Final

Feasibility Study Report

for the

Ilion (East Street) Site

August 2010

Prepared by:

TETRA TECH EC, INC.

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Executive Summary

This report presents the results of a Feasibility Study (FS) performed by Tetra Tech EC, Inc. (TtEC) on behalf of National Grid (NG) for contaminated soil and groundwater at the Ilion (East Street) Former Manufactured Gas Plant (MGP) Site (the Site) in the Village of Ilion, Herkimer County, New York. The FS approach is based on the Remedial Investigation (RI) Report approved by the New York State Department of Environmental Conservation (NYSDEC) on May 6, 2009. The final remedial alternatives presented in this FS Report are the outcome of numerous discussions between NG and NYSDEC, and comments provided by NYSDEC in a letter dated February 4, 2010, responded to by NG in a letter dated May 18, 2010. This FS satisfies requirements specified in the 2003 Order on Consent Index Number A4-0473-0000 between NG and the NYSDEC. This report was completed in accordance with the NYSDEC "DER-10 – Technical Guidance for Site Investigation and Remediation" (2010).

The purpose of this FS is to address soil and groundwater affected by MGP residuals and to identify and evaluate remedial alternatives for these media. The FS process included:

- Establishment of remedial action objectives (RAOs);
- Identification of general response actions (GRAs) to address the RAOs;
- Identification and screening of technologies applicable to each GRA;
- Selection of process options for retained technologies;
- Combination of selected process options to form remedial alternatives;
- Detailed evaluation of remedial alternatives;
- Selection of the preferred remedial alternative; and
- Documentation of the FS process in this report.

The Ilion (East Street) Former MGP Site is a 1.3-acre parcel located in a mixed commercial/residential part of the Village of Ilion, Herkimer County, New York. The Site is bounded by East Clark Street and residential properties to the north, East Street to the east, State Street (formerly Canal Street) to the south, and a commercial property and several residences to the west. State Street overlies the location of the former Erie Canal. The study area of the Ilion (East Street) Former MGP is composed of the Site and the off-site areas. This FS addresses both site and off-site impacts affected by MGP residuals.

Soil Investigation Summary

The strata underlying the Site and the off-site areas are as follows in sequence from upper to lower:

1. Fill Layer – sand, gravel, silt, clay, wood, coal, ash, cinders, clinkers, brick fragments, wire, and wood chips (3 to 13 feet thick)
2. Lacustrine Deposits – silt, sand, and clay (varies in thickness from absent to 15 feet thick)
3. Peat (2 to 5 feet thick)
4. Sand and Gravel (based on regional information, likely to be approximately 250 feet thick)

BTEX, PAHs, and cyanide were detected in surface and subsurface soil at the Site. Contaminant concentrations in surface soils are relatively low. Fingerprinting analysis of off-site soils identified some coal tar-related contamination at some locations. However, fingerprinting analysis also identified fuel-related contamination, and there are other sources of impacts from a variety of known sources such as the former Ilion Landfill, the former railroad along the present location of Route 5S, storm water discharge to the swale from the surrounding commercial and industrial areas, activities at the Ilion DPW garages and DPW debris disposal area, several pipe discharges of unknown origin to the swale, and backup flooding of the Mohawk River.

Non-Aqueous Phase Liquids

Impacts from NAPL were observed in the subsurface within the study area at three locations: within the footprints of the former 200,000-gal and the octagonal gas holders (on-site locations), and in the southern portion of the open swale area (off-site location).

It should be noted that NAPL is not included as a separate media of concern because free NAPL was observed in only three soil samples, located at the former gas holders. For the purposes of this study, it is included within the soil media impacts. As such, throughout the FS process, NAPL is addressed within the development and analysis of remedial alternatives for soil.

Groundwater Investigation Summary

Groundwater is not currently used as a source of potable water on site or in the off-site areas. The water supply in the area is municipal. Within the study area, groundwater is encountered at depths of approximately 5 to 15 feet within fill or the lacustrine unit. In a drainage ditch within the off-site area, standing water is present at the surface. A thin saturated zone of up to approximately 3 feet is locally present within the fill on top of the lacustrine layer. In the southern and central portions of the Site, the top of the lacustrine formation occurs close to the ground surface, and the saturated zone within the fill is absent. A water-bearing zone in the sand and gravel unit is present throughout the study area, and is regional in nature. The thickness of the unit is unknown; however, it is most likely 250 feet or more.

Groundwater impacts are localized and do not indicate significant migration of contaminants from the Site. Dissolved-phase contamination exceeding the NYSDEC WQ Class GA criteria, consisting of BTEX compounds and cyanide, is present in the southern and central portions of the Site, and cyanide contamination appears to also extend to a well adjacent to the site proper immediately east of the Site. However, cyanide was only detected at or exceeding criteria in one of the three sampling events, was detected at a concentration equivalent to the NYSDEC Class GA Water Quality Criteria, and was not detected during the most recent sampling event. PAHs were identified in one off-site location slightly in excess of the NYSDEC WQ Class GA criteria during the most recent sampling event. However, other sources of PAHs are present in this area.

Remedial Action Objectives (RAOs)

The RAOs developed for soil on and off-site to address MGP-related impacts are:

- Prevent ingestion of, or direct contact with, MGP-contaminated soil
- Prevent inhalation of, or exposure to MGP-related contamination volatilizing from soil
- Prevent migration of MGP-related contaminants that may result in groundwater or surface water contamination, to the extent practicable

The RAOs developed for the groundwater are:

- Prevent ingestion of groundwater with MGP-related contaminant levels exceeding drinking water standards
- Prevent contact with, or inhalation of MGP-related volatiles from, contaminated groundwater
- Restore groundwater to pre-release conditions to the extent practicable
- Reduce or eliminate sources of MGP-related groundwater contamination to the extent practicable

General Response Actions (GRAs)

To meet the RAOs, the following GRAs for soil and groundwater have been identified:

1. No Action
2. Limited Action
    a. Institutional Controls (*e.g.*, environmental easement, HASP, SMP)
    b. Engineering Controls (*e.g.*, fencing)
3. Containment
4. Treatment/Disposal
    a. *In Situ* Treatment
    b. Removal/Treatment/Disposal

Development of Alternatives

Based on the screening and evaluation of technologies and process options, the following media-specific remedial alternatives were developed for the Site:

Soil Alternatives:

- S-1: No Action
- S-2: Limited Action
- S-3: Excavation of MGP-Related Impacts, Soil Capping, Off-Site Disposal, and Institutional Controls
- S-4: Excavation of MGP-Related Impacts, Removal of On-Site Source Soils to Restricted-Residential SCOs, Soil Capping, Off-Site Disposal, and Institutional Controls
- S-5: Excavation of Soils Exhibiting Concentrations Above Unrestricted Use SCOs and Off-Site Disposal

Groundwater Alternatives:

- GW-1: No Action
- GW-2: Limited Action (Institutional Controls)
- GW-3: Monitored Natural Attenuation and Institutional Controls

The following paragraphs briefly summarize each of the alternatives:

Alternative S-1 – No Action

No remedial action would be performed at the site. Evaluation of this alternative is a requirement as per NYSDEC's DER-10.

Alternative S-2 – Limited Action

This alternative would include addressing MGP-related impacts on and off site through institutional and engineering controls such as fencing, environmental easements, site management plan (SMP) development and implementation, and/or health and safety plan (HASP) development and implementation.

Alternative S-3 - Excavation of MGP-Related Impacts, Soil Capping, Off-Site Disposal, and Institutional Controls

This alternative includes removal of MGP-related impacts (including soil contaminated with NAPL, soil exhibiting concentrations of coal-tar-related PAHs above 500 ppm, and/or cyanide above 40 ppm), soil capping, off-site disposal, and implementation of institutional controls. The estimated volume of contaminated soil to be removed under this alternative is approximately 8,160 cubic yards (cy), including contingency soils.

Alternative S-4 - Excavation of MGP-Related Impacts, Removal of On-Site Source Soils to Restricted-Residential SCOs, Soil Capping, Off-Site Disposal, and Institutional Controls

This alternative includes removal of MGP-related impacts and on-site source area soils exceeding NYSDEC Restricted-Residential Use Soil Cleanup Objectives, soil capping, off-site disposal and institutional controls. The estimated volume of soil to be removed under this alternative is approximately 9,860 cy, including contingency soils.

Alternative S-5 - Excavation of Soils Exhibiting Concentrations Above Unrestricted Use SCOs and Off-Site Disposal

This alternative includes removal of soils exceeding NYSDEC Unrestricted Use Soil Cleanup Objectives and off-site disposal, including impacts potentially related to sources other than MGP activities. Evaluation of this alternative is a requirement as per NYSDEC's DER-10 and 6 NYCRR Paragraph 375-2.8(c)(2)(i). The estimated volume of soil to be removed under this alternative is approximately 82,800 cy, including contingency soils.

Alternative GW-1 – No Action

Under this alternative, no remedial action or monitoring would be performed. Evaluation of this alternative is required as per NYSDEC's DER-10.

Alternative GW-2 – Limited Action (Institutional Controls)

This alternative would include no remedial action, but would include institutional controls such as groundwater use restrictions and health and safety planning.

Alternative GW-3 – Monitored Natural Attenuation and Institutional Controls

This alternative would include long-term monitoring for natural attenuation of contaminants in groundwater in conjunction with implementation of institutional controls. Existing monitoring wells would comprise a long-term monitoring network, and groundwater use restrictions and health and safety planning would be implemented.

Evaluation of Alternatives

The media-specific remedial alternatives identified above were first evaluated individually and then on a comparative basis using the following seven evaluation criteria:

1. Compliance with Standards, Criteria and Guidance (SCGs);
2. Overall Protection of Human Health and the Environment;
3. Short-Term Impact and Effectiveness;
4. Long-Term Effectiveness and Permanence;
5. Reduction of Toxicity, Mobility, and/or Volume;
6. Implementability; and
7. Cost.

Soil Alternatives

Compliance with SCGs

The soil remedial alternatives can all be accomplished in accordance with action- and location-specific SCGs. Alternative S-5 achieves chemical-specific SCGs, and removes the most material from the Site and off-site areas; however, this alternative includes excavation of soils exceeding NYSDEC Unrestricted Use SCOs potentially related to other sources, such as the former landfill and the spoil piles. Alternatives S-3 and S-4 achieve Unrestricted Use SCOs for MGP-impacted soils that are removed, and Alternative S-4 achieves Restricted-Residential SCOs in the source areas on site through excavation. Alternatives S-1 and S-2 do not remove contamination from the Site or from the off-site areas.

Overall Protection of Human Health and the Environment

Alternatives S-3, S-4 and S-5 are the most protective of human health and the environment. Alternative S-5 removes contamination above Unrestricted Use SCOs from the Site and the off-site areas, including contamination potentially related to other sources, and the future use of these areas would be unrestricted. Alternatives S-3 and S-4 are also protective, since they remove the MGP-related sources of contamination, and mitigate exposure to residual contamination through capping and implementation of a HASP and SMP. Alternative S-4 removes a larger volume of impacted soil from the Site to address Restricted-Residential SCOs associated with source areas; however, since Alternative S-3 also addresses source areas, and both alternatives include placement of a cap, this additional soil removal offers little additional protection of human health or the environment than Alternative S-3. Alternative S-2 prevents human exposure, but does not provide any removal or treatment that would expedite the cleanup of the site to regulatory standards. Alternative S-1 is the least protective, since it does not remove or treat contaminants nor reduce the risk of human or environmental exposure.

Short-Term Impacts and Effectiveness

Alternatives S-1 and S-2 would have the lowest short-term impact. There would be no potential risks to workers or the public during implementation of these alternatives, since no active remediation would be performed. For the active remedial alternatives, the short-term impact of Alternative S-3 would be less than Alternative S-4, since there would be less disturbance of on-site contamination. The short-term impacts of Alternatives S-3 and S-4 would both be significantly less than Alternative S-5 due to the smaller volume of contaminated soil disturbed both on and off-site. Alternatives S-3 and S-4 would be implemented in approximately the same period of time, though Alternative S-4 would take slightly longer to implement due to the additional soil removal on site. Alternatives S-5 would have the highest short-term impact, since extensive excavation and driving of sheet piling would disturb the soil and more excavated material would need to be transported through off-site (residential) areas for off-site disposal. Each of these alternatives could potentially increase risk of exposure to workers and the public. These impacts would be minimized through proper construction and transportation procedures and engineering controls.

Long-Term Effectiveness and Permanence

Alternative S-5 is the most effective, since contamination is removed from the Site and off-site areas to Unrestricted Use SCOs. Alternatives S-3 and S-4 are effective at reducing potential human exposure through removal of source areas and soil with MGP-related contamination from the Site and the off-site areas, and capping residual on-site contamination. The Site would be subject to institutional controls to prevent potential exposures under both of these alternatives, and an SMP would be implemented to mitigate off-site exposures. Long-term O&M (*e.g.*, monitoring) would be required to ensure that these alternatives continues to be effective, in addition to maintenance of use restrictions on the Site. Alternative S-2 is less effective, since all existing contamination, including source areas, would remain. Human health exposure would be mitigated through a HASP and SMP. Long-term O&M and land use restrictions for the Site would be required to ensure the effectiveness of this alternative

Reduction of Toxicity, Mobility and/or Volume

Alternative S-5 offers the most significant reduction in mobility, toxicity, and volume of contaminated soil, since soil exceeding Unrestricted Use SCOs, including impacts potentially related to non-MGP sources, would be excavated for appropriate off-site treatment and/or disposal. Alternatives S-3 and S-4 also offers reduction in mobility, toxicity and/or volume through removal of MGP source material and soil with MGP-related contamination. Alternatives S-3, S-4 and S-5 would remove approximately 8,160 cy, 9,860 cy and 82,800 cy of impacted soil, respectively (note: these volumes included contingency soils). Alternatives S-1 and S-2 offer no reduction in mobility, toxicity, or volume.

Implementability

All of the alternatives evaluated are technically feasible. Alternative S-1 is the easiest to implement, since no remedial activities are employed in this alternative. Alternative S-2 is also relatively easy to implement, involving only institutional controls. Alternatives S-3 and S-4 would be more difficult to implement, as they require deeper excavations with the potential need for shoring. Significant technical feasibility concerns are associated with Alternative S-5. The physical configuration of the off-site areas, the proximity to residential homes, and the presence of standing surface water would limit the ability to stage equipment, and impact productivity more so than with Alternatives S-3 and S-4. Odors and vapors could be emitted for extended durations during implementation of S-5. Furthermore, during implementation of Alternative S-5, excavation of roadways would require re-routing of traffic and re-paving of roadways.

Alternatives S-3 and S-4 provide protection to human health and the environment from NAPL-impacted soil with less impact to the community and site workers than Alternative S-5.

Services, equipment, and materials are available for all alternatives. Alternative S-1 requires no materials and limited services. Alternative S-2 requires limited services. Alternatives S-3, S-4 and S-5 require excavation services in addition to backfill materials. The quantities of both excavated material and backfill to be handled and transported are extremely large for Alternative S-5.

All of the alternatives evaluated are administratively feasible. Alternative S-1 would be the easiest to implement, since no activity would be performed. Alternative S-2 would be relatively easy to implement, requiring only preparation of a HASP and SMP and notification to affected parties. Alternatives S-3, S-4 and S-5 would involve negotiations with multiple off-site property owners for access to implement these alternatives. Alternatives S-3, S-4 and S-5 involve construction activities and associated administrative activities (*e.g*., permitting, public participation and coordination, etc.). They would also require coordination requirements for off-site transportation, which the other alternatives would not entail. Long-term institutional management (*e.g*., monitoring, reporting, public coordination) would be associated with Alternatives S-2, S-3 and S-4. Coordination with local authorities and homeowners would be required during implementation of Alternative S-5 during roadway excavation and re-paving activities.

Cost

Alternative S-1 has no capital or O&M costs. Alternative S-2 has the next lowest capital cost at $65,000, no annual O&M costs, and a net present value (NPV) of $121,000. Alternative S-3 has the next lowest capital cost at $4,890,000, annual O&M costs of $3,000, and a NPV of $5,053,000. Alternative S-4 has the second highest capital cost at $5,598,000, annual O&M costs of $6,000, and a NPV of $5,799,000. Alternative S-5 has the highest capital costs at $36,994,000 and no O&M costs. Overall, the ranking of the alternatives based on net present value (capital and O&M) from lowest to highest is: S-1, S-2, S-3, S-4 and S-5.

Groundwater Alternatives

Compliance with SCGs

Alternatives GW-1, GW-2, and GW-3 would be performed in accordance with action- and location-specific SCGs and would eventually achieve chemical-specific SCGs over a long period of time if implemented in conjunction with a soil remediation alternative.

Overall Protection of Human Health and the Environment

Alternative GW-3 is a passive alternative that does not provide active treatment of contaminated groundwater, but achieves the remedial goals when combined with an appropriate soil remedial alternative. Monitoring would be implemented under this alternative until the treatment goals were achieved and groundwater use restrictions would be maintained. Groundwater is not currently used as a source of potable water on-site or in the off-site areas. Alternative GW-1 and GW-2 are the least protective, since they do not remove or treat contaminated groundwater, and GW-1 does not reduce the potential risk of human exposure. In addition, GW-1 does not provide for monitoring to assess potential changes in risk to human health or the environment.

Short-Term Impacts and Effectiveness

Alternatives GW-1 and GW-2 would have the lowest short-term impact. There would be no potential risks to workers or the public during implementation of these alternatives, since no activities or construction would be performed. The short-term impact and short-term effectiveness of Alternative GW-3 would be favorable, since monitoring would result in minimal risks of exposure for workers or the public.

Long-Term Effectiveness and Permanence

Alternatives GW-1, GW-2, and GW-3 would ultimately provide long-term protection of human health and the environment over a long period of time if implemented in conjunction with a soil remediation alternative. Monitoring would provide additional risk mitigation assurance under Alternative GW-3.

Reduction of Toxicity, Mobility and/or Volume

Alternatives GW-1, GW-2, and GW-3 offer no reduction in mobility, toxicity, or volume, since no active remediation would be performed. Over time, through natural processes, contaminant concentrations in the groundwater will decline, resulting in a reduction in toxicity of the contaminated groundwater and/or a reduction in the dissolved phase volume. Implementation of soil Alternatives S-3, S-4 or S-5 would result in a volume reduction of contaminated groundwater since contaminated groundwater would be removed through dewatering operations. Furthermore, the ongoing source of contamination in groundwater would also be reduced (S-3, S-4) or eliminated (S-5).

Implementability

All of the alternatives evaluated are technically feasible. Alternative GW-3 requires only consulting services for monitoring and data evaluation, which are readily available. All of the alternatives evaluated are administratively feasible. All of the groundwater alternatives would be easy to implement (short-term) since there would be no construction activity involved. Alternative GW-3 would involve long-term monitoring.

Cost

Alternative GW-1 has no capital or O&M costs. Alternative GW-2 has a higher capital cost at $26,000, no annual O&M costs, and an NPV of $82,000, including periodic reviews. Alternative GW-3 has the highest capital cost at $68,000, annual O&M costs of $28,000, and an NPV of $247,000, including periodic reviews.

Conceptual Plan for Remediation

The conceptual plan for the remediation of the Ilion (East Street) Site incorporates Alternatives S-3 and GW-3, as the combination of these alternatives effectively achieves the remedial objectives and provides protection of human health and the environment. Alternative S-3 will achieve the RAOs for soil on and off site, providing a reduction in toxicity, volume and potential mobility through elimination of MGP-contaminated material from the Site and the off-site areas, with the exception of isolated impacts at locations MW-02, SB-01 and FW-20A2. Removal of approximately 8,160 cy (including contingency soils) of MGP-contaminated material will provide a permanent, effective remedy in a short period of time, with minimal disruption to the community. This alternative will minimize potential risks to human health through the implementation of institutional controls (*i.e.*, HASP, SMP, and periodic reviews). This alternative will also remove the most significant potential sources of groundwater contamination.

Implementation of Alternative GW-3 in conjunction with Alternative S-3 will minimize potential risk to human health through the implementation of groundwater monitoring and institutional controls (*i.e.*, groundwater use restrictions, health and safety planning) with periodic reviews.

The overall capital cost for implementation of the selected remedy is $4,958,000. The annual O&M cost is estimated to be $31,000. The net present cost based on a 30-year period and a five percent discount rate is $5,300,000.

1.0 Introduction

This report presents the results of a Feasibility Study (FS) performed by Tetra Tech EC, Inc. (TtEC) on behalf of National Grid (NG) for contaminated soil and groundwater at the Ilion (East Street) Former Manufactured Gas Plant (MGP) Site (the Site) in the Village of Ilion, Herkimer County, New York.

The FS approach is based on the Remedial Investigation (RI) Report approved by the New York State Department of Environmental Conservation (NYSDEC) on May 6, 2009. The final remedial alternatives presented in this FS Report are the outcome of numerous discussions between NG and NYSDEC, and comments provided by NYSDEC in a letter dated February 4, 2010, responded to by NG in a letter dated May 18, 2010. This FS satisfies requirements specified in the 2003 Order on Consent Index Number A4-0473-0000 between NG and the NYSDEC. This report was completed in accordance with the NYSDEC "DER-10 – Technical Guidance for Site Investigation and Remediation" (2010).

1.1 Purpose and Organization of the Report

The purpose of the Feasibility Study (FS) is to identify and evaluate media-specific remedial alternatives for contaminated soil and groundwater at the Site, including non-aqueous phase liquid (NAPL) present within the soil media, and to develop the conceptual Site-wide remediation plan.

This FS Report consists of seven sections whose contents are set forth below:

Section 1.0 Introduction – This section provides a description of the Site and its operating and compliance history, a summary of the Site investigation work that has been undertaken, a summary of the Site physical conditions, and a summary of the Site contaminant conditions.

Section 2.0 Remedial Action Objectives – This section provides the applicable chemical-specific, action-specific, and location-specific standards, criteria and guidance (SCGs), the remedial action objectives (RAOs), and the general response actions (GRAs).

Section 3.0 Identification and Screening of Technologies and Process Options – This section describes the methodology and the results of the technology identification and screening, selection of process options, and the development of alternatives.

Section 4.0 Detailed Analysis of Remedial Alternatives – This section provides a description of the seven criteria that were used in analysis of the remedial alternatives in accordance with 6 NYCRR Part 375-1.8(f), and it describes the detailed analysis of four soil remedial alternatives, and the detailed analysis of three groundwater remedial alternatives.

Section 5.0 Comparative Analysis of Alternatives – This section provides a comparative analysis of the soil alternatives and the groundwater alternatives, using the seven criteria that were utilized for the Section 4.0 Detailed Analysis.

Section 6.0 Proposed Remedial Alternative – This section provides the media-specific results of the proposed process for soil remedial alternatives and groundwater remedial alternatives. In addition, it proposes a conceptual site-wide remediation plan.

Section 7.0 References – This section cites the references that were relied upon for information and guidance during the preparation of this FS Report.

1.2 Site Background

This section summarizes relevant information concerning the Site conditions, the operating and compliance history, the investigation history, and the Site physical conditions as presented in the Revised RI Report (TtEC, 2009).

1.2.1 Site Description

The Ilion (East Street) Former MGP Site is a 1.3-acre parcel located in a mixed commercial/residential part of the Village of Ilion, Herkimer County, New York (Figure 1-1). The Site is bounded by East Clark Street and residential properties to the north, East Street to the east, State Street (formerly Canal Street) to the south, and a commercial property and several residences to the west (Figure 1-2). State Street overlies the location of the former Erie Canal.

The study area of the Ilion (East Street) Former MGP is composed of the Site and the off-site areas (defined on Figure 1-2). The Site is generally "L" shaped and surrounded by an eight-foot chain link fence topped with barbed wire. Two locked access gates are located along East Street and East Canal Street, respectively. A gas regulator station in a small building near the facility gate off East Street was recently taken out of service. The Site ground surface slopes gently from south to north.

The southeastern portion of the Site was, until recently, occupied by buildings that originally housed former gas operations and later housed electrical substation facilities. With the exception of the recently decommissioned gas regulator station, these buildings were demolished in September 2000. Some rubble from the building demolition, including building and wall foundations, steel piping, and appurtenances remain in the ground. A gravel driveway and parking area surround the northern and western sides of the former buildings. The northern and western portions of the Site are grass-covered, and a number of large coniferous trees are present across the central portion of the property.

The off-site study area comprises approximately four acres and extends generally north of the Site (Figure 1-2), along a storm sewer that extends north from the vicinity of the Site and ultimately discharges to an open swale. The open swale is a 1,100 foot long linear feature approximately 1,500 feet north-northeast of the Site. From the intersection of East Street and East/North Clark Street, the storm sewer proceeds north beneath East Street and east beneath East North Street Extension. The storm sewer then proceeds north beneath the field on the north side of the East North Street Extension and to an open swale. This storm sewer line collects drainage from areas upgradient of the Site, from streets in the vicinity of the Site, and from streets between the Site and the field north of the East North Street Extension. The open swale is positioned within a relatively low-lying area and is comprised of four segments separated by culverts. The first and second segments are positioned south of New York State Route 5S. The open swale passes underneath Route 5S, which is located along a former railroad line. The third and fourth segments are located north of Route 5S, with the end of the fourth segment terminating at the confluence of the swale with the Mohawk River, located approximately 2,200 feet north of the Site.

The field on the north side of East North Street Extension (based on observations made during the RI) is an area in which refuse was formerly deposited and is currently being used for disposal of construction debris. The off-site study area is bounded generally on the south and west by residential properties along East Street that back up to the East North Street Extension, residential properties on East Street and East Clark Street, the Site, and the Village of Ilion Department of Public Works (DPW). The off-site study area is bounded to the north and east by the Mohawk River and disposal areas, respectively.

Much of the off-site study area is within a relatively low-lying area that includes portions of the former Ilion landfill (see Section 1.3.3), an open parcel of land, approximately 25 acres in size, to the northeast of the Site (EA, 1988). The limits of the former Ilion landfill are shown on Figure 1-1. The former landfill site was used by the Village of Ilion between 1933 and 1971 as a dump to dispose municipal waste, including wastes from Remington Arms and other local industries. The area currently occupied by the Village of Ilion DPW is situated within the former Ilion landfill, and both sides of the open swale abut the former disposal area. The area west of the open swale and north of Route 5S was also formerly a sewage disposal plant (Figure 1-1).

1.2.2 Site History

The Ilion (East Street) Site was the location of a former gas manufacturing plant from the 1870s through 1912. Subsequently, the Site was used for various utility operations (including gas storage and distribution), electrical substation applications, and as a service center. Former site features are shown on Figure 1-3. A detailed Site operational history was provided in the Preliminary Site Assessment/Interim Remedial Measures Report (Parsons, 1998). A brief summary is provided below.

In 1874, the first parcel (0.7 acres) was purchased by the Ilion Mohawk Gas Light Company at the corner of East Street and the north tow path for the Erie Canal, the former bed of the Erie Canal being directly south of the Site (Figure 1-3). By 1881, the Site contained an octagonal gas holder at the corner of East and East State Streets and a gashouse with a coal shed to the west of the gas holder. In 1890, the Site was expanded north to East Clark Street with the purchase of an additional 0.31 acre parcel.

An electric light station was added to the north side of the gas works building around 1891. By 1897, an 80,000 cubic-foot gas holder was constructed north of the gas plant, adjacent to East Street, and the octagonal gas holder was taken out of service. By 1912, the gas plant was no longer in operation. In 1917, a 200,000 cubic-foot gas holder was constructed aboveground, adjacent to the former gas plant, to store manufactured gas from the Harbor Point MGP in Utica, New York.

The Erie Canal was filled in 1921, and East Canal Street (now State Street) was realigned to the south. In 1940, an outdoor substation was constructed at the corner of East and East State Streets, covering the foundation of the former octagonal gas holder. By 1940, the 80,000 cubic foot gas holder had been removed. Circa 1950/1951, an auto repair shop, gasoline station, auto dealers, and a junkyard were located south and west of the Site, and natural gas replaced manufactured gas in Ilion.

In 1956, the 200,000 cubic foot gas holder and most of the remaining gas equipment were removed from the Site. In 1995, National Grid (formerly Niagara Mohawk) submitted an oil spill report to NYSDEC "due to the presence of visibly stained soil underneath and adjacent to electrical equipment" at the on-site substation. The top 6-inches of soil below the substation were removed and properly disposed to remediate the reported spill (Parsons, 1998). The substation was decommissioned and removed in 1997. The last of the buildings associated with former gas manufacturing operations were demolished in September 2000.

1.2.3 Site Assessment and Investigation

Investigations conducted at the Site and off-site areas include:

- *Engineering Investigations at Inactive Hazardous Waste Sites, Phase II Investigation, Ilion Landfill Site no. 622004, Village of Ilion, Herkimer County. EA Science and Technology, 1988;*
- *PSA/IRM Study Ilion (East Street) Site. Parsons Engineering Science, 1998; and*
- *Revised Remedial Investigation Report for the Ilion (East Street) Site. Tetra Tech EC, 2009.*

The summary of the investigative programs is presented in the remainder of this section. Results of the Phase II Investigation and the PSA/IRM have been incorporated in the RI; therefore, the RI Report contains the comprehensive data set that includes results from all investigations conducted at the Site. The RI Report was used to support the FS effort.

1.2.3.1 Phase II Investigation

This investigation was conducted for NYSDEC to investigate an area to the north of the Site used for disposal of municipal wastes. During drilling, a "tar-like" substance was encountered in one boring south of the open swale. No boring log or analytical data are available for this boring. The presence of this material suggested the possibility of off-site impacts of coal gas manufacturing activities at the Site.

1.2.3.2 PSA/IRM

As a result of its former use as an MGP, the Site is one of the properties that NG was required to address under its original 1992 Order on Consent with NYSDEC (Number D0-0001-9210). Parsons Engineering Science (Parsons) conducted a PSA/IRM at the Site under the 1992 Order on behalf of NM to:

- Determine whether MGP by-products, other utility related substances, or non-utility chemical constituents possibly contributed by others are present at the Site, and, if present, the nature of the respective constituents;
- Determine if detected chemical constituents can be attributed to other possible sources or parties;
- Determine whether any detected substances constitute a significant threat to public health or the environment;
- Determine if additional remedial investigations are necessary at the Site; and
- Determine if IRMs might be appropriate based on the results of the PSA.

Based on the results of the PSA, it was determined that additional information was necessary to adequately evaluate site conditions, address specific data gaps identified in the PSA, and determine the potential risks posed by the Site. In its review, NYSDEC concurred with these conclusions and requested that the data gaps be addressed in a RI/FS. In addition, the NYSDEC also requested that the investigation be extended to evaluate whether off-site study area impacts, encountered during a separate study of the former Ilion landfill (EA, 1988), were associated with former MGP operations at the Site.

1.2.3.3 Remedial Investigation

The RI performed by TtEC included both on-site and off-site investigations executed over multiple mobilizations:

- August/September 1999
- December 1999
- February 2000
- December 2000
- January/February 2001
- March 2001
- January/February 2002
- September/October/ November 2004
- August 2006
- February 2008
- December 2008

Site investigations were conducted within the property boundary of the former MGP site, and off-site study area investigations were conducted immediately adjacent to or nearby (within 0.5 miles) the former MGP property. A large portion of the off-site study area investigations occurred at the area of the former Ilion landfill (at the Village of Ilion DPW facility) and at the field north of the East North Street Extension. The objectives of the RI included the following:

- Evaluate the horizontal and vertical extent of MGP-related impacts for the soils and groundwater on site;
- Evaluate the horizontal and vertical extent of MGP-related impacts for the soil and groundwater at the Off-Site Study Area, located to the northeast of the Site;
- Investigate whether MGP-related volatile organics in soil and groundwater are volatilizing and migrating off-site as soil vapor;
- Characterize "background" soil located in areas not likely impacted by MGP-related activities;
- Evaluate if impacts identified in the open swale are related to the former MGP or other local sources;
- Assess the potential fate and transport of detected contaminants; and
- Develop the technical database for the completion of a feasibility study (FS) to address mitigation of possible impacts.

The investigation and its results are described in detail in the RI report. The RI findings are summarized in the FS sections describing the site conditions and nature and extent of contamination.

1.2.4 Site Physical Conditions

In this section, the site physical conditions are summarized based on findings of the RI.

1.2.4.1 Topography

The Ilion (East Street) Former MGP Site, comprising approximately 1.3 acres of property in the Village of Ilion, is sloped to the north toward the boundary with East Clark Street. The Site is covered primarily with vegetation, a gravel driveway/parking area in the central portion of the Site, and former building foundation walls (concrete) located in the southern portion of the Site. Based on the survey generated during the RI field program, the Site surface elevation ranges from approximately 392 to 402 feet above mean sea level (msl).

The off-site study area is also primarily vegetated, although there are gravel driveways, spoil piles, and a highway (New York State Route 5S) in the vicinity (Figure 1-2). A drainage swale (open swale), which receives drainage from a storm water sewer and conveys it to the Mohawk River, runs through the central portion of this area. Surface elevations range from approximately 379 feet above msl within the open swale to approximately 397 feet above msl at New York State Route 5S.

1.2.4.2 Surface Water Hydrology

The nearest surface water body is the Mohawk River, located approximately 2,200 feet northeast of the Site. The Mohawk River flows east approximately 80 miles before joining the Hudson River. The Mohawk River is classified by the NYSDEC as a Class B surface water body. Other surface water bodies within one mile of the Site include Fulmer Creek, located approximately 4,000 feet east of the Site, and Steele Creek located approximately 3,500 feet west of the Site. Both streams flow north and are tributaries of the Mohawk River. Fulmer Creek and Steele Creek are classified by the NYSDEC as Class C surface water bodies. Class B surface water bodies are suitable for primary contact recreation and any other uses except as a source of water for drinking, culinary, or food processing purposes. Class C waters are suitable for fish, shellfish, and wildlife propagation and survival. The water quality is suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

No surface water bodies are present on the Site. The open swale draining to the Mohawk River is present in the off-site area.

1.2.4.3 Stratigraphy

The top-most continuous bedrock formation in the region is the Late Ordovician-age Utica Shale. Top of bedrock is generally located at depths of approximately 250 feet below ground surface (bgs) or greater. The general dip of the bedding planes is to the south-southwest. Utica Shale is underlain by the Trenton Group limestones and Black River Group limestones, dolomites and shales. Locally, Younger Frankfort Formation shales and siltstone are present above the Utica Shale in the hills south and north of the Site. The unconsolidated deposits are predominantly alluvial of glacial origin, with glacial lacustrine soils also present south, southwest and southeast of the site.

Four unconsolidated stratigraphic units have been identified in the study area, encompassing the Site and the off-site area. The units are, from top to bottom: fill; lacustrine silts, sands and clays; a sand and gravel unit; and peat. The stratigraphy is illustrated on Figures 1-4 and 1-5 (Site cross section location and geologic cross section) and Figures 1-6 and 1-7 (off-site cross section location and geologic cross section). Bedrock was not reached during the RI.

Fill

Fill is the top-most unit in the study area, and it appears to be continuous. Elements identified in the fill at the Site are sand, gravel, silt, clay, wood, coal, ash, cinders, clinkers, brick fragments, wire and wood chips. In the off-site study area, in addition to the elements present at the Site, the investigation identified glass, bottles, newspaper, paint and various debris. The thickness of the fill layer varies from approximately 3 feet to approximately 13 feet.

Lacustrine Deposits

Lacustrine deposits in the study area are composed of silt, sand and clay. The unit varies in thickness from absent within the footprint of the former 80,000 cubic feet gas holder to approximately 15 feet in the vicinity of the former octagonal gas holder. Generally, the thickness of the lacustrine deposits diminished from the south (Site) to the north (off-site area). The top of the unit is encountered at depth of approximately 4 feet to 13 feet bgs.

Peat

The peat unit is absent in the southern and central part of the Site. It appears in the northern portion of the Site and extends north into the off-site area. Where present at the Site, the peat layer is approximately 2 feet thick. In the off-site area, the thickness of the peat has not been determined, as most borings did not penetrate to the bottom of the layer. Based on the limited number of borings, it appears that the thickness of the peat layer in the off-site area is up to approximately 5 feet. The top of peat unit is encountered at depths ranging from approximately 4 feet to approximately 12 feet bgs.

Sand and Gravel

The sand and gravel has been encountered in borings completed within the Site, at depths of approximately 13 to 20 feet bgs. In the off-site area, borings generally terminated in the peat layer without reaching the sand and gravel unit. Therefore, the depth to the top of sand and gravel unit in the off-site area is not known. However, the sand and gravel unit is a regional feature, extending throughout the entire study area. The depth to the top of the unit in the off-site area is most likely similar to the depth determined for the Site. The thickness of the unit is not known, as the deepest boring of 62 feet did not reach its bottom. Based on the regional information, the unit is likely to be approximately 250 thick.

1.2.4.4 Hydrogeology

At the regional scale, groundwater in the unconsolidated deposits is expected to flow towards the Mohawk River. The study area is located south of the river; therefore, the regional flow in the area encompassing the Site is to the north.

Within the study area, groundwater is encountered at depths of approximately 5 to 15 feet within fill or the lacustrine unit. In the drainage ditch within the off-site area, standing water is present at the surface, most likely in direct connection with groundwater. A thin saturated zone of up to approximately 3 feet is locally present within the fill on top of the lacustrine layer. In the southern and central portions of the Site, the top of the lacustrine formation occurs close to the ground surface, and the saturated zone within the fill is absent. A water-bearing zone in the sand and gravel unit is present throughout the study area, and is regional in nature. As indicated previously, the thickness of the unit is unknown; however, it is most likely 250 feet or more.

The flow direction within the fill layer, where the saturated zone is present, is determined by the local topography of the lacustrine unit, which forms the bottom of the fill water-bearing zone. This water bearing zone is relatively thin, and most likely the flow rate within it is negligible. The fill water-bearing zone is fed directly by the infiltration from ground surface.

Based on eight complete synoptic rounds of groundwater level measurements collected during the PSA and RI, it appears that there is a moderate hydraulic gradient within the sand and gravel water-bearing zone across the study area of approximately 5/1,000. The flow direction is to the north and northwest, towards the Mohawk River, as illustrated on Figure 1-8. Slug tests conducted in wells screened in the sand and gravel unit indicated relatively high values of hydraulic conductivity, on the order of 10^{-3} to 10^{-2} centimeters per second (cm/sec). Considering the significant thickness of the unit, a moderate gradient, and high hydraulic conductivity, the magnitude of flow within the sand and gravel water-bearing zone is most likely significant.

The Village of Mohawk has municipal supply wells south of the Mohawk River, approximately one mile downstream (east) of the Site. The Village of Frankfort has supply wells, approximately two miles west and upstream of the Site along the Mohawk River. The Villages of Mohawk and Frankfort municipal supply wells are most likely screened in the same sand and gravel unit. The wells are screened at depths of up to approximately 100 feet and are reported to provide yields on the order of 100 to 1,000 gpm. Such high well yields of the sand and gravel water-bearing zone indicate that most of the water flowing across the study area originates from upgradient, as opposed to infiltration within the Site boundaries or within the off-site study areas.

1.2.5 Nature and Extent of Contamination

Evidence of past MGP operations was observed during investigations performed at the Site. Specifically, MGP-impacted material, characterized by observations of NAPL, NAPL-saturated soil, or a combination of blebs, sheens, odors, and staining is noted in boring logs from the site proper and the off-site areas. MGP-related contaminants of potential concern (COPCs) (benzene, toluene, ethylbenzene, and xylene (BTEX), semivolatile organic compounds (SVOCs) summarized as total polycyclic aromatic hydrocarbons (total PAHs), and the inorganic compound cyanide), were detected in samples from various media at the Site and in the off-site areas. Fingerprinting analysis of off-site soils identified some coal tar-related contamination at some locations. However, fingerprinting analysis also identified fuel-related contamination, and there are other sources of impacts from a variety of known sources.

The nature and extent of the site contamination has been evaluated with respect to current NYSDEC standards, and is presented in detail in the 2009 Revised RI Report. Figure 1-9 shows which NYSDEC standards were applied across the study area, based on the current zoning (reviewed at the Village of Ilion on March 4, 2010) of the Site and off-site area. The extent of

NAPL, as well as soil and groundwater contamination above the applicable NYSDEC standards, are summarized in Figures 1-10 through 1-17. A statistical summary of the soil analytical data collected during the RI is presented in Appendix A. Table A-1 provides a summary of on-site surface soil samples compared to SCOs and background data. Table A-2 provides a summary of near-site surface soil samples compared to SCOs and background data. Table A-3 provides a summary of background surface soil samples compared to SCOs. Table A-4 provides a summary of on-site subsurface soil samples compared to SCOs. Table A-5 provides a summary of off-site subsurface soil samples compared to SCOs.

