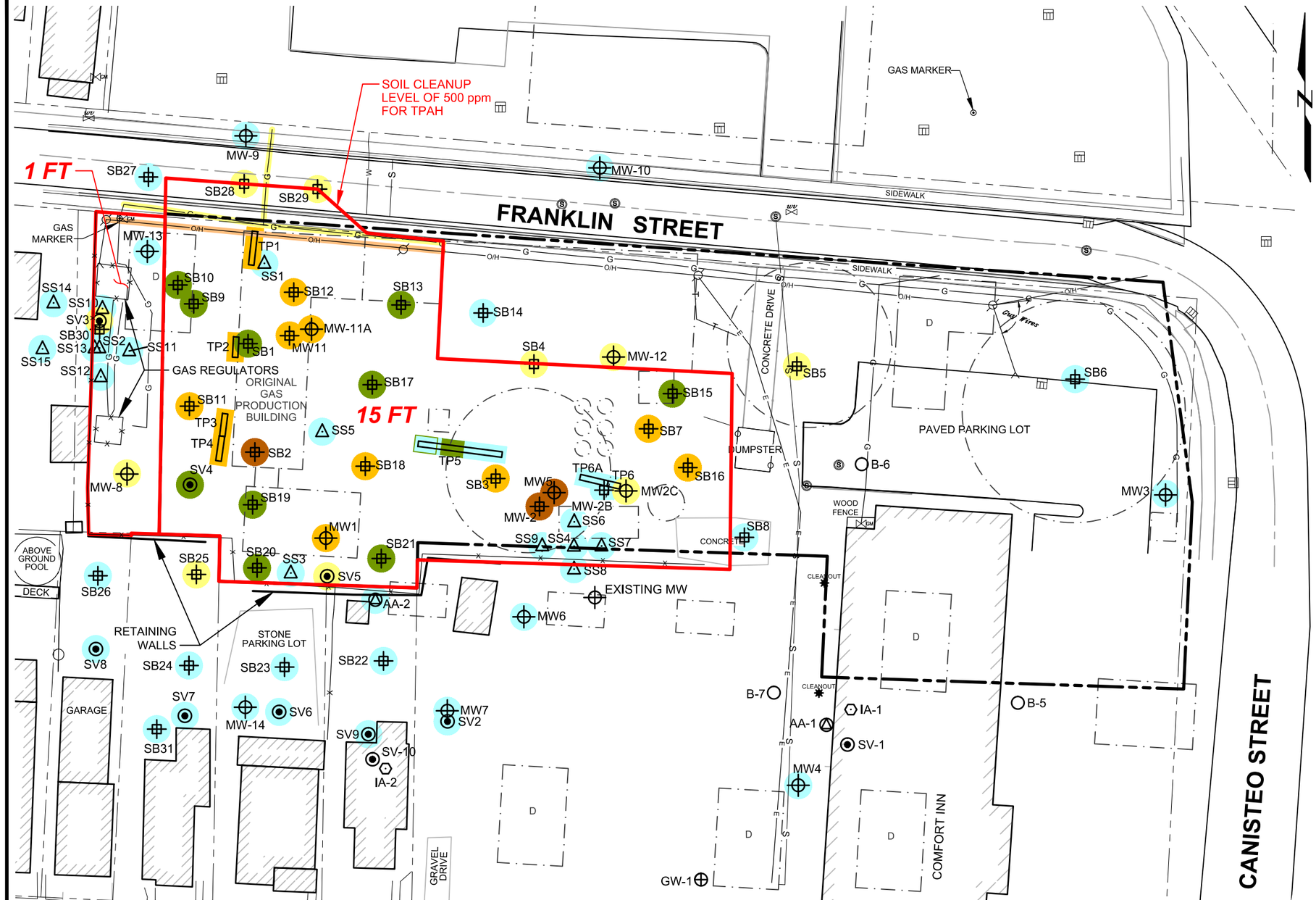
National Fuel Gas Distribution Company

GEI Consultants

ALTERNATIVE 2 -
SOIL REMOVAL ≤ 15 FEET,
MNA FOR DEEP SOILS

Project 1412830 | February 2018 | Fig. 8

\\ral1v-fs01\ \\ral1v-fs01\Data\CAD\Project\National Fuel Gas\Hornell\FS\Working\Figure 8_Hornell - FS.dwg - 8/27/2015



LEGEND

- APPROXIMATE SITE BOUNDARY (FROM NYSDEC)
- APPROXIMATE PROPERTY BOUNDARIES
- CHAIN-LINK FENCE
- EXISTING STRUCTURE
- APPROXIMATE LOCATION OF HISTORICAL STRUCTURES
- INDICATES DWELLING
- ELECTRIC OVERHEAD WIRE TO BE RELOCATED
- UNDERGROUND ELECTRIC LINE TO BE RELOCATED
- UNDERGROUND GAS LINE TO BE RELOCATED
- TELEPHONE LINE
- SANITARY SEWER LINE
- UTILITY POLE
- LIGHT POLE
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REMEDIAL INVESTIGATION SAMPLE LOCATIONS

- MW1 — MONITORING WELL LOCATION
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- B-1 — FORMER SOIL BORING LOCATION
- SS1 — SURFACE SOIL SAMPLE LOCATION

VISUAL IMPACTS

- NO IMPACTS
- MGP-LIKE ODORS
- TAR STAINING OR SHEEN
- TAR BLEBS, GLOBS, LENSES, STRINGERS, COATINGS
- TAR SATURATED

ALTERNATIVE 3:

- Relocate gas and electric lines
- Excavate soil exceeding 500 ppm TPAH on Former MGP Parcel, Gas Regulator Parcel and Franklin Street.
- 1-ft soil on MPG Parcel and Gas Regulator Parcel
- Groundwater Monitoring
- IC/ECs
- ISCO Wells on MGP Parcel to 26 ft

SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
2. City of Hornell, Steuben County, NY Tax Map No. 166.06 dated Oct. 18, 2008.
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0 40' 80'

SCALE: 1" = 40'

Feasibility Study Report
Hornell Former MGP Site
Hornell, New York

National Fuel Gas Distribution Company

GEI Consultants

ALTERNATIVE 3 - SOIL REMOVAL ≤ 15 FEET

Project 1412830 | February 2018 | Fig. 9a

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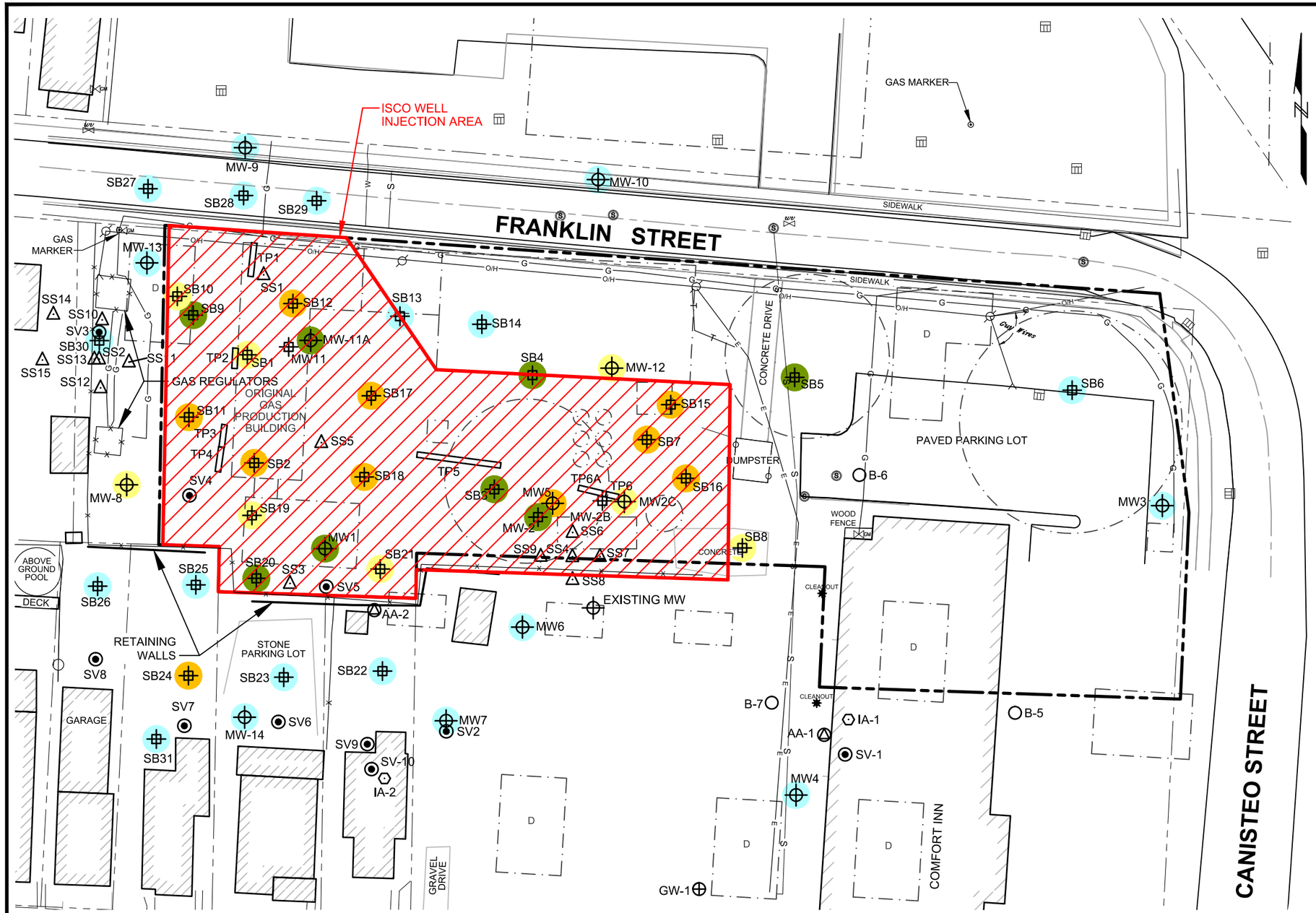

LEGEND

- APPROXIMATE SITE BOUNDARY (FROM NYSDEC)
- APPROXIMATE PROPERTY BOUNDARIES
- CHAIN-LINK FENCE
- EXISTING STRUCTURE
- APPROXIMATE LOCATION OF HISTORICAL STRUCTURES
- INDICATES DWELLING
- ELECTRIC OVERHEAD WIRE
- UNDERGROUND ELECTRIC LINE
- UNDERGROUND GAS LINE
- TELEPHONE LINE
- SANITARY SEWER LINE
- UTILITY POLE
- LIGHT POLE
- GAS METER
- WATER VALVE
- MANHOLE
- FIRE HYDRANT
- DROP INLET

REMEDIAL INVESTIGATION SAMPLE LOCATIONS

- MW1 — MONITORING WELL LOCATION
- SB1 — SOIL BORING LOCATION
- TP1 — TEST PIT LOCATION
- IA-1 — INDOOR AIR SAMPLE LOCATION
- AA-1 — AMBIENT AIR SAMPLE LOCATION
- SV-1 — SOIL VAPOR SAMPLE LOCATION
- GW-1 — FORMER MONITORING WELL LOCATION
- B-1 — FORMER SOIL BORING LOCATION
- SS1 — SURFACE SOIL SAMPLE LOCATION

VISUAL IMPACTS

- NO IMPACTS
- MGP-LIKE ODORS
- TAR STAINING OR SHEEN
- TAR BLEBS, GLOBS, LENSES, STRINGERS, COATINGS
- TAR SATURATED

ALTERNATIVE 3:

- Relocate gas and electric lines
- Excavate soil exceeding 500 ppm TPAH on Former MGP Parcel, Gas Regulator Parcel and Franklin Street.
- 1-ft soil on MGP Parcel and Gas Regulator Parcel
- Groundwater Monitoring
- IC/ECs
- ISCO Wells on MGP Parcel up to 26 ft.

SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
2. City of Hornell, Steuben County, NY Tax Map No. 166.06 dated Oct. 18, 2008.
3. *Modification to Order on Consent and Administrative Settlement, Attachment 1* between New York State Department of Environmental Conservation, Office of General Counsel, and National Fuel Gas dated Oct. 21, 2010.
4. Sanborn Fire Insurance Maps from 1888 to 1961.

0 40' 80'

SCALE: 1" = 40'

Feasibility Study Report
Hornell Former MGP Site
Hornell, New York

National Fuel Gas Distribution Company

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ALTERNATIVE 3 -
ISCO BELOW 15 FEET

Project 1412830 | February 2018 | Fig. 9b

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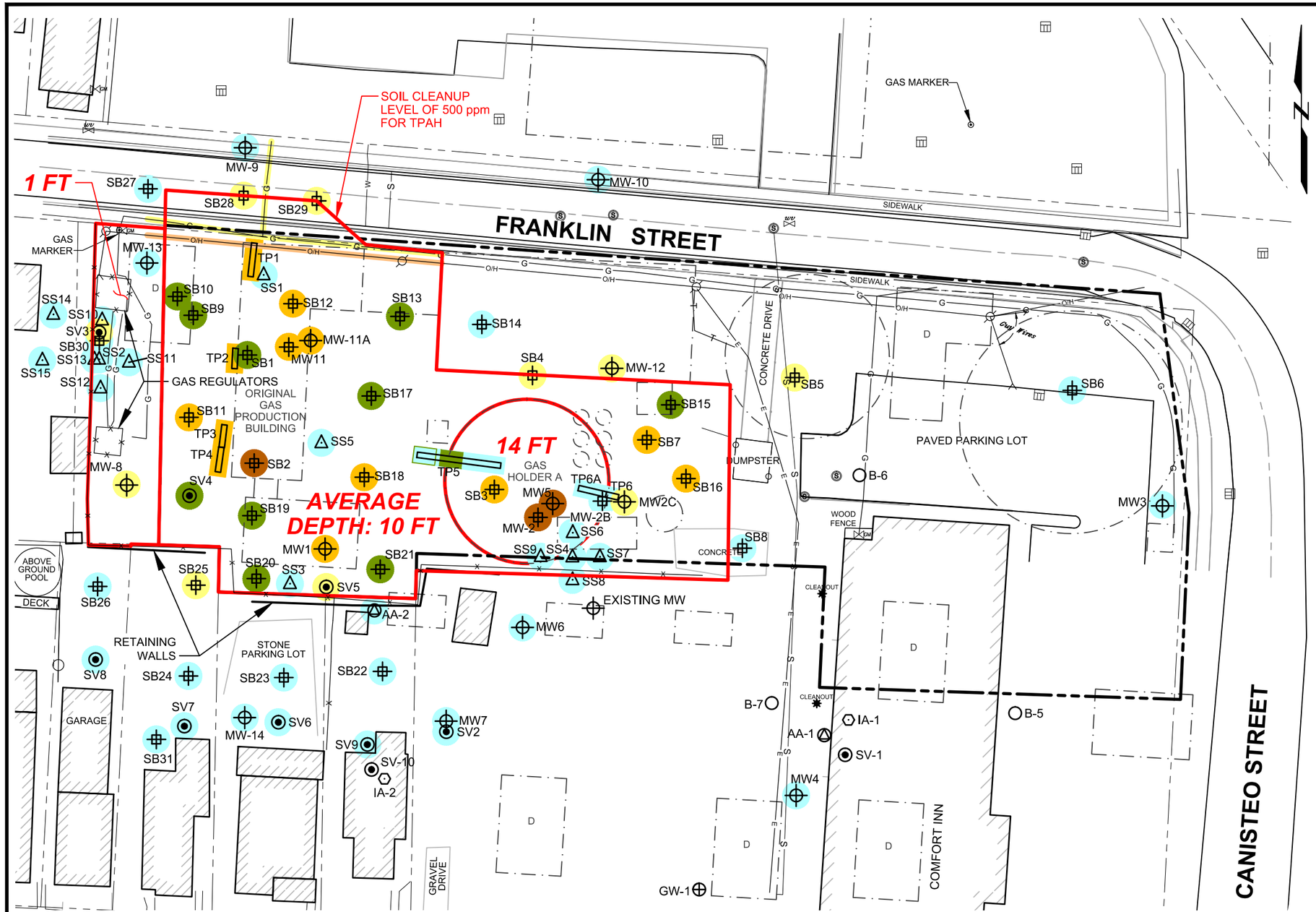

LEGEND

- APPROXIMATE SITE BOUNDARY (FROM NYSDEC)
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- CHAIN-LINK FENCE
- EXISTING STRUCTURE
- APPROXIMATE LOCATION OF HISTORICAL STRUCTURES
- INDICATES DWELLING
- ELECTRIC OVERHEAD WIRE TO BE RELOCATED
- UNDERGROUND ELECTRIC LINE TO BE RELOCATED
- UNDERGROUND GAS LINE TO BE RELOCATED
- TELEPHONE LINE
- SANITARY SEWER LINE
- UTILITY POLE
- LIGHT POLE
- GAS METER
- WATER VALVE
- MANHOLE
- FIRE HYDRANT
- DROP INLET

REMEDIAL INVESTIGATION SAMPLE LOCATIONS

- MW1 — MONITORING WELL LOCATION
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- SV-1 — SOIL VAPOR SAMPLE LOCATION
- GW-1 — FORMER MONITORING WELL LOCATION
- B-1 — FORMER SOIL BORING LOCATION
- SS1 — SURFACE SOIL SAMPLE LOCATION

VISUAL IMPACTS

- NO IMPACTS
- MGP-LIKE ODORS
- TAR STAINING OR SHEEN
- TAR BLEBS, GLOBS, LENSES, STRINGERS, COATINGS
- TAR SATURATED

ALTERNATIVE 4:

- Relocate gas and electric lines
- Excavate soil/debris exceeding 500 ppm TPAH in Franklin Street and gas regulator parcel. Pre-excavation of soils for ISS areas on Former MGP Parcel, .
- 1-ft soil on MPG Parcel and Gas Regulator Parcel
- Groundwater Monitoring & IC/ECs
- ISS of soils >15 ft with tar or NAPL on MGP Parcel.

SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
2. City of Hornell, Steuben County, NY Tax Map No. 166.06 dated Oct. 18, 2008.
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4. Sanborn Fire Insurance Maps from 1888 to 1961.

0 40' 80'

SCALE: 1" = 40'

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Hornell Former MGP Site
Hornell, New York

National Fuel Gas Distribution Company

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ALTERNATIVE 4 -
PRE-ISS SOIL REMOVAL

Project 1412830 | February 2018 | Fig. 10a

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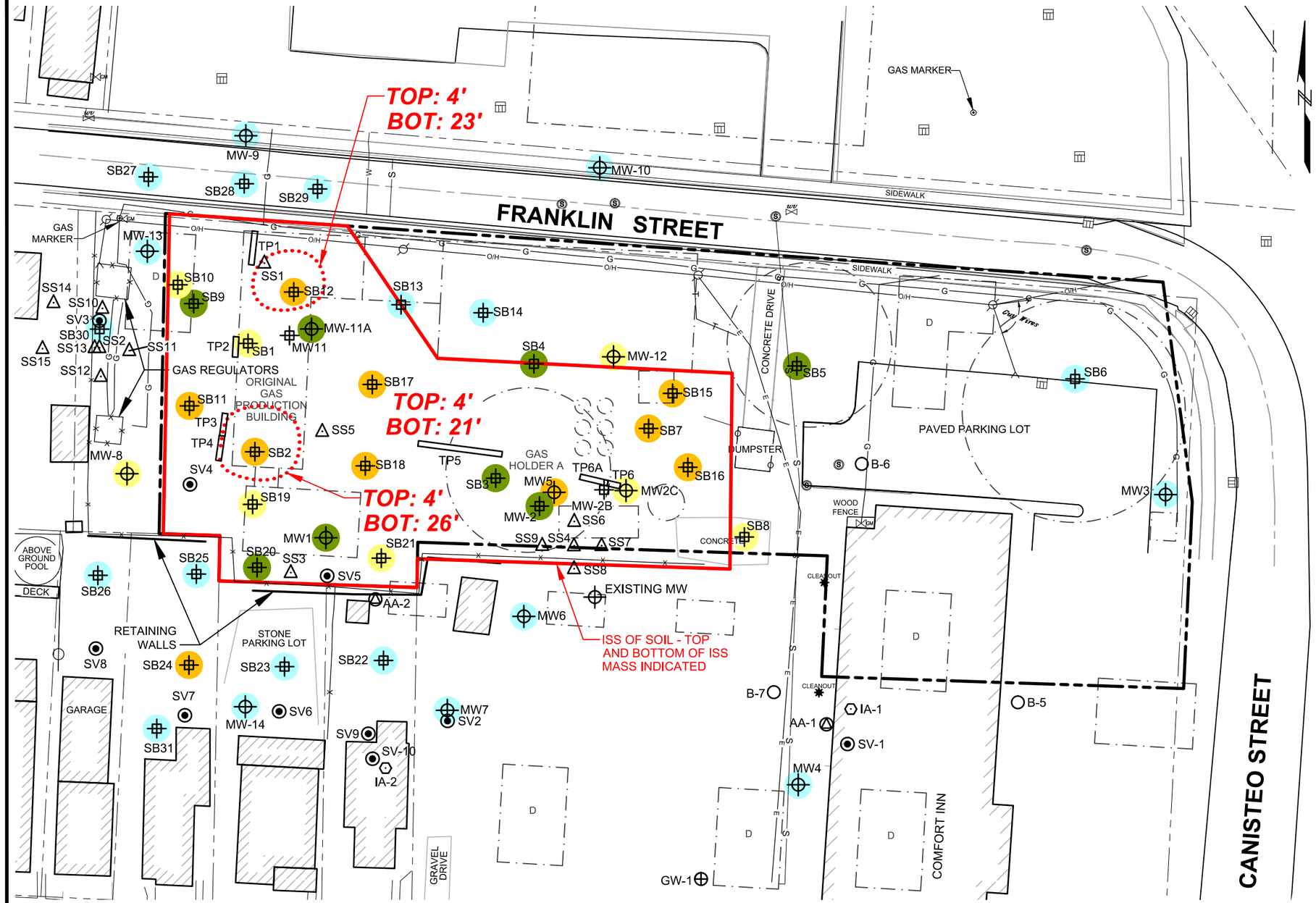