Since PAHs are present in other products ubiquitous within our environment, including fuels, asphalt, internal combustion engine exhaust, and other petroleum based products and byproducts, background samples were collected from areas not likely to be impacted by Site activities to determine PAH concentrations found in the surrounding suburban, commercial, and industrial environment. The purpose of the background soil sampling was to evaluate and compare the concentrations detected in surface soil samples collected at the Site and near site study areas to a representative concentration obtained from samples collected from areas surrounding the site not believed to be impacted by Site operations. The analytical results for the background samples are presented in the RI Report. Appendix A, Table A-3 provides a statistical summary of the background analytical data.

1.2.5.1 Soils

As shown on Figures 1-10 and 1-11 (site and off-site areas, respectively), soils samples exhibiting exceedances of the NYSDEC Subpart 375-6 Soil Cleanup Objectives (SCOs) are interspersed throughout the study area. The horizontal extent of soil contamination in excess of the SCOs has not been fully delineated. Although sporadically found at depths of up to 25 feet bgs, the bulk of the contamination appears to be located in the 0-10 feet bgs interval.

Concentrations of contaminants in surface soils are relatively low. Minimum and maximum concentrations for Total PAHs were noted at SS-29 (minima of approximately 4.2 ppm) and SS-08 (maxima of about 180 ppm). In background surface soil locations collected during the RI, samples contained concentrations of Total PAH from approximately 1 to 44.7 ppm. Therefore, some of the PAH contamination observed in surface soils may be attributable to non-MGP-related sources such as vehicular activity, land use, and fill from other sources.

Cyanide was not detected in on-site or background surface soil samples, but was detected in 3 near-site surface soil samples at concentrations ranging from 0.96-12.4 mg/kg; these concentrations do not exceed the SCOs. In subsurface soils, cyanide was detected on site in 21 of 72 samples, at concentrations ranging from 0.66-266 mg/kg. However, only 4 of the samples had concentrations above the SCOs. Cyanide was not detected in off-site subsurface soil samples.

Fingerprinting analysis of off-site soils identified some coal tar-related contamination at some locations. However, fingerprinting analysis also identified fuel-related contamination, and there are other sources of impacts from a variety of known sources such as the former Ilion Landfill, the former railroad along the present location of Route 5S, activities at the Ilion DPW garages and DPW debris disposal area, and backup flooding of the Mohawk River.

The horizontal extent of MGP-related impacts (defined herein as NAPL-contaminated soils, soils impacted with PAHs > 500 ppm, and soils impacted with cyanide concentrations > 40 ppm) observed on- and off-site is shown on Figures 1-13 and 1-14, respectively.

1.2.5.2 Swale Soils

During the RI, soil borings were advanced to depths of up to 20 feet in the open swale area. Results of RI data show contamination present at approximately 4 feet bgs. Therefore, in this FS, deposits within the open swale are referred to as swale soils and are discussed with the soil medium.

Exceedances of the SCOs were identified at approximately 15 locations, as shown on Figure 1-12. Petroleum-like odors were identified during sampling. Oil sheen has also been observed on the water surface near sampling locations. Locations of exceedances and clean samples are interspersed throughout the open swale area. PAHs and BTEX compounds account for most of the exceedances. Fingerprinting analysis identified coal tar- and fuel-related contamination. Figure 1-14 shows the horizontal extent of coal-tar related impacts and PAHs in excess of 500 ppm located in the open swale area. Cyanide was not detected in swale soils. Detected metals in the open swale area are not considered to be related to former MGP operations and may be related to the former or current local operations and conditions.

As discussed in the RI Report, most of the observed impacts in the open swale area are not related to the Site. The swale area has been impacted by a variety of known sources, such as the former Ilion Landfill, the former railroad along the present location of Route 5S, storm water discharge from the surrounding commercial and industrial areas, activities at the Ilion DPW garages and DPW debris disposal area, several pipe discharges of unknown origin, and backup flooding of the Mohawk River.

1.2.5.3 Non-Aqueous Phase Liquids (NAPL)

Impacts from NAPL were observed in the subsurface within the study area at three locations: within the footprints of the former 200,000-gal and the octagonal gas holders (on-site locations), and in the southern portion of the open swale area (off-site location). The horizontal and vertical extents of NAPL impacts are presented in Figures 1-13 and 1-14.

Based on the results of soil borings and test trenches, it appears that the sidewalls of the former 200,000-gal gas holder were removed, while the horizontal bottom slab was left in place. The slab is located at a depth of approximately two to three bgs, and was set on approximately six feet of fill overlying the top of lacustrine deposits. NAPL impacts were located within an area spanning the eastern boundary of the former gas holder, at depths above the slab. Impacts were also found at depths of approximately eight to 13 feet, below the slab and above or within the fill/lacustrine interface. NAPL was described as being either in the form of blebs, or a “taffy-like” substance.

A circular footing of the former octagonal gas holder remains in place. The diameter of the footing is approximately 40 feet. It is not clear whether the bottom slab or portions of it are still present. The footing reaches to a depth of approximately 13 feet bgs. The bottom of the footing is in contact with the top of the lacustrine layer. Based on the results of groundwater monitoring, it appears that the volume of the subsurface encompassed by the footing is hydraulically isolated from the onsite water-bearing zone (water levels inside the footing are 8 feet higher than outside). Likewise, NAPL impacts associated with this area are confined to the footprint of the former gas holder. NAPL in the form ranging from blebs to full saturation has been identified in the approximately one-foot thick zone immediately above the bottom of the footing.

NAPL impacts were identified off-site in the southern portion of the open swale area. NAPL blebs were observed at depths of approximately six to nine feet bgs, within an area of approximately 110 by 30 feet. The impacted soils were located at the bottom of the lacustrine unit and at the lacustrine/peat interface. A 24-inch storm sewer whose invert is approximately six feet bgs crosses the impacted open swale area. The storm sewer has the potential to contribute contaminants, particularly PAHs, into the environment at this location.

1.2.5.4 Groundwater

Groundwater in the study area was sampled with the use of a monitoring well network. The following presents a summary of the groundwater results detailed in the RI Report. Groundwater analytical data can be found in Appendix F of the 2009 Revised RI Report. Figures 1-15 through 1-17 of this FS summarize the historical extent of MGP-related contamination in groundwater.

Groundwater impacts are localized and do not indicate significant migration of contaminants from the Site. Dissolved-phase contamination exceeding the NYSDEC WQ Class GA criteria, consisting of BTEX compounds and cyanide, is present in the southern and central portions of the Site, and cyanide contamination appears to also extend to a well adjacent to the site proper immediately east of the Site. However, cyanide was only detected at or exceeding criteria in one of the three sampling events, and was detected at a concentration equivalent to the NYSDEC Class GA Water Quality Criteria. PAHs were identified in one off-site location slightly in excess of the NYSDEC WQ Class GA criteria during the most recent sampling event. However, other sources of PAHs are present in this area.

Natural Attenuation

An evaluation of the Monitored Natural Attenuation (MNA) capacity of the aquifer at the Site, via a review of site-specific chemical and geochemical parameters, indicates that aerobic biodegradation of the BTEX compounds can occur at the Site. However, aerobic biodegradation does not appear to be a primary Natural Attenuation Process (NAP) occurring at the Site because of the relatively low dissolved oxygen concentrations and MGP-related constituent concentrations. A more detailed discussion of natural attenuation at the Site is presented in Appendix B.

Overall Groundwater Assessment

Dissolved-phase contamination exceeding the NYSDEC WQ Class GA criteria, consisting of BTEX compounds and cyanide, is present in the southern and central portions of the Site. Cyanide contamination appears to also extend to the area adjacent to the site proper immediately east of the Site. Concentrations of BTEX, PAHs, and cyanide have decreased over time. The highest concentrations of total BTEX, total PAHs, and cyanide from the most recent sampling event (when analyzed) are 77.7 ppb (2008), 24.8 ppb (2004), and 3.6 ppm (2008), respectively. The cyanide contamination does not appear to have migrated beyond areas immediately adjacent to the Site. The off-site concentration of total PAHs from the 2008 sampling event was 13 ppb at MW-15. BTEX compounds were not detected off-site.

NAP are likely occurring, and total BTEX concentrations have decreased over time. Remediating NAPL and soils affected by MGP-related constituents at the Site will likely result in a further reduction of the groundwater concentrations by removing the source of contamination affecting groundwater.

1.2.5.5 Soil Gas

Soil vapor samples were collected at the northern and eastern perimeter boundaries of the Site during the February and December 2008 soil vapor sampling events. Ambient (outdoor) air sample were also collected. Analysis of samples indicated the presence of low-level VOC concentrations in the soil vapor (BTEX and BTEX isomers, non-chlorinated contaminants, and chlorinated solvents). The soil vapor concentrations were generally of the same order of magnitude as the ambient air concentrations, or slightly higher. Results were compared to the USEPA Target Shallow Soil Gas Concentrations identified in Table 2b of the 2002 USEPA Vapor Intrusion Guidance. The observed concentrations were detected at levels below the USEPA guidance; therefore, no further action was recommended. In a letter dated February 2, 2009, NYSDOH concurred with this recommendation. Therefore, soil gas was not evaluated further at part of this Feasibility Study.

2.0 Remedial Action Objectives

This section discusses the development of Remedial Action Objectives (RAOs) based on the Standards, Criteria, and Guidance (SCGs). General Response Actions to address the RAOs are then identified.

2.1 Standards, Criteria and Guidance (SCGs)

The Ilion (East Street) Former MGP Site is categorized as a Class 2 Inactive Hazardous Waste site by the NYSDEC. Activities at the Site are being performed under an Order on Consent. In accordance with 6 NYCRR 375-1, NYSDEC-issued permits are not required for environmental remediation activities conducted at this Site and at the off-site areas. Rather, the activities are evaluated and implemented based on the substantive elements of the applicable and relevant and appropriate state environmental laws and regulations.

NYSDEC evaluates compliance with Standards, Criteria, and Guidance (SCGs). As defined in NYSDEC's DER-10, SCGs are promulgated requirements ("standards" and "criteria") and non-promulgated guidance ("guidance") which govern activities that may affect the environment and are used at various stages of investigation and remediation of a site. SCGs incorporate both the CERCLA concept of "applicable or relevant and appropriate requirements" (ARARs) and EPA's "to be considered" (TBCs) category of non-enforceable criteria or guidance. Consistent with USEPA's definition of TBCs presented in the *CERCLA Compliance with Other Laws Manual*, guidance does not have the same status as promulgated requirements; however, remedial programs should be designed with consideration of guidance (USEPA, 1988).

The SCGs that may guide the remedial action activities at the site are addressed in this section. This includes both New York State SCGs, as well as federal standards that are more stringent than State SCGs. New York State SCGs are standards or requirements that implement the New York State Environmental Conservation Law. Remedial actions conducted in New York State are required to attain SCGs to the extent practicable as per NYSDEC Subpart 375: Environmental Remediation Programs (December 2006).

SCGs are categorized as chemical-, location-, or action-specific:

- Chemical-specific SCGs set health or risk-based concentration limits or ranges in various environmental media for specific hazardous substances, pollutants or contaminants.
- Location-specific SCGs set restrictions on activities within specific locations, such as wetlands and floodplains, and depend on the characteristics of a site and its immediate environs.
- Action-specific SCGs set controls or restrictions on particular kinds of activities that may be selected to accomplish a remedy. These SCGs may specify particular performance levels, actions or technologies to be used to manage hazardous substances, pollutants or contaminants.

2.1.1 Chemical-Specific SCGs

Chemical-specific SCGs are health- or risk-based concentrations for specific hazardous substances, pollutants, or contaminants in various environmental media. Chemical-specific SCGs include remediation goals for contaminants of potential concern (COPCs) in designated media (*i.e.*, soil and groundwater). Statutes, regulations, and guidelines to be used in the identification of chemical-specific SCGs are listed in Table 2-1.

TABLE 2-1
CHEMICAL-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
STATE				
Inactive Hazardous Waste Sites	Program for designating and managing inactive hazardous waste sites	Article 27, Title 13	Establishes general cleanup goals for environmental media to levels that will eliminate a significant threat to the environment. This allows NYSDEC to designate inactive hazardous waste disposal sites.	Sites are listed based on evidence of a significant threat posed by hazardous waste disposed of at the Site. A significant adverse impact on the environment and/or a significantly increased risk to human health would constitute a significant threat. The Ilion (East Street.) site is classified as an Inactive Hazardous Waste Site.
Soil Cleanup Goals	NYSDEC Soil Cleanup Objectives	Subpart 375-6: Remedial Program Soil Cleanup Objectives	Establishes soil cleanup objectives based on Protection of Public Health (Commercial, Industrial, or Residential); Protection of Ecological Resources, and Protection of Groundwater	Referenced in determining soil cleanup levels.
Groundwater Cleanup Goals	NYSDEC Class GA Standards	TOGS 1.1.1: Ambient Water Quality Standards and Guidance Values	Establishes groundwater cleanup objectives based on Class GA, Source of Drinking Water	Groundwater quality standards may be referenced.

Notes:
SCGs = standards, criteria, and guidance

2.1.2 Action-Specific SCGs

Action-specific SCGs are technology- or activity-based requirements or limitations. These SCGs are triggered by, and apply to, the implementation of particular remedial activities. Federal and state statutes, regulations, and guidelines used to identify action-specific SCGs for the site are listed in Table 2-2.

Of primary consideration are the Resource Conservation and Recovery Act (RCRA) hazardous waste management regulations (and the NYSDEC equivalents). Additionally, the NYSDEC policy “Management Of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment (DER-4)” (NYSDEC, 2002) provides criteria for excluding coal tar waste and impacted soils from former MGPs which exhibit the hazardous characteristic for benzene (D018) from the hazardous requirements of 6 NYCRR Parts 370-374 and 376 when destined for permanent thermal treatment.

Other Action-Specific SCGs that may apply to the remedial activities at the site include the NYSDEC solid and hazardous waste handling, transportation and disposal regulations and ambient air quality standards and emission limitations.

TABLE 2-2
ACTION-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
FEDERAL				
Generation, Management, and Treatment of Hazardous Waste	Resource Conservation and Recovery Act (RCRA) Subtitle C - Hazardous Waste Management Identification and Listing of Hazardous Wastes	40 U S C Section 6901 *et seq.* 40 CFR Part 261	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 40 CFR Parts 260-266	These regulations do not set clean-up standards, but would apply to the classification of all MGP-impacted soils and residual waste streams generated during remedial activities.
	Hazardous Waste Determinations	40 CFR Part 262.11	Generators must characterize their wastes to determine if the waste is hazardous by listing (40 CFR 261, Subpart D) by characteristic (40 CFR 261, Subpart C) or excluded from regulation (40 CFR 261.4)	Neither coal tars nor petroleum-based residuals are listed hazardous wastes but may be hazardous by characteristic (particularly for benzene toxicity).
	Manifesting	40 CFR 262, Subpart B	Generators must prepare a Hazardous Waste Manifest (EPA form 8700-22) for all off-site shipments of hazardous waste to disposal or treatment facilities	Will apply to all off-site shipments of RCRA/NYSDEC hazardous wastes.
	Recordkeeping	40 CFR 262.40	Generators must retain copies of all hazardous waste manifests used for off-site disposal	Generator must retain copies of waste manifests for a minimum period of three years after shipment date.
Generation, Management, and Treatment of Hazardous Waste (cont'd)	Labeling and Marking	40 CFR 262, Subpart C	Species EPA marking, labeling and container requirements for off-site disposal of hazardous waste	Pre-transportation requirements for off-site shipments of hazardous wastes.
	Accumulation Limitations	40 CFR Part 262.34	Allows generators of hazardous waste to store and treat hazardous waste at the generation site for up to 90 days in tanks, containers, and containment buildings without having to obtain a RCRA hazardous waste permit.	Hazardous wastes may be stored for up to 90 days on-site without the need for a storage permit unless NYSDEC waives the 90-day limit as an administrative requirement. Requirement will likely apply to coal tar or purifier wastes that contain little or no soil and treatment residuals that are characteristically hazardous.

TABLE 2-2
ACTION-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
	Standards for Owners/Operators of Hazardous Waste Treatment, Storage, Disposal (TSD) Facilities General Facility Standards	40 CFR Part 264/265 Subpart B	General requirements for owners/operators of TSD facilities including general waste analysis and compatibility, notices and inspection requirements, location and construction standards, and security	These subpart standards would be applicable to the on-site management of hazardous waste soils in tanks, containers or containment buildings.
	Closure and Post-Closure	Subpart G	Established closure and post-closure requirements for hazardous waste treatment and storage units	Applicable to storage and/or treatment of hazardous wastes in containers on-site.
	Container Management	Subpart I	Hazardous waste stored in containers must comply with management requirements, including types of containers used, waste compatibility and inspection requirements.	Applicable to storage and/or treatment of hazardous wastes in containers on-site.
	Tank Systems	Subpart J	Tank systems for the treatment or storage of hazardous wastes are to be designed and operated in a manner to prevent releases to the environment	Applicable for the tank treatment and/or storage of all site generated wastes classified as a hazardous waste.
	Containment Buildings	Subpart DD	Containment buildings must be designed, constructed, and operated to meet regulatory performance standards	Standards applicable to the construction of containment buildings used to treat and/or store hazardous waste.
Capping of Hazardous Waste	RCRA Subtitle C Standards for Capping Surface Impoundments Waste Piles Landfills	40 U S C Section 6901 et seq. 40 CFR Part 264/265 Subpart K Subpart L Subpart N	Regulations governing placement of caps or similar barriers over hazardous waste. Requirements for installation, permeability, maintenance of cover, elimination of free liquids or solidification, run-on/run-off damage control, and post-closure use of property	Requirements potentially applicable to the disposal of hazardous waste excavated material.
Water Quality Impacts	Clean Water Act Ambient Water Quality Criteria Guidelines Wastewater Discharge Permits, Effluent Guidelines, Best Available Technology (BAT) and BMPPT	33 U S C Section 1251-1376 40 CFR Part 131 40 CFR Parts 122, 125, 401	Establishes toxicity-based surface water quality criteria for protection of aquatic organisms and human health. Permit requirements for point source discharges to waters of the United States, establishes effluent standards and requirements for preventing toxic releases	Ambient water quality criteria would be potentially applicable in establishing cleanup standards and establishing discharge standards for treated groundwater. Potentially applicable for remedial activities involving a direct wastewater discharge to nearby surface water and/or diversions/disruptions of the surface water flows of the streams and pond that would impact water quality.

TABLE 2-2
ACTION-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
Air Emissions from a Point Source	Clean Air Act (CAA) National Ambient Air Quality Standards (NAAQS)	40 U S C Section 7401-7642 40 CFR Part 50	Establishes ambient air quality standards for protection of public health	NAAQS may be applicable in evaluating whether there are air impacts at the site during remedial activities.
	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)	These regulations are potentially applicable and would require a comparison of potential emissions from the remedial activity to the emission thresholds for NSR
	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)	NESHAPs may be applicable if emissions from remediation activities exceed the thresholds for compliance
	New Source Performance Standards (NSPS)	40 CFR Part 6	Source-specific regulations which establish testing, control monitoring and reporting requirements for new emission sources	NSPS could be relevant and appropriate if steam-generating equipment, thermal desorption units, or other regulated new sources were to be used onsite
Land Disposal of Hazardous Waste	RCRA Subtitle C Land Disposal Restrictions (LDRs)	40 U S C Section 6901 et seq. 40 CFR Part 268	Restricts land disposal of hazardous wastes that exceed specific criteria. Establishes Universal Treatment Standards (UTSs) to which hazardous wastes must be treated to prior to land disposal. Phase IV rule revision establishes Alternate Treatment Standards for Soils containing hazardous wastes.	Hazardous petroleum-based residuals are subject to LDRs, including UTSs. Wastes exhibiting a hazardous characteristic would need to be treated to meet UTS for all hazardous constituents present in the residuals prior to any disposal. Characteristically hazardous soils can be treated to meet the UTS standards or to meet the alternative treatment standards for RCRA hazardous soils.
Characteristic Hazardous Waste Soil Management	MGP Site Remediation Strategy	MGP Site Remediation Strategy MGP Subcommittee, Edison Electric Institute (EEI, 1993)	Strategy document intended to facilitate responsible parties undertaking the source removal of heavily contaminated organic residues and contaminated soils at MGP sites in a manner that is consistent with the RCRA hazardous waste program. The remediation strategy is based on the fact that RCRA hazardous materials may be blended on-site and decharacterized prior to off-site transport and disposed of at a permitted facility. It covers relevant onsite activities including characterization, excavation, accumulation and treatment in 90-day units, and off-site transportation.	The remediation strategy applies only to the management of excavated solid materials that are hazardous by characteristic. The strategy does not supersede existing regulations, it is not intended to be the presumptive remedy under CERCLA, nor can it serve as a shield against enforcement under RCRA or any other statute.

TABLE 2-2
ACTION-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
STATE				
Generation, Management, and Treatment of Hazardous Waste	Siting of Industrial Hazardous Waste Facilities	6 NYCRR Part 361	Establishes procedures for selecting appropriate sites for hazardous waste facilities	These regulations are potentially applicable for remediation activities which would involve the construction of upland hazardous waste management facilities
	NYSDEC Division of Hazardous Substances Regulation Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 372-376	These regulations do not set clean-up standards, but would apply during the management of excavated hazardous waste soils and the upland management of and residual waste streams generated during remediation activities.
	New York State Hazardous Waste Management Facility Regulations	6 NYCRR Part 370.373.372	Establishes New York State's hazardous waste management program. Includes regulations for hazardous waste facility construction, operation, and closure, and standards for hazardous waste generation, manifesting, and transport	[See RCRA Hazardous Waste Management Regulations. 40 CFR Parts 263 and 264/265 under Federal SCGs listed in this table]
	Management Of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment (DER-4)	NYSDEC Division of Environmental Remediation, Technology Section	Provides criteria for excluding coal tar waste and impacted soils from former MGPs which exhibit the hazardous characteristic for benzene (D018) from the hazardous requirements of 6 NYCRR Parts 370-374 and 376 when destined for permanent thermal treatment	The provisions of the Guidance will be referenced in developing and evaluating MGP-impacted soil treatment alternatives.
Capping of Non-Hazardous Waste	New York State Solid Waste Management Facility Regulations	6 NYCRR Part 360, 364	Establishes New York State's equivalent solid waste management program. Includes regulations governing construction, operation, and closure of solid waste disposal facilities	These regulations are potentially applicable to remediation activities involving the upland management and disposal of non-hazardous wastes. Coal tars and petroleum-based site residuals must be identified as solid and/or hazardous waste in order to determine applicability of waste management requirements.
Water Treatment Discharge	New York State Regulations on the State Pollution Discharge Elimination System (SPDES)	6 NYCRR Parts 750-758	State Pollution Discharge Elimination System (SPDES) Permitting Requirements	May be applicable to discharge of treated groundwater.

TABLE 2-2
ACTION-SPECIFIC SCGs

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
	New York State Water Classifications and Quality Standards NYSDEC Ambient Water Quality Standards and Guidance Values	6 NYCRR Parts 701, 702, 703, 704 Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1	Defines surface water classifications and ambient water quality standards that are the basis for establishing effluent limitations under the SPDES program. Provides a compilation of ambient water quality standards and guidance values for toxic and non-conventional pollutants for use in NYSDEC programs, including the SPDES permit program.	Potentially applicable to alternatives where treated groundwater discharges to surface water. The Mohawk River is classified by the NYSDEC as a Class B surface water body. These standards and guidance values are applicable in establishing discharge limitations to surface waters
Air Emissions	New York State Air Pollution Control Regulations	6 NYCRR Parts 120, 200-203, 207, 211, 211, 212, 219 Air Guide-1	Establishes emissions standards for new sources of air pollutants and specific contaminants.	Requirements would be applicable to remediation alternatives that result in emissions of air contaminants, including particulate matter.
	New York State Ambient Air Quality Standards	6 NYCRR Part 257	Establishes state ambient air quality standards and guidelines for protection of public health.	May be applicable in evaluating air impacts during remediation activities. Establishes short-term action limits for occupational exposure.

Notes:
SCGs = standards, criteria, and guidance

2.1.3 Location-Specific SCGs

Location-specific SCGs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Statutes, regulations, and guidelines to be used in the identification of location-specific SCGs are listed in Table 2-3.

TABLE 2-3
LOCATION-SPECIFIC SCGs

LOCATION	REQUIREMENTS	CITATION	DESCRIPTION	COMMENT
FEDERAL				
Floodplains	Executive Order 11988 - Floodplain Management	40 CFR 6, Subpart A; 40 CFR 6.302	Activities taking place within floodplains must be done to avoid adverse impacts and preserve beneficial values in floodplains.	Activities may occur within the floodplain of the Mohawk River.
Wetlands/Waters of the U.S.	Dredge and Fill in Wetlands	33 CFR Parts 320-330/40 CFR Part 230	Dredge or fill material into wetlands must be evaluated based on specific criteria.	Would be applicable to remediation activities impacting jurisdictional wetlands. Wetland delineation may be required prior to remedial activities.
	Executive Order 11990 - Protection of Wetlands	40 CFR Part 6 Subpart A	Activities taking place within wetlands must be done to avoid adverse impacts.	Would be applicable to remediation activities conducted in any perimeter jurisdictional wetlands.
Historic/Cultural Resources	National Historic Preservation act	16 USC 470	Establishes requirements for the identification and preservation of historic and cultural resources	Would be applicable to the management of historic or archeological artifacts identified on the site.
Critical Habitat	Endangered Species Act and Fish and Wildlife Coordination Act	16 USC 661 and 16 U.S.C. 1531	Actions must be taken to conserve critical habitat in areas where there are endangered or threatened species.	Requirements would be applicable if endangered or threatened species are identified on or adjacent to the site.
STATE				
Floodplains	Floodplain Management Regulations	6 NYCRR Part 500	Establishes floodplain management requirements including limitations on projects, including placement of fill, which may result in an increase in flood levels or water surface elevations during a base flood discharge.	Remediation activities may occur within the floodplain of the Mohawk River.
Floodplain	TSD Facility Permitting Requirements	6 NYCRR Subpart 373-1	Facility must be designed and operated to avoid washout.	Requirements are potentially applicable to any upland treatment, storage or disposal of hazardous wastes within the floodplain of the Mohawk River.
Wetlands	Alteration of Freshwater Wetlands	6 NYCRR Subpart 663	Establishes requirements for activities taking place in freshwater wetlands, including dredging, draining, fill or placement of structures.	Would be applicable if wetlands are identified in association with the swale area and are greater in area than 12.4 acres.
Water Resources	Use and Protection of Waters	6 NYCRR Part 608	Establishes requirements and limitations on activities within waters. Regulates removal or placement of fill materials within state waters.	Requirements may be applicable to activities conducted within the open swale area since it is hydraulically connected to the Mohawk River.

2.2 Development of Remedial Action Objectives

Consistent with NYSDEC's DER-10, the RAOs are developed based on contaminants exceeding applicable SCGs and the environmental media impacted by the contaminants, applicable SCGs taking into consideration the current and future land use for the Site, and actual or potential public health and/or environmental exposures resulting from contaminants in environmental media at, or impacted by, the Site.

2.2.1 Contaminants of Concern

A number of chemical contaminants of potential concern (COPCs) were selected for evaluation in the qualitative risk assessment performed during the RI. COPCs were selected separately for each environmental medium (soil and groundwater), based on validity of the analytical results, frequency of occurrence, concentrations relative to natural (background) levels and/or toxicological, physical, and chemical characteristics. For both soil and groundwater, the COPCs are BTEX, PAHs, and cyanide.

2.2.1.1 PRGs

PRGs are based on TOGS 1.1.1 Class GA Groundwater Criteria for groundwater and Subpart 375-6 values for soil.

Table 2-4 summarizes the potential SCG-based PRGs for groundwater.

Table 2-5 summarizes the potential SCG-based PRGs for soil.

For the site-wide groundwater, a comparison is made in Table 2-4 of Groundwater Class GA standards and practical quantitation limits (PQLs). The site-wide groundwater PRGs are based on the higher value of either the GA standard or the PQL.

For the on-site soil, Protection of Public Health Commercial SCGs was considered the applicable SCO, because the Site is zoned as commercial. For off-site soil, the Protection of Public Health Residential standards were applied in the off-site area adjacent to the site proper and the southwest because these areas are zoned as residential. Protection of Public Health Industrial standards were applied in the undeveloped east/northeast portion of the off-site soil, including the swale, because these areas are zoned as manufacturing.

For cyanide, since the only exceedances of SCOs were in subsurface soils on site, and since cyanide exceedances of the Class GA standards were also observed on site, the Subpart 375-6 SCO for protection of groundwater, 40 ppm, was applied.

TABLE 2-4
POTENTIAL SCG-BASED PRGs FOR GROUNDWATER

MGP Residuals	TOGS 1.1.1 Class GA-Based Groundwater SCGs (ug/L)	Practical Quantitation Limit (ug/L)	Selected PRG (ug/L)
Volatiles			
Benzene	1	1	1
Toluene	5	1	5
Ethylbenzene	5	1	5
Xylene	5	2	5
Semi-Volatiles			
Acenaphthene	20	0.2	20
Anthracene	50	0.2	50
Benzo(a)anthracene	0.002	0.1	0.1
Benzo(a)pyrene	ND	0.2	0.2
Benzo(b)fluoranthene	0.002	0.2	0.2
Benzo(k)fluoranthene	0.002	0.2	0.2
Chrysene	0.002	0.2	0.2
Fluoranthene	50	0.2	50
Fluorene	50	0.2	50
Indeno(1,2,3-c,d)pyrene	0.002	0.2	0.2
Naphthalene	10	0.2	10
Phenanthrene	50	0.2	50
Pyrene	50	0.2	50
Inorganics			
Cyanide	200	10	200

TABLE 2-5
POTENTIAL SCG-BASED PRGs FOR SOIL

MGP Residual	SCG-Based PRGs Residential (mg/kg)	SCG-Based PRGs Commercial (mg/kg)	SCG-Based PRGs Industrial (mg/kg)
Volatiles			
Benzene	2.9	44	89
Toluene	100	500	1,000
Ethylbenzene	30	390	780
Xylene	100	500	1,000
Semi-Volatiles			
Acenaphthene	100	500	1,000
Acenaphthylene	100	500	1,000
Anthracene	100	500	1,000
Benzo(a)anthracene	1	5.6	11
Benzo(a)pyrene	1	1	1.1
Benzo(b)fluoranthene	1	5.6	11
Benzo(g,h,i)perylene	100	500	1,000
Benzo(k)fluoranthene	1	56	110
Chrysene	1	56	110
Dibenzo(a,h)anthracene	0.33	0.56	1.1
Fluoranthene	100	500	1,000
Fluorene	100	500	1,000
Indeno(1,2,3-c,d)pyrene	0.5	5.6	11
Naphthalene	100	500	1,000
Phenanthrene	100	500	1,000
Pyrene	100	500	1,000
Inorganics			
Cyanide	27	27	10,000

2.2.2 Remedial Action Objectives

In this section, Remedial Action Objectives (RAOs) for the Site and off-site MGP-related impacts are identified.

2.2.2.1 Soil

The RAOs developed for impacted soil on and off-site are:

- Prevent ingestion of, or direct contact with, contaminated soil
- Prevent inhalation of, or exposure to contamination volatilizing from soil
- Prevent migration of contaminants that may result in groundwater or surface water contamination, to the extent practicable

2.2.2.2 Groundwater

The RAOs developed for the groundwater are:

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards
- Prevent contact with, or inhalation of volatiles from, contaminated groundwater
- Restore groundwater to pre-release conditions to the extent practicable
- Reduce or eliminate sources of groundwater contamination to the extent practicable

2.3 General Response Actions

To meet the RAOs developed for the Site and the off-site areas, the following GRAs for soil and groundwater have been identified:

1. No Action
2. Limited Action
    c. Institutional Controls (*e.g.*, environmental easement, HASP, SMP)
    d. Engineering Controls (*e.g*. fencing)
3. Containment
4. Treatment/Disposal
    c. *In Situ* Treatment
    d. Removal/Treatment/Disposal

No Action involves no treatment but would implement reviews for periodic reevaluation of site conditions. Limited Action involves measures that restrict access to contaminated areas through physical and/or administrative measures, and include long-term monitoring.

Containment actions include technologies that involve little or no treatment, but provide protection of human health and the environment by reducing mobility of contaminants and/or eliminating pathways of exposure.

Treatment/Disposal actions include technologies that act to reduce the volume, toxicity, and/or mobility of contaminants. These technologies include *in situ* treatment or removal and *ex situ* treatment (*e.g.*, physical, chemical, thermal, biological). Disposal actions include both on-site and off-site disposal technologies.

3.0 Identification and Screening of Technologies and Process Options

Media-specific technologies and process options considered for the Ilion (East Street) Site and off-site impacted areas are identified and screened in this section. This process is summarized in Tables 3-1 and 3-2 for soil and groundwater, respectively.

3.1 Soil

The following technologies were considered for the contaminated soil. Soil technologies are also considered for use in NAPL remediation.

- No Action
- Limited Action
- Containment
- Removal
- *Ex Situ* Treatment
- Disposal
- *In Situ* Treatment

3.1.1 No Action

Description: No Action is an option that does not include any remedial measures. No Action allows for long-term monitoring, periodic reviews of the site and reevaluation of the need for remedial action at periodic intervals.

Initial Screening: This approach would not provide any remedial action. Although it will be shown that the No Action would not meet remedial objectives, it will be retained throughout the detailed evaluation as a baseline for comparison of other alternatives.

3.1.1.1 Limited Action

Limited Action consists of technologies that are generally passive, including monitoring, access restrictions (*e.g*., engineering controls such as fencing and warning signs) and institutional controls (*e.g*., environmental easements, Health and Safety Plan, Site Management Plan, etc.).

3.1.1.1.1 Access Restrictions

Description: Access to the site, and use of the site, would be restricted by providing a security fence around the site and affixing signs, as appropriate.

Initial Screening: Fencing around the impacted soil areas would effectively prevent exposure to the contaminated soil. A security fence currently exists around the Site. Fencing the off-site area is not practical because of its size, the presence of streets, and the location immediately adjacent to local roads and the river. However, signs could be posted at the off-site areas, and notifications distributed as needed. This process option is retained for further evaluation.

3.1.1.1.2 Environmental Easements

Description: With this process option, land use restrictions would be retained through real estate transactions. Examples would include use restrictions and limitations on excavation at the Site.

Initial Screening: Use restrictions would be required as a final step in the development of remedial alternatives that do not remediate the Site to unrestricted use conditions. Environmental easements are retained as a process option.

3.1.1.1.3 Health and Safety Plan and Site Management Plan

Description: This process option includes the preparation, implementation and maintenance of Plans for the property. The Plans would require monitoring and use of personal protective equipment (PPE) during construction activities at the site, and would provide soil management requirements.

Initial Screening: Plans would be required as the final step in the development of remedial alternatives that do not remediate the Site or impacted off-site areas to unrestricted use conditions. Plans are retained as a process option.

3.1.1.1.4 Monitoring and Site Reviews

Description: This process option includes periodic data collection (*e.g.*, quarterly, annual, etc.) and review of the data to assess the current conditions. These data would be used to determine if implemented remedial activities have achieved the RAOs or are continuing to be protective of human health and the environment as conditions improve towards achieving the RAOs. Should site reviews indicate conditions are worsening or the current conditions pose an unacceptable risk to human health or the environment, additional activities could be implemented.

Initial Screening: Periodic monitoring and reviews are necessary to assess the progress of remedial activities and the protectiveness of implemented actions until RAOs are achieved. They are a necessary component of nearly all remedial actions, the exception being those that immediately achieve RAOs, and are therefore retained as a process option.

3.1.1.2 Containment

Containment provides isolation of contaminated soil from potential receptors and/or uncontaminated media. Capping technologies and/or vertical barriers can be used to contain contaminated soil, minimize human exposure to soil, control migration of NAPL, and reduce leaching of contaminants from the soil to groundwater. Capping of contaminated soil could be achieved by using permeable soil caps, clay caps, asphalt caps, and multiple layer caps. Vertical barriers include sheet piling, slurry walls and grout curtains, which can be used to mitigate contaminant migration.

3.1.1.2.1 Permeable Soil Cap

Description: A permeable soil cap can be installed over contaminated soil to mitigate direct contact with contaminants. A permeable soil cap would have a high permeability relative to clay, and would allow percolation of surface water, runoff, etc. It would prevent migration of soil-related contamination via the pathways of fugitive dust and soil erosion.

Initial Screening: A permeable soil cap would be effective in mitigating direct contact with contaminated surface soils; however, soil caps do not reduce contaminant migration to groundwater. Permeable soil caps are susceptible to erosion from climatic and storm forces which can be mitigated with a properly maintained vegetative cover. Permeable soil caps are also susceptible to settling, ponding of liquids, and naturally occurring invasions by burrowing animals and deep rooted vegetation if not properly maintained. Soil caps would not be applicable to areas already covered by asphalt (*e.g.*, existing streets). This option is retained.

3.1.1.2.2 Clay Cap

Description: Clay caps are commonly used as cover for lands that contain both hazardous and non-hazardous wastes. Bentonite, natural clay with high swelling properties, is often mixed with on-site soil and water to produce a low permeability layer. A low permeability clay cap would not only physically isolate the source, but also reduce the potential for leaching of contaminants to groundwater by creating a low permeability barrier. The clay cap would also prevent migration of soil-related contamination via the pathways of fugitive dust and soil erosion.

Initial Screening: A clay cap would be effective in mitigating direct contact with contaminated soils and would also mitigate contaminant migration by reducing surface infiltration; however, clay caps do not mitigate contaminant migration beneath the water table. Clay, which consists of fine material, is susceptible to erosion from climatic and storm forces which can be mitigated with a properly maintained vegetative cover. Proper particle distribution is essential to create a low permeability cap. Clay caps are also susceptible to cracking, settling, ponding of liquids and naturally occurring invasions by burrowing animals and deep rooted vegetation if not properly maintained. Clay caps would not be applicable to areas already covered by asphalt (*e.g.*, existing streets). This option is retained.

3.1.1.2.3 Asphalt Cap

Description: An asphalt cap would consist of graded soil and a gravel sub-base, with asphalt paving as a final cover. The cap minimizes wind and rain erosion, preserves slope stability, and provides protection from the elements for layers below it. It would also prevent migration of soil-related contamination via the pathways of fugitive dust and soil erosion.

Initial Screening: Asphalt caps provide a low permeability cover to mitigate direct contact with contaminated soils and infiltration; however, asphalt caps do not mitigate contaminant migration beneath the water table. They are less susceptible to erosion from climatic and storm forces than a soil or clay cap. An asphalt cap is subject to cracking and settling if not properly maintained. However, it would be effective in achieving remedial action objectives for soil including mitigating direct contact with contaminated soils. This option is retained.

3.1.1.2.4 Multi-Media Cap

Description: A multi-media cap is a combination of two or more of the single layer capping technologies. A disadvantage of one can be compensated for by an advantage of another. Most caps recommended for hazardous waste projects are multi-layer caps. The multi-media cap would typically consist of 2 feet of clay, a synthetic liner, filter fabric, 1 foot of sand, 2 feet of top soil, and vegetation at the top. The multi-media cap would effectively prevent direct exposure to soil contamination, and prevent migration of soil-related contamination via the pathways of fugitive dust and soil erosion.

Initial Screening: The performance of a properly installed, multi-layered cap is generally excellent. There is still a need for periodic monitoring and maintenance of the cap but to a lesser extent than a single media cap. This type of cap would require more restrictions on future use of the site and would be less practical to install around buildings and on small areas while offering little increased benefit. However, this type of cap has the advantage of reducing infiltration, in addition to minimizing exposure. This option is retained.

3.1.1.2.5 Horizontal Barriers

Description: Horizontal barriers include slurry walls, steel sheet pile walls, grout curtains and synthetic cutoff walls. They do not reduce migration of, or exposure to, soil-related contaminants; however they can be effective in preventing the migration of NAPL and groundwater.

Initial Screening: As indicated previously, migration of impacted groundwater does not appear to be a concern at the Ilion Site. Impacts were identified primarily on site, and sample results indicate that these impacts are localized and well-defined. The data does not indicate that migration of impacted groundwater is occurring. NAPL has been found; however, it appears as blebs, globules, staining, or sheens and confined largely to discrete areas of the central part of the Site. Therefore, vertical barriers would not be effective in improving the environmental conditions at the Site or off-site area, and are not considered further.

3.1.1.3 Removal

This process involves physical removal of contaminated soil, with the intention of subsequent treatment and/or disposal. This category includes excavation for soil or for soil/NAPL mix, and recovery for NAPL.

3.1.1.3.1 Excavation

Description: Excavation refers to the use of construction equipment such as backhoes, bulldozers, front end loaders, and clamshells that are typically used on land to excavate and handle contaminated soil. Excavation could also be used to access shallow NAPL zones to provide a means for physical removal of NAPL.

Initial Screening: Both soil exceedances of SCOs and visual evidence of NAPL in soil at the Site are relatively shallow, and can be effectively remediated using excavation, followed by treatment or disposal. Excavation is retained for both the Site and off-site areas.

3.1.1.3.2 NAPL Recovery Wells

Description: Recovery wells can be screened in the zones where layers of free NAPL have been found. They rely on the ability of NAPL to flow from the formation into the well annulus. Once inside the well, NAPL is removed either manually or by pumping.

Initial Screening: This technology is effective on relatively thick layers of low-viscosity NAPLs, located in relatively highly permeable and homogeneous formations. Fingerprint analyses of samples collected from the Site indicate the NAPL is related to the past MGP operations and is highly weathered. The NAPL observed has typically been viscous and has been present as blebs, globs, staining, or sheens with little or no saturated materials. No NAPL has been observed in the network of monitoring wells, including MW-5, which was installed within the former octagonal gas holder. Also, NAPL has been found within low-permeability clayey silt. Recovery wells are generally not effective under these conditions. Therefore, they are not retained for further analysis.

3.1.1.4 Ex Situ Treatment

Description: *Ex situ* treatment is a group of technologies that could be implemented to remediate the contaminated soils or soil/NAPL mixture after the materials are excavated. Examples of *ex situ* treatment methods are thermal desorption, incineration, biodegradation, soil washing, bioventing and soil vapor extraction.

Initial Screening: *Ex situ* treatment technologies are typically applicable to one type of contamination (*e.g.*, volatile organics, metals, etc). At the Ilion Site, soil contamination above the 6 NYCRR Subpart 375-6 Soil Cleanup Objectives was found for several types of contaminants, including volatile organics, semi-volatile organics, and cyanide. Finding a single technology to address all these contaminants is not realistic, while combining them into treatment trains, although possible, would be difficult and cumbersome. It would not be practical to construct an on-site treatment train for the small quantity of impacted soil that would require treatment. If necessary, excavated soils would be treated at an off-site facility prior to disposal. Therefore, this option is not retained for further analysis.

3.1.1.5 Disposal

This category of remedial process options refers to disposal of impacted soil on or off-site, with or without treatment. The remedial technologies are on-site landfill (with or without treatment) and off-site disposal (with or without treatment).

3.1.1.5.1 On-Site Landfill

Description: Impacted soil would be excavated and then disposed of in an on-site landfill. A regulated landfill would have to be constructed on-site, including liner system, leachate collection and treatment, and multi-layer cap.

Initial Screening: The landfill would have to meet rigorous regulatory requirements. The depth to groundwater is not sufficient to allow for the construction of an efficient landfill, and there is not sufficient space available on site for this option. In addition, it is not practical to construct an on-site landfill for the small quantity of material that would need to be disposed. Therefore, this option is not retained.

3.1.1.5.2 Off-Site Disposal

Description: Hazardous impacted material (if any) would be transported to a regulated facility and properly disposed of following treatment to meet LDRs (if necessary). The treatment, if required, would be conducted at the disposal facility as part of the off-site disposal process, and is not evaluated as a stand-alone option. Non-hazardous soil can be disposed of off-site in a non-hazardous landfill.

Initial Screening: Off-site disposal of hazardous or non-hazardous soil at an off-site landfill is a viable option. Both hazardous and non-hazardous materials may be encountered during remedial operations. Both materials would have to be managed and therefore this option is retained.

3.1.1.6 In Situ Treatment

In situ treatment is a technology category in which contaminated soil is treated "in place," without removal of the soil media. Examples of technologies in this category are soil vapor extraction, air sparging, bioventing, soil washing, stabilization/solidification, steam stripping, biodegradation, and chemical oxidation.

3.1.1.6.1 Soil Vapor Extraction

Description: Vapor extraction wells are installed throughout the impacted material down to the water table. Through a network of piping, a vacuum is applied to the wells to draw off the constituents as a vapor. Some variations utilize injected air into wells within the water table combined with vacuum extraction to liberate contaminants within the groundwater along with vadose zone contamination. The removed vapor usually requires further treatment via thermal oxidation or carbon adsorption prior to release to the atmosphere.

Initial Screening: PAHs, the predominant contaminant of concern at the Site, are not volatile and not highly amenable to this treatment process, particularly the higher-ringed compounds. Therefore, this process option is not retained.

3.1.1.6.2 In Situ Soil Flushing/Washing

Description: Organic constituents can be washed from contaminated soils by means of an extraction process termed "soil washing." An aqueous solution (*e.g.*, surfactant) is injected into the area of impacted material. As the aqueous solution flows through the impacted media, sorbed contaminants are mobilized into solution by reason of solubility, formation of an emulsion, or by chemical reaction with the flushing solution. The solution, combined with the removed constituents, is then extracted from the subsurface utilizing wells and multi-phase extraction methods. Surfactants can be used to improve the solvent property of the recharge water, emulsify insoluble organics, and enhance the removal of hydrophobic organics sorbed onto soil particles. Surfactants improve the effectiveness of contaminant removal by improving both the detergency of aqueous solutions and the efficiency by which organics may be transported by aqueous solutions. Additional treatment of the extracted aqueous waste is necessary prior to disposal.

Initial Screening: *In situ* soil washing relies on the homogeneity of the subsurface medium for proper transmission of the washing reagent throughout the saturated zone and contact with organic constituents. As noted above, the site geology includes heterogeneous fill material, lacustrine deposits, peat, and subsurface structures which could negatively impact the ability of the washing reagent to contact all impacted material. NAPL is potentially treatable with this technology. The low solubility of the heavier PAHs in the MGP impacted areas could prevent effective soil washing even in the presence of a surfactant. Additionally, when this process is used over a wide area, it would generate a substantial quantity of wastewater that would require treatment and disposal. Also, due to the site's proximity to the Mohawk River, there may also be the potential to mobilize contamination. Therefore, this technology is not retained.

3.1.1.6.3 In Situ Stabilization/Solidification

Description: *In situ* stabilization is a process whereby contaminated soils are converted in-place into a stable cement type matrix in which contaminants are bound or trapped and become immobile. Silicates can stabilize contaminants such as metals and some organics, including low concentrations of PAHs. It has been demonstrated that chemical fixation products of certain silicate-based mixtures do not leach metals and most organics. Large augers are used to inject the stabilizing reagents and mix the impacted material. Treatment may be achieved in both the saturated and unsaturated zones with this technology.

Initial Screening: For the site contaminants and physical conditions present, this process option could effectively reduce the risks associated with the Site and off-site areas. Treatability studies would be required prior to design of an *in situ* stabilization remedy for the Site. This technology is retained for further evaluation.

3.1.1.6.4 In Situ Steam Stripping (Dynamic Underground Stripping (DUS))

Description: *In situ* steam stripping is a physical separation treatment process that utilizes steam introduced into the impacted material to strip off the organic constituents. Steam is injected into the periphery of the contaminated areas to vaporize and mobilize contaminants, which are then extracted at centrally located vapor and liquid extraction points. In combination, electrical heating may be used to vaporize contaminants in less permeable zones or lenses. Vapor and liquid collection and treatment systems would be required to process the extracted liquid and vapor prior to disposal. Treatment is achieved in both the saturated and unsaturated zones.

Initial Screening: For the site contaminants and physical conditions present, this process option could effectively reduce the risks associated with the Site and off-site areas. Treatability studies would be required prior to design of a DUS remedy for the site. However, the process can result in phase separation and contaminant mobilization in mid process and is therefore a concern near a river. Therefore, this technology is not retained for further evaluation

3.1.1.6.5 In Situ Biodegradation

Description: Biological treatment involves the use of native microbes or selectively adapted bacteria to degrade a variety of organic compounds. The biological processes usually involve the addition of microbes, nutrients, and oxygen. To enhance the performance of microbial activity in the subsurface, oxygen is added to the saturated zone via either an oxygen releasing compound or controlled direct injection of air or oxygen itself. Treatment is generally only accomplished in the saturated zone.

Initial Screening: This process option relies on the natural action of microbial activity to reduce levels of organic constituents in the subsurface. This is a lengthy process and not well established for MGP-related NAPL, therefore, this technology is not retained for further evaluation.

3.1.1.6.6 In Situ Chemical Oxidation

Description: This technology involves the use of a chemical reagent that is injected into the soil via constructed wells or driven well points to break down the organic constituents into carbon dioxide and water. Generally, a hydrogen peroxide based mixture is used, with additives and catalysts to enhance the reaction characteristics. The amount of reagent needed, spacing of injection points, and the frequency of addition to achieve cleanup goals are dependent upon organic concentrations and soil characteristics.

Initial Screening: This technology has been shown to be effective in the destruction of high levels of organic constituents in the subsurface saturated zone. Bench scale testing, in combination with field pilot studies, would be necessary to further refine the operational conditions of this technology. The technology may not be capable of oxidizing both organic and inorganic compounds to an appropriate extent. In addition, if sufficient reagents cannot reach and oxidize the targeted contaminants, then there is a potential to mobilize contaminants. Therefore, this process option is not retained for further evaluation.

3.2 Groundwater

The following technologies were considered for the groundwater medium:

- No Action
- Limited Action
- Natural Attenuation
- Removal, *Ex Situ* Treatment, and Disposal
- *In Situ* Treatment

3.2.1 No Action

Description: No Action is an option that does not include any remedial measures. No Action allows for long-term monitoring, periodic reviews of the conditions, and reevaluation of the need for remedial action at periodic intervals.

Initial Screening: This approach would not provide any remedial action. Although it will be shown that the No Action would not meet remedial objectives, it will be retained throughout the detailed evaluation as a baseline for comparison of other alternatives.

3.2.1.1 Limited Action

Description: Limited Action technologies include use restrictions, planning, long-term monitoring and periodic reviews to assess migration of contaminants. Some actions included in this category could be restrictions placed in the property title deed to restrict use of the groundwater, and actions initiated by the local government or the state to implement well permit requirements that would restrict or regulate the installation of new groundwater wells.

Other actions could include implementation of a Health and Safety Plan that would include and establish guidelines for groundwater management and use in the area, and implementation of a monitoring program with periodic reviews that would include evaluation of long-term restoration to Class GA standards by natural processes.

Initial Screening: The majority of known groundwater contamination is localized within the Site boundaries (only one, low level off-site detection was noted). Groundwater impacts are localized and do not indicate significant migration of contaminants from the Site. Dissolved-phase contamination exceeding the NYSDEC WQ Class GA criteria, consisting of BTEX compounds and cyanide, is present in the southern and central portions of the Site, and cyanide contamination appears to also extend to a well adjacent to the site proper immediately east of the Site. Cyanide was only detected in one of the three sampling events, was detected at a concentration equivalent to the screening criteria, and was not detected during the most recent sampling event. PAHs were identified in one off-site location slightly in excess of the NYSDEC WQ Class GA criteria during the most recent sampling event. Currently, groundwater is not used as a potable water source at the Site or in the off-site areas and the water supply is from a municipal source. Restrictions and other institutional control actions would ensure that groundwater at the Site would not be used in the future. Therefore, this option, including an environmental easement, health and safety planning, and monitoring with periodic reviews is retained.

3.2.1.2 Monitored Natural Attenuation

Description: Monitored Natural Attenuation (MNA) is an action that relies on the ability of the water-bearing zone to lower the concentrations of contaminants through naturally occurring processes, such as biodegradation, adsorption onto soil, dilution and dispersion. MNA includes an analysis of the historic trends in dissolved-phase concentrations of contaminants of concern and attenuation parameters, a predictive analysis of the future levels of contamination, and periodic confirmatory sampling and data evaluation.

Initial Screening: Considering the age of the Site, groundwater contamination has most likely reached an equilibrium state between the mass introduced into the water bearing zone from the source and the system's ability to destroy or disperse that mass. Therefore, MNA alone is not likely to result in significant reduction in contaminant concentrations. However, should remedial activities leading to the reduction in the source be implemented, a new equilibrium would be established, resulting in lower levels of the dissolved-phase concentrations of contaminants. Therefore, this approach will be retained for consideration in conjunction with source reduction measures. Potential source reduction measures are described in Section 3.1.

3.2.1.3 Removal, Ex Situ Treatment, and Disposal

Description: Removal, *ex situ* treatment and disposal is a group of technologies in which the migration of the dissolved-phase contamination in groundwater is controlled by means of a combination of groundwater extraction (followed by treatment and discharge) and optional vertical and horizontal barriers (*e.g.*, impermeable caps, sheet pile walls, etc.). Groundwater is extracted from the water-bearing zone by means of extraction wells or collection trenches. The extraction creates an "inward" flow pattern resulting in the capture of the plume and cessation of the off-site migration. This flow pattern must be maintained by means of groundwater extraction for as long as the source of contamination is present. Horizontal and vertical barriers may be used to reduce the extraction rate required to achieve hydraulic containment. The inclusion of the barriers depends on the cost-benefit of the reduction in the extraction rate versus the cost of constructing the barriers. Extracted groundwater is typically directed to a treatment plant. Following treatment, the water is discharged to a POTW, surface water body, or re-injected into the water-bearing zone.

Initial Screening: Groundwater contamination has most likely reached an equilibrium state between the mass introduced into the water bearing zone from the source and the system's ability to destroy or dilute that mass. The majority of the dissolved-phase contamination has been found within the Site's boundaries. With further migration of the groundwater contamination being very unlikely, there is little if any benefit anticipated from hydraulically containing the contaminated groundwater. Therefore, this approach is not retained for further evaluation.

3.2.1.4 In Situ Treatment

Description: There is a wide variety of *in situ* treatment options for contaminated aquifers. These technologies work by destroying or immobilizing the contaminants without the necessity of bringing the contaminated groundwater above ground. Examples include biodegradation or chemical oxidation for organics, and chemical stabilization for metals.

Initial Screening: Organic and inorganic contaminants of concern in groundwater may make it difficult to pinpoint an appropriate treatment technology. Also, *in situ* treatment of cyanide is a relatively new technology. Furthermore, the extent of contamination in groundwater is limited to a small area. For these reasons, implementation of *in situ* treatment technologies may not be cost effective for the Ilion Site. Therefore, *in situ* treatment of groundwater is not retained for further analysis.

TABLE 3-1
SCREENING OF SOIL TECHNOLOGIES AND PROCESS OPTIONS

General Response Actions	Remedial Technology Types	Process Options	Technical Feasibility
No Action	No Action	Monitoring and Site Reviews	Retained
Limited Action	Access Restrictions	Access Restrictions	Retained
	Institutional Controls	Environmental Easement	Retained
		Health and Safety Plan and Site Management Plan	Retained
	Monitoring	Monitoring and Site Reviews	Retained
Containment	Capping	Permeable Soil	Retained
		Clay	Retained
		Asphalt	Retained
		Multi-Media	Retained
	Barrier Walls	All	Not Retained
Removal/ Treatment/Disposal	Removal	Excavation	Retained
		Recovery Wells	Not Retained
	Ex Situ Treatment	All	Not Retained
	Disposal	On-site Landfill	Not Retained
		Off-site Disposal	Retained
	In Situ Treatment	Soil Vapor Extraction	Not Retained
		Soil Flushing/Washing	Not Retained
		Stabilization/ Solidification	Retained
		Steam stripping (DUS)	Not Retained
		Biodegradation	Not Retained
		Oxidation	Not Retained

TABLE 3-2
SCREENING OF GROUNDWATER TECHNOLOGIES AND PROCESS OPTIONS

General Response Actions	Remedial Technology Types	Process Options	Technical Feasibility
No Action	No Action	Reviews	Retained
Limited Action	Institutional Controls	Use Restrictions	Retained
		Health and Safety Plan	Retained
		Monitoring and Periodic Reviews	Retained
Monitored Natural Attenuation	Natural Attenuation	Sampling and Analysis	Retained (in conjunction with source control options)
Removal/*Ex Situ* Treatment/Disposal	Removal	All	Not Retained
	Ex Situ Treatment	All	Not Retained
	Disposal	All	Not Retained
In Situ Treatment	*In Situ* Treatment	All	Not Retained

3.3 Selection of Process Options

Process options are evaluated on the basis of overall remedial effectiveness, technical implementability, and cost relative to site-specific conditions, contaminant types, and contaminant concentrations.

Process option effectiveness focuses on: 1) ability to process the estimated quantities of material and to meet contaminant reduction goals; 2) effectiveness of protecting human health and the environment during the construction and implementation phases; and 3) reliability of the technology with respect to contaminants and site conditions.

Implementability refers to how easy it will be to employ the process option based on site and contaminant characteristics.

The cost evaluation is preliminary and relies upon engineering judgment and vendor-provided information to generate a relative cost of process options within a technology type.

The initially screened and accepted process options are evaluated qualitatively, based on effectiveness, implementability, and cost as described above. Comparisons are made within each technology type by assessing the effectiveness, implementability and cost of each process option as low, moderate, or high relative to other process options within the technology type. When significant variations between process options within a technology type do not exist, a moderate rating was assigned. Based on this evaluation, specific process options were selected for development of media-specific remedial alternatives. Process options that were retained in the initial screening but are not selected in the process option evaluation are still technically feasible and may be substituted for the selected process option during remedial design. The results of the process option evaluation and selection are summarized in Tables 3-3 and 3-4 for soil and groundwater, respectively.

TABLE 3-3
SELECTION OF SOIL PROCESS OPTIONS

Process Option	Effectiveness	Implementability	Cost
***No Action**	Does not meet RAOs	Easily implemented	Very low cost
Limited Action			
*Environmental easement	Prevents exposure to site contaminants	Easily implemented for on-site areas; very difficult to implement on third-party properties	Low cost
*Access Restrictions	Prevents exposure to site contaminants	Easily implemented for on-site areas; very difficult to implement on third-party properties	Low cost
*Health and Safety Plan and Site Management Plan	Protects workers during future activities and manages exposures to contaminated soil.	Easily implemented	Low cost
*Monitoring and Site Reviews	Monitors site conditions	Easily implemented	Moderate cost
Containment			
*Permeable Soil Capping	Prevents exposure to site contaminants. Would not address presence of NAPL on- and off-site	Easily implemented on site; however, would require long-term inspection and maintenance. Construction and maintenance on various properties would make this option moderate to difficult to implement off site.	Low cost
Clay Capping	Prevents exposure to site contaminants. Would not address presence of NAPL on- and off-site	Easily implemented on site; however, would require long-term inspection and maintenance. Construction and maintenance on various properties would make this option moderate to difficult to implement off site	Moderate cost

Asphalt Capping	Prevents exposure to site contaminants. Would not address presence of NAPL on- and off-site	Easily implemented on site; however, would require long-term inspection and maintenance. Construction and maintenance on various properties would make this option moderate to difficult to implement off site	Moderate cost
Multi-Media Capping	Prevents exposure to site contaminants. Would not address presence of NAPL on- and off-site	Easily implemented on site; however, would require long-term inspection and maintenance. Construction and maintenance on various properties would make this option moderate to difficult to implement off site	Moderate cost
***In Situ* Treatment**			
In situ stabilization/ solidification	Moderate effectiveness for MGP-related contaminants.	Moderate to difficult to implement, and is equipment intensive.	Moderate to high cost
Removal			
*Excavation	Effective for removal of soil contamination and NAPL-impacted materials for subsequent treatment and disposal	Implementable at shallow depths; more complex for deeper contamination	Low to High cost, depending on required depth
Disposal			
*Off-site landfill	Effective for final disposal of treated soil	Easy to implement; requires transportation coordination	Moderate cost
*Process options that have been selected for development of remedial alternatives.			

TABLE 3-4
SELECTION OF GROUNDWATER PROCESS OPTIONS

Process Options	Effectiveness	Implementability	Cost
*No Action	Does not meet RAOs	Easily implemented	Very low cost
Limited Action			
*Use restrictions	Prevents exposure to contaminants	Easily implemented for on-site areas; difficult to implement on third-party properties	Low cost
*Health and Safety Plan	Protects workers during future activities	Easily implemented	Low cost
*Monitoring and Periodic Reviews	Monitors site conditions; no active remediation	Easily implemented	Moderate cost
Monitored Natural Attenuation			
*Sampling and Analysis	Monitors site conditions; no active remediation	Easily implemented	Low to moderate cost
*Process options selected for development of remedial alternatives.			

3.4 Development of Alternatives

Media-specific remedial alternatives for the Ilion (East Street) Site were developed based on the evaluations discussed in the preceding sections.

3.4.1 Soil Alternatives

Remedial alternatives developed for the contaminated soil on and off-site are:

- S-1: No Action
- S-2: Limited Action
- S-3: Excavation of MGP-Related Impacts, Soil Capping, Off-Site Disposal, and Institutional Controls
- S-4: Excavation of MGP-Related Impacts, Removal of On-Site Source Soils to Restricted-Residential SCOs, Soil Capping, Off-Site Disposal, and Institutional Controls
- S-5: Excavation of Soils Exhibiting Concentrations Above Unrestricted Use SCOs and Off-Site Disposal

It should be noted that both soil contaminants and NAPL are addressed within the soil media. Alternative S-1 does not achieve RAOs. Use restrictions are relatively easy to implement and enforce, but more difficult for off-site impacted areas. Alternatives S-3 and S-4 achieve RAOs by a combination of removal and engineering/institutional controls, while Alternative S-5 achieves RAOs through removal of contamination.

3.4.2 Groundwater Alternatives

Remedial alternatives developed for groundwater are:

- GW-1: No Action
- GW-2: Limited Action (Institutional Controls)
- GW-3: Monitored Natural Attenuation and Institutional Controls

Alternative GW-1 would not achieve RAOs. Groundwater use restrictions are practical to implement and enforce. Therefore, groundwater alternatives GW-2 and GW-3 were developed to meet the RAO of preventing future ingestion of groundwater exceeding NYSDEC WQ Class GA standards. In addition, Alternative GW-3 would provide long-term monitoring to assess the impact of source removal activities.

3.5 Preliminary Screening of Alternatives

The next stage in the feasibility evaluation typically consists of a preliminary screening of potential remedial alternatives based on the general criteria of effectiveness, implementability, and cost. The purpose of the screening step is to reduce the number of alternatives requiring detailed evaluation by identifying those alternatives having sufficient merit to undergo detailed evaluation. As a result of the relatively small number of feasible alternatives developed for the site, preliminary screening was not performed; all of the alternatives identified in the previous section were carried forward for detailed analysis in Section 4.0.

4.0 Detailed Analysis of Remedial Alternatives

This section presents a detailed description and analysis of the remedial alternatives developed in Section 3.0. Section 4.1 discusses the evaluation criteria against which the remedial actions are analyzed. Section 4.2 presents detailed descriptions of each of the alternatives and the results of the analysis of each alternative with respect to each of the criteria.

4.1 Description of Analysis Criteria

The remedial alternatives developed in Section 4.1 are evaluated using the following seven criteria:

- Compliance with Standards, Criteria, and Guidance (SCGs);
- Overall Protection of Human Health and the Environment;
- Short-Term Impacts and Effectiveness;
- Long-Term Effectiveness and Permanence;
- Reduction of Toxicity, Mobility, and/or Volume;
- Implementability; and
- Cost.

The seven criteria are described in the following sections.

4.1.1 Compliance with SCGs

This criterion is used to determine how each remedial alternative complies with Standards, Criteria and Guidance (SCGs). Each alternative is evaluated in detail for:

- Compliance with chemical-specific SCGs (*e.g.*, NYSDEC WQ Class GA standards);
- Compliance with action-specific SCGs (*e.g.*, RCRA minimum technology standards); and,
- Compliance with location-specific SCGs (*e.g.*, floodplains).

4.1.2 Overall Protection of Human Health and the Environment

This criterion provides an overall assessment of protection based on a composite of factors such as long-term and short-term effectiveness and compliance with SCGs. Evaluations of the overall protectiveness address:

- How well a specific site remedial action achieves protection over time;
- How well site risks are reduced; and
- How well each source of contamination is eliminated, reduced, or controlled for each remedial alternative.

4.1.3 Short-Term Impacts and Effectiveness

This criterion addresses the impacts of the action during the construction and implementation phase until the remedial action objectives have been met. Factors evaluated include protection of the community during the remedial actions; protection of workers during the remedial actions; environmental impacts resulting from the implementation of the remedial actions; and the time required to achieve protection.

4.1.4 Long-Term Effectiveness and Permanence

This criterion addresses the results of the remedial action in terms of the potential risk remaining at the site after the remedial action objectives have been met. The components of this criterion include the magnitude of the residual risks; the adequacy and suitability of controls used to manage treatment residuals or untreated wastes; and the long-term reliability of management controls for providing continued protection from residuals (*i.e.*, the assessment of potential failure of the technical components).

4.1.5 Reduction of Toxicity, Mobility and/or Volume

This criterion addresses the statutory preference that treatment is used to result in the reduction of the total mass of toxic contaminants, the irreversible reduction in contaminant mobility, or the reduction of the total volume of contaminated media. Factors to be evaluated in this criterion include the treatment process employed; the amount of hazardous material destroyed or treated; the degree of reduction in toxicity, mobility or volume expected; and the type and quantity of treatment residuals.

4.1.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing a remedial action and the availability of various services and materials required during its implementation. *Technical feasibility* factors include construction and operation difficulties; reliability of technology; ease of undertaking additional remedial actions; and the ability to monitor the effectiveness of the remedy. *Administrative feasibility* includes the ability and time required for permit approval and for activities needed to coordinate with other agencies. Factors employed in evaluating the availability of services and materials include availability of treatment, storage, and disposal services with required capacities; availability of equipment and specialists; and availability of prospective technologies for competitive bid.

4.1.7 Cost

The types of costs that would be addressed include: capital costs, operation and maintenance (O&M) costs, costs of periodic reviews (where required), present value of capital and O&M costs, and potential future remedial action costs. Capital costs consist of direct and indirect costs. Direct costs include expenditures for the equipment, labor, and materials necessary to install remedial actions. Indirect costs include expenditures for engineering, administrative, and other services required to complete the implementation of remedial alternatives. Annual O&M costs include auxiliary materials and energy, disposal of residues, purchased services, administrative costs, insurance, taxes, license costs, maintenance reserve and contingency funds, rehabilitation costs, and costs for long-term monitoring.

This assessment evaluates the costs of the remedial actions on the basis of present worth. Present worth analysis allows remedial actions to be compared on the basis of a single cost representing an amount that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A required operating performance period and a discount rate are assumed to calculate present worth cost. A discount rate of five percent is assumed for a base calculation. The discount rate represents the anticipated difference between the rate of investment return and inflation. The estimated costs provided for the remedial actions have an accuracy of -30 to +50 percent.

4.2 Detailed Analysis of Alternatives

The following sections present descriptions of each of the remedial alternatives and the results of the evaluation of the alternatives against the seven criteria defined above.

4.2.1 Soil Remedial Alternatives

This section presents the evaluation of remedial alternatives for soil.

4.2.1.1 Alternative S-1: No Action

The No Action alternative includes no active remediation at the Site. Contaminated soils (*i.e.*, posing a potential threat to human health and/or the environment) would be left in place with no treatment or controls to prevent future exposure to contaminated media. Periodic reviews would be performed to assess any changes in the risk to human health and the environment posed by the site. This alternative is developed as a basis of comparison for other alternatives.

4.2.1.1.1 Compliance with SCGs

The No Action alternative does not comply with chemical-specific SCGs since no action would be taken to address PRG exceedances. Action- and location-specific SCGs are not triggered, since no on-site remedial activities would be performed.

4.2.1.1.2 Overall Protection of Human Health and the Environment

The No Action alternative would not remove, contain, or treat the contaminated media, resulting in continued source areas. Therefore, potential risks to human health and the environment resulting from contaminated soil above cleanup levels would remain unchanged. Risks associated with the potential for direct contact of contaminated soil would persist. In addition, there is the continued potential for migration of contaminants.

4.2.1.1.3 Short-Term Impacts and Effectiveness

Under the No Action alternative, there would be no short-term impacts to workers or the surrounding community. No construction would be required for implementation of this alternative. Workers conducting periodic reviews would potentially be exposed to contaminated soil. However, there is a Health and Safety Plan (HASP) in place for the Site that requires use of personal protective equipment (PPE) to minimize the risks of direct contact. This alternative would not result in any short-term improvement over current conditions. As no design or construction activities are required for this alternative, it would take no time to implement.

4.2.1.1.4 Long-Term Effectiveness and Permanence

The No Action alternative would have no long-term effectiveness and/or permanence. The magnitude of human health and ecological risks would be the same following implementation of this alternative. No engineering controls would be implemented to manage the remaining contaminated material.

4.2.1.1.5 Reduction of Mobility, Toxicity, and/or Volume

This alternative would not involve any containment, removal, treatment, or disposal of the contaminated soil. Therefore, this alternative would not provide any reduction in the toxicity, mobility, and/or volume of contaminants.

4.2.1.1.6 Implementability

There are no technical feasibility concerns with the No Action alternative. The effectiveness of the remedy would be evaluated in periodic reviews and implementation of this alternative would not preclude further remedial action in the future.

There are no administrative feasibility concerns with this alternative. As this alternative involves no construction activities, availability of resources and use of proven technologies is not applicable. Consulting services are readily available for periodic reviews. Coordination with regulatory agencies would be required for making decisions regarding any future remedial alternatives. However, there are no concerns with the ability or time required to interact with regulatory agencies.

4.2.1.1.7 Cost

There is no capital cost or annual O&M cost for the No Action alternative.

4.2.1.2 Alternative S-2: Limited Action

The Limited Action alternative includes no active remediation. Contaminated soils would be left in place with no treatment and limited controls to mitigate future exposure to contaminated media. This alternative would be implemented for the Site, the FW-20A area beneath the roadway and the off-site areas where MGP-contaminated soils have been identified (i.e., the area of the spoil pile, and the City of Ilion and DPW properties to the north). This alternative would be more effective on site, which is controlled by NG, than off site on properties owned and controlled by others.

Under this alternative, an environmental easement would be implemented to restrict future use of the Site. Access restrictions, including maintenance of Site fencing, and signs (as necessary) would be put in place. A HASP would be developed and implemented to describe adequate control measures and PPE/monitoring to be implemented during intrusive activities at the Site.

A Site Management Plan (SMP) would also be developed for the Site. The SMP will include a requirement to evaluate the potential for vapor intrusion for any buildings developed on the Site, and provisions for mitigating impacts, if identified. The SMP would also address requirements for intrusive activities in off-site areas as well. The SMP and other site-related documentation that provides pertinent information relative to site conditions will be provided to the Village of Ilion Highway, Electric Utility, Public Works, and other local Departments and Village officials in order to provide information regarding residual contamination to public workers who could potentially be exposed to contamination during the course of their work activities.

Periodic reviews of Site conditions, including off-site areas, would also be performed to assess changes in the potential risk to human health and the environment.

4.2.1.2.1 Compliance with SCGs

The Limited Action alternative does not comply with chemical-specific SCGs since no action would be taken to address PRG exceedances. Action- and location-specific SCGs are not triggered, since no remedial activities would be performed.

4.2.1.2.2 Overall Protection of Human Health and the Environment

The Limited Action alternative would not remove, contain, or treat the contaminated media, resulting in continued source areas. MGP-related impacts would be mitigated by institutional controls, including an environmental easement for the Site, and implementation of a HASP and SMP. Fencing and signs would also help mitigate the potential for direct contact exposure. However, there is the continued potential for migration of contaminants.

4.2.1.2.3 Short-Term Impacts and Effectiveness

Under the Limited Action alternative, there would be no short-term impacts to workers or the surrounding community. No construction would be required for implementation of this alternative. Through development and implementation of a HASP, direct contact risks would be minimized; use of PPE would be required during intrusive activities. The SMP would help to mitigate exposure to MGP-related impacts. The time required to implement this alternative would vary based on negotiations with multiple property owners.

4.2.1.2.4 Long-Term Effectiveness and Permanence

Potential human exposure to MGP-related impacts would be reduced by institutional controls following implementation of this alternative. Limited controls would be implemented to manage the remaining contaminated material, consisting of maintenance of on-site fencing, and restricting future use. These controls would be effective at mitigating potential exposures, though there is the potential for violation of these controls. This alternative would be re-evaluated periodically.

4.2.1.2.5 Reduction of Mobility, Toxicity, and/or Volume

This alternative would not involve any containment, removal, treatment, or disposal of the contaminated soil. Therefore, this alternative would not provide any reduction in the toxicity, mobility, and/or volume of contaminants.

4.2.1.2.6 Implementability

There are no technical feasibility concerns with the Limited Action alternative for soil. The effectiveness of the remedy would be evaluated in periodic reviews. As this alternative involves no construction activities, availability of resources and use of proven technologies is not a concern. Consulting services are readily available for implementation of an environmental easement for the Site and development of a HASP and SMP. Services are also available for conducting periodic reviews.

4.2.1.2.7 Cost

The capital cost associated with negotiation and implementation of the required institutional controls is $65,000. There is no annual O&M cost associated with this alternative. The net present cost of the alternative, based on a 30-year period of performance and a 5% discount rate, is $121,000. See Appendix C for details.

4.2.1.3 Alternative S-3: Excavation of MGP-Related Impacts, Soil Capping, Off-Site Disposal, and Institutional Controls

This alternative includes excavation of MGP-related impacts (i.e., NAPL-contaminated soil, soils impacted with PAHs > 500 ppm, and soils impacted with cyanide concentrations > 40 ppm) on and off site, excavation of near-site impacted soils, placement of a one-foot soil cap over on-site impacted soils with contaminant concentrations above the commercial use SCOs over the eastern portion of the Site, the extent of which is specified on the figure provided to National Grid by NYSDEC on March 31, 2010, and implementation of institutional controls as described in Section 4.2.1.2. Soil data for the western portion of the site indicates that the concentrations and types of PAHs observed in that area are similar to those found in the background samples and typical fill material, and do not appear MGP-related. Furthermore, no evidence of MGP-related impacts was observed in this area. Therefore, the western portion of the Site is not addressed under this alternative. The primary goal of this alternative is to remove the MGP sources of contamination from the Site and the off-site areas, thereby eliminating potential ongoing sources of contamination, and to mitigate potential exposures through a combination of engineering and institutional controls. Near-site PAH contamination that may be MGP-related, based on the presence of multiple PAHs above the unrestricted-use SCOs, will also be excavated, as requested by NYSDEC/NYSDOH, to mitigate potential exposure to these contaminants in shallow soils immediately adjacent to the Site and accessible to the public.

Areas of MGP-related impacts, both on and off-site, would be removed as part of this alternative, excluding soils at SB-01 and MW-02 on site, and FW-20A2 off site. Elevated cyanide concentrations at SB-01 represent an isolated occurrence, at depth, and do not appear to correlate with other site-related soil contamination nor with groundwater contamination. Based on the remedial investigation data, the elevated PAHs at 4-6 feet bgs at location MW-02 appear to correlate with a layer of ash and fill material, and are not associated with a NAPL source area; however, during the pre-design investigation, additional data will be gathered to evaluate and define this area. The PAH concentration in this sample (680 ppm) just slightly exceeds the 500 ppm criteria for this alternative, and there are no NAPL or cyanide impacts in this area that would suggest these PAHs are MGP-related. Soils at FW-20A2 represent an isolated occurrence and are located beneath the paved surface of East Street, minimizing the potential for direct contact exposure. Furthermore, excavation of this location would result in potential damage to or relocation of utilities and would require repair of the roadway, making excavation of this area impracticable.

For the purposes of this FS, the estimated areas of excavation for this alternative are shown on Figures 4-1A (On and Near-Site) and 4-1B (Off-Site). These areas were estimated based on the available data, with the excavation limits for on-site and off-site areas typically defined by the nearest sample below the removal criteria (i.e., no NAPL, PAHs < 500 ppm and/or cyanide < 40 ppm). Near-site excavation areas were identified based on nearest samples below unrestricted-use criteria or comparable to background. A pre-design investigation would be performed to more accurately delineate the areas to be excavated under this alternative. The pre-design investigation would likely include the following:

- Installation of soil borings and collection of surface and/or subsurface soil samples to further delineate the NAPL-impacted areas and areas with PAH concentrations > 500 ppm both on and off site;
- Sampling to further define and delineate on-site detections of cyanide which exceed 40 ppm;
- Sampling to delineate the near-site soils impacted by the Site and;
- Collection of additional forensic data from off-site areas to assist in the delineation of potential Site-related impacts and discrimination of MGP-related impacts from contamination from other potential sources off site.

The estimated excavation areas, based on the currently available data, are described below. For the purposes of this FS, the areas described below were used for cost estimating purposes. These areas, and the associated costs for implementation of this alternative, may be modified based on the pre-design investigation discussed above.

- In the area of the former 200,000 gallon gas holder, excavation would include the removal of the concrete slab of the former holder, located between two and three feet bgs, in order to facilitate removal of NAPL, PAHs and cyanide impacted soils. The excavation would extend from the area around SB-08 (where NAPL was observed), southeast to approximately the site boundary, in order to encompass the areas around SB-15 (where NAPL was observed), TTSB05 (which exhibited total PAH concentrations >500 ppm), and MW-08 (where cyanide concentrations > 40 ppm were detected). NAPL was observed in SB-08 from approximately 8 to 10.5 feet bgs, with staining observed to a depth of approximately 16 feet bgs; no visible impacts or PAHs > 500 ppm were observed below 16 feet bgs. NAPL was also observed in SB-15 from approximately 8.4 to 14 feet bgs, with staining observed down to a maximum depth of approximately 17 feet bgs; no visible impacts were noted below 17 feet bgs. Based on these sample points, a maximum excavation depth for this area of 17 feet was estimated. The horizontal limit of the excavation for this alternative was estimated based on visual and analytical results from TTSB03, TTSB04, SB-24, TTSB02, CB-03A and TP-02, which did not exhibit PAH concentrations above 500 ppm, visual NAPL impacts, or cyanide > 40 ppm. The horizontal limit of the excavation was approximated as the midpoint between the samples exhibiting NAPL and/or PAHs > 500 ppm and the nearest sample location not exhibiting NAPL or PAHs > 500 ppm. The volume of soil to be excavated in this area (as shown on Figure 4-1A) is approximately 2,100 cubic yards (cy). Due to the large distance to the nearest samples not exhibiting impacts (specifically TTSB04, TTSB03 and CB-03A), it is possible that the horizontal extent of this excavation could expand based on the pre-design investigation. Groundwater is encountered at approximately eight feet bgs in this area. Shoring and/or sheet piling may be needed for this alternative for safety and stability or dewatering purposes.
- In the area of the former octagonal holder, excavation would extend to the bottom of the holder footings (approximately 13 feet bgs) and would include the entire volume of soil above the 40 foot diameter holder, in order to remove NAPL and PAHs in this area

observed in SB-11, SB-14, and MW-05. Soil borings completed within the holder indicate that NAPL is present just above the holder slab from approximately 8 to 10.7 feet bgs. No NAPL or PAHs > 500 ppm were observed in borings outside of the holder footings (i.e., SB-12, SB-12A and SB-13). Based on these observations, the horizontal limit of this excavation is estimated to be within the footprint of the holder. The volume of soil to be excavated in this area is approximately 600 cy. Since no samples were collected north of the holder footprint, there is the potential that the horizontal extent of this excavation could expand to the north based on the pre-design investigations. Groundwater is encountered at approximately six feet bgs in this area. Shoring and/or sheet piling may be needed for safety and stability or dewatering purposes.

- As requested by NYSDEC/NYSDOH, soils in the vicinity of SS-16 to the northwest of the Site, and between the sidewalk and the Site fence along East Street (i.e., SS-10, SS-11, SS-12, SS-13 and SS-22) would be excavated to a depth of 2 feet bgs to address PAH impacts in near-site surface soils. Multiple PAHs significantly above the unrestricted-use SCOs are present at these locations, which are outside the site fence and generally accessible to the public. The horizontal extent of the excavation at SS-16 is estimated based on the midpoint to the nearest samples (i.e., SS-28 and SS-29) with significantly lower PAH concentrations (PAHs in these samples slightly exceed the unrestricted-use SCOs, but are comparable to background concentrations). For SS-10, SS-11, SS-12, SS-13 and SS-22, the horizontal extent of excavation is bounded by the site fence and the sidewalk. These samples also had multiple PAHs significantly above the unrestricted-use SCOs, compared to other off-site samples along East Street (i.e., SS-24, SS-25, SS-26 and SS-27), which also exceeded the unrestricted-use SCOs, but had PAH concentrations comparable to background. The volume of soil to be excavated from these areas is approximately 130 cy. Groundwater would not be encountered in these excavations, and no shoring would be required to complete these excavations.