LEGEND

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- UNDERGROUND ELECTRIC LINE
- UNDERGROUND GAS LINE
- TELEPHONE LINE
- SANITARY SEWER LINE
- UTILITY POLE
- LIGHT POLE
- GAS METER
- WATER VALVE
- MANHOLE
- FIRE HYDRANT
- DROP INLET

TOP: 4' / **BOT: 23'** — TOP DEPTH (BGS) OF CURED ISS / BOTTOM DEPTH OF ISS

REMEDIAL INVESTIGATION SAMPLE LOCATIONS

- MW1 — MONITORING WELL LOCATION
- SB1 — SOIL BORING LOCATION
- TP1 — TEST PIT LOCATION
- IA-1 — INDOOR AIR SAMPLE LOCATION
- AA-1 — AMBIENT AIR SAMPLE LOCATION
- SV-1 — SOIL VAPOR SAMPLE LOCATION
- GW-1 — FORMER MONITORING WELL LOCATION
- B-1 — FORMER SOIL BORING LOCATION
- SS1 — SURFACE SOIL SAMPLE LOCATION

VISUAL IMPACTS

- NO IMPACTS
- MGP-LIKE ODORS
- TAR STAINING OR SHEEN
- TAR BLEBS, GLOBS, LENSES, STRINGERS, COATINGS
- TAR SATURATED

ALTERNATIVE 4:

- Relocate gas and electric lines
- Excavate soil/debris exceeding 500 ppm TPAH in Franklin Street and gas regulator parcel. Pre-excavation of soils for ISS areas on Former MGP Parcel.
- 1-ft soil on MGP Parcel and Gas Regulator Parcel
- Groundwater Monitoring & IC/ECs
- ISS of soils >15 ft with tar or NAPL on MGP Parcel.

SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
2. City of Hornell, Steuben County, NY Tax Map No. 166.06 dated Oct. 18, 2008.
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Hornell, New York

National Fuel Gas Distribution Company

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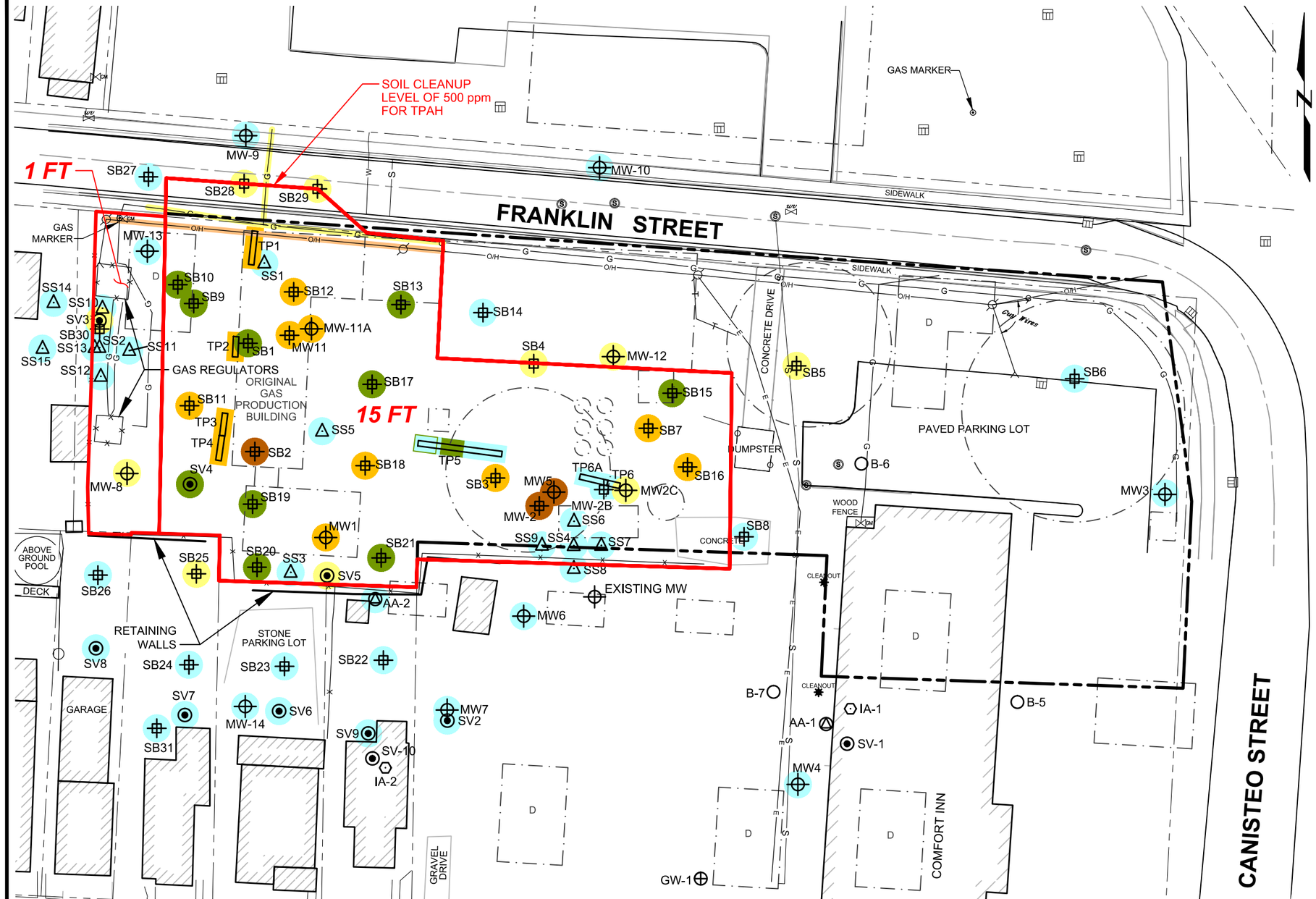
ALTERNATIVE 4 - DEPTHS OF TOP AND BOTTOM OF ISS

Project 1412830 | February 2018 | Fig. 10b



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VISUAL IMPACTS

- NO IMPACTS
- MGP-LIKE ODORS
- TAR STAINING OR SHEEN
- TAR BLEBS, GLOBS, LENSES, STRINGERS, COATINGS
- TAR SATURATED

ALTERNATIVE 5:

- Relocate gas and electric lines
- Excavate soil exceeding 500 ppm TPAH on Former MGP Parcel, Gas Regulator Parcel and Franklin Street.
- 1-ft soil on MPG Parcel and Gas Regulator Parcel
- Groundwater Monitoring & IC/ECs
- Excavation of soils >15 ft with tar or NAPL.

SOURCES:

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0 40' 80'

SCALE: 1" = 40'

Feasibility Study Report
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Hornell, New York

National Fuel Gas Distribution Company

GEI Consultants

ALTERNATIVE 5 - SOIL REMOVAL ≤ 15 FEET

Project 1412830 | February 2018 | Fig. 11a

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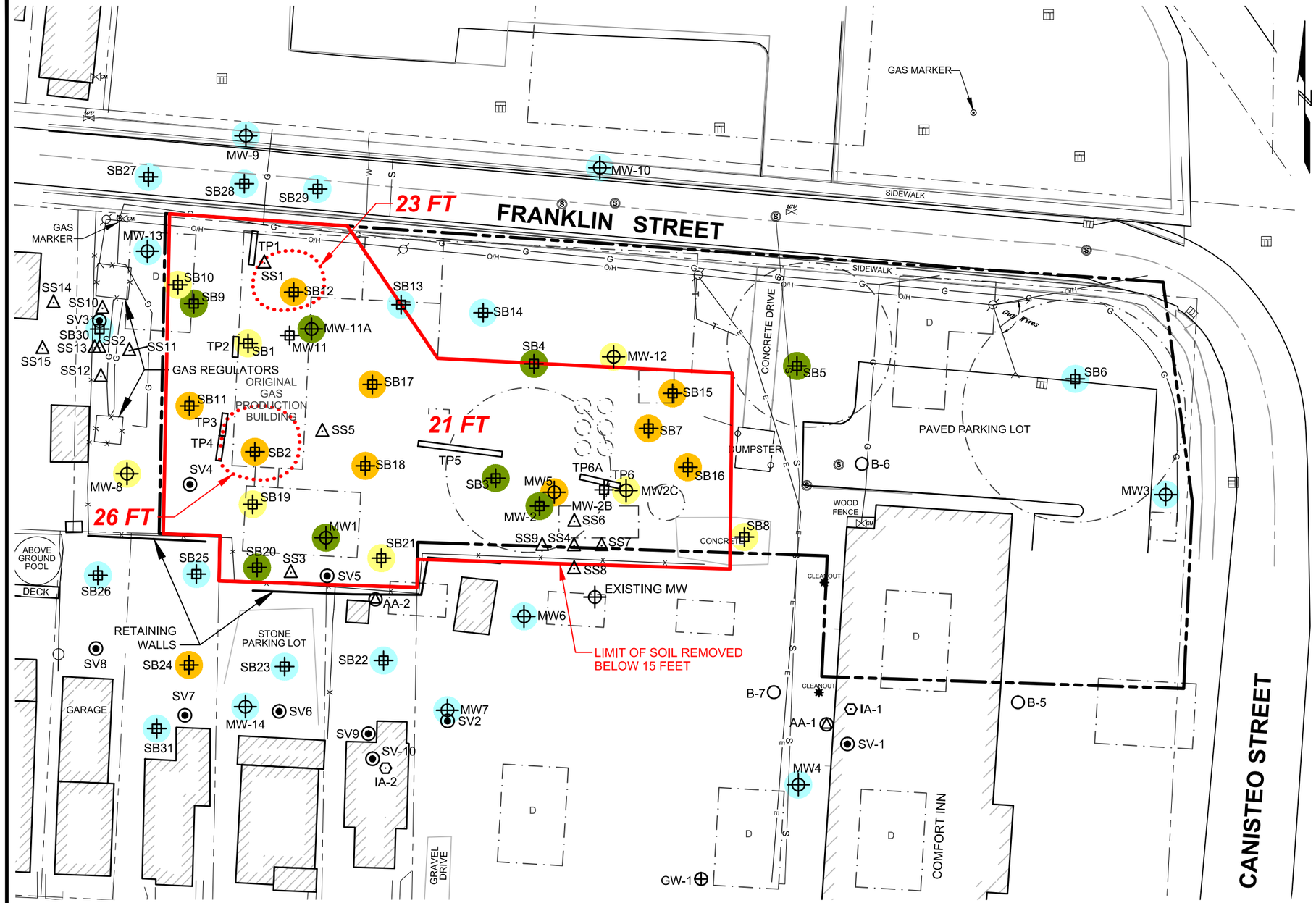