- In the off-site area depicted by geologic cross section B-B', excavation would extend from the area of test pit OFTP-04 south to the area around test pit TTTP10. NAPL was observed in test pits excavated in this area, but not in test pits and/or soil borings completed to the east and west. The estimated horizontal extent of the excavation is based on observations of NAPL in the test pits. Although the eastern edge of TTTP07 did not exhibit NAPL, there is the potential that this excavation could expand to the east; this potential expansion should not go beyond test pits 2007 TP01 and 2007 TP02, where no impacts were observed. This excavation would also encompass the area around FW-11H, to the south of observed NAPL, where PAHs >500 were detected. The excavation would extend to approximately eight feet bgs, the maximum depth at which NAPL was observed in this area. Within the test pits, an unimpacted peat layer was generally observed below the NAPL-impacted zone; test pits did not extend below this layer. Groundwater is encountered at approximately three feet bgs in this area. Therefore, shoring and/or sheet piling would be needed for safety and stability or dewatering purposes. A 24-inch storm sewer whose invert is approximately 6 feet bgs crosses the NAPL-impacted area. The sewer line would be supported during excavation activities. The volume of soil to be excavated in this area is approximately 500 cy.

- In the off-site area in the vicinity of FW-10A, excavation would encompass the area around FW-10A, 10B, and 10C, to address detected PAHs >500 ppm. No NAPL was observed in these borings. The horizontal extent of the excavation would be 10 feet north of these locations, south to test pit TTTP17, where no NAPL was observed and concentrations of PAHs were less than 500 ppm. The excavation would be bounded by the closest unimpacted (i.e., no NAPL and PAHs less than 500 ppm) borings to the east and west (FW-10D and FW-10E), and would extend to approximately 8 feet bgs, below the depth of detected PAHs >500 ppm. Groundwater would be encountered at approximately three feet bgs in this area. Shoring and/or sheet piling may be needed for safety and stability or dewatering purposes. The volume of soil to be excavated in this area is approximately 300 cy.

- In the off-site area in the vicinity of FW-09A, 09B, and 09C, excavation would be conducted to remove PAHs >500 ppm, where fingerprint analysis indicated that the PAHs could be MGP-related. No NAPL was observed in these borings. The horizontal extent of the excavation would be bounded by unimpacted borings (i.e., PAHs < 500 ppm) to the south and east, and would extend approximately 10 feet to the west of FW-09A. The northern limit of the excavation would be determined by the limits of the contingency excavation, described below. The excavation would extend to approximately 10 feet bgs, below the depth of detected PAHs >500 ppm. PAHs in samples collected from the area between FW-10A and FW-09C were below 500 ppm;, therefore this area it was not included for excavation in this alternative. Groundwater would be encountered at approximately three feet bgs in this area. Shoring and/or sheet piling may be needed for safety and stability or dewatering purposes. The volume of soil to be excavated in this area is approximately 150 cy.

- In the off-site area in the vicinity of FW-08A, excavation would extend to approximately 11 feet bgs to remove PAHs in this area, below the depth of detected PAHs >500 ppm. No NAPL was observed in this boring. The horizontal extent of the excavation would be bounded by unimpacted borings to the east and west (i.e., FW-08C and FW-08E), and the northern and southern limits of the excavation would be determined by the limits of the contingency excavations, described below. Groundwater would be encountered at approximately eight feet bgs in this area. Shoring and/or sheet piling may be needed for safety and stability or dewatering purposes. The volume of soil to be excavated in this area is approximately 260 cy.

- In the off-site area in the vicinity of OFTP-02, excavation would extend to approximately seven feet bgs to remove PAHs in this area, below the depth of detected PAHs >500 ppm and observed NAPL. The horizontal extent of the excavation would include the extent of test pit OFTP-02 (NAPL observed) and GP-16 (PAHs>500ppm). The horizontal limits of this excavation were determined based on unimpacted soil borings (i.e., no NAPL and PAHs less than 500 ppm) to the west (GP-15), east (GP-17), and north (GP-08 and GP-09); to the south, the limit is based on the contingency excavation described below. Groundwater may be encountered in the bottom foot of excavation. Shoring and/or sheet piling may be needed for safety and stability or dewatering purposes. The volume of soil to be excavated in this area is approximately 120 cy.

- In the swale,, excavation would remove soils with MGP-related impacts, specifically, PAHs > 500 ppm and any observations of NAPL from SED-05 downstream to SED-02. Fingerprint analyses indicate that PAHs in this area may be present as a result of MGP related impacts, therefore the entire area between these locations will be removed to address the presence of PAHs, as requested by NYSDEC/NYSDOH. The excavation would encompass the physical extent of the swale, i.e., the area of standing water, in this vicinity. The excavation would be completed to a depth of approximately four feet bgs, the maximum observed depth of PAH impacts. Dewatering would be required due to the presence of shallow or standing water in the excavation area. The volume of swale soil to be excavated in this area is approximately 1,300 cy.

Based on the available data, the total estimated volume of soil to be removed to address NAPL, MGP-related PAHs, and cyanide is approximately 5,460 cy. Soil reuse samples will be taken to determine reuse suitability. Material not deemed appropriate for reuse will be transported off-site for disposal.

Odor control measures would be implemented as-needed during the excavation activity. The excavated soil could be amended as-needed for moisture content and, if suitable from a contaminant concentration standpoint, could be re-used as fill onsite. Alternately, the soil could be staged and transported to a non-hazardous landfill or to a thermal de-sorption facility for disposal. During remedial design, as with the other alternatives, the market conditions would be evaluated to assess the cost-effectiveness of these various soil management methods. Hazardous materials, if encountered, would be managed in accordance with the appropriate protocols for these materials.

For the purposes of estimating a cost for this alternative, the following assumptions were used to calculate a volume of potentially reusable soil:

- Former 200,000 gallon holder excavation area: the top 8 feet of soils would be suitable for reuse (with the exception of the concrete slab).
- Former octagonal holder excavation area: the top 8 feet of soils would be suitable for reuse.
- Geologic Cross Section B-B' excavation area: the top 6 feet of excavated soils would be suitable for reuse.
- FW-10A excavation area: the top 6 feet of excavated soils would be suitable for reuse.
- FW-09C excavation area: the top 6 feet of excavated soils would be suitable for reuse.
- FW-08A excavation area: the top 7 feet of excavated soils would be suitable for reuse.
- OFTP-02 excavation area: the top 4 feet of excavated soils would be suitable for reuse.
- Excavated soils from near-site surface soils and TTSED06 and TTSED09 (swale) excavation areas would not be suitable for reuse.

Based on the assumptions above, a volume of approximately 2,300 cy of soil would be suitable for reuse.

This alternative also includes the placement of a one-foot clean soil cap over the eastern portion of the Site, as requested by NYSDEC in the February 4, 2010 comment letter. The horizontal extent of the one-foot cap is shown on Figure 4-1A. An area of approximately 40,000 sf would be covered with clean soil to mitigate exposure to residual contamination above unrestricted use SCOs.

This alternative also includes contingency excavation of the area between TTDP04 and FW-08A/B and the area between FW-08A/B and OFTP-02. Previous attempts to address data gaps in these areas were unsuccessful, as several large, densely vegetated, spoil piles prohibited access to this area from any direction. Therefore, the nature and extent of contamination is not fully delineated in these areas. Contingency excavation assumes excavation of an approximate 5,100 sf corridor connecting TTDP04 and FW-08A/B, and an approximate 1,700 sf corridor connecting

FW-08A/B and OFTP-02. Debris associated with the spoil pile would be moved prior to excavation. It is assumed the excavation corridors would extend to a depth of approximately 11 feet bgs, resulting in a total of approximately 2,700 cy of contingency excavation soils to be removed for off-site treatment and/or disposal. Based on depths to water in nearby sample locations, groundwater may be encountered at approximately seven feet bgs in the area of contingency soil excavation. Shoring and/or sheet piling may be needed for safety and stability or dewatering purposes. For the purposes of this FS, reuse of contingency excavated soils is not considered.

Since potential MGP-related contamination above the unrestricted use SCOs will remain on site following cleanup activities under this alternative, an environmental easement would be implemented to restrict future use of the Site. Access restrictions, including maintenance of Site fencing, and signs (as necessary) would also be maintained/installed. A HASP would be developed and implemented to describe adequate control measures and PPE/monitoring to be implemented during intrusive activities at the Site.

An SMP would also be developed under this alternative as discussed in section 4.2.1.2. The SMP would address vapor intrusion concerns, cap maintenance requirements, and requirements for disturbance/restoration of the cap for the Site. The SMP would also address requirements for intrusive activities in off-site areas, including MGP-related soil contamination remaining in the vicinity of FW-20A2, and would be provided to local agencies as discussed in section 4.2.1.2.

Periodic reviews of Site conditions, including off-site areas, would also be performed to assess changes in the potential risk to human health and the environment.

4.2.1.3.1 Compliance with SCGs

Unrestricted Use SCOs would be achieved for MGP-impacted soils through excavation. Residual exceedances of SCOs as a result of other potential sources of contamination would be addressed through a combination of capping and institutional controls. Construction activities would be conducted in accordance with action- and location-specific SCGs. Wastes generated would be managed, transported, and treated in accordance with applicable local, State, and Federal requirements. Prior to excavation activities, a presence/absence determination for wetlands would be conducted, and the jurisdictional status of the wetlands, if present, would be determined.

4.2.1.3.2 Overall Protection of Human Health and the Environment

The excavations would remove the sources of contamination and concentrations of coal-tar related PAHs above 500 ppm and cyanide above 40 ppm. By removing the sources of contamination, the potential for continued contaminant migration to groundwater would be reduced to the maximum extent practicable. Furthermore, dewatering during soil removal would remove some volume of impacted groundwater. Capping and implementation of a HASP and SMP would mitigate potential direct contact exposure associated with residual contamination.

4.2.1.3.3 Short-Term Impacts and Effectiveness

This alternative would involve on- and off-site construction efforts to remove soil. In addition, this alternative would include transportation of this contaminated material through off-site (residential) areas. There would be a transportation risk in addition to the potential for exposure to contaminants that may be mobilized during these activities. These would be minimized by developing engineering controls and implementing a HASP to provide protection for on-site workers. In addition, appropriate engineering controls (*i.e.*, water sprays, excavation in an enclosed structure, etc.) may be necessary to mitigate the possibility of fugitive dust, etc. Off-site transportation would be performed in strict accordance with transportation plans to minimize impacts to neighborhoods through which contaminated soil will be transported. Development of a SMP would help to mitigate potential exposures. The timeframe required for implementation of this alternative is approximately 6 to 12 months.

4.2.1.3.4 Long-Term Effectiveness and Permanence

This alternative would have significant long-term effectiveness and/or permanence since the sources of MGP contamination and highly contaminated areas would be removed. Potential residual human exposure would be reduced by capping and implementation of institutional controls following implementation of this alternative. Limited controls would be implemented to manage the remaining contaminated material, consisting of fencing, signage and restricting future use of the Site. The removal of source soils and placement of a 1-foot soil cap would allow for continued commercial use of the Site. A SMP would be implemented to address residual exposure potential for both on and off-site areas. These controls would be effective at mitigating potential exposures, though there is the potential for violation of these controls. The effectiveness of this alternative would be re-evaluated periodically.

4.2.1.3.5 Reduction of Mobility, Toxicity, and/or Volume

Migration of contaminants would be significantly reduced by removing the sources of contamination. Off-site treatment of the excavated materials would substantially reduce the toxicity of the majority of contaminants by destruction. In addition, there would be a reduction in the volume of contaminants remaining following remedy implementation.

4.2.1.3.6 Implementability

Technical Feasibility: This is an alternative requiring a moderate level of effort, planning, and acceptance of short-term risk. Excavation with off-site disposal, with or without pre-treatment, is a widely used treatment technology and is well developed. Excavation does not extend below approximately 17 feet bgs; therefore, conventional equipment can be used. Remnants of one of the subsurface holders would be broken-up and removed during soil excavation. A utility mark-out is required before any intrusive activities. The known 24-inch storm sewer line would need to be supported during excavation activities. Dewatering would be required, and water encountered during excavation would be treated for discharge or off-site disposal, depending on quantity to be managed. Planning, design, and risk mitigation efforts would be required to complete this alternative, and even with a great deal of care, there would be short-term construction risks that would require management.

Administrative Feasibility: Administratively, this alternative would be relatively easy to implement. An acceptable transportation plan for the large quantities of soil that would need to be transported to an appropriate disposal facility would be established. Remedial activities in off-site areas would be conducted in consultation and coordination with the affected property owners. In addition, access agreements would be need to be obtained for work conducted in the off-site areas. Coordination with regulatory agencies would also be required for periodic reviews. However, there are no concerns with the ability or time required to interact with local and regulatory agencies.

4.2.1.3.7 Cost

The capital cost of implementing this alternative is $4,890,000. There are annual O&M costs of $3,000 associated with cap maintenance and costs for periodic reviews under this alternative. The net present cost of the alternative, based on a 30-year period of performance and a 5% discount rate, is $5,053,000. Appendix C provides a detailed breakdown of the costs for the on and off-site portions of this alternative.

4.2.1.4 Alternative S-4: Excavation of MGP-Related Impacts, Removal of On-Site Source Soils to Restricted-Residential SCOs, Soil Capping, Off-Site Disposal, and Institutional Controls

This alternative was developed to provide an intermediate alternative between Alternatives S-3 and S-5. This alternative includes removal of on-site and off-site MGP-related impacts as discussed in Alternative S-3, removal of on-site source area soils to achieve the restricted-residential SCOs, excavation of near-site impacted soils to achieve residential SCOs, placement of a two-foot soil cap over the eastern portion of the Site, the extent of which is specified on the figure provided to National Grid by NYSDEC on March 31, 2010, and implementation of institutional controls as described in Section 4.2.1.2. Soil data for the western portion of the site indicates that the concentrations and types of PAHs observed in that area are similar to those found in the background samples and typical fill material, and do not appear MGP-related. Furthermore, no evidence of MGP-related impacts was observed in this area. Therefore, the western portion of the Site is not addressed under this alternative. The primary goal of this alternative, as in Alternative S-3, is to remove the MGP sources of contamination from the Site and the off-site areas, thereby eliminating potential ongoing sources of contamination, and to mitigate potential exposures through a combination of engineering and institutional controls.

As in Alternative S-3, areas of MGP-related impacts (i.e., NAPL, PAHs > 500 ppm, and cyanide > 40 ppm) would be removed as part of this alternative, excluding the isolated impacts observed in soils at the SB-01 and FW-20A2 sample locations. This alternative also includes expansion of the on-site source area excavations to include on-site soils that exceed the restricted-residential SCOs and that are contiguous with the MGP-related impacts. Note that the intent of this alternative is only to remove additional soils exceeding restricted-residential SCOs that are in proximity to, and deemed to be associated with, MGP-impacts. The objective of this alternative is not to remove all on-site soils exceeding the restricted-residential SCOs, as this would require excavation of nearly the entire Site, and would make the on-site portion of this alternative practically identical to the on-site portion of Alternative S-5.

For the purposes of this FS, the estimated areas of excavation for this alternative are shown on Figures 4-2A (On and Near-Site) and 4-2B (Off-Site). The on-site areas of excavation were determined based on the previously discussed source areas, and were extended beyond soils in proximity to source areas that are known to be impacted above the restricted-residential SCOs based on the existing data, to reflect the uncertainty associated with the current data. Figure 4-2A presents the estimated horizontal extent of the potential excavation on site. As discussed previously, the excavations do not encompass all soils that exceed the restricted-residential SCOs, but only those soils in proximity to known MGP impacts. The areas of excavation near site and off site for this alternative are identical to Alternative S-3.

A pre-design investigation would be performed to fully delineate the areas to be excavated under this alternative. The pre-design investigation would likely include the following:

- Installation of soil borings and collection of surface and/or subsurface soil samples to further delineate the extent of impacted soils associated with the MGP source areas and exceeding restricted-residential SCOs on site;
- Sampling to further define and delineate on-site detections of cyanide which exceed 40 ppm;
- Sampling to delineate the near-site soils impacted by the Site, and;
- Collection of additional forensic data from off-site areas to assist in the delineation of potential Site-related impacts and discrimination of MGP-related impacts from contamination from other potential sources off site.

The estimated on-site excavation areas, based on the currently available data, are described below. For the purposes of this FS, the areas described below were used for cost estimating purposes. These areas, and the associated costs for implementation of this alternative, may be modified based on the results of the pre-design investigation discussed above.

- In the area of the former 200,000 gallon gas holder, excavation would encompass the areas discussed in Alternative S-3 to address NAPL, PAHs > 500 ppm and cyanide > 40 ppm. In addition, this excavation would extend further to the north toward CB-03A and further south to the area just north of MW-02 and TTSB02 to address contaminant concentrations above restricted-residential SCOs associated with source soils. Since there are no sample locations in close proximity to the estimated southern limit of this excavation, there is a potential that the excavation could expand significantly in this direction based on the pre-design investigation. The depth of the excavation in the vicinity of SB-08 and east towards MW-08 is estimated to be 17 feet bgs, as discussed previously. Groundwater is encountered at approximately eight feet bgs in this area. For the southern portion of this excavation, near MW-02 and TTSB02, the estimated depth of the excavation is 8 feet bgs. Shoring and/or sheet piling may be needed for this alternative for safety and stability or dewatering purposes. The volume of soil to be excavated in this area is approximately 2,400 cy.
- In the area of the former octagonal holder, excavation would extend to the bottom of the holder footings (approximately 13 feet bgs) and would include the entire volume of soil above the 40 foot diameter holder, and would include soil removal at SB-11, in order to remove NAPL and associated source soils with contaminant concentrations above restricted-residential SCOs. Groundwater is encountered at approximately six feet in this area. Shoring and/or sheet piling may be needed for safety and stability or dewatering purposes. NAPL impacts associated with this area are confined to the zone immediately above the holder. The volume of soil to be excavated in this area is approximately 700 cy.

As discussed above, the near-site and off-site excavations associated with this alternative are identical to Alternative S-3. The total estimated volume of soil to be removed to address NAPL, MGP-related PAHs, on-site source soils above restricted-residential SCOs and cyanide above 40 ppm is approximately 5,860 cy. Soil reuse samples will be taken to determine reuse suitability. Material not deemed appropriate for reuse will be transported off-site for disposal.

Odor control measures would be implemented as-needed during the excavation activity. The excavated soil could be amended as-needed for moisture content and, if suitable from a contaminant concentration standpoint, could be re-used as fill onsite. Alternately, the soil could be staged and transported to a non-hazardous landfill or to a thermal de-sorption facility for disposal. During remedial design, as with the other alternatives, the market conditions would be evaluated to assess the cost-effectiveness of these various soil management methods. Hazardous materials, if encountered, would be managed in accordance with the appropriate protocols for these materials.

For the purposes of estimating a cost for this alternative, the following assumptions were used to calculate a volume of potentially reusable soil:

- Former 200,000 gallon holder excavation area: the top 8 feet of soils would be suitable for reuse (with the exception of the concrete slab).
- Former octagonal holder excavation area: the top 8 feet of soils would be suitable for reuse.
- Geologic Cross Section B-B' excavation area: the top 6 feet of excavated soils would be suitable for reuse.
- FW-10A excavation area: the top 6 feet of excavated soils would be suitable for reuse.
- FW-09C excavation area: the top 6 feet of excavated soils would be suitable for reuse.
- FW-08A excavation area: the top 7 feet of excavated soils would be suitable for reuse.
- OFTP-02 excavation area: the top 4 feet of excavated soils would be suitable for reuse.
- Excavated soils from MW-02, near site surface soils, TTSED06 and TTSED09 excavation areas would not be suitable for reuse.

Based on the assumptions above, a volume of approximately 2,900 cy of soil would be suitable for reuse.

This alternative also includes the placement of a two-foot clean soil cover over the eastern portion of the Site to address residual contamination above the Restricted-Residential SCOs, as requested by NYSDEC in the February 4, 2010 comment letter specified on the figure provided to National Grid by NYSDEC on March 31, 2010. The horizontal extent of the two-foot cover is shown on Figure 4-2A. An area of approximately 40,000 SF would be covered with clean soil.

This alternative also includes contingency excavation of the area between TTDP04 and FW-08A/B and the area between FW-08A/B and OFTP-02. Previous attempts to address data gaps in these areas were unsuccessful, as several large, densely vegetated, spoil piles prohibit access to this area from any direction. Therefore, the nature and extent of contamination is not fully delineated in these areas. Contingency excavation assumes excavation of an approximate 5,100 sf corridor connecting TTDP04 and FW-08A/B, and an approximate 1,700 sf corridor connecting FW-08A/B and OFTP-02. Debris associated with the spoil pile would be moved prior to excavation. It is assumed the excavation corridors would extend to a depth of approximately 11 feet bgs, resulting in a total of 2,700 cy of contingency excavation soils to be removed for off-site treatment and/or disposal. Based on depths to water in nearby sample locations, groundwater may be encountered at approximately seven feet bgs in the area of contingency soil excavation. Shoring and/or sheet piling may be needed for safety and stability or dewatering purposes. For the purposes of this FS, reuse of contingency excavated soils is not considered.

Since potential MGP-related contamination above the unrestricted use SCOs will remain on site following cleanup activities under this alternative, an environmental easement would be implemented to restrict future use of the Site. Access restrictions, including maintenance of Site fencing, and signs (as necessary) would be put in place. A HASP would be developed and implemented to describe adequate control measures and PPE/monitoring to be implemented during intrusive activities at the Site.

An SMP would also be developed under this alternative as discussed in section 4.2.1.2. The SMP would address vapor intrusion concerns, cap maintenance requirements, and requirements for disturbance/restoration of the cap for the Site. The SMP would also address requirements for intrusive activities in off-site areas, including MGP-related soil contamination remaining in FW-20A2, and would be provided to local agencies as discussed in section 4.2.1.2.

Periodic reviews of Site conditions, including off-site areas, would also be performed to assess changes in the potential risk to human health and the environment.

4.2.1.4.1 Compliance with SCGs

Restricted-residential SCOs would be achieved in the areas of MW-02 and MW-08. Residual exceedances of SCOs as would be addressed through a combination of capping and institutional controls. Construction activities would be conducted in accordance with action- and location-specific SCGs. Wastes generated would be managed, transported, and treated in accordance with applicable local, State, and Federal requirements. Prior to excavation activities, a presence/absence determination for wetlands would be conducted, and the jurisdictional status of the wetlands, if present, would be determined.

4.2.1.4.2 Overall Protection of Human Health and the Environment

The excavations would remove NAPL, MGP-related PAHs above 500 ppm, cyanide concentrations > 40 ppm, and restricted-residential SCO exceedances. By removing the sources of contamination, the potential for continued contaminant migration to groundwater would be reduced to the maximum extent practicable. Furthermore, dewatering during soil removal would remove some volume of impacted groundwater. Capping and implementation of a HASP and SMP would mitigate potential direct contact exposure associated with residual contamination.

4.2.1.4.3 Short-Term Impacts and Effectiveness

This alternative would involve on- and off-site construction efforts to remove soil. In addition, this alternative would include transportation of this contaminated material through off-site (residential) areas. There would be a transportation risk in addition to the potential for exposure to contaminants that may be mobilized during these activities. These would be minimized by developing engineering controls and implementing a HASP to provide protection for on-site workers. In addition, appropriate engineering controls (*i.e.,* water sprays, excavation in an enclosed structure, etc.) may be necessary to mitigate the possibility of fugitive dust, etc. Off-site transportation would be performed in strict accordance with transportation plans to minimize impacts to neighborhoods through which contaminated soil will be transported. Development of a SMP would help to mitigate potential exposures. The timeframe required for implementation of this alternative is approximately 6 to 12 months.

4.2.1.4.4 Long-Term Effectiveness and Permanence

This alternative would have significant long-term effectiveness and/or permanence since the sources of MGP contamination and highly contaminated areas would be removed. Potential residual human exposure would be reduced by capping and implementation of institutional controls. Limited controls would be implemented to manage the remaining contaminated material, consisting of fencing, signage and restricting future use of the Site. A SMP would be implemented to address residual exposure potential for both on and off-site areas. These controls would be effective at mitigating potential exposures, though there is the potential for violation of these controls. The effectiveness of this alternative would be re-evaluated periodically.

4.2.1.4.5 Reduction of Mobility, Toxicity, and/or Volume

Migration of contaminants would be significantly reduced by removing the sources of contamination. Off-site treatment of the excavated materials would substantially reduce the toxicity of the majority of contaminants by destruction. In addition, there would be a reduction in the volume of contaminants remaining following remedy implementation.

4.2.1.4.6 Implementability

Technical Feasibility: This is an alternative requiring a moderate level of effort, planning, and acceptance of short-term risk. Excavation with off-site disposal, with or without pre-treatment, is a widely used treatment technology and is well developed. Excavation does not extend below approximately 17 feet bgs; therefore, conventional equipment can be used. Remnants of one of the subsurface holders would be broken-up and removed during soil excavation. A utility mark-out is required before any intrusive activities. The known 24-inch storm sewer line would need to be supported during excavation activities. Dewatering would be required, and water encountered during excavation would be treated for discharge or off-site disposal, depending on the quantity to be managed. Planning, design, and risk mitigation efforts would be required to complete this alternative, and even with a great deal of care, there would be short-term construction risks that would require management. Negotiations with multiple off-site property owners would be required for implementation of institutional controls following remedial activities.

Administrative Feasibility: Administratively, this alternative would be relatively easy to implement. An acceptable transportation plan for the large quantities of soil that would need to be transported to an appropriate disposal facility would be established. Remedial activities in off-site areas would be conducted in consultation and coordination with the affected property owners. In addition, access agreements would be need to be obtained for work conducted in the off-site areas. Coordination with regulatory agencies would also be required for periodic reviews. However, there are no concerns with the ability or time required to interact with local and regulatory agencies.

4.2.1.4.7 Cost

The capital cost of implementing this alternative is $5,598,000. There are limited O&M costs of $6,000 associated with cap maintenance, and costs for periodic reviews under this alternative. The net present cost of the alternative, based on a 30-year period of performance and a 5%

discount rate is $5,799,000. Appendix C provides a detailed breakdown of the costs for the on and off-site portions of this alternative.

4.2.1.5 Alternative S-5: Excavation of Soils Exhibiting Concentrations Above Unrestricted Use SCOs and Off-Site Disposal

Alternative S-5 would include the removal of impacted soil to the most stringent NYSDEC SCOs (Unrestricted Use), which are more conservative than other applicable SCOs as identified on Figure 1-9. Evaluation of this alternative is a requirement as per NYSDEC's DER-10. Figures 4-3A and 4-3B show the horizontal extent of soil removal to Unrestricted Use SCOs for the Site and Off-Site Areas, respectively. Vertically, soil would be removed to the identified depth of contamination, both MGP-related and non-MGP related, exceeding Unrestricted Use SCOs within each excavation area. Surface soils exceeding Unrestricted Use SCOs would be removed to approximately two feet bgs. Excavation depths are shown for each subsurface excavation area on Figures 4-3A and 4-3B. Approximately 71,600 cy of soil will be removed as part of this alternative. Remnants of the 200,000 gallon former gas holder and the octagonal former gas holder would also be removed as part of this alternative.

Groundwater is encountered at depths of approximately zero to 15 feet within the excavation areas. Shoring and/or sheet piling may be needed for this alternative for slope stability and safety, as well as for dewatering purposes since the excavations proceed below the water table. Any dewatering will provide the added benefit of removing the impacted area of groundwater contamination.

Excavated soils may be reused as backfill if below regulatory criteria. For the purposes of this FS, it is assumed that clean backfill will replace all areas where soil is removed. Post-remediation confirmatory sampling is included as part of this alternative in areas where soil will be removed. Post-remediation sampling will be performed to ensure that remedial design objectives have been met.

For the purposes of this FS, off-site landfill disposal at an appropriate facility was considered. During remedial design, market conditions will be re-evaluated to assess the cost-effectiveness of alternative treatment options, facilities, or technologies.

This alternative includes a contingency excavation of approximately 11,200 cy of soils between TTDP04 and FW-08A/B, which was not sampled during the RI due to access restrictions.

4.2.1.5.1 Compliance with SCGs

This alternative would be implemented in accordance with chemical, action, and location specific SCGs. This alternative would achieve Unrestricted Use SCOs, which are more conservative than other applicable SCOs, in all areas of identified soils exceeding Unrestricted Use SCOs on and off site. Wastes generated would be managed, transported, and treated in accordance with applicable local, State, and Federal requirements. Prior to excavation activities, a presence/absence determination for wetlands would be conducted, and the jurisdictional status of the wetlands, if present, would be determined.

4.2.1.5.2 Overall Protection of Human Health and the Environment

This alternative would remove impacted media and source areas to the maximum extent practicable, providing the maximum protection for human health and the environment.

4.2.1.5.3 Short-Term Impacts and Effectiveness

This alternative would involve extensive on- and off-site remedial activities to remove soils exceeding Unrestricted Use SCOs. There would be risks typically associated with construction activities, including movement of heavy equipment through areas adjacent to roads and residential properties. A HASP would be developed and implemented to provide protection for on-site workers. The timeframe required for implementation of this alternative is approximately 18 to 24 months.

4.2.1.5.4 Long-Term Effectiveness and Permanence

This alternative would be effective and permanent over the long-term, as the maximum removal of materials is performed under this alternative.

4.2.1.5.5 Reduction of Mobility, Toxicity, and/or Volume

Removal of soils exceeding Unrestricted Use SCOs from the Site would eliminate the potential for exposure and migration of impacts. Treatment at the off-site disposal facility could potentially reduce the mobility, toxicity and/or volume of impacted soil.

4.2.1.5.6 Implementability

Technical Feasibility: There are major technical feasibility concerns associated with this alternative. This alternative would require a very high level of effort, planning and acceptance of short-term risk. Excavation of soil with off-site disposal, with or without pre-treatment, is a widely used technology and well developed. However, due to the extent of excavation and quantities of soil that would be removed, the implementation difficulty would be high. Streets and private properties surrounding the Site would be included in the excavation areas, creating further implementation difficulties. The narrow nature of the off-site areas, the proximity to residential homes, and the presence of standing surface water would limit the ability to stage equipment, impact productivity, and may extend mobilization phases. Odors and vapors could be emitted for extended durations. Subsurface utilities would need to be supported and large quantities of water would be treated. Excavation of roadways would require re-routing traffic, and re-paving of the road upon completion, resulting in a significant disturbance to the community. Extensive planning, design, and risk mitigation efforts would be required to complete this alternative, and even with a great deal of care, there would be significant short-term construction risks that would require management. There would be worker safety risks, risks of damage to equipment, risk of damage to adjacent structures and properties, and risks of contaminant release during the work.

Administrative Feasibility: Administratively, this alternative would be moderately difficult to implement. An acceptable transportation plan for the large quantities of soil that would need to be transported to an appropriate disposal facility would be established. Coordination with local authorities would be required to establish an acceptable transportation plan for transportation of material to the Site. Remedial activities in off-site areas would be conducted in consultation and coordination with the affected property owners. In addition, access agreements would need to be obtained for work conducted in the off-site areas. Coordination with local authorities and homeowners would be required to re-route traffic during excavation of roadways. Consulting services are readily available for implementation of the HASP.

4.2.1.5.7 Cost

The estimated capital cost associated with this alternative is $36,994,000. There is no annual O&M cost associated with this alternative. Appendix C provides a detailed breakdown of the costs for the on and off-site portions of this alternative.

4.2.2 Groundwater Remedial Alternatives

This section presents the evaluation of remedial alternatives for groundwater contamination present at the Site.

4.2.2.1 Alternative GW-1: No Action

The No Action alternative includes no active remediation at the Site. Contaminated groundwater would be left in place with no treatment or controls to prevent future exposure. Periodic reviews would be performed to assess any changes in the risk to human health and the environment posed by the Site. This alternative is developed as a basis for comparison of other alternatives.

4.2.2.1.1 Compliance with SCGs

The No Action alternative for groundwater does not comply with SCGs. Groundwater currently exceeds NYSDEC WQ Class GA values on site. However, groundwater is not currently used on site, and the water supply in the area is from a municipal source. Under this alternative, groundwater would continue to exceed criteria for an extended period of time until natural processes reduce the contaminant levels. Location- and action-specific SCGs would not be triggered, since no remedial activities would be performed.

4.2.2.1.2 Overall Protection of Human Health and the Environment

The No Action alternative would not remove, contain, or treat the contaminated groundwater. Therefore, potential risks to human health and the environment resulting from contaminated groundwater above SCGs would remain unchanged. Groundwater from the Site discharges into the nearby Mohawk River. However, groundwater is not used either at the Site, or in the area between the Site and the river. Moreover, the majority of known groundwater contamination is concentrated within the Site boundaries (only one, low level off-site detection was noted). Considering the age of the Site, the extent of groundwater contamination has most likely reached equilibrium and will not increase any further. However, risks associated with the potential for exposure to contaminated groundwater would persist. In addition, there is the continued potential for migration of contaminants.

4.2.2.1.3 Short-Term Impacts and Effectiveness

Under the No Action alternative, there would be no short-term impacts to workers or the surrounding community. No construction would be required for implementation of this alternative. This alternative would not result in any short-term improvements over current conditions.

4.2.2.1.4 Long-Term Effectiveness and Permanence

The No Action alternative includes no active remediation at the Site. Contaminated groundwater would be left in place with no treatment or controls to prevent future exposure to contaminated media or further contaminant migration. The only source of controls at the Site would be periodic reviews.

4.2.2.1.5 Reduction of Toxicity, Mobility, and/or Volume

This alternative would not involve any containment, removal, treatment, or disposal of the contaminated groundwater. Therefore, this alternative would not result in any immediate reduction in the toxicity, mobility, or volume of contaminants. Over time, through natural processes, contaminant concentrations in the groundwater may eventually decline, resulting in a reduction in toxicity of the contaminated groundwater and/or a reduction in the dissolved phase volume.

4.2.2.1.6 Implementability

There are no technical feasibility concerns with the No Action alternative. The effectiveness of the remedy would be evaluated periodically, and implementation of this alternative would not preclude implementing remedial action in the future.

4.2.2.1.7 Cost

There are no capital costs or annual O&M costs for the No Action alternative.

4.2.2.2 Alternative GW-2: Limited Action (Institutional Controls)

This alternative includes no active remediation of groundwater, but rather relies on institutional controls to eliminate potential exposure pathways at the Site and in off-site areas. Currently, groundwater is not used as a potable water source at the Site or in the off-site areas and the water supply is from a municipal source. Restrictions in the form of environmental easements would be implemented to prohibit future use of groundwater for potable purposes on the Site. In addition, a HASP would be developed and implemented to ensure use of adequate control measures and PPE during intrusive activities. Groundwater monitoring and periodic reviews would also be performed to assess changes in the risk to human health and the environment posed by the Site.

4.2.2.2.1 Compliance with SCGs

The Limited Action (Institutional Controls) alternative does not immediately comply with chemical-specific SCGs. Since no active reduction of contamination is performed, groundwater contaminant concentrations will continue to exceed NYSDEC WQ Class GA levels for some period after implementation of this alternative in conjunction with the selected soil alternative. However, in conjunction with soil remediation strategies, NYSDEC WQ Class GA levels could ultimately be achieved at the point of compliance as a result of naturally occurring degradation processes.

4.2.2.2.2 Overall Protection of Human Health and the Environment

The Limited Action (Institutional Controls) alternative would not remove, contain, or treat the contaminated groundwater. However, risks associated with the potential for ingestion of contaminated groundwater and/or dermal contact with contaminated groundwater would be reduced by implementation of institutional controls, including an environmental easement for the Site, and a HASP and SMP for both on- and off-site areas.

4.2.2.2.3 Short-Term Impacts and Effectiveness

No construction would be involved in this alternative. This alternative would not result in any short-term improvement over current conditions. Contaminants would persist until concentrations were reduced by natural attenuation processes following soil remediation. It is estimated that this alternative could be implemented in less than six months. Long-term, periodic monitoring until final cleanup levels have been achieved would be required.

4.2.2.2.4 Long-Term Effectiveness and Permanence

It is anticipated that naturally occurring processes will at some time in the future achieve target cleanup levels in the groundwater at the point of compliance. Once achieved, this remedy will be permanent as long as soil remediation measures are permanent (or maintained) to prevent re-contamination of groundwater. Maintenance of groundwater use restrictions until Class NYSDEC WQ Class GA levels are achieved will ensure the protection of human health.

4.2.2.2.5 Reduction of Mobility, Toxicity, and/or Volume

This alternative would not involve any containment, removal, treatment, or disposal of the contaminated groundwater. Therefore, this alternative would not result in any immediate reduction in the toxicity, mobility, or volume of contaminants. Over time, in conjunction with a soil remediation alternative and through natural processes, contaminant concentrations in the groundwater may eventually decline to be in compliance with NYSDEC WQ Class GA levels, resulting in a reduction in toxicity of the contaminated groundwater and/or a reduction in the dissolved phase volume.

4.2.2.2.6 Implementability

There are no major technical feasibility concerns with the Limited Action (Institutional Controls) alternative for groundwater. Contaminated groundwater is mostly concentrated within the site boundaries. However, an area-wide restriction of wells may be involved. The effectiveness of the remedy would be evaluated in periodic reviews.

As this alternative involves no construction activities, availability of resources and use of proven technologies is not applicable. Consulting services are readily available for implementation of an environmental easement for the Site. Services are also available for conducting periodic reviews. Coordination with regulatory agencies would be required for review of groundwater data and periodic reviews, as well as making decisions regarding any future remedial alternatives. However, there are no concerns with the ability or time required to interact with regulatory agencies.

4.2.2.2.7 Cost

A capital cost of $26,000 is estimated for implementation of institutional controls. The net present cost of the alternative, based on a 30-year period of performance and a 5% discount rate is $82,000, including periodic reviews. See Appendix C for details.

4.2.2.3 Alternative GW-3: Monitored Natural Attenuation and Institutional Controls

This alternative includes the implementation of MNA for groundwater. MNA has been included as a remedial component at former MGP sites, typically in conjunction with some degree of source removal. The NYSDEC has selected remedies which incorporate MNA at other MGP Sites, including the NG Water Street Site in Troy and the NG Watertown Engine Street Site. At the Ilion (East Street) Site, MNA in conjunction with source removal could provide the mechanism to address constituents in groundwater.

Dissolved-phase contamination exceeding the NYSDEC WQ Class GA criteria, consisting of BTEX compounds and cyanide, is present in the southern and central portions of the Site. The extent of cyanide in groundwater appears to also extend to the area adjacent to the site proper immediately east of the Site. Concentrations of individual compounds are relatively low, and the contaminated groundwater does not appear to have migrated beyond areas immediately adjacent to the Site. Natural Attenuation Processes (NAP) are likely occurring and Total BTEX concentrations have decreased over time. Evaluation of the MNA capacity of the aquifer at the Site via a review of site-specific chemical and geochemical parameters indicates aerobic biodegradation of the BTEX compounds can occur at the Site but does not appear to be a primary NAP occurring at the Site because of the relatively low dissolved oxygen concentrations and MGP-related constituent concentrations. Removing MGP-related constituents through implementation of a soil remedial alternative will likely result in a reduction of groundwater concentrations by eliminating the source of contamination affecting groundwater. It is anticipated that any residual contamination in groundwater could effectively reach NYSDEC WQ Class GA levels through natural attenuation processes.

As part of the remedial design for this alternative, a monitoring network comprised of existing wells and a point of compliance system would be developed, and data would be collected to determine the fate and transport of contaminants.

This alternative would also include institutional controls such as implementing groundwater use restrictions to prohibit use of groundwater for potable purposes on site or in the adjacent community. In addition, a HASP would be developed and implemented at the property to ensure use of adequate control measures and PPE during intrusive activities. Periodic reviews would also be performed to assess changes in the risk to human health and the environment.

4.2.2.3.1 Compliance with SCGs

The MNA alternative does not immediately comply with chemical-specific SCGs. Groundwater contaminant concentrations may continue to exceed NYSDEC WQ Class GA values during implementation of this alternative. In conjunction with source removal strategies, residual groundwater exceeding NYSDEC WQ Class GA values will ultimately be achieved at the point of compliance as a result of naturally occurring degradation processes. Groundwater monitoring required to assess the effectiveness of the MNA strategy will be performed in accordance with applicable action and location-specific SCGs.