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REMEDIAL INVESTIGATION SAMPLE LOCATIONS

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- SV-1 — SOIL VAPOR SAMPLE LOCATION
- GW-1 — FORMER MONITORING WELL LOCATION
- B-1 — FORMER SOIL BORING LOCATION
- SS1 — SURFACE SOIL SAMPLE LOCATION

VISUAL IMPACTS

- NO IMPACTS
- MGP-LIKE ODORS
- TAR STAINING OR SHEEN
- TAR BLEBS, GLOBS, LENSES, STRINGERS, COATINGS
- TAR SATURATED

ALTERNATIVE 5:

- Relocate gas and electric lines
- Excavate soil exceeding 500 ppm TPAH on Former MGP Parcel, Gas Regulator Parcel and Franklin Street.
- 1-ft soil on MPG Parcel and Gas Regulator Parcel
- Groundwater Monitoring & IC/ECs
- Excavation of soils >15 ft with tar, NAPL or sheen on MGP and one Residential Parcel.

SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
2. City of Hornell, Steuben County, NY Tax Map No. 166.06 dated Oct. 18, 2008.
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0 40' 80'

SCALE: 1" = 40'

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Hornell, New York

National Fuel Gas Distribution Company

GEI Consultants

ALTERNATIVE 5 - REMOVAL OF SOIL > 15 FEET WITH TAR OR NAPL

Project 1412830 | February 2018 | Fig. 11b

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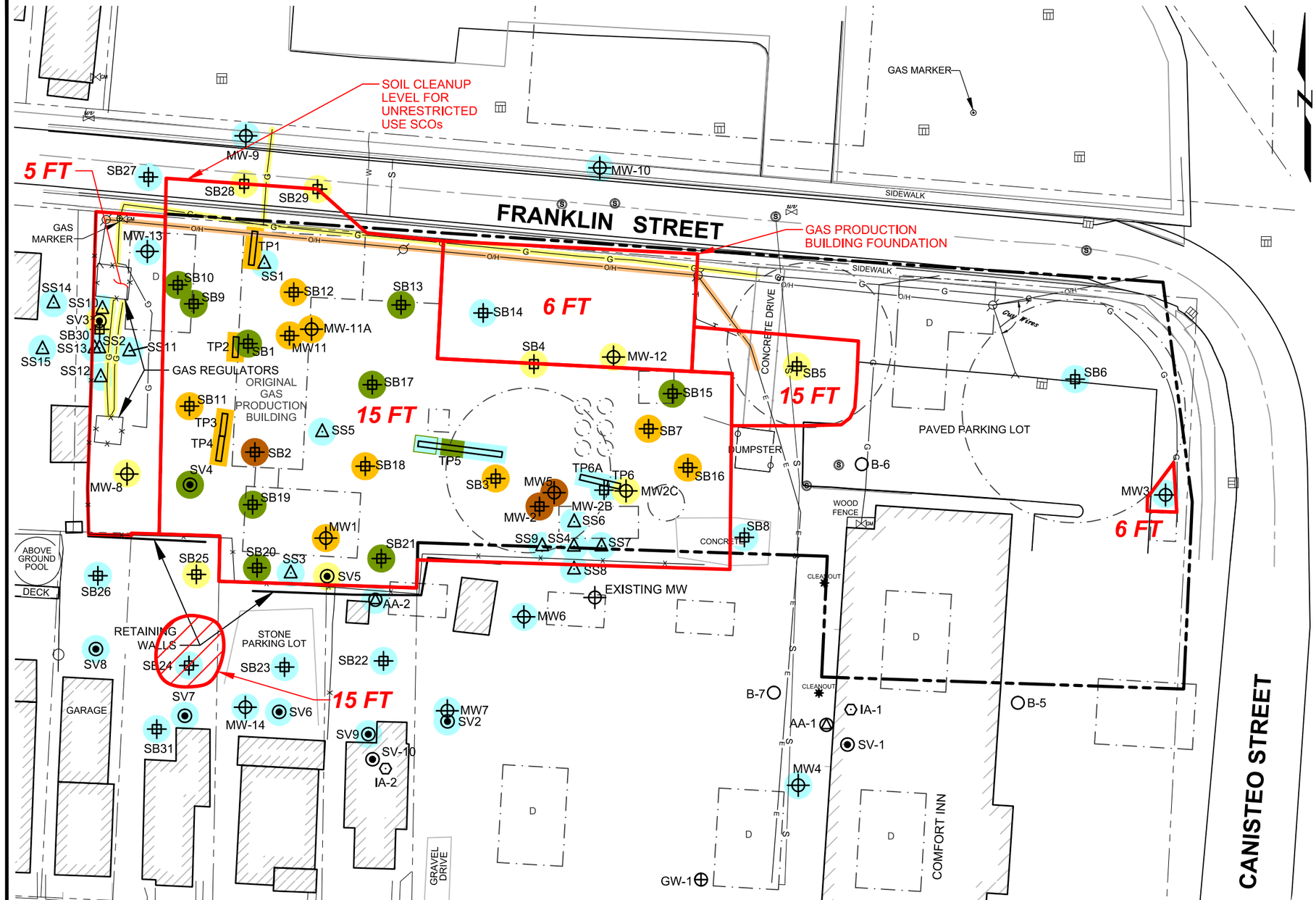

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- WATER VALVE
- MANHOLE
- FIRE HYDRANT
- DROP INLET

REMEDIAL INVESTIGATION SAMPLE LOCATIONS

- MW1 — MONITORING WELL LOCATION
- SB1 — SOIL BORING LOCATION
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- AA-1 — AMBIENT AIR SAMPLE LOCATION
- SV-1 — SOIL VAPOR SAMPLE LOCATION
- GW-1 — FORMER MONITORING WELL LOCATION
- B-1 — FORMER SOIL BORING LOCATION
- SS1 — SURFACE SOIL SAMPLE LOCATION

VISUAL IMPACTS

- NO IMPACTS
- MGP-LIKE ODORS
- TAR STAINING OR SHEEN
- TAR BLEBS, GLOBS, LENSES, STRINGERS, COATINGS
- TAR SATURATED

ALTERNATIVE 6:

- Relocate gas and electric lines
- Excavate soil exceeding Unrestricted Use SCOs for TPAH on Former MGP Parcel, Gas Regulator Parcel and Franklin Street.

SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
2. City of Hornell, Steuben County, NY Tax Map No. 166.06 dated Oct. 18, 2008.
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4. Sanborn Fire Insurance Maps from 1888 to 1961.

0 40' 80'

SCALE: 1" = 40'

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National Fuel Gas Distribution Company

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ALTERNATIVE 6 -
SOIL REMOVAL ≤ 15 FEET
(UNRESTRICTED USE)