4.2.2.3.2 Overall Protection of Human Health and the Environment

The groundwater contamination occurs primarily within the Site boundaries. The MNA alternative by itself would not remove or contain the contaminated groundwater. Risks associated with the potential for ingestion of contaminated groundwater and/or dermal contact with contaminated groundwater would be mitigated by implementation of use restrictions (there is no groundwater use at the Site or in the off-site areas). Long-term groundwater use restrictions would be required while NYSDEC WQ Class GA values are achieved.

4.2.2.3.3 Short-Term Impacts and Effectiveness

The monitoring network will be comprised of existing monitoring wells. Therefore, no construction activities are associated with this alternative. This alternative by itself would not result in any immediate improvement over current conditions. Contaminants would persist at the Site until concentrations were reduced by natural attenuation processes. Long-term, periodic monitoring would be required as part of this alternative.

4.2.2.3.4 Long-Term Effectiveness and Permanence

It is anticipated that MNA will achieve target cleanup levels (NYSDEC WQ values) for organics in groundwater at a point of compliance. Once achieved, this remedy will be permanent as long as soil source control measures are permanent (or maintained) to prevent re-contamination of groundwater. Maintenance of groundwater use restrictions will ensure the protection of human health and the environment.

4.2.2.3.5 Reduction of Toxicity, Mobility, and/or Volume

This alternative by itself would not result in any immediate reduction in the toxicity, mobility, or volume of contaminants. Over time, through natural processes, contaminant concentrations in the groundwater will decline, resulting in a reduction in toxicity of the contaminated groundwater and/or a reduction in the dissolved phase volume. However, implementation of Soil Alternatives S-3, S-4, or S-5 would result in a significant reduction of mobility, toxicity, and/or volume of contaminants in groundwater through source removal and dewatering; therefore, making MNA a viable alternative.

4.2.2.3.6 Implementability

Technical Feasibility: As this alternative involves no construction activities, resources are readily available. Contaminated groundwater is mostly concentrated within the site boundaries. However, an area-wide restriction of wells may be involved. There are no major technical feasibility concerns with the MNA alternative for groundwater. The effectiveness of the remedy would be evaluated in periodic reviews. Additional remedial action can be easily undertaken.

Administrative Feasibility: Consulting services are readily available for negotiation and implementation of use restrictions and monitoring. Services are also available for conducting periodic reviews. Coordination with regulatory agencies would be required for review of groundwater data and periodic reviews, as well as making decisions regarding any future remedial alternatives.

4.2.2.3.7 Cost

The capital cost for the MNA with Institutional Controls alternative is estimated to be $68,000. The annual O&M cost is estimated to be $28,000. The net present cost of the alternative, based on a 30-year period of performance and a 5% discount rate, is $247,000, including periodic reviews. See Appendix C for details.

5.0 Comparative Analysis of Alternatives

The following section compares the relative performance of each remedial alternative using the specific evaluation criteria presented in Section 4.1. Comparisons are presented in a qualitative manner, and identify substantive differences between the alternatives. As with the detailed evaluation, the following criteria are used for the comparative analysis.

- Compliance with SCGs;
- Overall Protection of Human Health and the Environment;
- Short-Term Impact and Effectiveness;
- Long-Term Effectiveness and Permanence;
- Reduction of Toxicity, Mobility, and/or Volume;
- Implementability; and
- Cost

5.1 Comparative Analysis of Soil Remedial Alternatives

5.1.1 Compliance with SCGs

The alternatives can all be accomplished in accordance with action- and location-specific SCGs. Alternative S-5 achieves chemical-specific SCGs, and removes the most material from the Site and off-site areas; however, this alternative includes excavation of soils exceeding NYSDEC Unrestricted Use SCOs potentially related to other sources, such as the former landfill and the spoil piles. Alternatives S-3 and S-4 achieve Unrestricted Use SCOs for MGP-impacted soils that are removed, and Alternative S-4 achieves Restricted-Residential SCOs in the source areas on site through excavation. Alternatives S-1 and S-2 do not remove contamination from the Site or from the off-site areas.

5.1.2 Overall Protection of Human Health and the Environment

Alternatives S-3, S-4 and S-5 are the most protective of human health and the environment. Alternative S-5 removes contamination above Unrestricted Use SCOs from the Site and the off-site areas, including contamination potentially related to other sources, and the future use of these areas would be unrestricted. Alternatives S-3 and S-4 are also protective, since they remove the MGP-related sources of contamination, and mitigate exposure to residual contamination through capping and implementation of a HASP and SMP. Alternative S-4 removes a larger volume of impacted soil from the Site to address Restricted-Residential SCOs associated with source areas; however, since Alternative S-3 also addresses source areas, and both alternatives include placement of a cap, this additional soil removal offers little additional protection of human health or the environment than Alternative S-3. Alternative S-2 prevents human exposure, but does not provide any removal or treatment that would expedite the cleanup of the site to regulatory standards. Alternative S-1 is the least protective, since it does not remove or treat contaminants nor reduce the risk of human or environmental exposure.

5.1.3 Short-Term Impacts and Effectiveness

Alternatives S-1 and S-2 would have the lowest short-term impact. There would be no potential risks to workers or the public during implementation of these alternatives, since no active remediation would be performed. For the active remedial alternatives, the short-term impact of Alternative S-3 would be less than Alternative S-4, since there would be less disturbance of on-site contamination. The short-term impacts of Alternatives S-3 and S-4 would both be significantly less than Alternative S-5 due to the smaller volume of contaminated soil disturbed both on and off-site. Alternatives S-3 and S-4 would be implemented in approximately the same period of time, though Alternative S-4 would take slightly longer to implement due to the additional soil removal on site. Alternatives S-5 would have the highest short-term impact, since extensive excavation and driving of sheet piling would disturb the soil and more excavated material would need to be transported through off-site (residential) areas for off-site disposal. Each of these alternatives could potentially increase risk of exposure to workers and the public. These impacts would be minimized through proper construction and transportation procedures and engineering controls.

5.1.4 Long-Term Effectiveness and Permanence

Alternative S-5 is the most effective, since contamination is removed from the Site and off-site areas to Unrestricted Use SCOs. Alternatives S-3 and S-4 are effective at reducing potential human exposure through removal of source areas and soil with MGP-related contamination from the Site and the off-site areas, and capping residual on-site contamination. The Site would be subject to institutional controls to prevent potential exposures under both of these alternatives, and an SMP would be implemented to mitigate off-site exposures. Long-term O&M (*e.g.*, monitoring) would be required to ensure that these alternatives continues to be effective, in addition to maintenance of use restrictions on the Site. Alternative S-2 is less effective, since all existing contamination, including source areas, would remain. Human health exposure would be mitigated through a HASP and SMP. Long-term O&M and land use restrictions for the Site would be required to ensure the effectiveness of this alternative. Alternative S-1 would not be effective, since it would not reduce potential human exposure.

5.1.5 Reduction of Toxicity, Mobility and/or Volume

Alternative S-5 offers the most significant reduction in mobility, toxicity, and volume of contaminated soil, since soil exceeding Unrestricted Use SCOs, including impacts potentially related to non-MGP sources, would be excavated for appropriate off-site treatment and/or disposal. Alternatives S-3 and S-4 also offer reduction in mobility, toxicity and/or volume through removal of MGP source material and soil with MGP-related contamination. Alternatives S-3, S-4 and S-5 would remove approximately 8,160 cy, 9,860 cy and 82,800 cy of impacted soil, respectively (note: these volumes included contingency soils). Alternatives S-1 and S-2 offer no reduction in mobility, toxicity, or volume.

5.1.6 Implementability

All of the alternatives evaluated are technically feasible. Alternative S-1 is the easiest to implement, since no remedial activities are employed in this alternative. Alternative S-2 is also relatively easy to implement, involving only institutional controls. Alternatives S-3 and S-4 would be more difficult to implement, as they require deeper excavations with the potential need for shoring. Significant technical feasibility concerns are associated with Alternative S-5. The physical configuration of the off-site areas, the proximity to residential homes, and the presence of standing surface water would limit the ability to stage equipment, and impact productivity more so than with Alternatives S-3 and S-4. Odors and vapors could be emitted for extended durations during implementation of S-5. Furthermore, during implementation of Alternative S-5, excavation of roadways would require re-routing of traffic and re-paving of roadways. Alternatives S-3 and S-4 provide protection to human health and the environment from NAPL-impacted soil with less impact to the community and site workers than Alternative S-5.

Services, equipment, and materials are available for all alternatives. Alternative S-1 requires no materials and limited services. Alternative S-2 requires limited services. Alternatives S-3, S-4 and S-5 require excavation services in addition to backfill materials. The quantities of both excavated material and backfill to be handled and transported are extremely large for Alternative S-5.

All of the alternatives evaluated are administratively feasible. Alternative S-1 would be the easiest to implement, since no activity would be performed. Alternative S-2 would be relatively easy to implement, requiring only preparation of a HASP and SMP and notification to affected parties. Alternatives S-3, S-4 and S-5 would involve negotiations with multiple off-site property owners for access to implement these alternatives. Alternatives S-3, S-4 and S-5 involve construction activities and associated administrative activities (*e.g.*, permitting, public participation and coordination, etc.). They would also require coordination requirements for off-site transportation, which the other alternatives would not entail. Long-term institutional management (*e.g.*, monitoring, reporting, public coordination) would be associated with Alternatives S-2, S-3 and S-4. Coordination with local authorities and homeowners would be required during implementation of Alternative S-5 during roadway excavation and re-paving activities.

5.1.7 Cost

Alternative S-1 has no capital or O&M costs. Alternative S-2 has the next lowest capital cost at $65,000, no annual O&M costs, and a NPV of $121,000. Alternative S-3 has the next lowest capital cost at $4,890,000, annual O&M costs of $3,000, and a NPV of $5,053,000. Alternative S-4 has the second highest capital cost at $5,598,000, annual O&M costs of $6,000, and a NPV of $5,799,000. Alternative S-5 has the highest capital costs at $36,994,000 and no O&M costs. Overall, the ranking of the alternatives based on net present value (capital and O&M) from lowest to highest is: S-1, S-2, S-3, S-4 and S-5.

5.2 Comparative Analysis of Groundwater Remedial Alternatives

5.2.1 Compliance with SCGs

Alternatives GW-1, GW-2, and GW-3 would be performed in accordance with action- and location-specific SCGs and would eventually achieve chemical-specific SCGs over a long period of time if implemented in conjunction with a soil remediation alternative.

5.2.2 Overall Protection of Human Health and the Environment

Alternative GW-3 is a passive alternative that does not provide active treatment of contaminated groundwater, but achieves the goal of minimizing potential human health risks over time. Monitoring would be implemented until the treatment goals were achieved and groundwater use restrictions would be maintained. Alternative GW-1 and GW-2 are the least protective, since they do not remove or treat contaminated groundwater, and GW-1 does not reduce the potential risk of human exposure. In addition, GW-1 does not provide for monitoring to assess potential changes in risk to human health or the environment.

5.2.3 Short-Term Impacts and Effectiveness

Alternatives GW-1 and GW-2 would have the lowest short-term impact and highest short-term effectiveness. There would be no potential risks to workers or the public during implementation of these alternatives, since no activities or construction would be performed. The short-term impact and short-term effectiveness of Alternative GW-3 would also be favorable, since monitoring would result in minimal risks of exposure for workers or the public.

5.2.4 Long-Term Effectiveness and Permanence

Alternatives GW-1, GW-2, and GW-3 would ultimately provide long-term protection of human health and the environment over a long period of time if implemented in conjunction with a soil remediation alternative. Monitoring would provide additional risk mitigation assurance under Alternative GW-3.

5.2.5 Reduction of Toxicity, Mobility and/or Volume

Alternatives GW-1, GW-2, and GW-3 offer no reduction in mobility, toxicity, or volume, since no active remediation would be performed. Over time, through natural processes, contaminant concentrations in the groundwater will decline, resulting in a reduction in toxicity of the contaminated groundwater and/or a reduction in the dissolved phase volume. Implementation of soil Alternatives S-3, S-4 or S-5 would result in a volume reduction of contaminated groundwater since contaminated groundwater would be removed through dewatering operations. Furthermore, the ongoing source of contamination in groundwater would also be reduced (S-3/S-4) or eliminated (S-5).

5.2.6 Implementability

All of the alternatives evaluated are technically feasible. Services, equipment, and materials for monitoring associated with GW-3 are available. All of the alternatives evaluated are administratively feasible. Alternatives GW-1 and GW-2 would be easy to implement (short-term) since there would be no construction activity involved. Alternative GW-3 would involve long-term monitoring.

5.2.7 Cost

Alternative GW-1 has no capital or O&M costs. Alternative GW-2 has a higher capital cost at $26,000, no annual O&M costs, and an NPV of $82,000, including periodic reviews. Alternative GW-3 has the highest capital costs at $68,000, annual O&M costs of $28,000, and an NPV of $247,000.

6.0 Proposed Remedial Alternative

This section presents the proposed alternative for each media based on the evaluations presented in the previous sections. As noted in these evaluations, there are inter-relationships between the media-specific alternatives. Therefore, the media-specific alternative proposals are followed by a description of the overall conceptual plan for site remediation that describes how the selected alternatives result in the most effective overall remediation plan.

6.1 Media-Specific Remedial Alternative Proposal

The following sections describe the proposed alternatives for each media.

6.1.1 Soil

Based on the evaluation of soil alternatives, Alternative S-3 (Excavation of MGP-Related Impacts, Soil Capping, Off-Site Disposal, and Institutional Controls) is proposed.

Removal of the MGP-related source material and associated contamination provide protection against potential migration and transfer into other media. Soil capping on the Site would mitigate potential exposures to residual contamination for on-site workers. Implementation of a HASP and SMP would further mitigate potential exposures to residual contamination both on and off site.

The additional costs that would be incurred for implementation of Alternative S-4 are not warranted. Alternative S-4 provides no incremental benefit to human health or the environment in comparison to Alternative S-3. The small additional quantity of soil removed on site offers no significant reduction of source material or reduction in potential for human exposure, and the 2-foot cap will not significantly reduce the likelihood of exposure versus the 1-foot cap included in Alternative S-3.

The substantial additional costs for Alternative S-5 are also not warranted. Potential exposures and environmental impacts are adequately addressed with implementation of Alternative S-3, the cost of which is nearly an order of magnitude lower than Alternative S-5.

6.1.2 Groundwater

The proposed alternative for groundwater is Alternative GW-3 (Monitored Natural Attenuation and Institutional Controls). This alternative builds on the benefits of source removal activities associated with Alternative S-3. Under this alternative, the appropriate institutional protections would be provided to protect human health from potential exposure to impacted groundwater. In addition, a long-term monitoring program would be established to ensure that long-term groundwater contaminant concentrations remain at acceptable levels.

6.2 Conceptual Plan for Remediation

The conceptual plan for the remediation of the Ilion (East Street) Site incorporates Alternatives S-3 and GW-3, as the combination of these alternatives effectively achieves the remedial objectives and provides protection of human health and the environment. Alternative S-3 will achieve the RAOs for soil on and off site, providing a reduction in toxicity, volume and potential mobility through elimination of MGP- contaminated material from the Site and the off-site areas, with the exception of apparently isolated impacts at locations MW-02, SB-01 and FW-20A. Removal of approximately 8,160 cy (including contingency soils) of MGP-contaminated material will provide a permanent, effective remedy in a short period of time, with minimal disruption to the community. This alternative will minimize potential risks to human health through the implementation of a soil cap and institutional controls (*i.e.*, HASP, SMP, and periodic reviews). This alternative will also remove the most significant potential sources of groundwater contamination.

Implementation of Alternative GW-3 in conjunction with Alternative S-3 will minimize potential risk to human health through the implementation of groundwater monitoring and institutional controls (*i.e.*, groundwater use restrictions, health and safety planning) with periodic reviews.

The overall capital cost for implementation of the selected remedy is $4,958,000. The annual O&M cost is estimated to be $31,000. The net present cost based on a 30-year period and a five percent discount rate is $5,300,000.

7.0 References

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APPENDIX A

ANALYTICAL DATA STATISTICAL SUMMARY

APPENDIX B

NATURAL ATTENTUATION INVESTIGATION SUMMARY

APPENDIX C

ALTERNATIVES COST ESTIMATES

CERTIFICATION STATEMENT

I, Brian Sielski, certify that I am currently a NYS registered professional engineer and that this Feasibility Study Report was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and to the best of my knowledge that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

TETRA TECH ENGINEERING CORPORATION PC

Brian Sielski
Type/Printed Name

B. M. Sielski
Signature

8/31/2010
Date

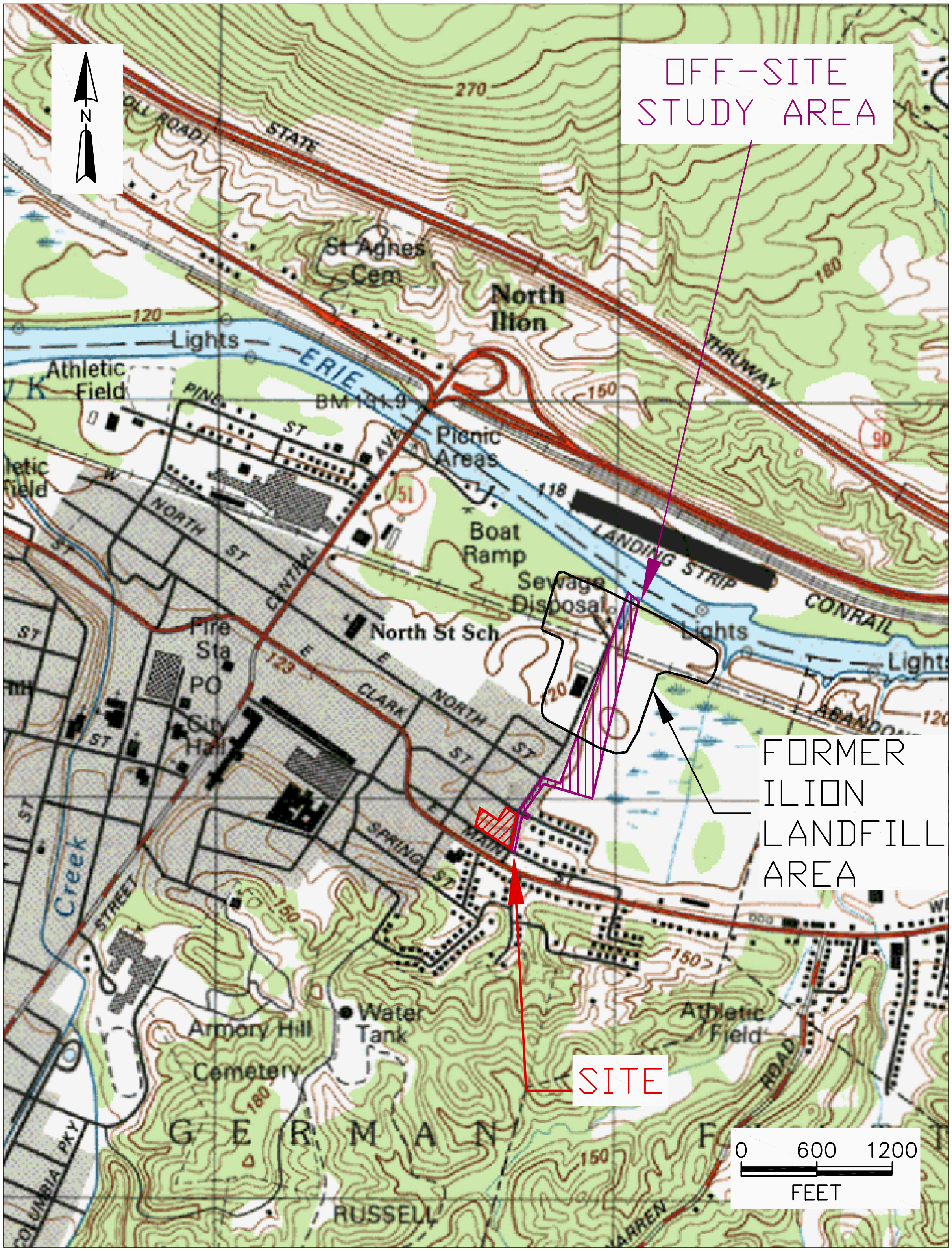
084250-1 / 9/30/2011
NY State PE Stamp and Seal #/Expiration Date

STATE OF NEW YORK
BRIAN M. SIELSKI
084250-1
LICENSED PROFESSIONAL ENGINEER

It is a violation of Education Law Article 145, Professional Engineering and Land Surveying, Section 7209, for any person, unless he is acting under the direction of a licensed professional engineer or land surveyor, to alter this item in any way. If an item bearing the seal of a professional engineer or land surveyor is altered, the altering engineer or land surveyor shall affix to this item his seal and the notation "altered by" followed by his signature and the date of such alteration, and a specific description of the alteration.

LIST OF TABLES

LIST OF FIGURES



Source: Ilion, N.Y. USGS Topographic Quadrangle, 7.5–minute series, dated 1982.

nationalgrid TETRA TECH EC, INC.	TITLE: SITE LOCATION MAP FEASIBILITY STUDY ILION (EAST STREET) SITE	DWN: EAG CHKD: PC DATE: 06/30/09	DES.: LEA APPD: RC REV.: 0	PROJECT NO.: 2907.0003.0003 FIGURE NO.: 1–1

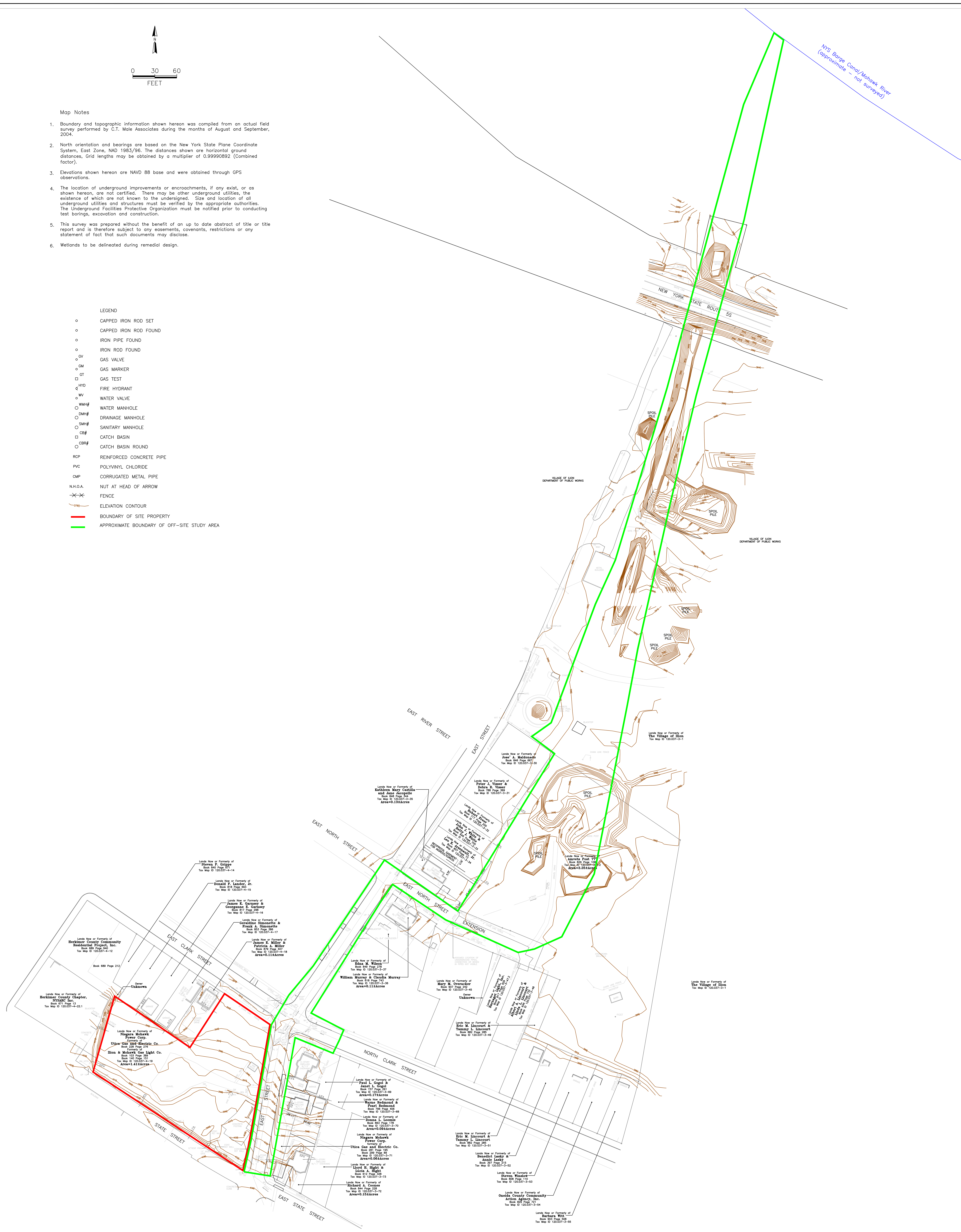
R:\GIS\GISKey\Gisproj31\Ilion East Street\2009 Feasibility Study Figures\FIGURE 1–1 SITE LOCATION.DWG

Map Notes

1. Boundary and topographic information shown hereon was compiled from an actual field survey performed by C.T. Male Associates during the months of August and September, 2004.
2. North orientation and bearings are based on the New York State Plane Coordinate System, East Zone, NAD 1983/96. The distances shown are horizontal ground distances, Grid lengths may be obtained by a multiplier of 0.99990892 (Combined factor).
3. Elevations shown hereon are NAVD 88 base and were obtained through GPS observations.
4. The location of underground improvements or encroachments, if any exist, or as shown hereon, are not certified. There may be other underground utilities, the existence of which are not known to the undersigned. Size and location of all underground utilities and structures must be verified by the appropriate authorities. The Underground Facilities Protective Organization must be notified prior to conducting test borings, excavation and construction.
5. This survey was prepared without the benefit of an up to date abstract of title or title report and is therefore subject to any easements, covenants, restrictions or any statement of fact that such documents may disclose.
6. Wetlands to be delineated during remedial design.

LEGEND

	CAPPED IRON ROD SET
	CAPPED IRON ROD FOUND
	IRON PIPE FOUND
	IRON ROD FOUND
GV	GAS VALVE
GM	GAS MARKER
GT	GAS TEST
HYD	FIRE HYDRANT
WV	WATER VALVE
WMH	WATER MANHOLE
DMH	DRAINAGE MANHOLE
SMH	SANITARY MANHOLE
CB	CATCH BASIN
CBR	CATCH BASIN ROUND
RCP	REINFORCED CONCRETE PIPE
PVC	POLYVINYL CHLORIDE
CMP	CORRUGATED METAL PIPE
N.H.O.A.	NUT AT HEAD OF ARROW
	FENCE
	ELEVATION CONTOUR
	BOUNDARY OF SITE PROPERTY
	APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA



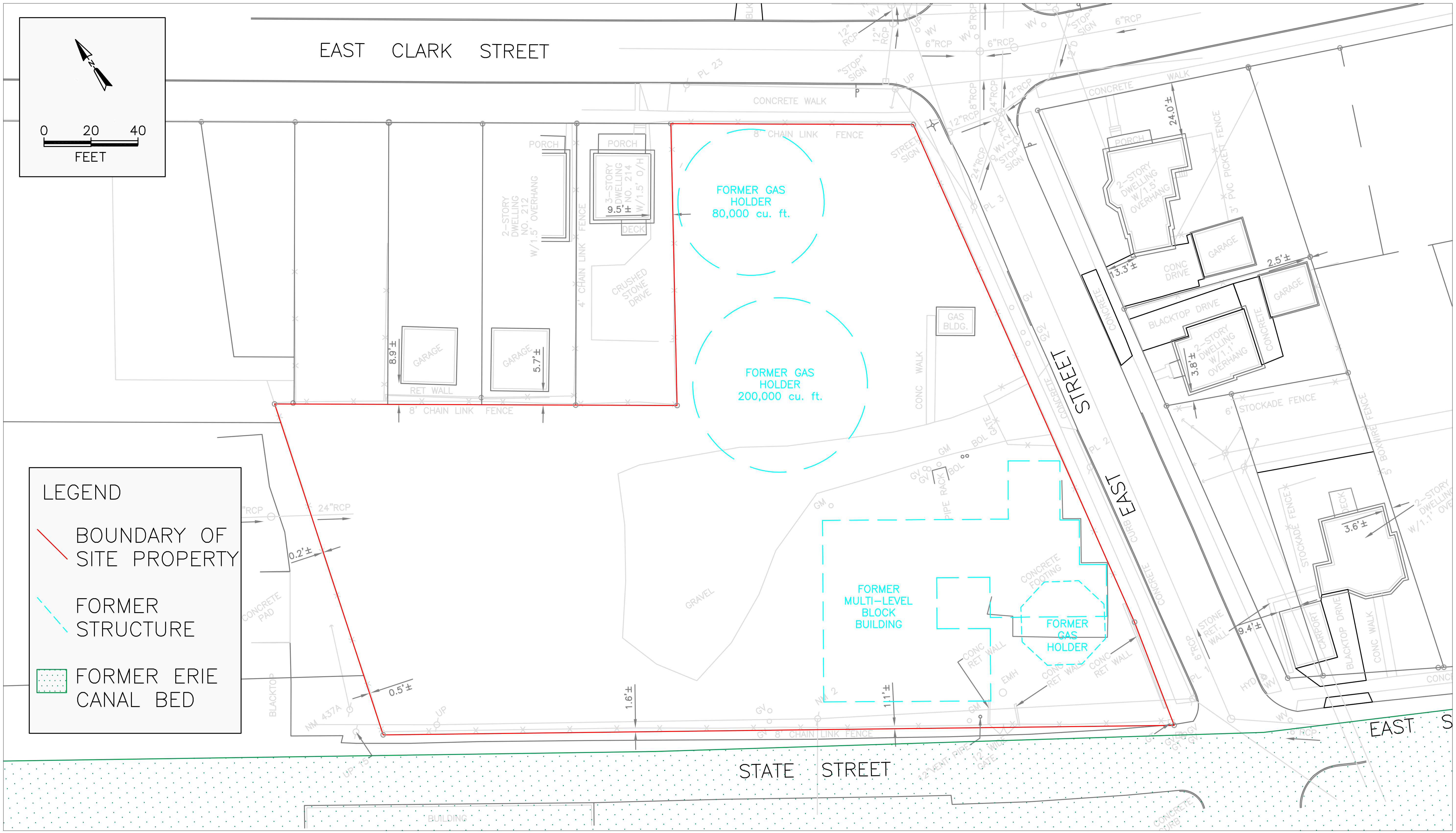
TETRA TECH EC, INC.

TITLE:
SITE PLAN AND SURROUNDING AREA
Feasibility Study
Ilion (East Street) Site

nationalgrid

DWN: EAG	DES.: LEA	PROJECT NO.: 2907.0003.0003
CHKD: PC	APPD: RC	
DATE: 11/02/09	REV.: 0	FIGURE NO.: 1-2

R:\GIS\GISKey\Gisproj31\Ilion East Street\2009 Feasibility Study Figures\FIGURE 1-2 SITE PLAN AND SURROUNDINGS.DWG



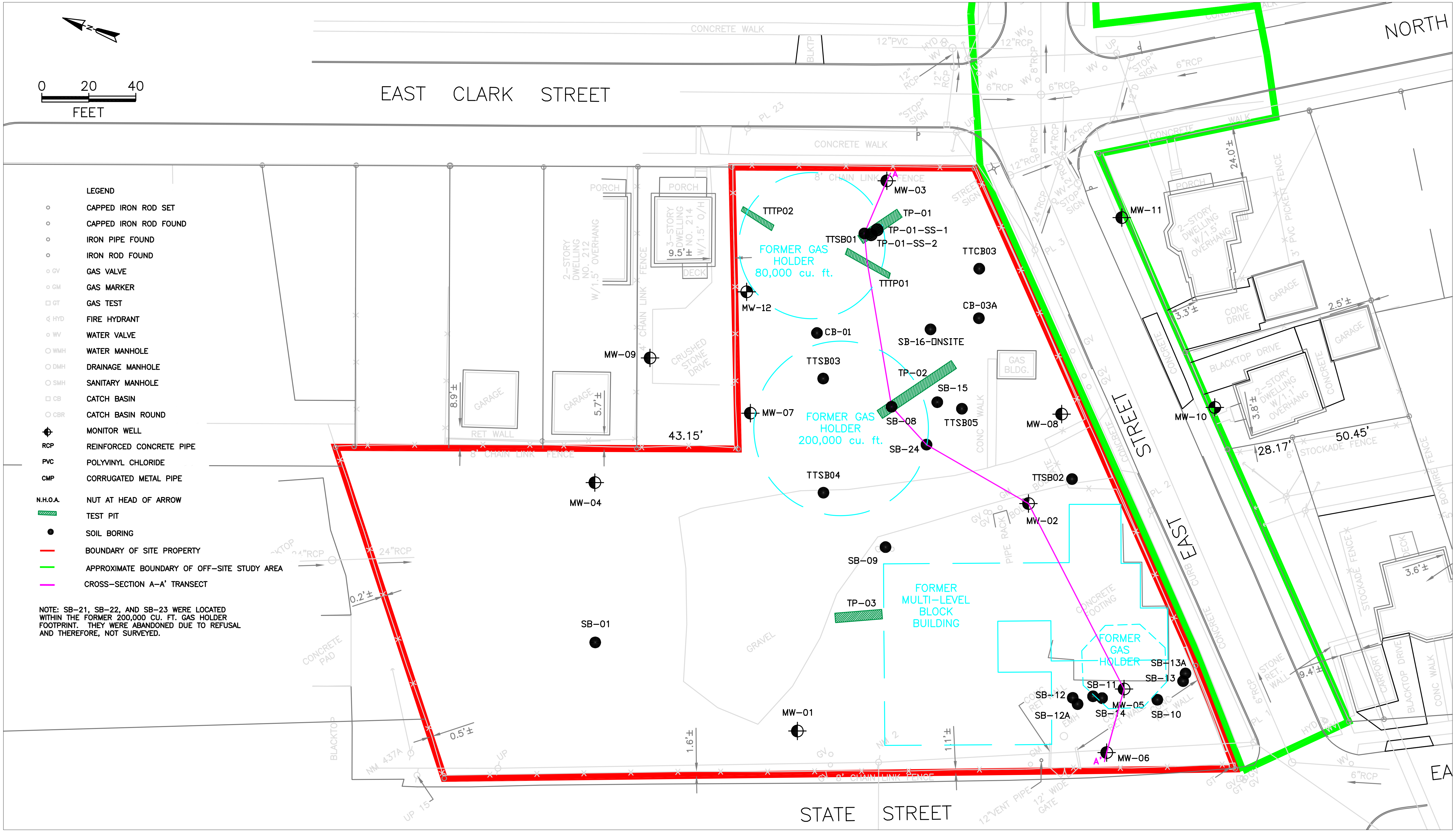
TITLE:
FORMER SITE FEATURES
Feasibility Study
Ilion (East Street) Site

TETRA TECH EC, INC.

nationalgrid

DWN.: EAG	DATE: 06/30/09	PROJECT NO.: 2907.0003.0003
CHKD:	REV.: 0	FIGURE NO.: 1-3
DES.: LEA	APPD:	

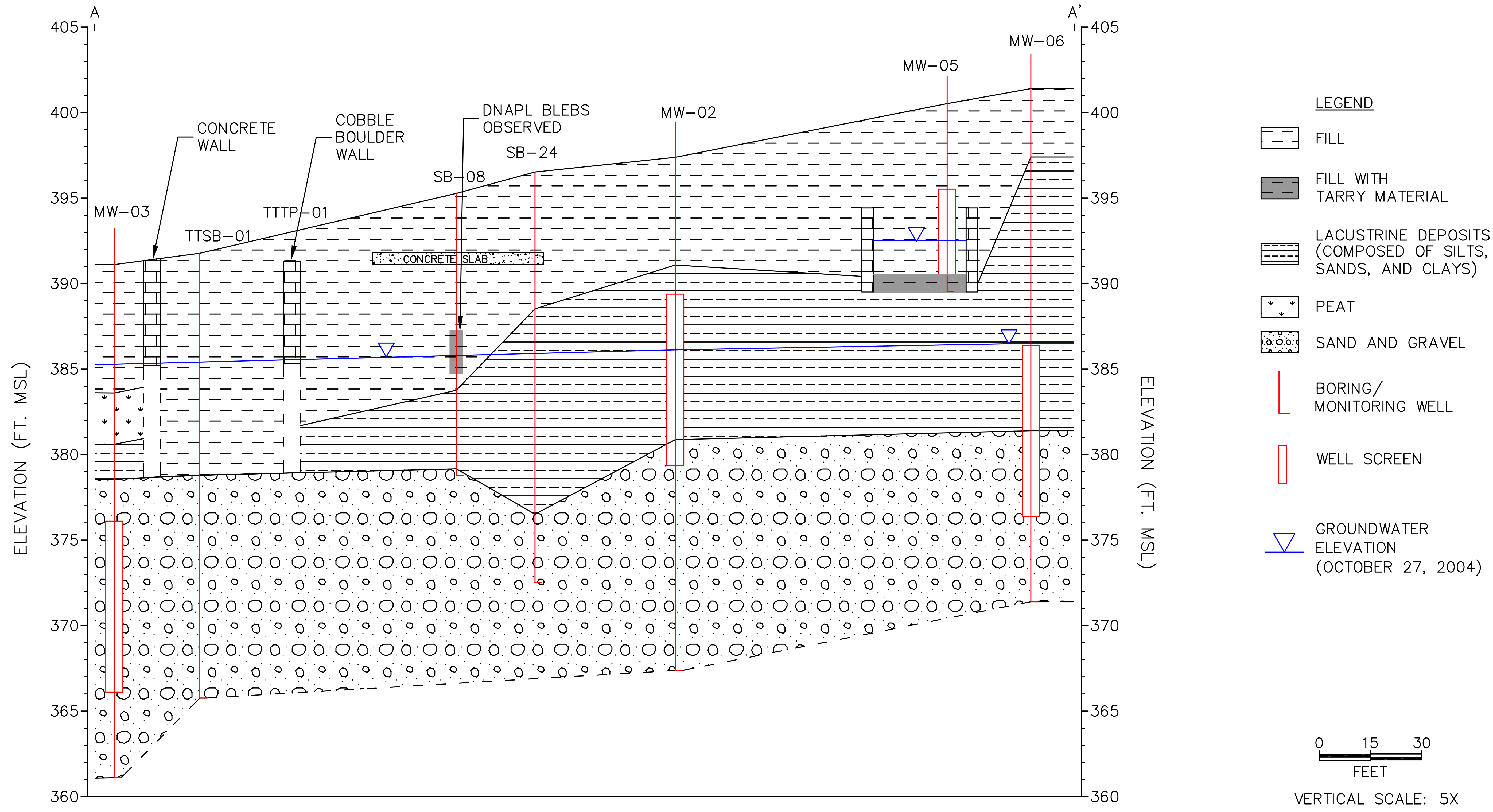
R:\GIS\GISKey\Gisproj31\Ilion East Street\2009 Feasibility Study Figures\FIGURE 1-3 FORMER STRUCTURES.DWG



TETRA TECH EC, INC.	TITLE: LOCATION OF GEOLOGIC CROSS SECTION – SITE Feasibility Study Ilion (East Street) Site	DWN.: LMC CHKD: DES.: CTS	DATE: 10/22/09 REV.: 0 APPD:
		PROJECT NO.: 2907.0003.0003	FIGURE NO.: 1–4

nationalgrid

R:\GIS\GISKey\Gisproj31\Ilion East Street\2009 Feasibility Study Figures\FIGURE 1-4 LOCATION OF GEOLOGIC CROSS SECTION – SITE.DWG



TETRA TECH EC, INC.