Project 1412830 | February 2018 | Fig. 12a

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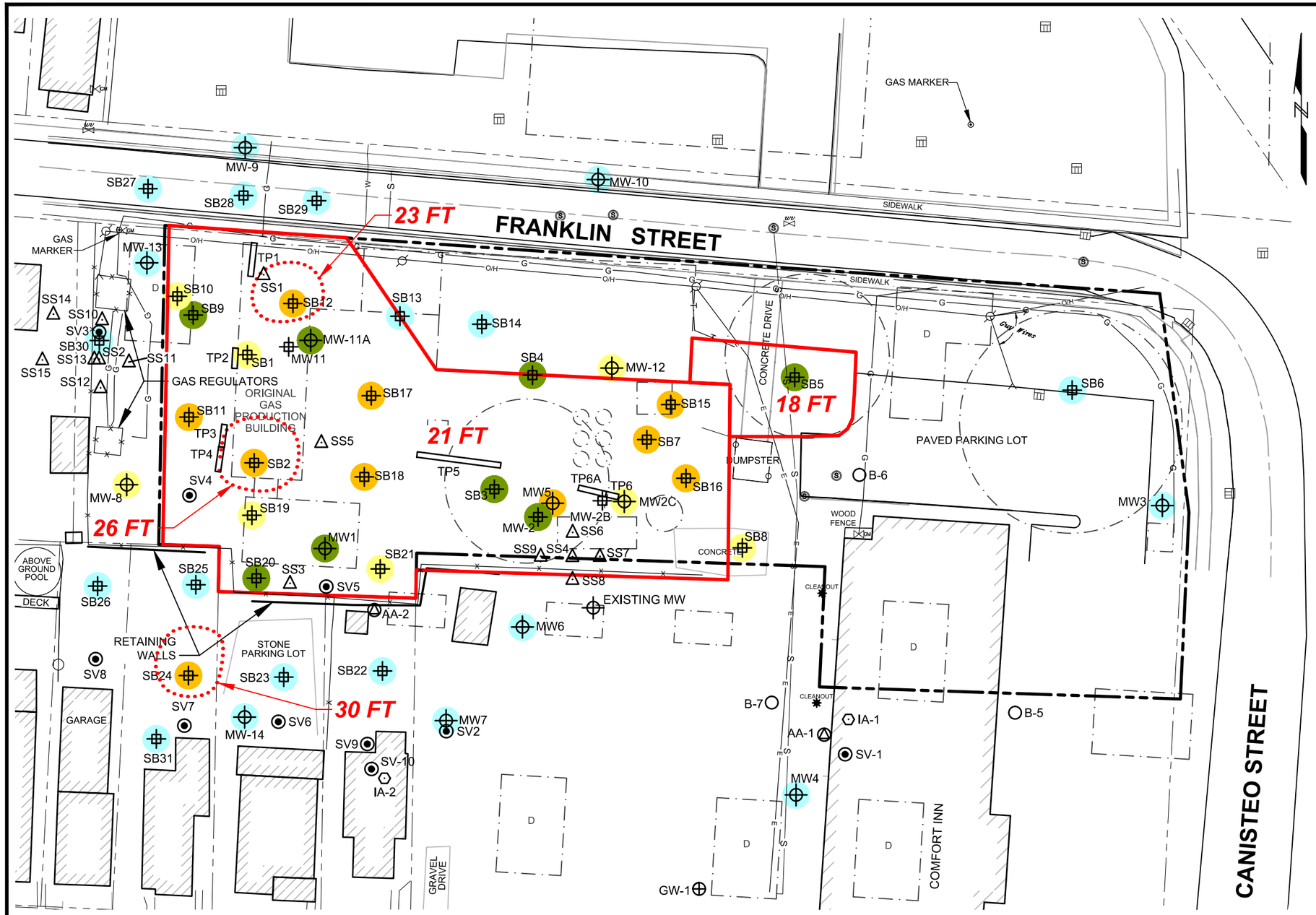

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- APPROXIMATE PROPERTY BOUNDARIES
- CHAIN-LINK FENCE
- EXISTING STRUCTURE
- APPROXIMATE LOCATION OF HISTORICAL STRUCTURES
- INDICATES DWELLING
- O/H — ELECTRIC OVERHEAD WIRE
- E — UNDERGROUND ELECTRIC LINE
- G — UNDERGROUND GAS LINE
- T — TELEPHONE LINE
- S — SANITARY SEWER LINE
- UTILITY POLE
- LIGHT POLE
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- WATER VALVE
- MANHOLE
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REMEDIAL INVESTIGATION SAMPLE LOCATIONS

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- B-1 — FORMER SOIL BORING LOCATION
- SS1 — SURFACE SOIL SAMPLE LOCATION

VISUAL IMPACTS

- NO IMPACTS
- MGP-LIKE ODORS
- TAR STAINING OR SHEEN
- TAR BLEBS, GLOBS, LENSES, STRINGERS, COATINGS
- TAR SATURATED

ALTERNATIVE 6:

- Relocate gas and electric lines
- Excavate soil exceeding Unrestricted Use SCOs for TPAH on Former MGP Parcel, Gas Regulator Parcel and Franklin Street.

SOURCES:

1. Survey prepared for GEI Consultants, Inc. by William J Tucker, II PLS #50369, Clear Creek Land Surveying, L.L.C., Springville, N.Y. dated February 11, 2011.
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0 40' 80'

SCALE: 1" = 40'

Feasibility Study Report
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National Fuel Gas Distribution Company

GEI Consultants

ALTERNATIVE 6 -
REMOVAL OF SOIL > 15 FEET
(UNRESTRICTED USE)

Project 1412830 | February 2018 | Fig. 12b

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Appendix A

Zoning and Property Use Information

City of Hornell

ZONING DISTRICTS

01/04/2001

SITE

Wal-Mart Plaza

Shaumat Park

Shaumat Industrial Park

Mobile Home Park

Maple City Park

James St Park

1 inch = 800 feet

N

8 Ward dist. number

Ward Boundaries

Overlay

- Business
- Park
- Residential

Zoning Codes

- B-1 Local
- B-2 General
- I-1 Light
- I-2 Heavy
- R-1 Single Family
- R-2 Residential Family
- R-3 Multi-Family

Steuben County Planning Dept
Thomas E. Sears
GIS Coordinator

ARTICLE III
Residential District Regulations

§ 315-6. Designation of residential districts; permitted uses.

Residential areas shall be designated as R-1, R-2 and R-3.

A. R-1 District uses shall be as follows:

(1) Principal buildings and uses: one-family dwelling; private garden; and government use. All one-family dwellings in any district must meet the standards in § 315-14.

(2) Accessory buildings and uses: recreational uses and private pools; fences and walls; and parking areas for automobiles accessory to one-family dwellings, and home occupations.

B. R-2 District uses shall be as follows:

(1) Principal buildings and uses: same as permitted in the R-1 District; bed-and-breakfast; church; cultural facilities; library; day-care home or center; and education use.

(2) Accessory buildings and uses: the same as permitted in R-1 Districts; the renting of rooms; signs consistent with other sections of this code; and storage garages.

C. R-3 District uses shall be as follows:

(1) Principal building and uses: the same as permitted in R-2 Districts; two-family dwellings; multifamily dwellings, including townhouse and apartment; hospital; and parking garage or lot.

(2) Accessory building and uses: the same as permitted in R-2 Districts; storage garages; and parking areas for automobiles accessory to multifamily dwellings.

§ 315-7. Number and location of buildings permitted on lot.

There will not be more than one one-family or one two-family dwelling permitted on a zoning lot. There may be more than one multifamily building on a zoning lot. In addition, there may be one or more accessory buildings on the same zoning lot with a main building if such accessory buildings are constructed subsequent to the main building in accordance with the regulations for such buildings set forth in this chapter. No one-family or two-family dwelling shall be located to the rear of any building on the same lot or on another lot that does not have the required frontage on a street. A group of multifamily buildings may be arranged in groups and not all directly front on a street.

§ 315-8. Accessory garages and parking facilities.

Private storage garages and open off-street parking areas shall be permitted on a zoning lot in a residential district if accessory to the permitted dwellings on the zoning lot, in accordance with the standards and regulations for such uses set forth in this chapter. Commercial vehicles

ARTICLE IV
Business District Regulations

§ 315-15. Purpose.

Business districts and their regulations are established herein in order to achieve, among others, the following purposes:

A. To provide, in appropriate and convenient locations, zoning districts of sufficient size for the exchange of goods and services and other business activities.

B. To provide B-1 Local Business Districts that do not attract a large volume of traffic to serve the needs for convenience goods and services in the immediate neighborhood.

C. To provide B-2 General Business Districts which do require larger land areas, which may be open in evenings and which generate large volumes of traffic serving the needs for both shopping and convenience goods and services of the entire community and region.

D. To protect adjacent residential neighborhoods by regulating the types and spacing of business uses, particularly at common boundaries, which would create hazards, noise, odors and the other objectionable influences.

E. To promote the most desirable land use and traffic patterns in accordance with the goals and the objectives of this chapter.

§ 315-16. Exception to applicability.

The ten-foot front yard building restriction shall not apply in the business area on the arterial route (Maple City Drive), Broadway and Main Street on both sides of the street from Center Street to West Street.

§ 315-17. Designation of business districts; permitted uses.

A. B-1 Local Business District. Building and land in B-1 Local Business Districts shall be used and buildings shall be created, altered and moved only for the uses set forth as permitted in the following regulations:

(1) Principal buildings and uses. Principal buildings and uses shall be as follows:

(a) Residential uses permitted and as regulated in the nearest adjacent residential district to the lot or parcel under consideration, amusement center, art gallery, bank/financial institution, bed-and-breakfast, car wash, church, medical clinic, commercial uses including commercial recreation, cultural facilities, drive-in uses, funeral homes, service station, convenience store, government use, hotel, motel, inn, motor court, library, day-care home or center, nursing home, office, parking garage or lot, education, professional service, repair shop, restaurant, retail store and laundromat.

(b) If allowed, residential and professional service uses are preferably located above the first story of any multistory building and may be located in the

first story of a multistory building only upon demonstration that no site or building within the district has suitable and available space for such use.

(2) Permitted accessory uses.

(a) Any accessory use, such as sales in open yards and the storage of goods or processing operations, which is clearly incidental to conducting a retail business, office or service establishment which is a permitted main use in a B-1 Local Business District shall be permitted, provided that such use has no injurious effect on adjoining zoning lots.

(b) Off-street parking and loading facilities and signs shall be provided in accordance with the off-street parking and loading and sign regulation of this chapter.

(c) Signs and fences consistent with the supplemental regulations of this code.

B. B-2 General Business District. Buildings and land in B-2 General Business Districts shall be erected, altered and moved only for the uses set forth as permitted in the following regulations:

(1) Principal main buildings and uses. Principal uses shall be as follows: buildings and uses permitted as regulated in any B-1 Local Business District, animal hospital, bar/nightclub not including adult entertainment, bus station, club, greenhouses, motor vehicle sales, storage garage, theater, warehousing and wholesale centers.

(2) Permitted accessory uses.

(a) Any accessory use, such as sales in open yards and the storage of goods or processing operations, which is clearly incidental to conducting a retail business, office or service establishment which is a permitted main use in a B-2 General Business District shall be permitted, provided that such accessory use has no injurious effect on the adjoining zoning lots.

(b) Off-street parking and loading facilities shall be provided in accordance with the off-street parking and loading regulations of this chapter.

(c) Signs and fences consistent with the supplemental regulations of this code.

§ 315-18. Area yard and height regulations.