TITLE:
CROSS SECTION A-A'
Feasibility Study
Ilion (East Street) Site

nationalgrid

DWN.: CTS	DATE: 06/30/09	PROJECT NO.: 2907.0003.0003
CHKD: DPC	REV.: 0	FIGURE NO.: 1-5
DES.: CTS	APPD: RC	

R:\GIS\GISKey\Gisproj31\Ilion East Street\2009 Feasibility Study Figures\FIGURE 1-5 A-A' XSECTION.DWG

LEGEND

○	CAPPED IRON ROD SET
○	CAPPED IRON ROD FOUND
○	IRON PIPE FOUND
○	IRON ROD FOUND
○ GV	GAS VALVE
○ GM	GAS MARKER
□ GT	GAS TEST
HYD	FIRE HYDRANT
○ WV	WATER VALVE
○ WMH	WATER MANHOLE
○ DMH	DRAINAGE MANHOLE
○ SMH	SANITARY MANHOLE
□ CB	CATCH BASIN
○ CBR	CATCH BASIN ROUND
	PIEZOMETER
RCP	REINFORCED CONCRETE PIPE
PVC	POLYVINYL CHLORIDE
CMP	CORRUGATED METAL PIPE
N.H.O.A.	NUT AT HEAD OF ARROW
	TEST PIT
	SOIL BORING
	BOUNDARY OF SITE PROPERTY
	APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA
	CROSS SECTION B-B' TRANSECT

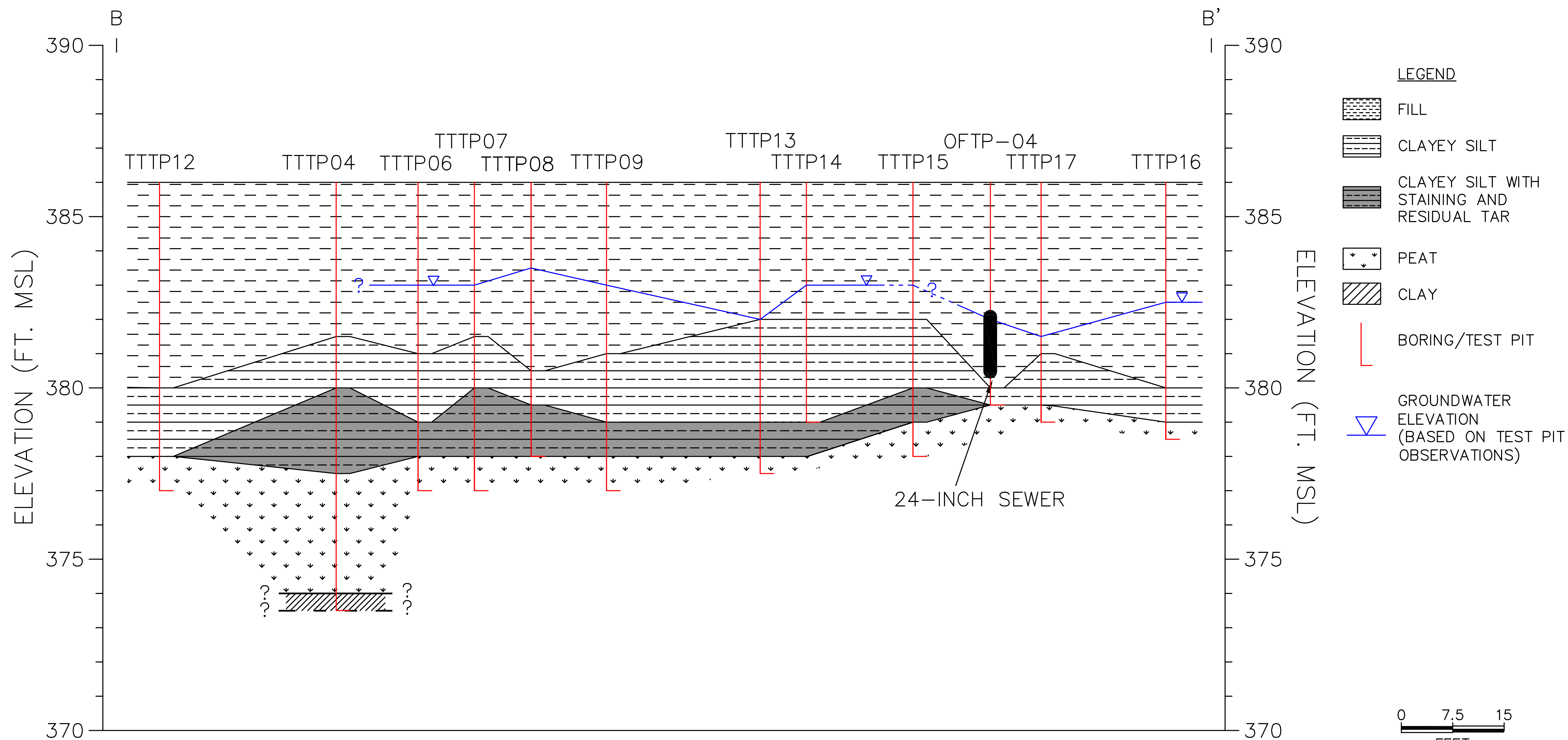
TETRA TECH EC, INC.

TITLE:
LOCATION OF GEOLOGIC CROSS SECTION – OFF-SITE AREA
Feasibility Study
Ilion (East Street) Site

nationalgrid

DWN: LMB	DES.: CTS	PROJECT NO.: 2907.0003.0003	
CHKD:	APPD:		
DATE: 06/30/09	REV.: 0	FIGURE NO.: 1–6	

R:\GIS\GISKey\Gisproj31\Ilion East Street\2009 Feasibility Study Figures\FIGURE 1-6 LOCATION OF GEOLOGIC CROSS SECTION - OFF-SITE AREA.DWG



NOTE: Groundwater was not evident in locations TtTP-04 and TtTP-12.

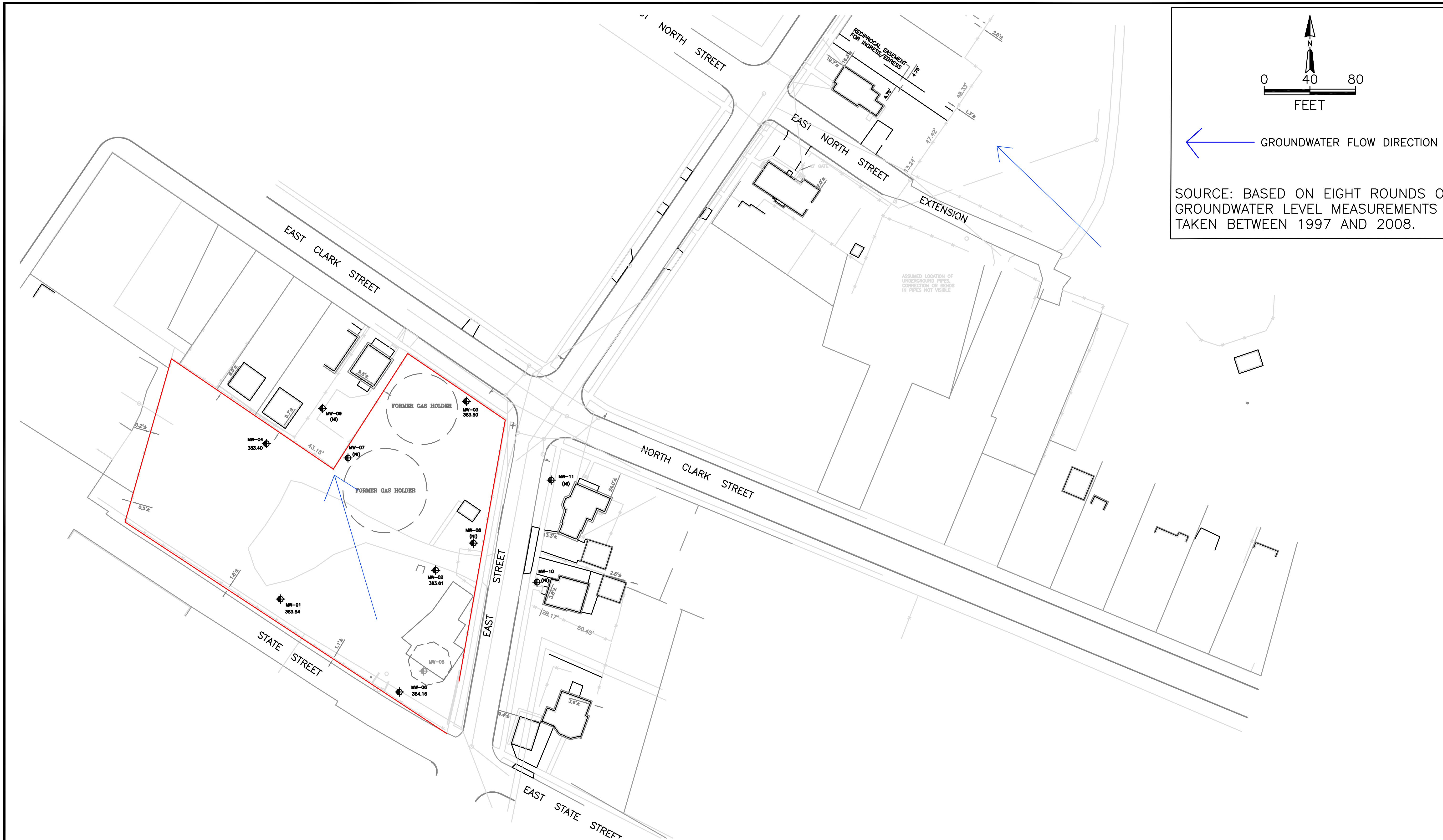
TETRA TECH EC, INC.

TITLE: CROSS SECTION B-B'
Feasibility Study
Ilion (East Street) Site

nationalgrid

DWN.: CTS	DATE: 06/30/09	PROJECT NO.: 2907.0003.0003
CHKD: DPC	REV.: 0	FIGURE NO.: 1-7
DES.: CTS	APPD: RC	

R:\GIS\GISKey\Gisproj31\Ilion East Street\2009 Feasibility Study Figures\FIGURE 1-7 B-B' XSECTION 032607.DWG



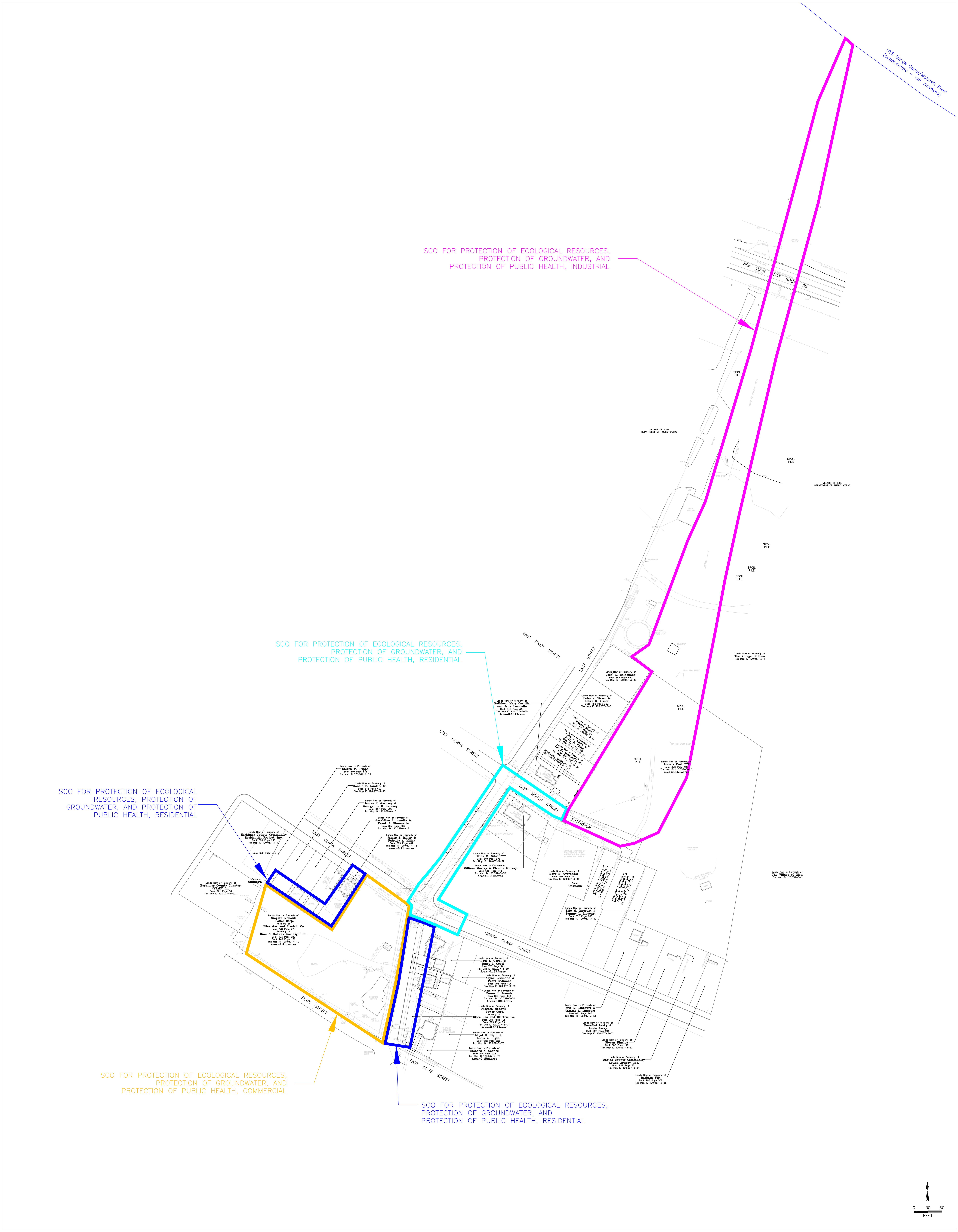
TETRA TECH EC, INC.

TITLE:
Flow Direction in the Sand and Gravel Unit
Feasibility Study
Ilion (East Street) Site

nationalgrid

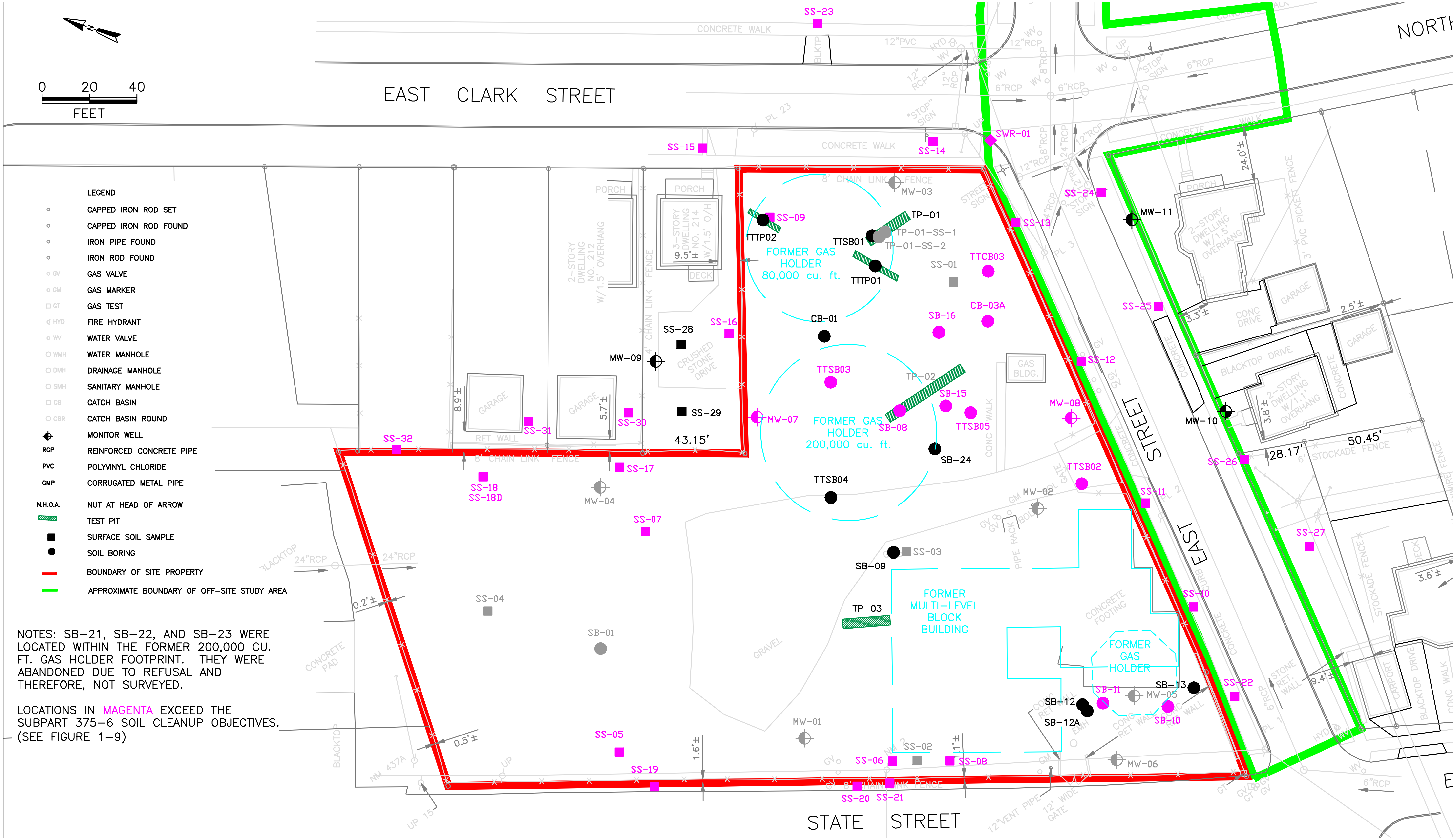
DWN.: EAG	DATE: 06/30/09	PROJECT NO.: 2907.0003.0003
CHKD:	REV.: 0	FIGURE NO.: 1-8
DES.: MO	APPD:	

R:\GIS\GISKey\Gisproj31\Ilion East Street\2009 Feasibility Study Figures\Figure 1-9 Flow Direction in the Sand and Gravel Unit.DWG



TETRA TECH EC, INC.	TITLE: Applicable Subpart 375-6 Soil Cleanup Objectives for the Site and the Surrounding Area Feasibility Study Ilion (East Street) Site nationalgrid	DWN: EAG CHKD: SA DATE: 11/02/09	DES.: LEA APPD: RC REV.: 1	PROJECT NO.: 2907.0003.0003 FIGURE NO.: 1-9

N:\GIS\GISKey\Gisproj31\Ilion East Street\2009 Feasibility Study Figures\Figure 1-8 Areas with Applicable Criteria 110209.dwg



TETRA TECH EC, INC.

TITLE:

ON SITE AND NEAR SITE EXTENT OF SOIL CONTAMINATION IN EXCESS OF SCOs

Feasibility Study

Ilion (East Street) Site

nationalgrid

DWN.: LMB	DATE: 11/02/09	PROJECT NO.: 2907.0003.0003
CHKD:	REV.: 0	FIGURE NO.: 1-10
DES.: CTS	APPD:	

R:\GIS\GISKey\Gisproj31\Ilion East Street\2009 Feasibility Study Figures\FIGURE 1-10 ON-SITE AND NEAR SITE EXTENT OF SOIL CONTAMINATION.DWG

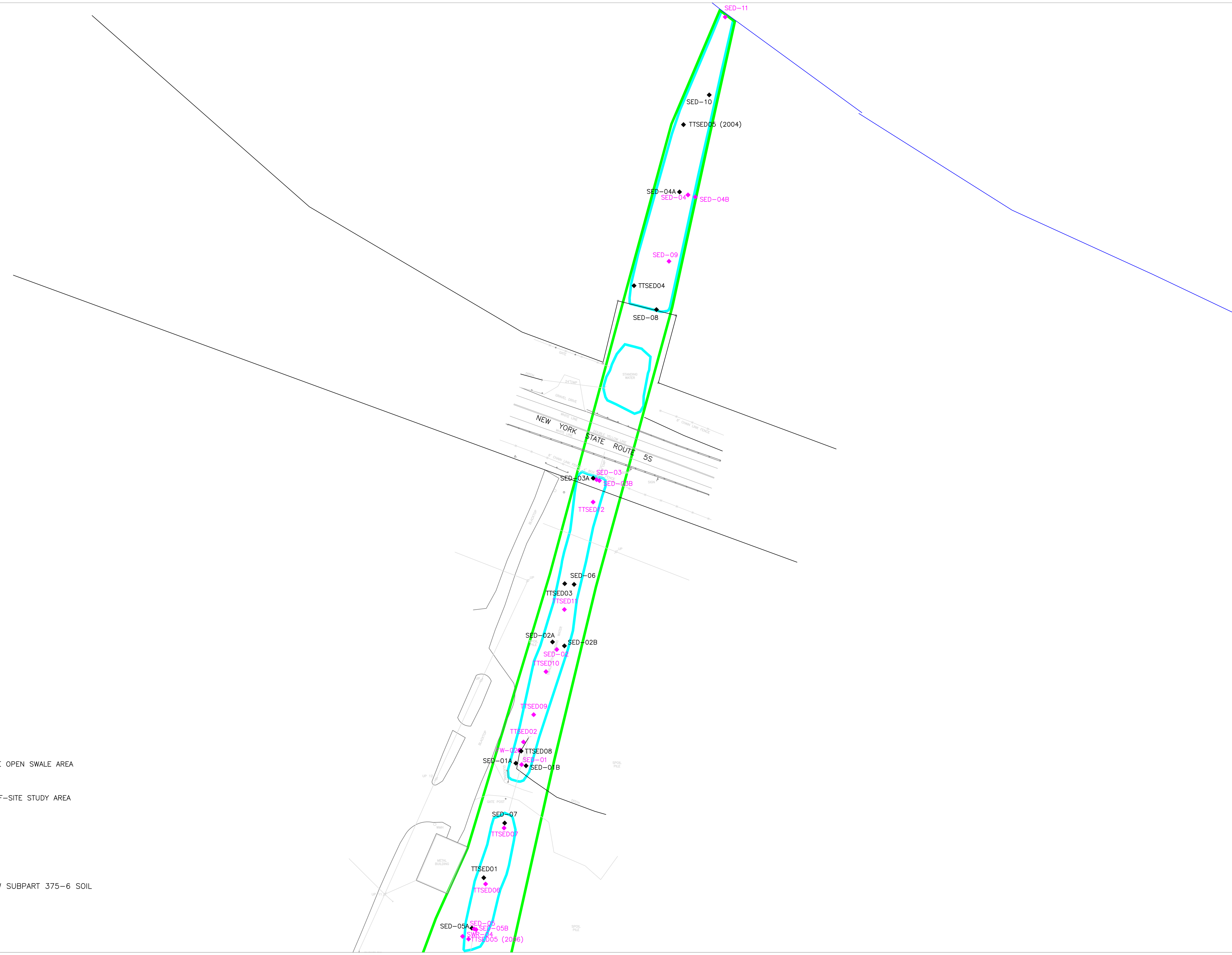
LEGEND

- CAPPED IRON ROD SET
- CAPPED IRON ROD FOUND
- IRON PIPE FOUND
- IRON ROD FOUND
- GV — GAS VALVE
- GM — GAS MARKER
- GT — GAS TEST
- HYD — FIRE HYDRANT
- WV — WATER VALVE
- WMH — WATER MANHOLE
- DMH — DRAINAGE MANHOLE
- SMH — SANITARY MANHOLE
- CB — CATCH BASIN
- CBR — CATCH BASIN ROUND
- PIEZOMETER
- RCP — REINFORCED CONCRETE PIPE
- PVC — POLYVINYL CHLORIDE
- CMP — CORRUGATED METAL PIPE
- N.H.O.A. — NUT AT HEAD OF ARROW
- TEST PIT
- SURFACE SOIL SAMPLE
- SOIL BORING
- TEST PIT
- BOUNDARY OF SITE PROPERTY
- APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA
- CROSS SECTION B-B' TRANSECT
- OUTLINE OF SWALE

NOTES:
LOCATIONS IN MAGENTA EXCEED THE NEW SUBPART 375-6 SOIL CLEANUP OBJECTIVES. (SEE FIGURE 1-9)

TETRA TECH EC, INC.	TITLE: OFF SITE EXTENT OF SOIL CONTAMINATION ABOVE SCOs (NOT INCLUDING SWALE SOILS) Feasibility Study Ilion (East Street) Site	nationalgrid	DWN: LMB	DES.: CTS	PROJECT NO.: 2907.0003.0003
			CHKD:	APPD:	FIGURE NO.: 1-11
			DATE: 11/02/09	REV.: 0	

R:\GIS\GISKey\Glaproj31\Ilion East Street\2009 Feasibility Study Figures\Figure 1-10 Off Site Extent of Soil Contamination.DWG



LEGEND

- CAPPED IRON ROD SET
- CAPPED IRON ROD FOUND
- IRON PIPE FOUND
- IRON ROD FOUND
- GV — GAS VALVE
- GM — GAS MARKER
- GT — GAS TEST
- HYD — FIRE HYDRANT
- WV — WATER VALVE
- WMH — WATER MANHOLE
- DMH — DRAINAGE MANHOLE
- SMH — SANITARY MANHOLE
- CB — CATCH BASIN
- CBR — CATCH BASIN ROUND
- PIEZOMETER
- RCP — REINFORCED CONCRETE PIPE
- PVC — POLYVINYL CHLORIDE
- CMP — CORRUGATED METAL PIPE
- N.H.O.A. — NUT AT HEAD OF ARROW
- TEST PIT
- TEST PIT
- SOIL SAMPLE COLLECTED IN THE OPEN SWALE AREA
- BOUNDARY OF SITE PROPERTY
- APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA
- OUTLINE OF SWALE

NOTES:
LOCATIONS IN MAGENTA EXCEED THE NEW SUBPART 375-6 SOIL CLEANUP OBJECTIVES (SEE FIGURE 1-9).

Map Notes

1. Boundary and topographic information shown hereon was compiled from an actual field survey conducted during the months of August and September, 2004.
2. North orientation and bearings are based on the New York State Plane Coordinate System, East Zone, NAD 1983/96. The distances shown are horizontal ground distances, Grid lengths may be obtained by a multiplier of 0.99990892 (Combined factor).
3. Elevations shown hereon are NAVD 88 base and were obtained through GPS observations.
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5. This survey was prepared without the benefit of an up to date abstract of title or title report and is therefore subject to any easements, covenants, restrictions or any statement of fact that such documents may disclose.
6. Wetlands to be delineated during the remedial design.

N

0 30 60
FEET

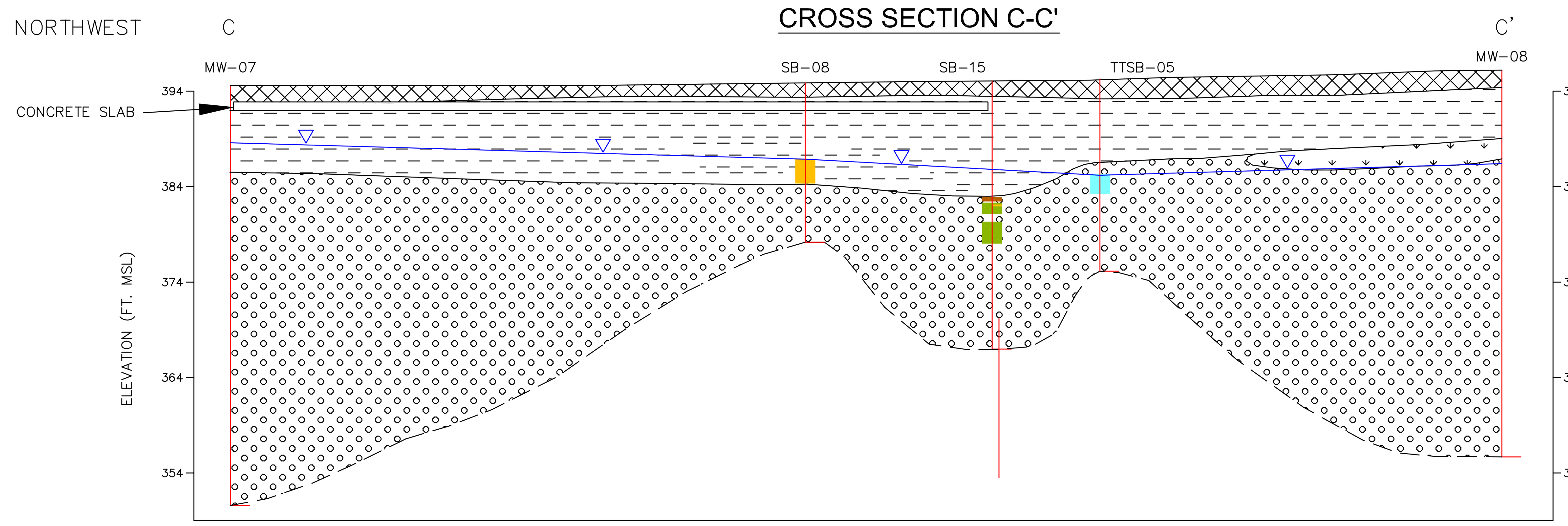
TETRA TECH EC, INC.

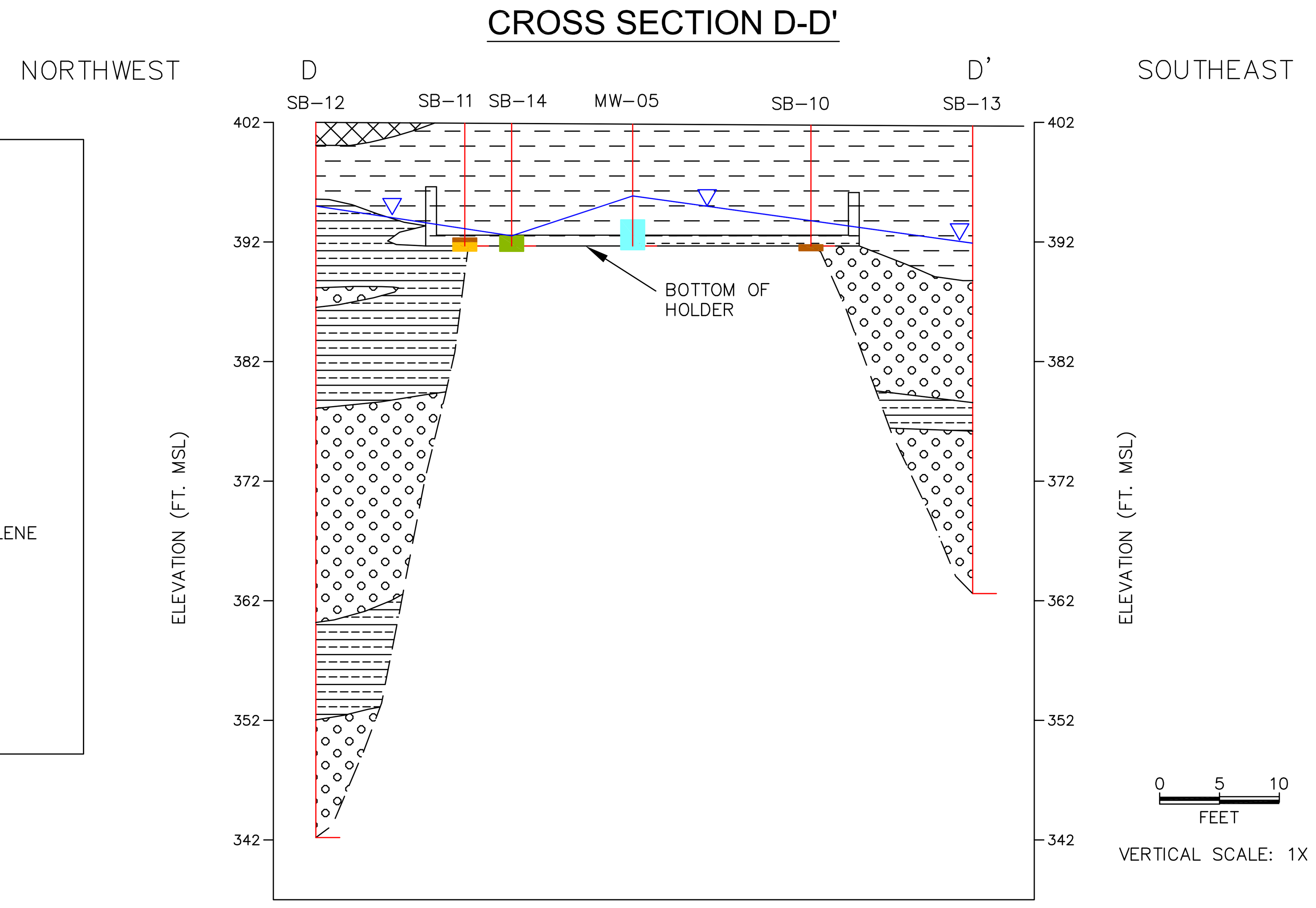
TITLE:
EXTENT OF SOIL CONTAMINATION ABOVE SCOs– SWALE AREA
Feasibility Study
Ilion (East Street) Site

nationalgrid

DWN: EAG	DES.: MO	PROJECT NO.: 2907.0003.0003
CHKD:	APPD:	FIGURE NO.: 1–12
DATE: 11/02/09	REV.: 0	

R:\GIS\GISKey\Gisproj31\Ilion East Street\2009 Feasibility Study Figures\Figure 1-12 Extent of Sediment Contamination.dwg





LEGEND

- TOPSOIL
- FILL
- SILTY, GRAVELLY SAND
- CLAYEY SILT
- PEAT
- LENSES WITH TAR SATURATION AND TAR/NAPHTHALENE ODORS
- BLEBS, GLOBS, LENSES, COATINGS, AND TAR/NAPHTHALENE ODORS
- TAR STAINING, SHEEN AND TAR/NAPHTHALENE ODORS
- TAR/NAPHTHALENE-LIKE ODORS
- BORING/TEST PIT
- GROUNDWATER ELEVATION

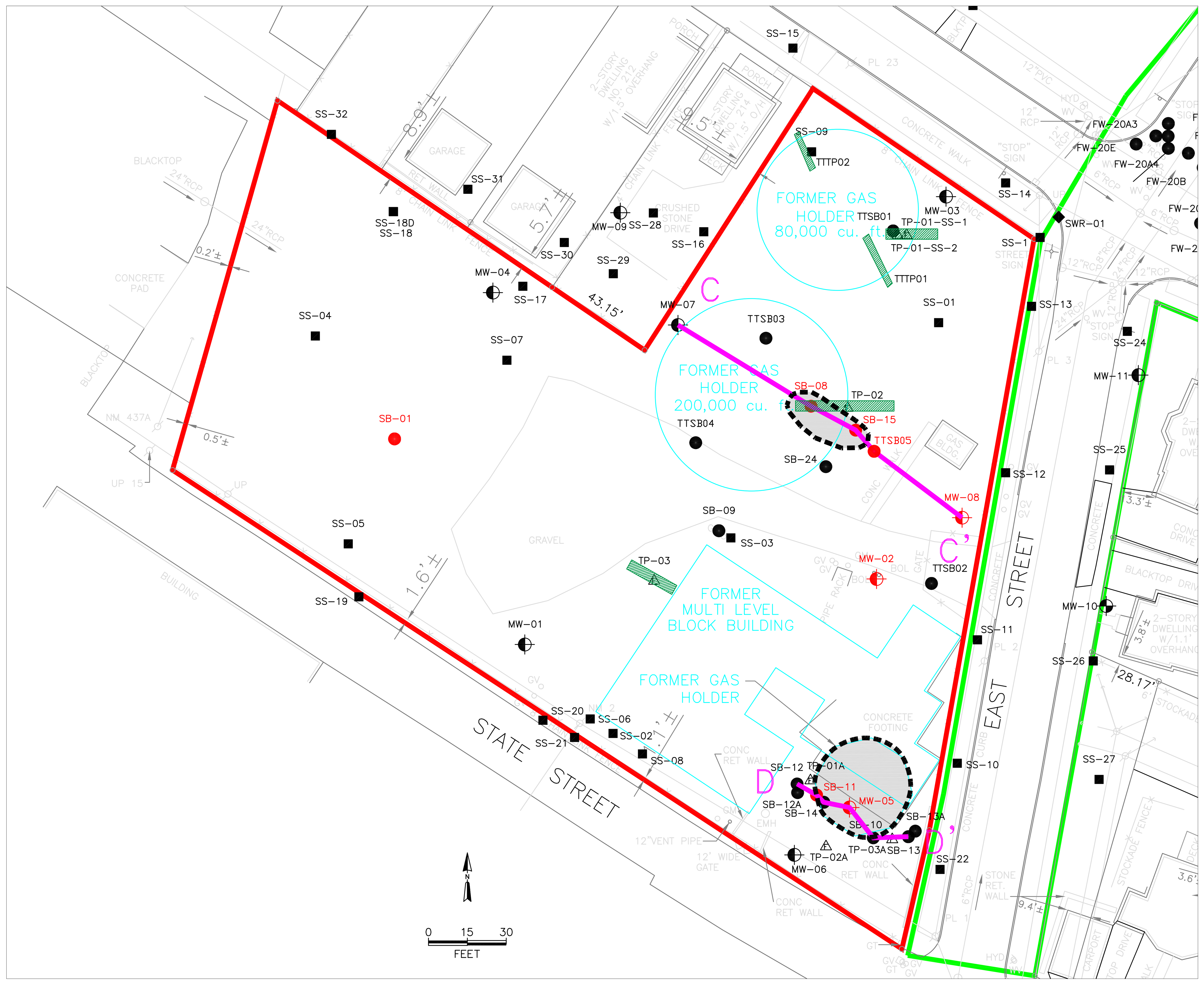
FEET
VERTICAL SCALE: 1X

LEGEND

- CAPPED IRON ROD SET
- CAPPED IRON ROD FOUND
- IRON PIPE FOUND
- IRON ROD FOUND
- GAS VALVE
- GAS MARKER
- GAS TEST
- FIRE HYDRANT
- WATER VALVE
- WATER MANHOLE
- DRAINAGE MANHOLE
- SANITARY MANHOLE
- CATCH BASIN
- CATCH BASIN ROUND
- PIEZOMETER
- RCP REINFORCED CONCRETE PIPE
- PVC POLYVINYL CHLORIDE
- CMP CORRUGATED METAL PIPE
- N.H.O.A. NUT AT HEAD OF ARROW
- TEST PIT
- SOIL BORING
- SURFACE SOIL SAMPLE
- BOUNDARY OF SITE PROPERTY
- APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA
- CROSS SECTION TRANSECT
- ESTIMATED HORIZONTAL EXTENT OF NAPL

NOTE:
LOCATIONS SHOWN IN RED INDICATE CONTAINED ELEVATED CONCENTRATIONS FOR TOTAL PAHs (i.e., >500 PPM) AND/OR CYANIDE (i.e., >40 PPM).

PLAN VIEW - CROSS SECTION C-C' AND D-D'

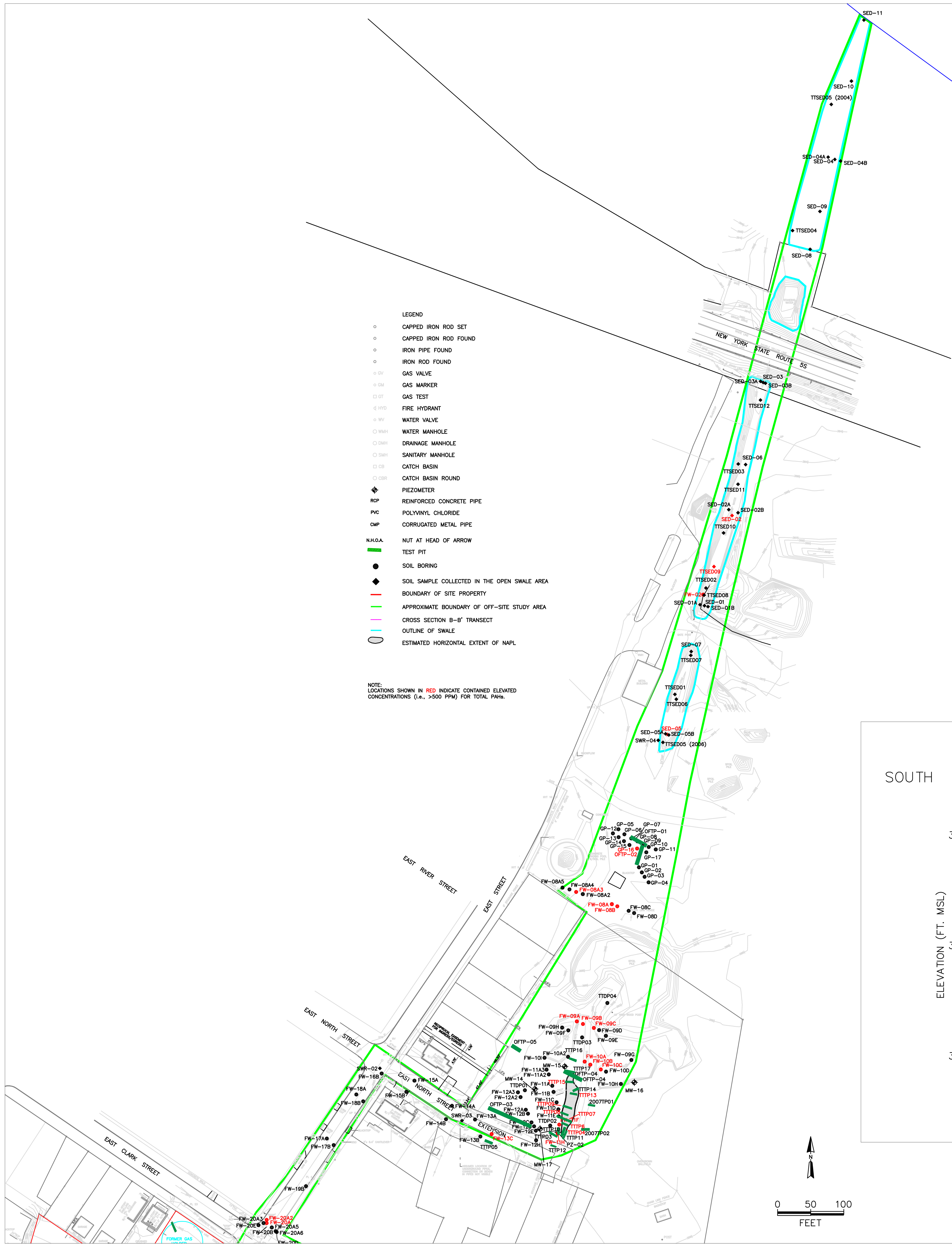


TITLE:
Extent of NAPL, PAHs > 500 ppm, and Cyanide > 40 ppm – Site Feasibility Study
Ilion (East Street) Site

TETRA TECH EC, INC.

nationalgrid

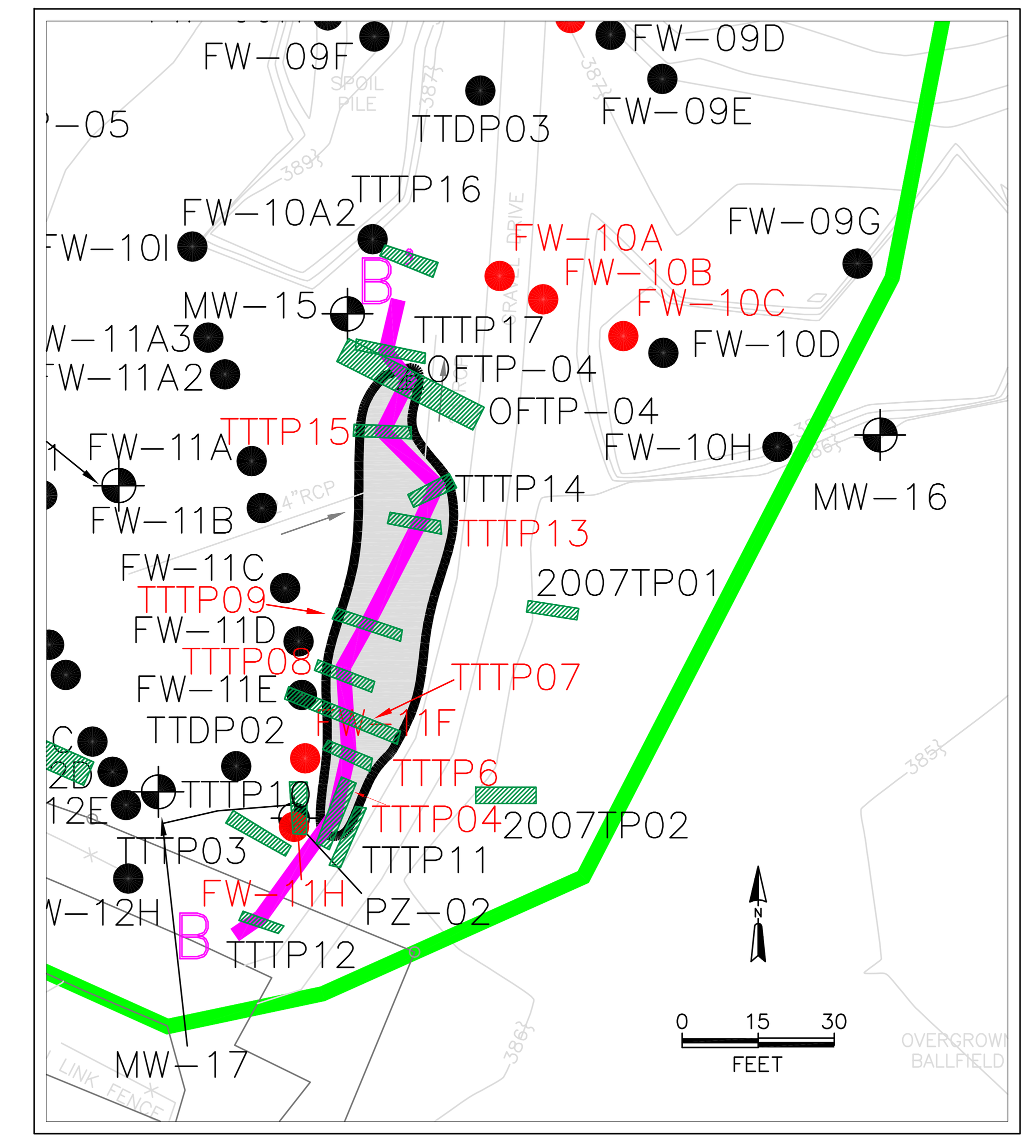
DWN: LMC	DES.: CTS	PROJECT NO.: 2907.0003
CHKD: EAG	APPD:	FIGURE NO.: 1-13
DATE: 08/05/10	REV.: 0	



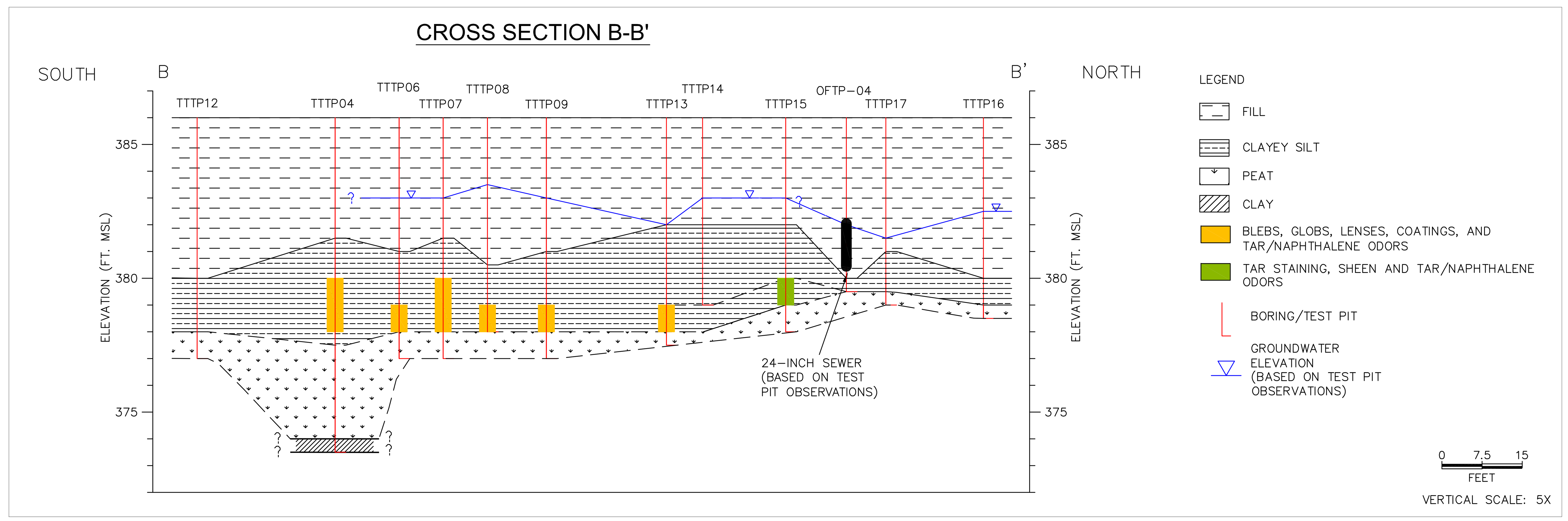
Map Notes

1. Boundary and topographic information shown hereon was compiled from an actual field survey conducted during the months of August and September, 2004.
2. North orientation and bearings are based on the New York State Plane Coordinate System, East Zone, NAD 1983/96. The distances shown are horizontal ground distances, Grid lengths may be obtained by a multiplier of 0.99990892 (Combined factor).
3. Elevations shown hereon are NAVD 88 base and were obtained through GPS observations.
4. The location of underground improvements or encroachments, if any exist, or as shown hereon, are not certified. There may be other underground utilities, the existence of which are not known to the undersigned. Size and location of all underground utilities and structures must be verified by the appropriate authorities. The Underground Facilities Protective Organization must be notified prior to conducting test borings, excavation and construction.
5. This survey was prepared without the benefit of an up to date abstract of title or title report and is therefore subject to any easements, covenants, restrictions or any statement of fact that such documents may disclose.
6. Wetlands to be delineated during remedial design.

PLAN VIEW - CROSS SECTION B-B'



CROSS SECTION B-B'



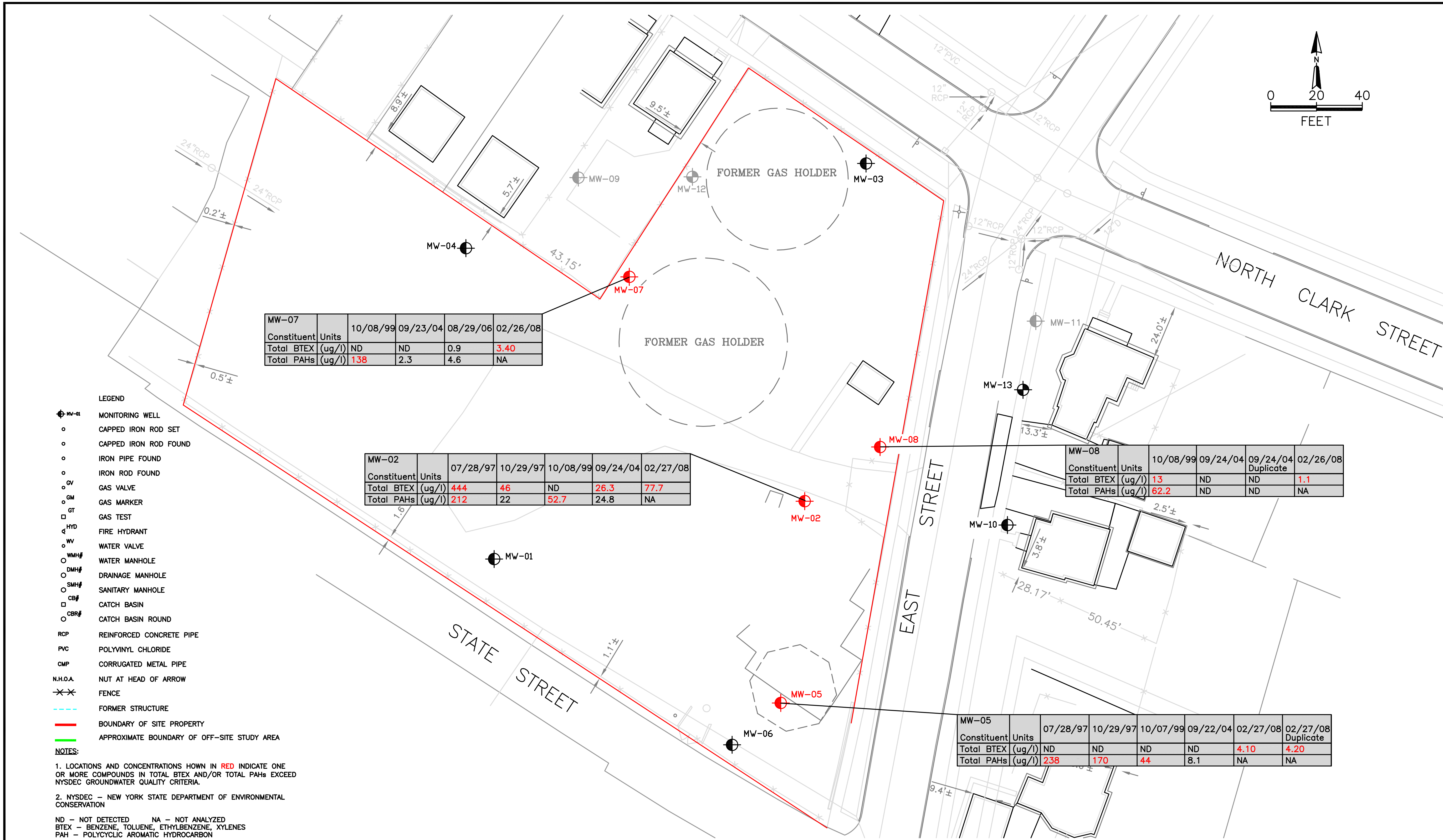
TETRA TECH EC, INC.

TITLE:
Extent of NAPL and PAHs > 500 ppm – Off–Site Area
Feasibility Study
Ilion (East Street) Site

nationalgrid

DWN:	LMC	DES.:	EAG	PROJECT NO.: 2907.0003
CHKD:	EAG	APPD:		FIGURE NO.: 1–14
DATE:	11/02/09	REV.:	0	

R:\GIS\GISKey\Gisproj31\Ilion East Street\2009 Feasibility Study Figures\Figures 1–14, 4–1, and 4–28 Offsite 110209.dwg



MW-07 Constituent	Units	10/08/99	09/23/04	08/29/06	02/26/08
Total BTEX	(ug/l)	ND	ND	0.9	3.40
Total PAHs	(ug/l)	138	2.3	4.6	NA

MW-02 Constituent	Units	07/28/97	10/29/97	10/08/99	09/24/04	02/27/08
Total BTEX	(ug/l)	444	46	ND	26.3	77.7
Total PAHs	(ug/l)	212	22	52.7	24.8	NA

MW-08 Constituent	Units	10/08/99	09/24/04	09/24/04 Duplicate	02/26/08
Total BTEX	(ug/l)	13	ND	ND	1.1
Total PAHs	(ug/l)	62.2	ND	ND	NA

MW-05 Constituent	Units	07/28/97	10/29/97	10/07/99	09/22/04	02/27/08	02/27/08 Duplicate
Total BTEX	(ug/l)	ND	ND	ND	ND	4.10	4.20
Total PAHs	(ug/l)	238	170	44	8.1	NA	NA

LEGEND

- MW-01 MONITORING WELL
- CAPPED IRON ROD SET
- CAPPED IRON ROD FOUND
- IRON PIPE FOUND
- IRON ROD FOUND
- GV GAS VALVE
- GM GAS MARKER
- GT GAS TEST
- HYD FIRE HYDRANT
- WV WATER VALVE
- WMH# WATER MANHOLE
- DMH# DRAINAGE MANHOLE
- SMH# SANITARY MANHOLE
- CB# CATCH BASIN
- CBR# CATCH BASIN ROUND
- RCP REINFORCED CONCRETE PIPE
- PVC POLYVINYL CHLORIDE
- CMP CORRUGATED METAL PIPE
- N.H.O.A. NUT AT HEAD OF ARROW
- FENCE
- FORMER STRUCTURE
- BOUNDARY OF SITE PROPERTY
- APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA

NOTES:

1. LOCATIONS AND CONCENTRATIONS HOWN IN RED INDICATE ONE OR MORE COMPOUNDS IN TOTAL BTEX AND/OR TOTAL PAHs EXCEED NYSDEC GROUNDWATER QUALITY CRITERIA.
2. NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

ND – NOT DETECTED NA – NOT ANALYZED
BTEX – BENZENE, TOLUENE, ETHYLBENZENE, XYLENES
PAH – POLYCYCLIC AROMATIC HYDROCARBON

TETRA TECH EC, INC.

TITLE:
HISTORICAL BTEX AND PAHS IN GROUNDWATER – SITE
Feasibility Study
Ilion (East Street) Site

nationalgrid

DWN.: LMC	DATE: 10/22/09	PROJECT NO.: 2907.0003.0003
CHKD:	REV.: 0	FIGURE NO.: 1–15
DES.: MO	APPD:	

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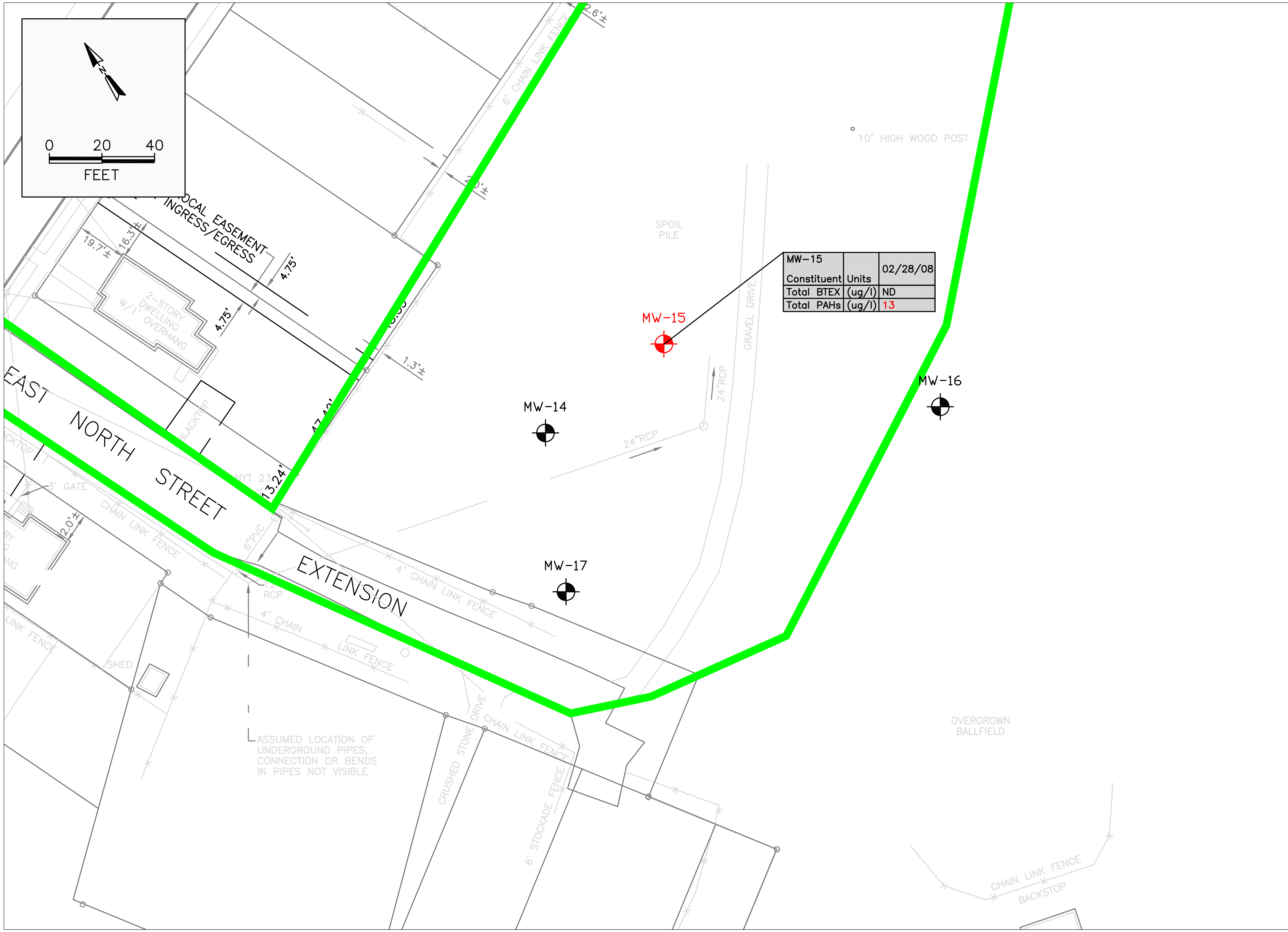

MW-15		
Constituent	Units	02/28/08
Total BTEX	(ug/l)	ND
Total PAHs	(ug/l)	13

LEGEND

- MONITORING WELL
- CAPPED IRON ROD SET
- CAPPED IRON ROD FOUND
- IRON PIPE FOUND
- IRON ROD FOUND
- GV — GAS VALVE
- GM — GAS MARKER
- GT — GAS TEST
- HYD — FIRE HYDRANT
- WV — WATER VALVE
- WMH# — WATER MANHOLE
- DMH# — DRAINAGE MANHOLE
- SMH# — SANITARY MANHOLE
- CB# — CATCH BASIN
- CBR# — CATCH BASIN ROUND
- RCP — REINFORCED CONCRETE PIPE
- PVC — POLYVINYL CHLORIDE
- CMP — CORRUGATED METAL PIPE
- N.H.O.A. — NUT AT HEAD OF ARROW
- FENCE
- FORMER STRUCTURE
- BOUNDARY OF SITE PROPERTY
- APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA

NOTES:

1. LOCATIONS AND CONCENTRATIONS SHOWN IN RED INDICATE ONE OR MORE COMPOUNDS IN TOTAL BTEX AND/OR TOTAL PAHs EXCEED NYSDEC GROUNDWATER QUALITY CRITERIA.

2. NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

ND – NOT DETECTED
BTEX – BENZENE, TOLUENE, ETHYLBENZENE, XYLENES
PAH – POLYCYCLIC AROMATIC HYDROCARBON

TETRA TECH EC, INC.

TITLE:
HISTORICAL BTEX AND PAHS IN GROUNDWATER – OFF SITE AREA
Feasibility Study
Ilion (East Street) Site

nationalgrid

DWN.: LMC	DATE: 10/22/09	PROJECT NO.: 2907.0003.0003
CHKD:	REV.: 0	FIGURE NO.: 1-16
DES.: LEA	APPD:	

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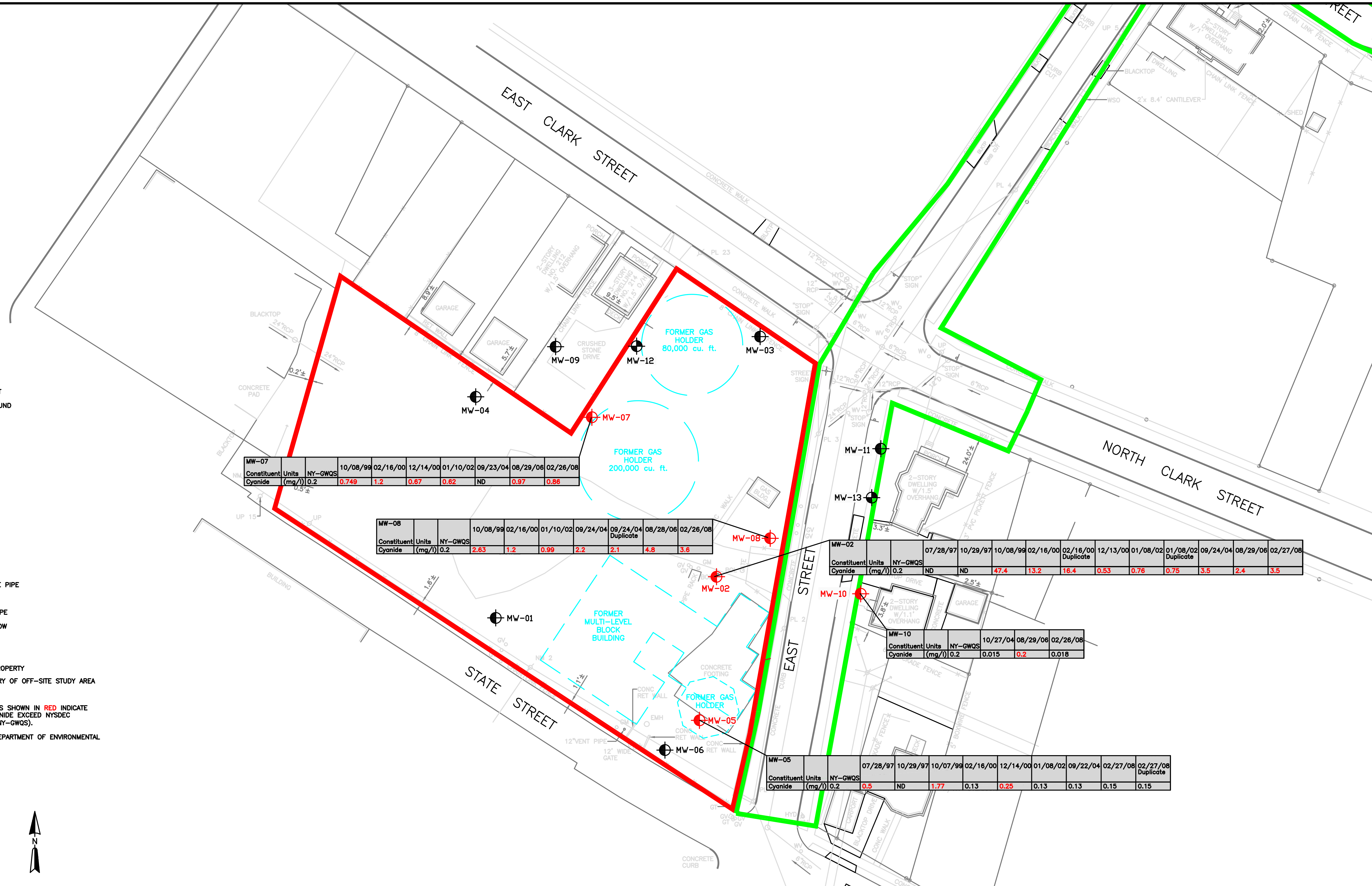

MW-07 Constituent	Units	NY-GWQS	10/08/99	02/16/00	12/14/00	01/10/02	09/23/04	08/29/06	02/26/08
Cyanide	(mg/l)	0.2	0.749	1.2	0.67	0.62	ND	0.97	0.86

MW-08 Constituent	Units	NY-GWQS	10/08/99	02/16/00	01/10/02	09/24/04	09/24/04 Duplicate	08/28/06	02/26/08
Cyanide	(mg/l)	0.2	2.63	1.2	0.99	2.2	2.1	4.8	3.6

MW-02 Constituent	Units	NY-GWQS	07/28/97	10/29/97	10/08/99	02/16/00	02/16/00 Duplicate	12/13/00	01/08/02	01/08/02 Duplicate	09/24/04	08/29/06	02/27/08
Cyanide	(mg/l)	0.2	ND	ND	47.4	13.2	16.4	0.53	0.76	0.75	3.5	2.4	3.5

MW-10 Constituent	Units	NY-GWQS	10/27/04	08/29/06	02/26/08
Cyanide	(mg/l)	0.2	0.015	0.2	0.018

MW-05 Constituent	Units	NY-GWQS	07/28/97	10/29/97	10/07/99	02/16/00	12/14/00	01/08/02	09/22/04	02/27/08	02/27/08 Duplicate
Cyanide	(mg/l)	0.2	0.5	ND	1.77	0.13	0.25	0.13	0.13	0.15	0.15

LEGEND

- MW-## MONITORING WELL
- CAPPED IRON ROD SET
- CAPPED IRON ROD FOUND
- IRON PIPE FOUND
- IRON ROD FOUND
- GV GAS VALVE
- GM GAS MARKER
- GT GAS TEST
- HYD FIRE HYDRANT
- WV WATER VALVE
- WMH# WATER MANHOLE
- DMH# DRAINAGE MANHOLE
- SMH# SANITARY MANHOLE
- CB# CATCH BASIN
- CBR# CATCH BASIN ROUND
- RCP REINFORCED CONCRETE PIPE
- PVC POLYVINYL CHLORIDE
- CMP CORRUGATED METAL PIPE
- N.H.O.A. NUT AT HEAD OF ARROW
- FENCE
- FORMER STRUCTURE
- BOUNDARY OF SITE PROPERTY
- APPROXIMATE BOUNDARY OF OFF-SITE STUDY AREA

NOTES:

1. LOCATIONS AND CONCENTRATIONS SHOWN IN RED INDICATE HISTORIC CONCENTRATIONS OF CYANIDE EXCEED NYSDEC GROUNDWATER QUALITY CRITERIA (NY-GWQS).
2. NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

ND – NOT DETECTED

TETRA TECH EC, INC.

TITLE:
Historical Cyanide in Groundwater
Feasibility Study
Ilion (East Street) Site

nationalgrid

DWN.: LMC	DATE: 10/22/09	PROJECT NO.: 2907.0003.0005
CHKD:	REV.: 0	FIGURE NO.: 1–17
DES.: MO	APPD:	

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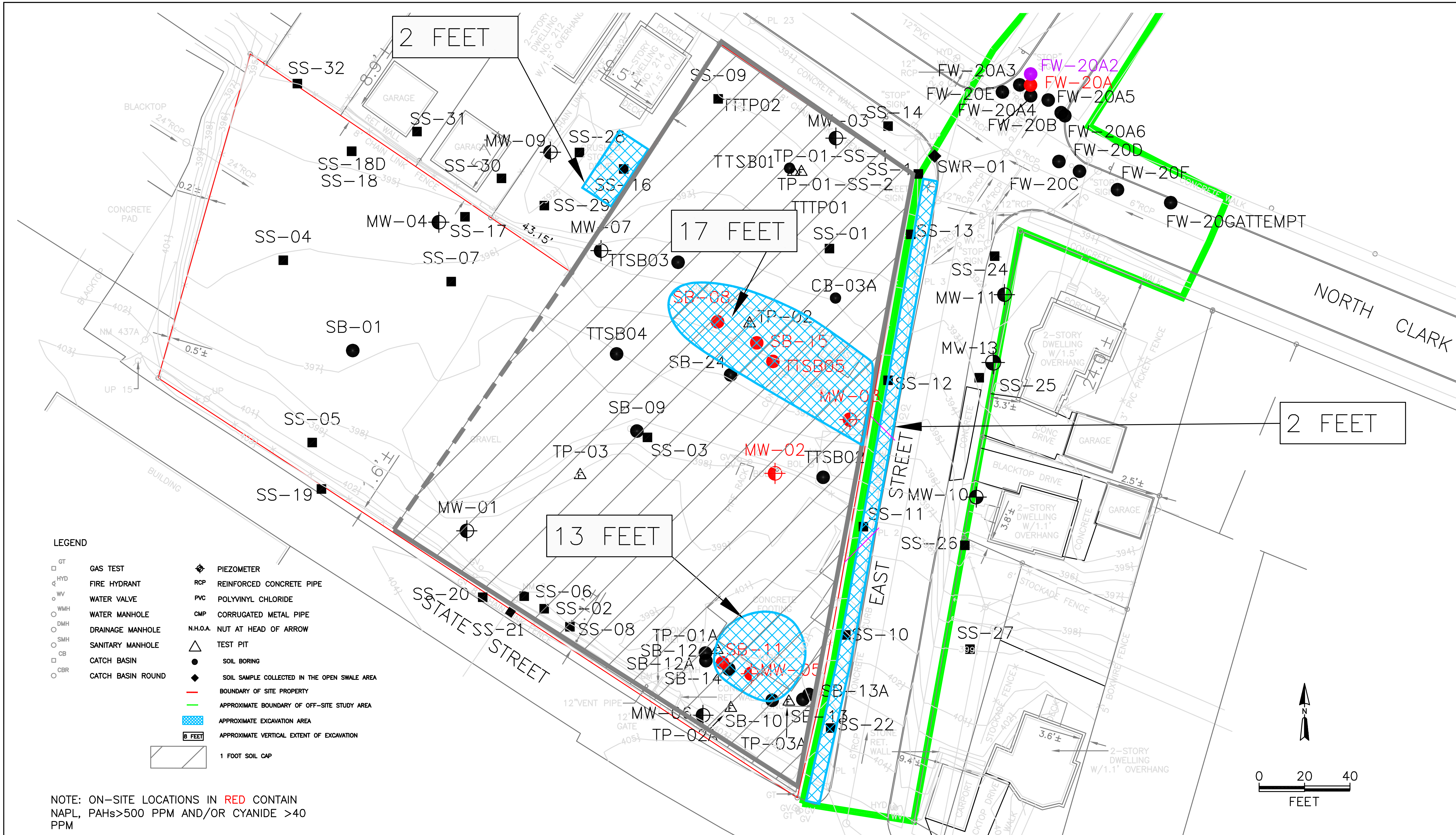
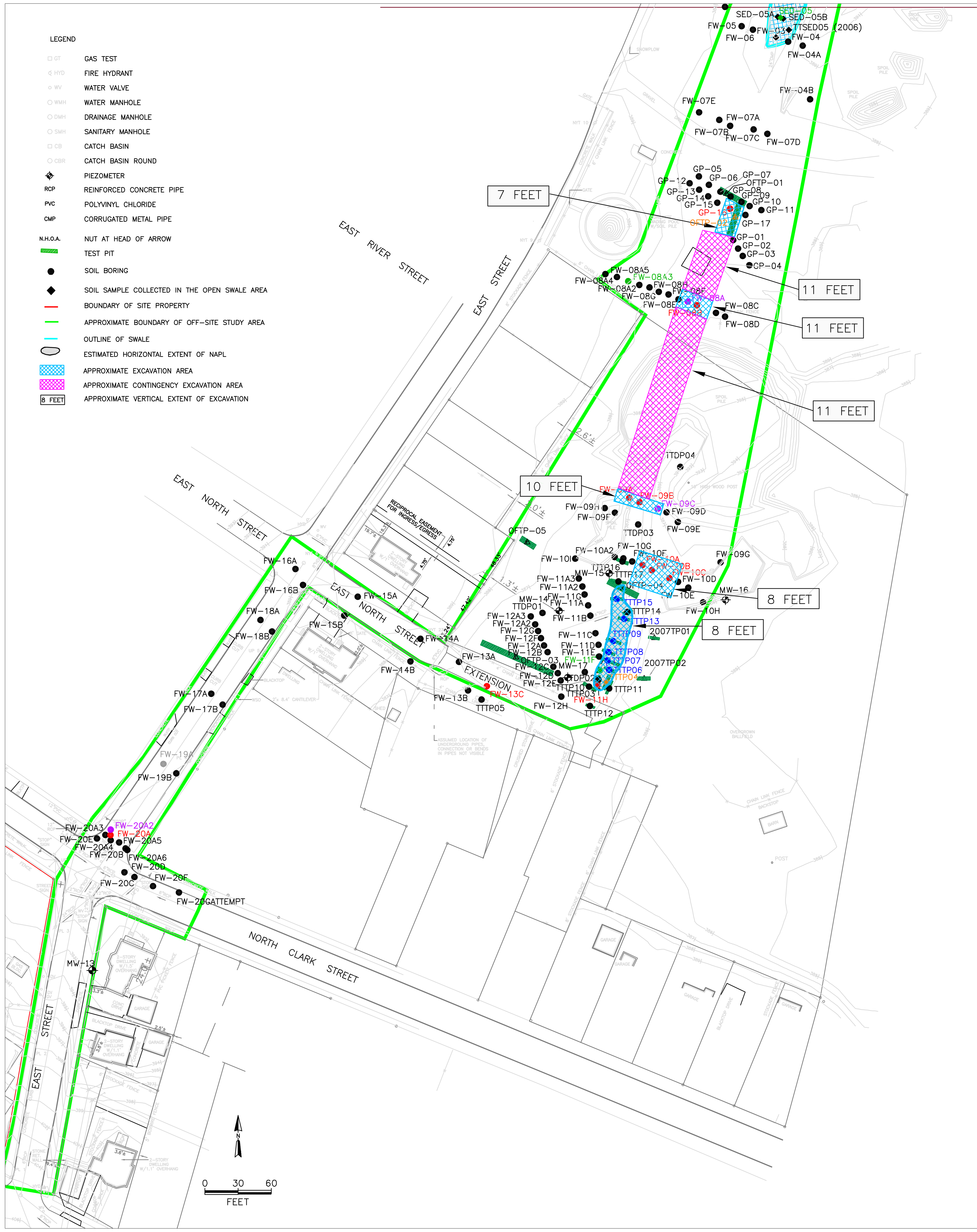
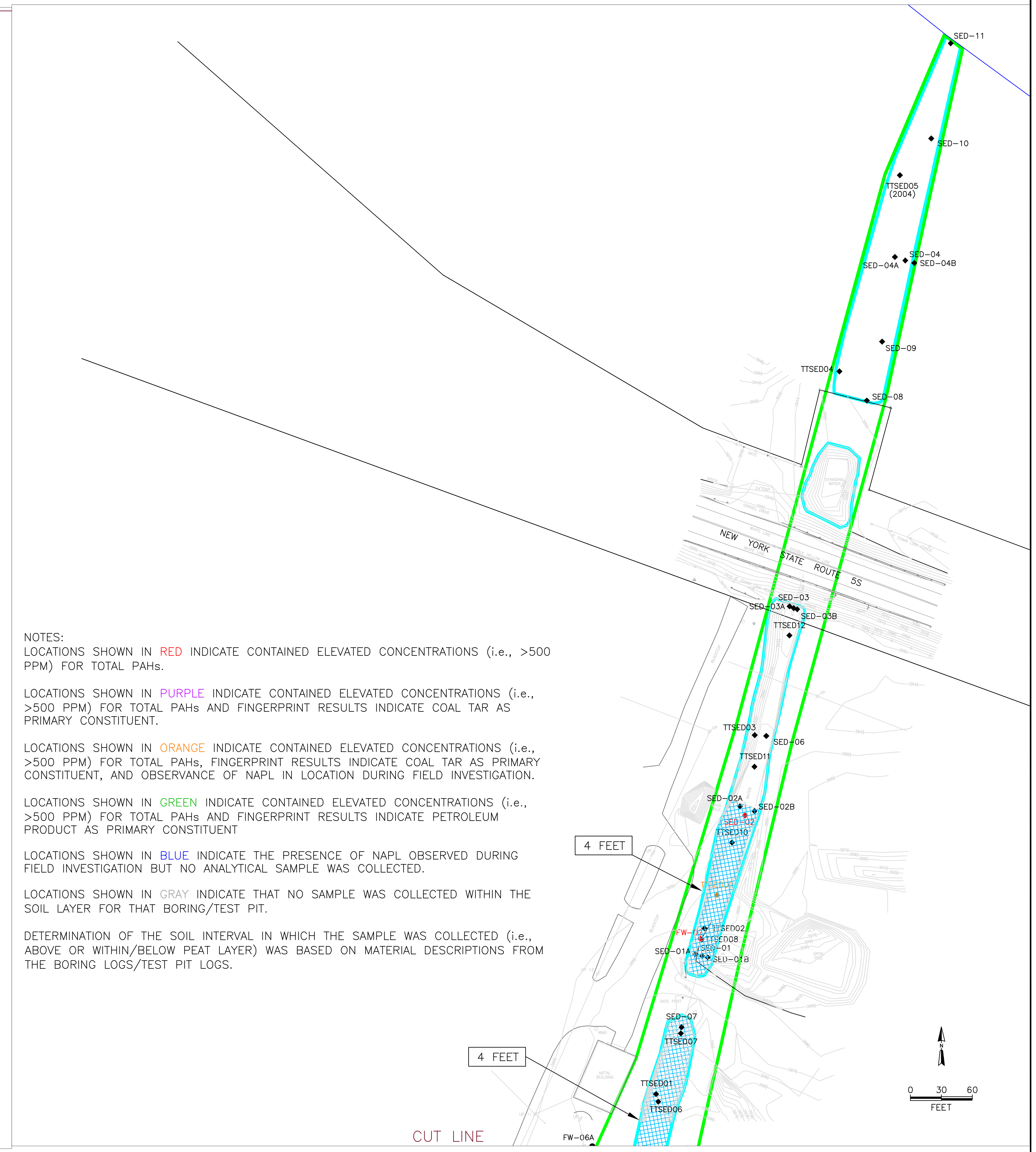


TETRA TECH EC, INC.

TITLE:
Alternative S-3: Excavation of MGP-Related Impacts, Soil Capping, Off-Site Disposal and Institutional Controls (On and Near-Site Areas)
Feasibility Study - Ilion (East Street) Site

DWN: LMC	DES.: CTS	PROJECT NO.: 2907.0003
CHKD: RC	APPD:	FIGURE NO.: 4-1A
DATE: 08/27/10	REV.: 0	





NOTES:
LOCATIONS SHOWN IN RED INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs.

LOCATIONS SHOWN IN PURPLE INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs AND FINGERPRINT RESULTS INDICATE COAL TAR AS PRIMARY CONSTITUENT.

LOCATIONS SHOWN IN ORANGE INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs, FINGERPRINT RESULTS INDICATE COAL TAR AS PRIMARY CONSTITUENT, AND OBSERVANCE OF NAPL IN LOCATION DURING FIELD INVESTIGATION.