Buildings and land in business districts shall be used, and buildings shall be erected, altered and moved only in accordance with the following schedule and regulations.[12]

A. Front yards. The front yard depth or setback for buildings and uses shall not be less than as set forth in Schedule II of this chapter.[13] Whenever off-street parking areas are proposed in front yards, a front yard depth greater than as showing in Schedule II may be

12. **Editor's Note: See Schedule II, Business Districts Yard Requirements, at the end of this chapter.**

13. **Editor's Note: See Schedule II, Business Districts Yard Requirements, at the end of this chapter.**

Appendix B

Remedial Alternative Cost Estimates

Table B-1
Cost Evaluation - Alternatives Summary
Hornell MGP Site FS

Alternative	Description	Total Cost (2015 $)
Alternative 1	No Action	No Cost
Alternative 2	Excavation of soil to 15 ft in main site, 1 ft soil removal in gas regulator area, and re-grading for cover, groundwater monitoring, IC/ECs	$4,330,000
Alternative 3	Excavation of soil to 15 ft in main site, 1 ft soil removal in gas regulator area, ISCO soil within and below main area (15-26 ft), and re-grading for cover, groundwater monitoring, IC/ECs	$5,650,000
Alternative 4	Excavation of soil to 15 ft in street, excavation of soil to pre-excavation depths (depending on total depths), 1 ft soil removal in gas regulator area, ISS soil within and below main area (15-26 ft), and re-grading for cover, groundwater monitoring, IC/ECs	$4,210,000
Alternative 5	Excavation of grossly impacted soil to depths up to 26 ft and re-grading for cover, groundwater monitoring, IC/ECs	$7,050,000
Alternative 6	Excavation of soil to Unrestricted Use SCOs (to 26-30 feet), backfill and site restoration	$8,080,000

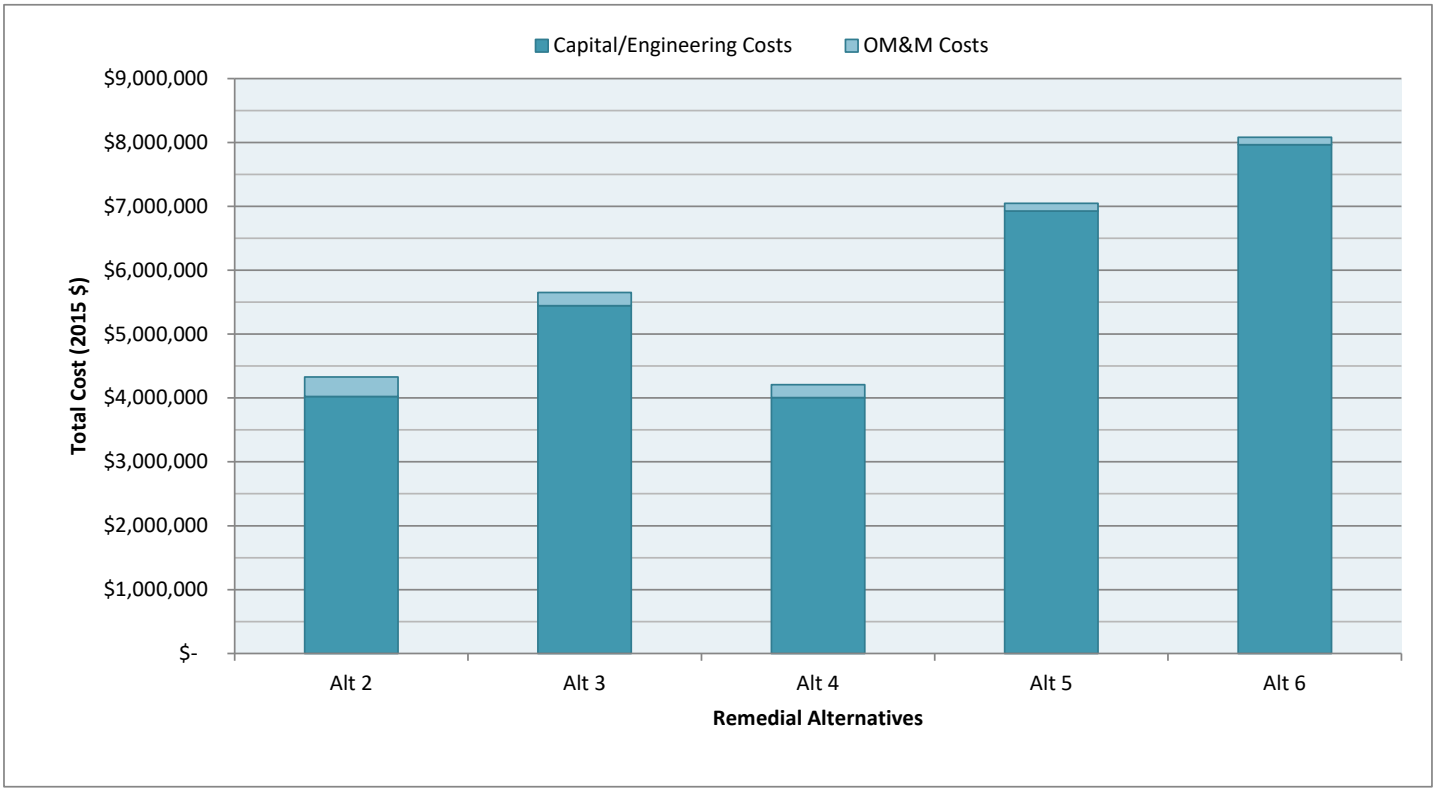

Table B-2 - Alternative 2
Cost Evaluation - Alternatives Summary
Hornell MGP Site FS

Total Cost (2015 $)

Remedial Component	Unit	Unit Price	Quantity	Total Cost
COMMON COST COMPONENTS				
100 ENGINEERING				
101 Engineering Design, Contract Drawings	Lump Sum	$80,000	1	$80,000
102 Draft Work Plan for NYSDEC Review	Lump Sum	$25,000	1	$25,000
103 Draft of Completion Report	Lump Sum	$30,000	1	$30,000
			Subtotal	$135,000
			% Total Costs	3%
			TOTAL ENGINEERING COSTS	**$135,000**
200 CONSTRUCTION MANAGEMENT				
201 Construction Oversight (including CAMP oversight)	Month	$31,675	2.5	$79,200
202 CAMP Technician	Month	$19,000	2.5	$47,500
203 CAMP Equipment Rental	Month	$6,875	2.5	$17,188
204 Pre-characterization sampling	Each	$425	59	$25,039
206 Project Management (including OM&M period)	Month	$27,500	3	$68,750
			Subtotal	$237,677
			% Total Costs	5%
300 REMEDIAL COMPONENTS				
301 Utility Relocation (Sanitary sewer, gas line & reg. station, OH utility lines)	Lump Sum	$50,000	1	$50,000
302 Mobilization / Demobilization	Lump Sum	$100,000	1	$100,000
303 Survey and Layout Work	Acre	$4,000	1	$4,000
305 Temporary Facilities	Month	$1,700	2.5	$4,250
306 Temporary Fence	Linear Foot	$27.65	530	$14,655
Earthwork				
307 Excavation Support for soil removal adjacent to Franklin St - Sheet Pile	Square Foot	$45	4725	$212,625
308 Excavation of 15 ft overburden	Cubic Yard	$25	13690	$342,250
310 Odor Control - Odor suppressant foam	Month	$20,000	2	$40,000
316 Disposal - Soil - Landfill	Ton	$60	18440	$1,106,400
315 Disposal - Soil - Thermal Desorption	Ton	$100	6150	$615,000
316a Disposal - Non-impacted Demolition Debris	Ton	$40	2747	$109,872
317 Backfill	Cubic Yard	$22	13690	$301,180
Soil Cover and Asphalt Restoration				
324 Borrow, compaction, grading, and seeding for 1-ft cover	Cubic Yard	$40	1000	$40,000
325 Asphalt along Franklin (3 inches thick)	Ton	$99	50	$4,950
Institutional Controls / Engineering Controls				
326 Environmental Easement, Groundwater Restrictions	Lump Sum	$10,000	1	$10,000
327 Site Management Plan	Lump Sum	$25,000	1	$25,000
Soil Cover and Asphalt Restoration			**Subtotal**	$2,980,182
			% Total Costs	69%
			TOTAL CAPITAL COSTS	**$3,217,858**
400 OPERATION AND MAINTENANCE				
First 5 Years Post Remediation				
402 Sample Collection	Semi-Annual	$4,832	2	$9,664
403 Lab Costs	Semi-Annual	$2,280	2	$4,560
404 Validation	Semi-Annual	$792	2	$1,584
405 Reports	Semi-Annual	$5,000	2	$10,000
406 EC Inspection	Annual	$1,100	1	$1,100
			Annual Subtotal	$26,908
Subsequent 25 Years				
402 Sample Collection	Annual	$4,832	1	$4,832
403 Lab Costs	Annual	$760	1	$760
404 Validation	Annual	$792	1	$792
405 Reports	Annual	$5,000	1	$5,000
406 EC Inspection	Annual	$1,100	1	$1,100
			Annual Subtotal	$12,484
			Present Worth Given a 30 Year Period with 5% Effective Rate	$ 254,358.05
			% Total Costs	6%
			TOTAL O&M COSTS	**$254,358**
REMEDIAL COST SUMMARY				
Total Engineering Costs				$135,000
Total Capital Costs				$3,217,858
Total Operation and Maintenance Costs				$254,358
			Total Capital, O&M, and Engineering Costs	**$3,607,216**
500 CONTINGENCY				
501 Allowance for Undefined Costs Associated with Utilities, Subsurface Structures, and Extent of Impacts.			20%	$721,443.25
			TOTAL COST	**$ 4,328,659**
			ROUNDED COST	**$4,330,000**

Table B-3 - Alternative 3
Cost Evaluation - Alternatives Summary
Hornell MGP Site FS

Total Cost (2015 $)

Remedial Component	Unit	Unit Price	Quantity	Total Cost
COMMON COST COMPONENTS				
100 ENGINEERING				
101 Engineering Design, Contract Drawings	Lump Sum	$130,000	1	$130,000
102 Draft Work Plan for NYSDEC Review	Lump Sum	$30,000	1	$30,000
103 Draft of Completion Report	Lump Sum	$40,000	1	$40,000
			Subtotal	$200,000
			% Total Costs	4%
		TOTAL ENGINEERING COSTS		**$200,000**
200 CONSTRUCTION MANAGEMENT				
201 Construction Oversight	Month	$31,675	3.25	$102,900
202 CAMP Technician	Month	$15,000	3.25	$48,750
203 CAMP Equipment Rental	Month	$6,875	3.25	$22,344
204 Pre-design investigation/pre-characterization/confirmation sampling	Each	$425	75	$31,784
205 ISCO Bench Scale Study	Each	$30,000	1	$30,000
206 Project Management (including OM&M period)	Lump Sum	$71,000	1	$71,000
			Subtotal	$306,778
			% Total Costs	5%
300 REMEDIAL COMPONENTS				
301 Utility Relocation (Sanitary sewer, gas line & reg. station, OH utility lines)	Lump Sum	$50,000	1	$50,000
302 Mobilization / Demobilization	Lump Sum	$100,000	1	$100,000
303 Survey and Layout Work	Acre	$4,000	1	$4,000
305 Temporary Facilities	Month	$1,700	3.25	$5,525
306 Temporary Fence	Linear Foot	$27.65	530	$14,655
Earthwork				
307 Excavation Support for soil removal adjacent to Franklin St - Sheet Pile	Square Foot	$45	4725	$212,625
309 Excavation of 15 ft overburden	Cubic Yard	$25	13690	$342,250
310 Odor Control - Odor suppressant foam	Month	$20,000	2	$40,000
316 Disposal - Soil - Landfill	Ton	$60	18440	$1,106,400
315 Disposal - Soil - Thermal Desorption	Ton	$100	6150	$615,000
316a Disposal - Non-impacted Demolition Debris	Ton	$40	2747	$109,872
317 Backfill	Cubic Yard	$22	13690	$301,180
In-Situ Chemical Oxidation (ISCO)				
318 Initial ISCO Batch testing and injection	Lump Sum	$547,640	1	$547,640
319 Additional Injections	Lump Sum	$481,923	1	$481,923
320 Sampling and Analysis	each	$250.00	80	$20,000
Soil Cover and Asphalt Restoration				
324 Borrow, compaction, grading, and seeding for 1-ft cover	Cubic Yard	$40	1000	$40,000
325 Asphalt along Franklin (3 inches thick)	Ton	$99	50	$4,950
Institutional Controls / Engineering Controls				
327 Environmental Easement, Groundwater Restrictions	Lump Sum	$10,000	1	$10,000
328 Site Management Plan	Lump Sum	$25,000	1	$25,000
			Subtotal	$4,031,020
			% Total Costs	71%
		TOTAL CAPITAL COSTS		**$4,337,798**
400 OPERATION AND MAINTENANCE				
First 5 Years Post Remediation				
401 Sample Collection	Semi-Annual	$4,832	2	$9,664
402 Lab Costs	Semi-Annual	$760	2	$1,520
403 Validation	Semi-Annual	$792	2	$1,584
404 Reports	Semi-Annual	$5,000	2	$10,000
405 EC Inspection	Annual	$1,100	1	$1,100
			Annual Subtotal	$23,868
Subsequent 25 Years				
404 Reports	Annual	$5,000	1	$5,000
405 EC Inspection	Annual	$1,100	1	$1,100
			Annual Subtotal	$6,100
		Present Worth Given a 30 Year Period with 5% Effective Rate		$ 170,698.09
			% Total Costs	3%
		TOTAL O&M COSTS		**$170,698**
REMEDIAL COST SUMMARY				
Total Engineering Costs				$200,000
Total Capital Costs				$4,337,798
Total Operation and Maintenance Costs				$170,698
Total Capital, O&M, and Engineering Costs				**$4,708,496**
500 CONTINGENCY				
501 Allowance for Undefined Costs Associated with Utilities, Subsurface Structures, and Extent of Impacts.			20%	$941,699.18
			TOTAL COST	**$ 5,650,195**

Table B-4 - Alternative 4
Cost Evaluation - Alternatives Summary
Hornell MGP Site FS

Total Cost (2015 $)

Remedial Component	Unit	Unit Price	Quantity	Total Cost
COMMON COST COMPONENTS				
100 ENGINEERING				
101 Engineering Design, Contract Drawings	Lump Sum	$185,000	1	$185,000
102 Draft Work Plan for NYSDEC Review	Lump Sum	$40,000	1	$40,000
103 Draft of Completion Report	Lump Sum	$45,000	1	$45,000
			Subtotal	$270,000
			% Total Costs	6%
		TOTAL ENGINEERING COSTS		**$270,000**
200 CONSTRUCTION MANAGEMENT				
201 Construction Oversight	Month	$31,675	3.5	$110,900
202 CAMP Technician	Month	$19,000	3.5	$66,500
203 CAMP Equipment Rental	Month	$6,875	3.5	$24,063
204 Pre-design investigation/pre-characterization/confirmation sampling	Each	$425	59	$25,039
205 ISS Bench Scale Study	Each	$60,000	1	$60,000
206 Project Management (including OM&M period)	Lump Sum	$71,000	1	$71,000
			Subtotal	$357,502
			% Total Costs	8%
300 REMEDIAL COMPONENTS				
301 Utility Relocation (Sanitary sewer, gas line & reg. station, OH utility lines)	Lump Sum	$50,000	1	$50,000
302 Mobilization / Demobilization	Lump Sum	$100,000	1	$100,000
303 Survey and Layout Work	Acre	$6,000	1	$6,000
305 Temporary Facilities	Month	$1,700	3.5	$5,950
306 Temporary Fence	Linear Foot	$27.65	530	$14,655
Earthwork				
307 Excavation Support for soil removal adjacent to Franklin St - Sheet Pile	Square Foot	$45	4190	$188,528
308 Pre-Excavation of overburden & debris	Cubic Yard	$25	9160	$229,000
310 Odor Control - Odor suppressant foam	Month	$20,000	2	$40,000
316 Disposal - Soil - Landfill	Ton	$60	7,340	$440,400
317 Disposal - Soil - Thermal Desorption	Ton	$100	2,447	$244,700
Disposal - Non-impacted demolition debris	Ton	$40	2,747	$109,880
318 Backfill to original grade	Cubic Yard	$22	4,790	$105,380
In-Situ Solidification (ISS)				
320 ISS and jet grouting equipment and batch plant mobilization	Lump Sum	$370,000	1	$370,000
321 Water for ISS mix	Gal	$0.05	40500	$2,025
322 Auger ISS	Cubic Yard	$80	9030	$722,370
Soil Cover and Asphalt Restoration				
324 Borrow, compaction, grading, and seeding for 1-ft cover	Cubic Yard	$40	1000	$40,000
325 Asphalt along Franklin (3 inches thick)	Ton	$99	50	$4,950
Institutional Controls / Engineering Controls				
326 Environmental Easement, Groundwater Restrictions	Lump Sum	$10,000	1	$10,000
327 Site Management Plan	Lump Sum	$25,000	1	$25,000
			Subtotal	$2,708,837
			% Total Costs	64%
		TOTAL CAPITAL COSTS		**$3,066,339**
400 OPERATION AND MAINTENANCE				
First 5 Years Post Remediation				
401 Sample Collection	Semi-Annual	$4,832	2	$9,664
402 Lab Costs	Semi-Annual	$760	2	$1,520
403 Validation	Semi-Annual	$792	2	$1,584
404 Reports	Semi-Annual	$5,000	2	$10,000
405 EC Inspection	Annual	$1,100	1	$1,100
			Annual Subtotal	$23,868
Subsequent 25 Years				
404 Reports	Annual	$5,000	1	$5,000
405 EC Inspection	Annual	$1,100	1	$1,100
			Annual Subtotal	$6,100
		Present Worth Given a 30 Year Period with 5% Effective Rate		$ 170,698.09
			% Total Costs	4%
		TOTAL O&M COSTS		**$170,698**
REMEDIAL COST SUMMARY				
Total Engineering Costs				$270,000
Total Capital Costs				$3,066,339
Total Operation and Maintenance Costs				$170,698
Total Capital, O&M, and Engineering Costs				**$3,507,037**
500 CONTINGENCY				
501 Allowance for Undefined Costs Associated with Utilities, Subsurface Structures, and Extent of Impacts.			20%	$701,407.43
			TOTAL COST	**$ 4,208,445**

Table B-5 - Alternative 5
Cost Evaluation - Alternatives Summary
Hornell MGP Site FS

Total Cost (2015 $)

Remedial Component	Unit	Unit Price	Quantity	Total Cost
COMMON COST COMPONENTS				
100 ENGINEERING				
101 Engineering Design, Contract Drawings	Lump Sum	$175,000	1	$175,000
102 Draft Work Plan for NYSDEC Review	Lump Sum	$45,000	1	$45,000
103 Draft of Completion Report	Lump Sum	$60,000	1	$60,000
104 Strategic planning and permitting with regulators	Lump Sum	$40,000	1	$40,000
			Subtotal	$320,000
			% Total Costs	5%
		TOTAL ENGINEERING COSTS		**$320,000**
200 CONSTRUCTION MANAGEMENT				
201 Construction Oversight	Month	$31,675	3.5	$110,900
202 CAMP Technician	Month	$15,000	3.5	$52,500
203 CAMP Equipment Rental	Month	$6,875	3.5	$24,063
204 Pre-design investigation (including utility recon)/pre-characterization	Each	$425	85	$36,324
206 Project Management	Lump Sum	$249,047	1	$249,047
			Subtotal	$472,833
			% Total Costs	7%
300 REMEDIAL COMPONENTS				
301 Utility Relocation (Relocate sanitary sewer, gas line, overhead utility lines)	Lump Sum	$75,000	1	$75,000
302 Mobilization / Demobilization	Lump Sum	$100,000	1	$100,000
303 Survey and Layout Work	Acre	$3,882	1.5	$5,822
305 Temporary Facilities	Month	$1,539.94	3.5	$5,390
306 Temporary Fence	Linear Foot	$27.65	530	$14,655
Excavation				
307 Shallow Excavation (to 15 ft bgs)	Cubic Yard	$25	12,640	$316,000
308 Deep Excavation	Cubic Yard	$35	4130	$144,550
309 Excavation Support for soil removal - Sheet Pile	Square Foot	$45	22080	$993,600
310 Odor Control - Odor suppressant foam	Month	$20,000	3	$60,000
313 Dewatering Equipment - Local	Month	$20,000	3	$60,000
314 Disposal - Water pre-treatment and disposal at POTW facility	gal	$0.1	3,750,000	$375,000
315 Disposal - Soil - Landfill	Ton	$60	24,450	$1,467,000
316 Disposal - Soil - Thermal Desorption	Ton	$100	8150	$815,036
317 Disposal - Non-impacted Demolition Debris	Ton	$40	2750	$110,000
318 Backfill	Cubic Yard	$22	16770	$368,940
Surface Soil (outside excavation limits) and Asphalt Restoration				
324 Borrow, compaction, grading, and seeding for (1ft thick)	Cubic Yard	$40	1000	$40,000
325 Asphalt along Franklin (3 inches thick)	Ton	$99	50	$4,950
Institutional Controls / Engineering Controls				
326 Environmental Easement, Groundwater Restrictions	Lump Sum	$10,000	1	$10,000
327 Site Management Plan	Lump Sum	$15,000	1	$15,000
			Subtotal	$4,980,943
			% Total Costs	71%
		TOTAL CAPITAL COSTS		**$5,453,776**
400 OPERATION AND MAINTENANCE				
5 Years Post Remediation				
401 Sample Collection	Semi-Annual	$4,832	2	$9,664
402 Lab Costs	Semi-Annual	$760	2	$1,520
403 Validation	Semi-Annual	$792	2	$1,584
404 Reports	Semi-Annual	$5,000	2	$10,000
			Annual Subtotal	$22,768
		Present Worth Given a 5 Year Period with 5% Effective Rate		$ 98,573.52
			% Total Costs	1%
		TOTAL O&M COSTS		**$98,574**
REMEDIAL COST SUMMARY				
Total Engineering Costs				$320,000
Total Capital Costs				$5,453,776
Total Operation and Maintenance Costs				$98,574
Total Capital, O&M, and Engineering Costs				**$5,872,349**
500 CONTINGENCY				
501 Allowance for Undefined Costs Associated with Utilities, Subsurface Structures, and Extent of Impacts.			20%	$1,174,469.85
			TOTAL COST	**$ 7,046,819**
		ROUNDED COST		**$7,050,000**

Table B-6 - Alternative 6
Cost Evaluation - Alternatives Summary
Hornell MGP Site FS

Total Cost (2015 $)

Remedial Component	Unit	Unit Price	Quantity	Total Cost
COMMON COST COMPONENTS				
100 ENGINEERING				
101 Engineering Design, Contract Drawings	Lump Sum	$175,000	1	$175,000
102 Draft Work Plan for NYSDEC Review	Lump Sum	$45,000	1	$45,000
103 Draft of Completion Report	Lump Sum	$60,000	1	$60,000
104 Strategic planning and permitting with regulators	Lump Sum	$40,000	1	$40,000
			Subtotal	$320,000
			% Total Costs	4%
		TOTAL ENGINEERING COSTS		**$320,000**
200 CONSTRUCTION MANAGEMENT				
201 Construction Oversight	Month	$31,675	4.0	$126,700
202 CAMP Technician	Month	$19,000	4.0	$76,000
203 CAMP Equipment Rental	Month	$6,875	4.0	$27,500
204 Pre-design investigation (including utility recon)/pre-characterization	Each	$425	93	$39,468
206 Project Management	Lump Sum	$287,938	1	$287,938
			Subtotal	$557,606
			% Total Costs	7%
300 REMEDIAL COMPONENTS				
301 Utility Relocation (Relocate sanitary sewer, gas line, overhead utility lines)	Lump Sum	$141,800	1	$141,800
302 Mobilization / Demobilization	Lump Sum	$100,000	1	$100,000
303 Survey and Layout Work	Acre	$6,000	1.5	$9,000
305 Temporary Facilities	Month	$1,540	4.5	$6,930
306 Temporary Fence	Linear Foot	$27.65	840	$23,226
Excavation				
307 Shallow Excavation (to 15 ft bgs)	Cubic Yard	$25	19,400	$485,000
308 Deep Excavation	Cubic Yard	$35	5550	$194,250
309 Excavation Support for deep foundation and soil removal - Sheet Pile	Square Foot	$45	22,080	$993,600
310 Odor Control - Odor suppressant foam	Month	$20,000	3.5	$70,000
313 Dewatering Equipment - Local	Month	$20,000	3.5	$70,000
314 Disposal - Water pre-treatment and disposal at POTW facility	gal	$0.1	3,750,000	$375,000
315 Disposal - Soil - Landfill	Ton	$60	35,740	$2,144,400
316 Disposal - Soil - Thermal Desorption	Ton	$100	2410	$241,000
317 Disposal - Non-impacted Demolition Debris	Ton	$40	3300	$132,000
317 Backfill	Cubic Yard	$28	24,950	$698,600
Surface Soil (outside excavation limits) and Asphalt Restoration				
324 Borrow, compaction, grading, and seeding for (1ft thick)	Cubic Yard	$40	1100	$44,000
325 Asphalt along Franklin (3 inches thick)	Ton	$99	50	$4,950
Institutional Controls / Engineering Controls				
326 Environmental Easement, Groundwater Restrictions	Lump Sum	$10,000	1	$10,000
327 Site Management Plan	Lump Sum	$15,000	1	$15,000
			Subtotal	$5,758,756
			% Total Costs	71%
		TOTAL CAPITAL COSTS		**$6,316,362**
400 OPERATION AND MAINTENANCE				
5 Years Post Remediation				
401 Sample Collection	Semi-Annual	$4,832	2	$9,664
402 Lab Costs	Semi-Annual	$760	2	$1,520
403 Validation	Semi-Annual	$792	2	$1,584
404 Reports	Semi-Annual	$5,000	2	$10,000
			Annual Subtotal	$22,768
		Present Worth Given a 5 Year Period with 5% Effective Rate		$ 98,573.52
			% Total Costs	1%
		TOTAL O&M COSTS		**$98,574**
REMEDIAL COST SUMMARY				
Total Engineering Costs				$320,000
Total Capital Costs				$6,316,362
Total Operation and Maintenance Costs				$98,574
Total Capital, O&M, and Engineering Costs				**$6,734,935**
500 CONTINGENCY				
501 Allowance for Undefined Costs Associated with Utilities, Subsurface Structures, and Extent of Impacts.			20%	$1,346,987.07
			TOTAL COST	**$ 8,081,922**
		ROUNDED COST		**$8,080,000**

Table B-7
Cost Evaluation - Alternatives Summary Notes
Hornell MGP Site FS

Detailed Cost Estimate Notes - Alternatives 2,3,4,5,6	Total Cost (2015 $)
Hornell Former MGP Site	
Hornell, New York	
100 ENGINEERING	
101 Engineering Design, Contract Drawings	GEI Project Experience
102 Draft Work Plan for NYSDEC Review	GEI Project Experience
103 Draft of Completion Report	GEI Project Experience
104 Strategic planning and permitting with regulators	GEI Project Experience
200 CONSTRUCTION MANAGEMENT	
201 Construction Oversight	Assume 1 Grade 3 Project Engineer, vehicle and supplies, no per diem
202 CAMP Technician	Assume 1 Grade 1 Staff Engineer, no per diem
203 CAMP Equipment Rental	Cost basis obtained from recent rental pricing. Cost assumes 4 CAMP stations (2 upwind, 2 downwind) with remote monitoring, 1 weather station, 1 work zone PID
204 Confirmation Sampling	Cost basis obtained from recent lab pricing. Assuming sampling for metals, semi-volatile and volatile organic compounds.
205 ISS Bench Scale Study	Recent contractor pricing.
206 Project Management	5% of total cost
300 REMEDIAL COMPONENTS	
301 Utility Relocation	Lyons MGP Estimate for the municipal and power utilities. NFG provided gas regulator station estimate via email on 2/1/2017.
302 Mobilization/Demobilization	GEI Project Experience
303 Survey and Layout Work	RS Means estimate, quantity increased to account for multiple rounds of surveying to document work
304 Pre-clear/Grub	RS Means estimate
305 Trailers and Chemical Toilets	RS Means estimate, assuming 2 trailers with supplies and utilities, and 2 chemical toilets per month.
306 Temporary Fence	RS Means, assuming an 8 ft fence height
Excavate and Backfill Materials	
307 Excavations to Remove Soils	Recent contractor pricing
308 Excavation of ISS ground swell within frost zone	Recent contractor pricing, assume final ISS mass cannot exist in 4-foot frost zone
309 Excavation Support for deep foundation removal and ISS/deep soil removal	Recent contractor pricing, cost in price per area of exposed sheeting
310 Odor Control - Odor suppressant foam	Recent contractor pricing.
311 Odor Control - Temporary Structure Mobilization/Demobilization	Recent contractor pricing.
312 Odor Control - Maintain/Operate Temporary Structure	Recent contractor pricing.
313 Dewatering Equipment - local	Recent contractor pricing, assuming the use of sumps and trash pumps for localized dewatering.
314 Disposal - Water pre-treatment and disposal at POTW facility	Recent contractor pricing
315 Disposal - Soil - Thermal Desorption	Recent contractor pricing, incl. transportation,
316 Disposal - Soil - Landfill	Recent contractor pricing, incl. transportation
317 Backfill	Recent contractor pricing, cost includes borrow, compaction, grading, and seeding
In-situ chemical oxidation	
318 Initial ISCO Batch Testing and Analysis	Recent contractor pricing for site in MA.
319 Additional Injections	Recent contractor pricing for site in MA.
320 Sampling and Analysis	Recent contractor pricing for site in MA.
In-Situ Solidification	
320 ISS Equipment and Batch Plant Mobilization	Recent contractor pricing
321 Water for ISS mix	
322 Bucket-mix ISS	Recent contractor pricing, incl. geotech testing, assuming water and electricity are readily available
323 Auger ISS	Recent contractor pricing, incl. geotech testing, assuming water and electricity are readily available
Soil Cover	
324 Borrow, compaction, grading, and seeding for 1-ft cover	Recent contractor pricing, assume 6" topsoil
325 Asphalt parking lot (1.5" thick)	Recent contractor pricing, includes tackcoat
Institutional Controls / Engineering Controls	
326 Groundwater Restrictions	GEI Project Experience
327 Site Management Plan	GEI Project Experience
400 OPERATION AND MAINTENANCE	For Alts 2,3,4,5 assume a semi-annual 5-year OMM period. For Alts 2,3,4 assume subsequent annual 25-year OMM period (Alts 3,4: EC inspection only).4 wells in the monitoring program. 2 sampling events per year for 5 years, 1 sampling event per year for subsequent 25 years. 3 QA/QC samples
Groundwater Monitoring	
401 Sample Collection	GEI Project Experience
402 Lab Costs	Recent lab pricing
403 Validation	GEI Project Experience
404 Reports	GEI Project Experience
405 EC Inspection	GEI Project Experience
REMEDIAL COST SUMMARY	
Total Engineering Costs	Includes Sections 100
Total Capital Costs	Includes Section 200,300
Total Operation and Maintenance Costs	Includes Section 400. Present Cost given a 30 year period and 5% effective rate. 5 year period for Alt 5.
500 CONTINGENCY	
501 Allowance for Undefined Costs Associated with Utilities, Subsurface Structures, and Extent of Impacts. Applied to Total Cost.	