LOCATIONS SHOWN IN GREEN INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs AND FINGERPRINT RESULTS INDICATE PETROLEUM PRODUCT AS PRIMARY CONSTITUENT

LOCATIONS SHOWN IN BLUE INDICATE THE PRESENCE OF NAPL OBSERVED DURING FIELD INVESTIGATION BUT NO ANALYTICAL SAMPLE WAS COLLECTED.

LOCATIONS SHOWN IN GRAY INDICATE THAT NO SAMPLE WAS COLLECTED WITHIN THE SOIL LAYER FOR THAT BORING/TEST PIT.

DETERMINATION OF THE SOIL INTERVAL IN WHICH THE SAMPLE WAS COLLECTED (i.e., ABOVE OR WITHIN/BELOW PEAT LAYER) WAS BASED ON MATERIAL DESCRIPTIONS FROM THE BORING LOGS/TEST PIT LOGS.

TETRA TECH EC, INC.

TITLE:
Alternative S-3 Excavation of MGP Related Impacts, Soil Capping, Off-Site Disposal and Institutional Controls (Off-Site Area)
Feasibility Study – Ilion (East Street) Site

nationalgrid

DWN:	DES.:
LMC	EAG
CHKD: RC	APPD:
DATE: 06/23/10	REV.: 0

PROJECT NO.: 2907.0003
FIGURE NO.: 4-1B

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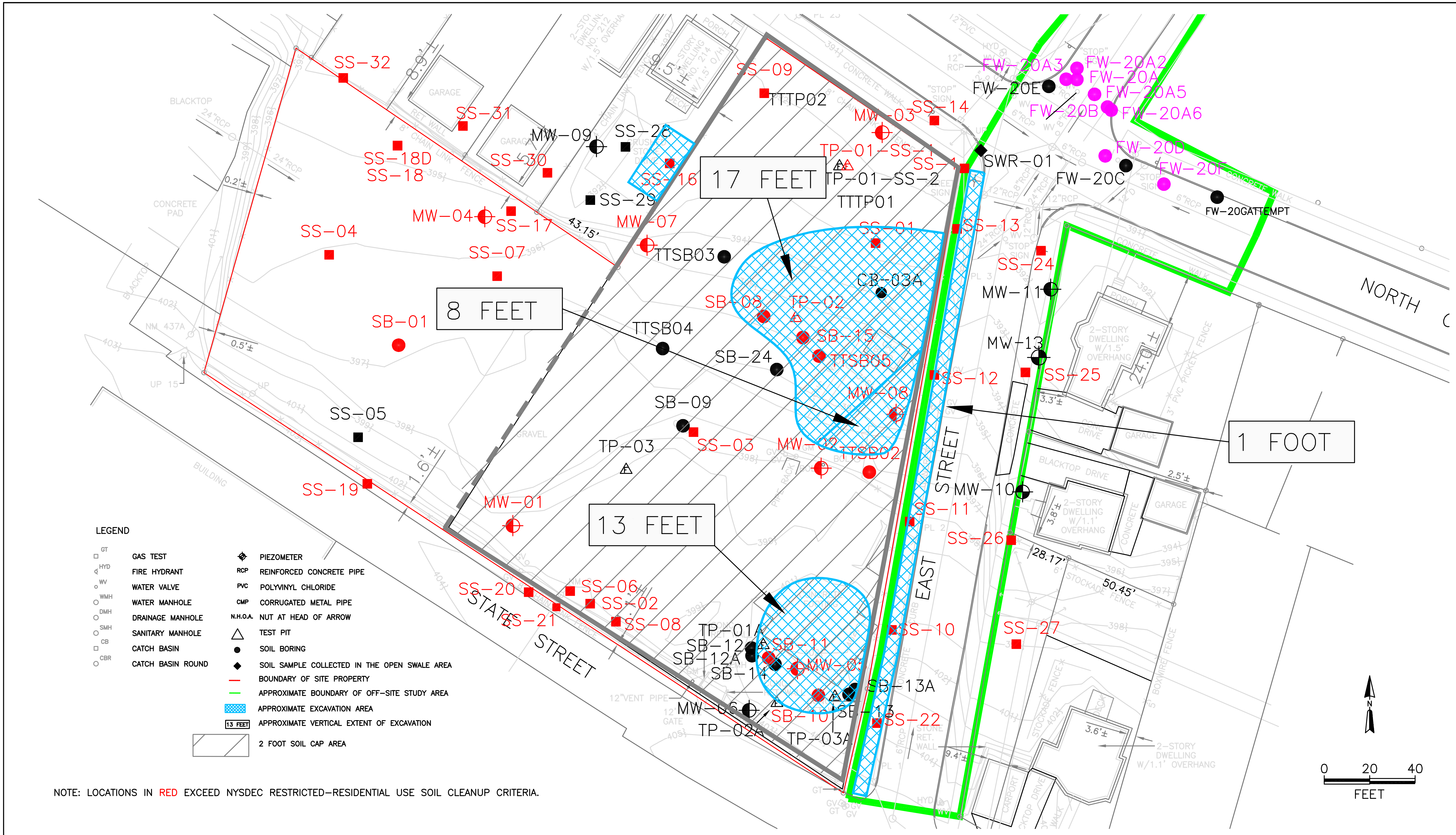
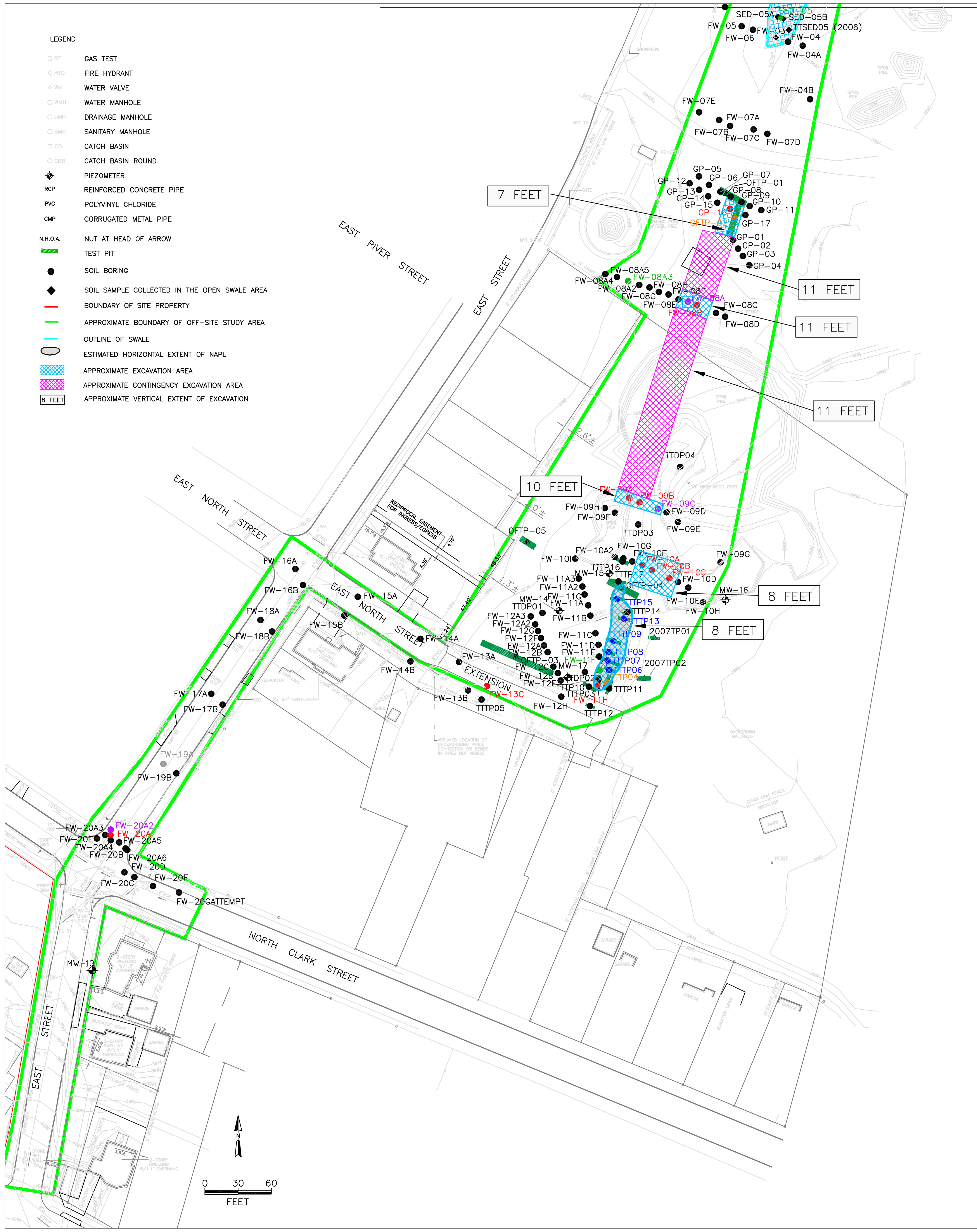


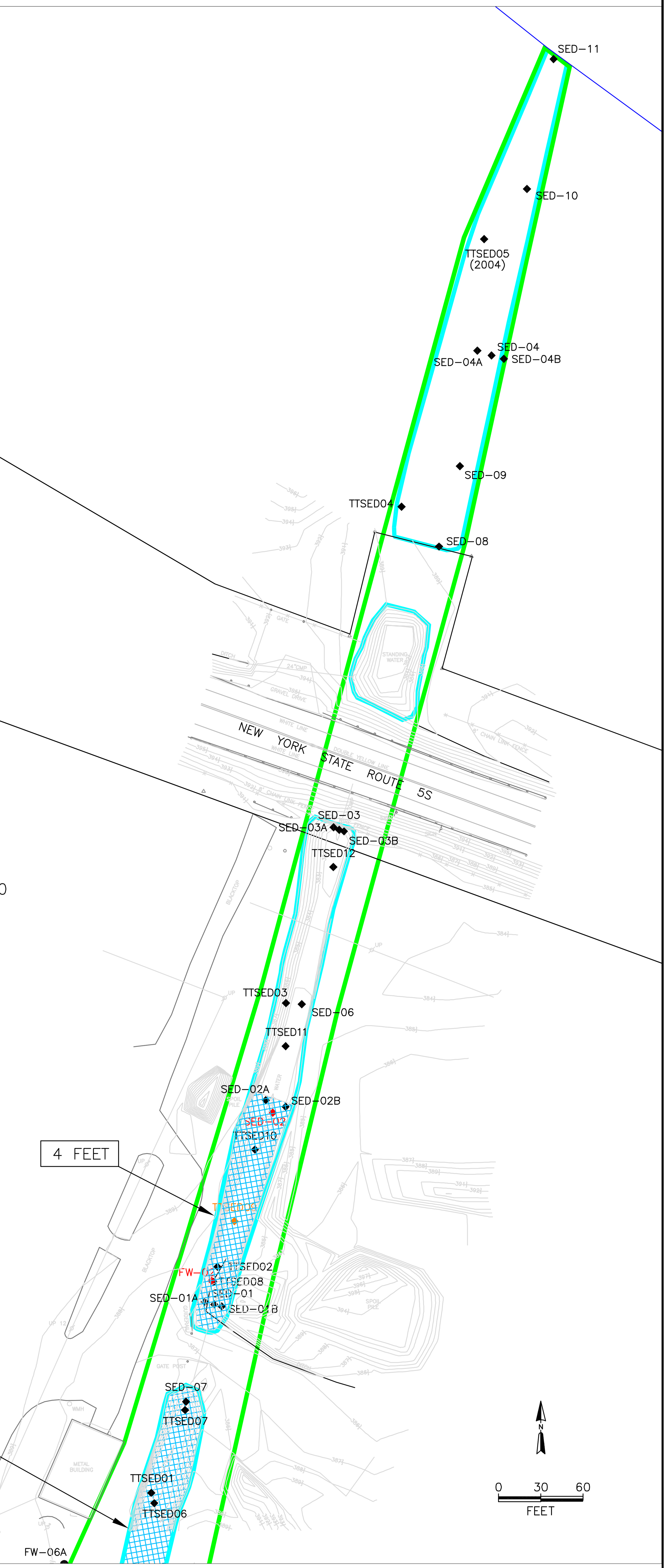
NOTE: LOCATIONS IN RED EXCEED NYSDEC RESTRICTED–RESIDENTIAL USE SOIL CLEANUP CRITERIA.

TETRA TECH EC, INC.

TITLE: Alternative S–4: Excavation of MGP–Related Impacts, Removal of Source Soils to Restricted–Residential SCOs Soil Capping, Off–Site Disposal and Institutional Controls (On and Near–Site Areas) Feasibility Study – Ilion (East Street) Site

DWN: LMC	DES.: CTS	PROJECT NO.: 2907.0003
CHKD: RC	APPD:	FIGURE NO.: 4–2A
DATE: 08/31/10	REV.: 0	





NOTES:
LOCATIONS SHOWN IN RED INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs.

LOCATIONS SHOWN IN PURPLE INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs AND FINGERPRINT RESULTS INDICATE COAL TAR AS PRIMARY CONSTITUENT.

LOCATIONS SHOWN IN ORANGE INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs, FINGERPRINT RESULTS INDICATE COAL TAR AS PRIMARY CONSTITUENT, AND OBSERVANCE OF NAPL IN LOCATION DURING FIELD INVESTIGATION.

LOCATIONS SHOWN IN GREEN INDICATE CONTAINED ELEVATED CONCENTRATIONS (i.e., >500 PPM) FOR TOTAL PAHs AND FINGERPRINT RESULTS INDICATE PETROLEUM PRODUCT AS PRIMARY CONSTITUENT

LOCATIONS SHOWN IN BLUE INDICATE THE PRESENCE OF NAPL OBSERVED DURING FIELD INVESTIGATION BUT NO ANALYTICAL SAMPLE WAS COLLECTED.

LOCATIONS SHOWN IN GRAY INDICATE THAT NO SAMPLE WAS COLLECTED WITHIN THE SOIL LAYER FOR THAT BORING/TEST PIT.

DETERMINATION OF THE SOIL INTERVAL IN WHICH THE SAMPLE WAS COLLECTED (i.e., ABOVE OR WITHIN/BELOW PEAT LAYER) WAS BASED ON MATERIAL DESCRIPTIONS FROM THE BORING LOGS/TEST PIT LOGS.

TETRA TECH EC, INC.

TITLE:
Alternative S-4: Excavation of MGP-Related Impacts Removal of On-Site Soils to Restricted-Residential SCOs, Soil Capping, Off-Site Disposal and Institutional Controls (Off-Site Area) - Ilion (East Street) Site

nationalgrid

DWN: LMC	DES.: EAG	PROJECT NO.: 2907.0003
CHKD: RC	APPD:	FIGURE NO.: 4-2B
DATE: 06/23/10	REV.: 0	

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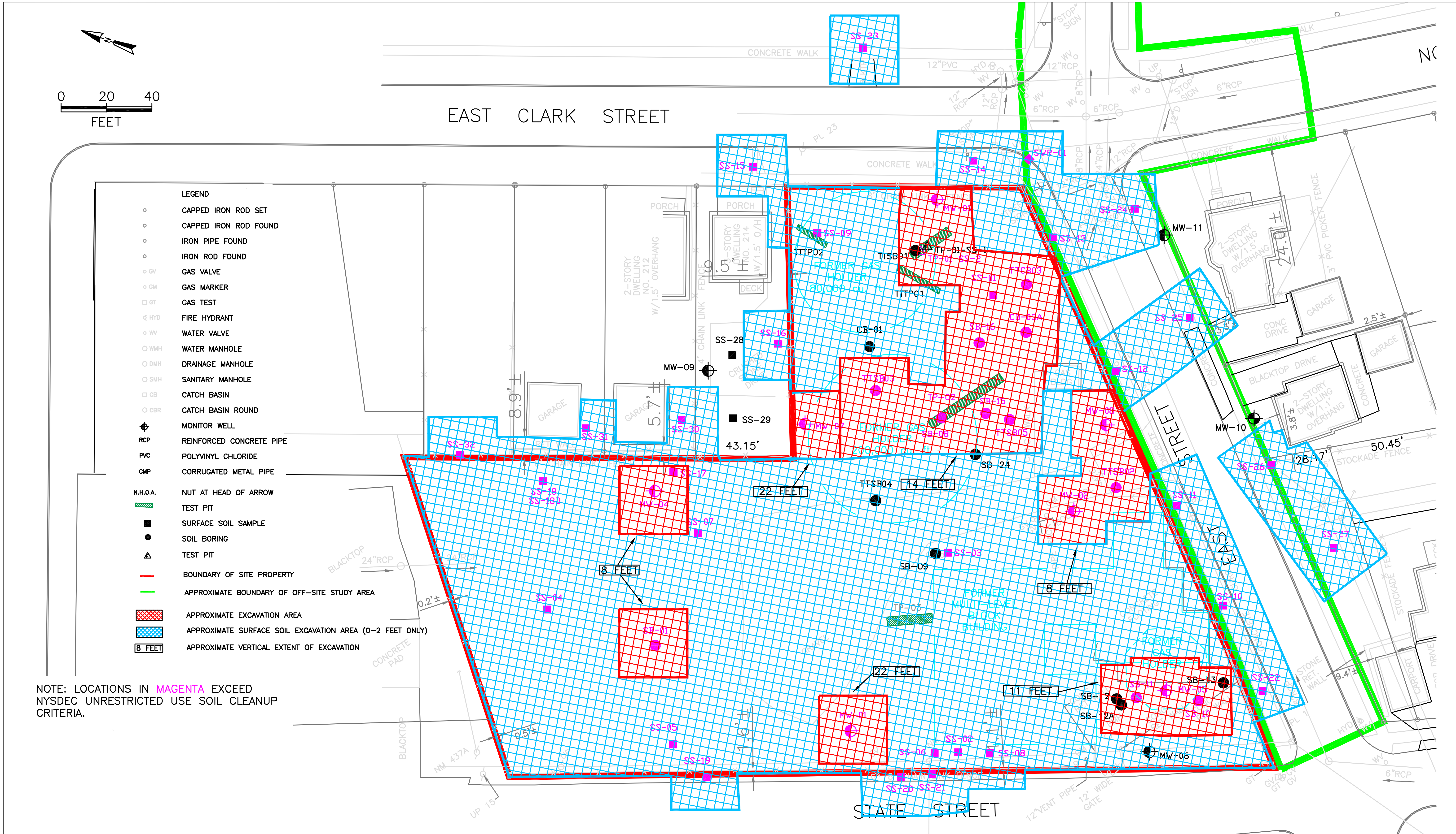

TETRA TECH EC, INC.

TITLE:
Alternative S-5: Excavation of Soils Exhibiting Concentrations Above Unrestricted Use SCOs – and Off-Site Disposal (On and Near-Site Areas)
Feasibility Study – Ilion (East Street) Site

nationalgrid

DWN: LMC	DES.: CTS	PROJECT NO.: 2907.0003
CHKD: EAG	APPD:	FIGURE NO.: 4-3A
DATE: 06/23/10	REV.: 0	

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TETRA TECH EC, INC.

TITLE:

Alternative S-5: Excavation of Soil Exhibiting Concentrations Above Unrestricted Use SCOs and Off-Site Disposal (Off-Site Area)
Ilion (East Street) Site – Feasibility Study

nationalgrid

DWN: LMC	DES.: EAG	PROJECT NO.: 2907.0003	
CHKD: EAG	APPD:	FIGURE NO.: 4-3B	
DATE: 06/23/10	REV.: 0		

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TABLE A-1
Summary of Statistical Values for On-Site Surface Soil Locations

	Number of Samples	Number of Detections	Frequency of Detection	Range of Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	90th Percentile (mg/kg)	Unrestricted SCOs		Restricted-Residential SCOs		Commercial SCOs		Background Mean		Background Median		Background 90th Percentile	
								Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance
Benzene	4	0	0.00	--	0.005	0.005	0.005	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Ethylbenzene	4	0	0.00	--	0.005	0.005	0.005	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Toluene	4	0	0.00	--	0.005	0.005	0.005	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Xylene (total)	4	0	0.00	--	0.005	0.005	0.005	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Acenaphthene	14	13	0.93	0.04 - 1.1	0.20	0.08	0.39	0	0.00	0	0.00	0	0.00	5	0.36	5	0.36	3	0.21
Acenaphthylene	14	14	1.00	0.14 - 3.9	0.92	0.48	2.38	0	0.00	0	0.00	0	0.00	10	0.71	12	0.86	5	0.36
Anthracene	14	14	1.00	0.11 - 5.6	1.20	0.63	2.74	0	0.00	0	0.00	0	0.00	11	0.79	13	0.93	5	0.36
Benzo(a)anthracene	14	14	1.00	0.63 - 17	4.42	2.75	11.29	12	0.86	12	0.86	3	0.21	11	0.79	12	0.86	8	0.57
Benzo(a)pyrene	14	14	1.00	0.66 - 17	4.69	2.75	13.12	12	0.86	12	0.86	12	0.86	12	0.86	12	0.86	6	0.43
Benzo(b)fluoranthene	14	14	1.00	0.46 - 14	4.65	3.85	10.35	12	0.86	12	0.86	4	0.29	10	0.71	12	0.86	7	0.50
Benzo(g,h,i)perylene	14	14	1.00	0.36 - 14	2.70	0.94	6.24	0	0.00	0	0.00	0	0.00	12	0.86	13	0.93	6	0.43
Benzo(k)fluoranthene	14	14	1.00	0.6 - 14	3.77	2.00	11.72	13	0.93	3	0.21	0	0.00	11	0.79	14	1.00	6	0.43
Chrysene	14	14	1.00	0.77 - 17	4.82	3.00	13.12	12	0.86	4	0.29	0	0.00	10	0.71	12	0.86	5	0.36
Dibenz(a,h)anthracene	14	14	1.00	0.07 - 6.5	0.91	0.30	1.73	6	0.43	6	0.43	4	0.29	10	0.71	12	0.86	7	0.50
Fluoranthene	14	14	1.00	1.2 - 22	6.97	4.75	16.20	0	0.00	0	0.00	0	0.00	9	0.64	12	0.86	5	0.36
Fluorene	14	13	0.93	0.04 - 1.2	0.28	0.15	0.70	0	0.00	0	0.00	0	0.00	5	0.36	10	0.71	2	0.14
Indeno(1,2,3-cd)pyrene	14	14	1.00	0.39 - 16	2.98	1.08	6.91	12	0.86	12	0.86	3	0.21	12	0.86	12	0.86	6	0.43
Naphthalene	14	13	0.93	0.03 - 0.87	0.23	0.17	0.56	0	0.00	0	0.00	0	0.00	8	0.57	10	0.71	4	0.29
Phenanthrene	14	14	1.00	0.55 - 12	3.46	2.00	8.01	0	0.00	0	0.00	0	0.00	10	0.71	12	0.86	4	0.29
Pyrene	14	14	1.00	0.98 - 22	6.83	5.10	13.80	0	0.00	0	0.00	0	0.00	12	0.86	13	0.93	8	0.57
Cyanide	4	0	0.00	--	0.25	0.25	0.25	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

NOTES:

1. The table provides statistical values for individual BTEX, PAH and cyanide parameters only.
2. The statistics were calculated with the following parameters:
   (a) The surface interval was defined to be from 0 to 0.5 feet bgs, therefore, samples collected from 0 to 2 inches and 0 to 6 inches were included.
   (b) Non-detected values were utilized at 50% of the detection limit (1/2DL) for calculation of mean, median and 90th percentile.
   (c) If field QC duplicate samples were collected, the statistics include the original environmental sample result but the duplicate result was not used in the calculations.

TABLE A-2
Summary of Statistical Values for Near-Site Surface Soil Locations

	Number of Samples	Number of Detections	Frequency of Detection	Range of Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	90th Percentile (mg/kg)	Unrestricted SCOs		Restricted-Residential SCOs		Commercial SCOs		Background Mean		Background Median		Background 90th Percentile	
								Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance
Benzene	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene (total)	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	18	18	1.00	0.012 - 2.3	0.34	0.21	0.67	0	0.00	0	0.00	0	0.00	11	0.61	13	0.72	8	0.44
Acenaphthylene	18	18	1.00	0.097 - 1.5	0.56	0.47	1.20	0	0.00	0	0.00	0	0.00	12	0.67	15	0.83	4	0.22
Anthracene	18	18	1.00	0.079 - 6.4	1.35	0.75	2.86	0	0.00	0	0.00	0	0.00	15	0.83	15	0.83	10	0.56
Benzo(a)anthracene	18	18	1.00	0.31 - 17	4.30	2.55	10.55	14	0.78	14	0.78	5	0.28	14	0.78	15	0.83	11	0.61
Benzo(a)pyrene	18	18	1.00	0.36 - 18	4.67	3.10	9.87	15	0.83	15	0.83	15	0.83	14	0.78	15	0.83	10	0.56
Benzo(b)fluoranthene	18	18	1.00	0.5 - 20	6.37	4.80	13.70	16	0.89	16	0.89	6	0.33	15	0.83	16	0.89	13	0.72
Benzo(g,h,i)perylene	18	18	1.00	0.27 - 8.1	1.77	0.99	4.06	0	0.00	0	0.00	0	0.00	15	0.83	16	0.89	7	0.39
Benzo(k)fluoranthene	18	18	1.00	0.2 - 7.7	2.52	1.90	5.19	14	0.78	5	0.28	0	0.00	14	0.78	15	0.83	6	0.33
Chrysene	18	18	1.00	0.42 - 15	4.33	3.05	9.88	15	0.83	5	0.28	0	0.00	14	0.78	15	0.83	6	0.33
Dibenz(a,h)anthracene	18	18	1.00	0.069 - 2	0.52	0.33	1.19	8	0.44	8	0.44	5	0.28	15	0.83	16	0.89	12	0.67
Fluoranthene	18	18	1.00	0.64 - 34	8.65	5.65	21.10	2	0.11	0	0.00	0	0.00	14	0.78	15	0.83	6	0.33
Fluorene	18	18	1.00	0.021 - 2.3	0.42	0.27	0.87	0	0.00	0	0.00	0	0.00	11	0.61	15	0.83	5	0.28
Indeno(1,2,3-cd)pyrene	18	18	1.00	0.28 - 9.6	2.11	1.20	4.93	16	0.89	16	0.89	1	0.06	14	0.78	16	0.89	8	0.44
Naphthalene	18	18	1.00	0.036 - 1.8	0.39	0.26	0.89	0	0.00	0	0.00	0	0.00	13	0.72	16	0.89	10	0.56
Phenanthrene	18	18	1.00	0.3 - 17	4.65	3.15	11.30	0	0.00	0	0.00	0	0.00	15	0.83	15	0.83	6	0.33
Pyrene	18	18	1.00	0.6 - 30	7.65	5.05	18.10	2	0.11	0	0.00	0	0.00	15	0.83	16	0.89	12	0.67
Cyanide	10	3	0.30	0.96 - 12.4	1.70	0.30	2.32	0	0.00	0	0.00	0	0.00	3	0.30	3	0.30	3	0.30

NOTES:

1. The table provides statistical values for individual BTEX, PAH and cyanide parameters only.
2. The statistics were calculated with the following parameters:
   (a) The surface interval was defined to be from 0 to 0.5 feet bgs, therefore, samples collected from 0 to 2 inches and 0 to 6 inches were included.
   (b) Non-detected values were utilized at 50% of the detection limit (1/2DL) for calculation of mean, median and 90th percentile.
   (c) If field QC duplicate samples were collected, the statistics include the original environmental sample result but the duplicate result was not used in the calculations.

TABLE A-3
Summary of Statistical Values for Background Surface Soil Locations

	Number of Samples	Number of Detections	Frequency of Detection	Range of Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	90th Percentile (mg/kg)	Unrestricted SCOs		Restricted-Residential SCOs		Commercial SCOs	
								Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance
Benzene	7	0	0.00	--	0.003	0.001	0.005	0	0.00	0	0.00	0	0.00
Ethylbenzene	7	0	0.00	--	0.003	0.001	0.005	0	0.00	0	0.00	0	0.00
Toluene	7	0	0.00	--	0.002	0.001	0.005	0	0.00	0	0.00	0	0.00
Xylene (total)	7	0	0.00	--	0.004	0.003	0.005	0	0.00	0	0.00	0	0.00
Acenaphthene	14	10	0.71	0.004 - 0.22	0.12	0.09	0.21	0	0.00	0	0.00	0	0.00
Acenaphthylene	14	13	0.93	0.02 - 0.95	0.28	0.22	0.64	0	0.00	0	0.00	0	0.00
Anthracene	14	13	0.93	0.03 - 0.77	0.29	0.20	0.71	0	0.00	0	0.00	0	0.00
Benzo(a)anthracene	14	13	0.93	0.08 - 4.1	1.20	0.82	2.48	6	0.43	6	0.43	0	0.00
Benzo(a)pyrene	14	13	0.93	0.08 - 4.1	1.32	0.97	2.96	7	0.50	7	0.50	7	0.50
Benzo(b)fluoranthene	14	13	0.93	0.08 - 5.8	1.63	1.25	3.29	7	0.50	7	0.50	1	0.07
Benzo(ghi)perylene	14	13	0.93	0.05 - 1.3	0.50	0.42	1.07	0	0.00	0	0.00	0	0.00
Benzo(k)fluoranthene	14	13	0.93	0.09 - 3.3	1.04	0.57	2.17	5	0.36	0	0.00	0	0.00
Chrysene	14	13	0.93	0.1 - 4.9	1.55	1.18	3.50	7	0.50	1	0.07	0	0.00
Dibenzo(a,h)anthracene	14	13	0.93	0.02 - 0.57	0.14	0.09	0.29	1	0.07	1	0.07	1	0.07
Fluoranthene	14	13	0.93	0.17 - 9.9	2.64	1.70	6.61	0	0.00	0	0.00	0	0.00
Fluorene	14	12	0.86	0.004 - 0.45	0.15	0.07	0.41	0	0.00	0	0.00	0	0.00
Indeno(1,2,3-cd)pyrene	14	13	0.93	0.05 - 1.4	0.55	0.45	1.27	5	0.36	5	0.36	0	0.00
Naphthalene	14	10	0.71	0.01 - 0.11	0.11	0.06	0.19	0	0.00	0	0.00	0	0.00
Phenanthrene	14	13	0.93	0.08 - 4.2	1.27	0.70	3.60	0	0.00	0	0.00	0	0.00
Pyrene	14	13	0.93	0.15 - 6.3	1.96	1.30	4.74	0	0.00	0	0.00	0	0.00
Cyanide	7	0	0.00	--	0.27	0.28	0.28	0	0.00	0	0.00	0	0.00

NOTES:
1. The table provides statistical values for individual BTEX, PAH and cyanide parameters only.
2. The statistics were calculated with the following parameters:
   (a) The surface interval was defined to be from 0 to 0.5 feet bgs, therefore, samples collected from 0 to 2 inches and 0 to 6 inches were included.
   (b) Non-detected values were utilized at 50% of the detection limit (1/2DL) for calculation of mean, median and 90th percentile.
   (c) If field QC duplicate samples were collected, the statistics include the original environmental sample result but the duplicate result was not used in the calculations.

TABLE A-4
Summary of Statistical Values for On-Site Subsurface Soil Locations

	Number of Samples	Number of Detections	Frequency of Detection	Range of Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	90th Percentile (mg/kg)	Unrestricted SCOs		Restricted-Residential SCOs		Commercial SCOs	
								Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance
Benzene	74	30	0.41	0.001 - 210	3.07	0.01	0.04	5	0.07	2	0.03	1	0.01
Ethylbenzene	74	20	0.27	0.001 - 38	0.99	0.01	0.04	3	0.07	0	0.00	0	0.00
Toluene	74	25	0.34	0.001 - 310	4.52	0.01	0.01	3	0.07	1	0.01	0	0.00
Xylene (total)	74	24	0.32	0.001 - 570	9.67	0.01	0.13	7	0.09	1	0.01	1	0.01
Acenaphthene	76	46	0.61	0.01 - 310	9.40	0.17	2.55	3	0.04	3	0.04	0	0.00
Acenaphthylene	76	53	0.70	0.01 - 780	20.78	0.20	5.50	2	0.03	2	0.03	2	0.03
Anthracene	76	55	0.72	0.01 - 1200	27.83	0.21	7.35	2	0.03	2	0.03	2	0.03
Benzo(a)anthracene	76	58	0.76	0.01 - 980	26.14	0.29	20.00	27	0.36	27	0.36	18	0.24
Benzo(a)pyrene	76	55	0.72	0.01 - 680	19.46	0.29	19.00	28	0.37	28	0.37	28	0.37
Benzo(b)fluoranthene	76	57	0.75	0.01 - 440	13.77	0.20	15.00	24	0.32	24	0.32	15	0.20
Benzo(ghi)perylene	76	51	0.67	0.01 - 400	11.13	0.21	7.75	2	0.03	2	0.03	0	0.00
Benzo(k)fluoranthene	76	56	0.74	0.01 - 670	18.36	0.29	17.50	27	0.36	18	0.24	2	0.03
Chrysene	76	59	0.78	0.01 - 780	21.54	0.27	23.00	27	0.36	20	0.26	3	0.04
Dibenzo(a,h)anthracene	76	35	0.46	0.01 - 150	7.05	0.17	1.30	16	0.21	16	0.21	15	0.20
Fluoranthene	76	63	0.83	0.01 - 1600	45.21	0.72	43.50	5	0.07	5	0.07	2	0.03
Fluorene	76	48	0.63	0.01 - 1100	25.42	0.20	8.40	5	0.07	3	0.04	2	0.03
Indeno(1,2,3-cd)pyrene	76	52	0.68	0.01 - 460	12.31	0.19	9.35	28	0.37	28	0.37	14	0.18
Naphthalene	76	55	0.72	0.01 - 2800	75.92	0.20	16.00	10	0.13	4	0.05	3	0.04
Phenanthrene	76	58	0.76	0.02 - 2600	64.82	0.61	24.50	5	0.07	5	0.07	2	0.03
Pyrene	76	62	0.82	0.01 - 1600	42.17	0.50	30.00	3	0.04	3	0.04	2	0.03
Cyanide	72	21	0.29	0.66 - 266	13.50	0.30	12.20	4	0.06	4	0.06	4	0.06

NOTES:
1. The table provides statistical values for individual BTEX, PAH and cyanide parameters only.
2. The statistics were calculated with the following parameters:
   (a) The subsurface interval was defined to be from 0.5 feet bgs to location completion depth.
   (b) Non-detected values were utilized at 50% of the detection limit (1/2DL) for calculation of mean, median and 90th percentile.
   (c) If field QC duplicate samples were collected, the statistics include the original environmental sample result but the duplicate result was not used in the calculations.

TABLE A-5
Summary of Statistical Values for Off-Site Subsurface Soil Locations

	Number of Samples	Number of Detections	Frequency of Detection	Range of Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	90th Percentile (mg/kg)	Unrestricted SCOs		Restricted-Residential SCOs		Commercial SCOs	
								Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance	Number of Exceedances	Frequency of Exceedance
Benzene	166	74	0.45	0.0007 - 36	0.27	0.00	0.03	10	0.06	1	0.01	0	0.00
Ethylbenzene	166	25	0.15	0.0006 - 68	0.72	0.00	0.01	4	0.02	2	0.01	0	0.00
Toluene	166	90	0.54	0.0005 - 58	0.43	0.00	0.01	1	0.01	0	0.00	0	0.00
Xylene (total)	166	66	0.40	0.0006 - 200	1.94	0.00	0.05	9	0.05	1	0.01	0	0.00
Acenaphthene	184	117	0.65	0.01 - 1500	20.33	0.34	6.07	11	0.06	6	0.03	3	0.02
Acenaphthylene	184	123	0.71	0.009 - 1500	11.14	0.31	10.00	3	0.02	3	0.02	1	0.01
Anthracene	184	140	0.80	0.011 - 2300	32.55	0.55	25.00	7	0.04	7	0.04	4	0.02
Benzo(a)anthracene	184	147	0.83	0.019 - 1400	28.90	0.70	56.40	76	0.41	76	0.41	51	0.28
Benzo(a)pyrene	184	145	0.82	0.011 - 1300	27.01	0.68	51.60	75	0.41	75	0.41	75	0.41
Benzo(b)fluoranthene	184	153	0.85	0.011 - 1000	27.02	0.86	58.10	84	0.46	84	0.46	52	0.28
Benzo(g,h,i)perylene	184	134	0.76	0.012 - 660	12.43	0.46	26.10	5	0.03	5	0.03	1	0.01
Benzo(k)fluoranthene	184	144	0.81	0.01 - 1200	16.32	0.44	30.80	66	0.36	49	0.27	9	0.05
Chrysene	184	149	0.84	0.018 - 1300	27.54	0.90	58.60	82	0.45	55	0.30	19	0.10
Dibenz(a,h)anthracene	184	110	0.61	0.011 - 220	3.69	0.12	6.75	59	0.32	59	0.32	51	0.28
Fluoranthene	184	157	0.88	0.014 - 3600	68.25	1.30	111.00	19	0.10	19	0.10	6	0.03
Fluorene	184	124	0.71	0.012 - 1500	19.02	0.35	10.20	10	0.05	5	0.03	3	0.02
Indeno(1,2,3-cd)pyrene	184	134	0.76	0.014 - 650	14.22	0.39	30.10	81	0.44	81	0.44	38	0.21
Naphthalene	184	126	0.72	0.009 - 9100	77.06	0.37	8.90	14	0.08	4	0.02	4	0.02
Phenanthrene	184	154	0.85	0.011 - 5700	74.67	0.80	64.10	13	0.07	13	0.07	6	0.03
Pyrene	184	160	0.89	0.013 - 2900	55.47	1.30	99.10	17	0.09	17	0.09	5	0.03
Cyanide	5	0	0.00	--	12.5	12.5	12.5	0	0.00	0	0.00	0	0.00

NOTES:
1. The table provides statistical values for individual BTEX, PAH and cyanide parameters only.
2. The statistics were calculated with the following parameters:
   (a) The subsurface interval was defined to be from 0.5 feet bgs to location completion depth.
   (b) Non-detected values were utilized at 50% of the detection limit (1/2DL) for calculation of mean, median and 90th percentile.
   (c) If field QC duplicate samples were collected, the statistics include the original environmental sample result but the duplicate result was not used in the calculations.

Appendix B

Ilion (East Street) Site

Natural Attenuation Analysis

Natural attenuation is defined as a reduction of concentrations of contaminants affecting environmental media via natural processes. Natural attenuation processes (NAP) occur as two types: non-destructive and destructive, and act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants affecting environmental media. Non-destructive mechanisms, such as dispersion, advection, sorption, volatilization, and dilution, occur as part of natural hydrogeologic and geochemical processes. Non-destructive NAP reduce contaminant concentrations, but do not destroy or reduce the contaminant mass. Destructive NAP result from microorganisms transforming available nutrients into compounds useful for cell reproduction, causing the biodegradation and destruction of contaminants. As a result of the action of destructive NAP, the total mass, volume, and concentrations of contaminants are reduced. The primary focus of this monitoring natural attenuation (MNA) evaluation is to assess if destructive NAP, such as biodegradation, is occurring at the Site.

The most recent groundwater sampling event conducted in February 2008 indicates BTEX compounds were detected in groundwater samples collected at MW-02, MW-05, MW-07, and MW-08 at concentrations exceeding their respective NYSDEC WQ Class GA Values. The maximum concentration detected was for benzene at MW-02, at a concentration of 43 ug/l. BTEX compounds present in the water-bearing zone are the primary focus of this natural attenuation evaluation for the Site.

As indicated, biodegradation is the process of microorganisms transforming available nutrients into compounds useful for cell reproduction by facilitating the transfer of electrons from electron donors to electron acceptors. Fuel hydrocarbons, such as BTEX compounds, are electron donors, while the electron acceptors are the naturally occurring compounds, such as dissolved oxygen, nitrate, iron, sulfate and carbon dioxide. Microorganisms preferentially use dissolved oxygen as an electron acceptor because oxygen supplies the highest amount of energy. This process is called aerobic respiration. When oxygen is depleted, the microbial populations will switch to utilizing other electron acceptors (nitrate, iron, sulfate or carbon dioxide), and will break down the contaminants under an anaerobic biodegradation pathway through the processes of denitrification, iron reduction, sulfate reduction or methanogenesis.

Microorganisms in the subsurface driving biodegradation prefer oxygen as an electron acceptor because they derive more energy from oxygen when compared to the secondary electron acceptors (nitrate, iron, sulfate, and carbon dioxide). This causes the aerobic biodegradation of fuels to occur at much greater rates when compared to anaerobic biodegradation of fuels (Borden, *et. al*., 1995). Most hydrocarbons prefer, and are biodegradable under, aerobic conditions, as opposed to chlorinated VOCs, which preferentially biodegrade under anaerobic conditions. Aerobic and anaerobic biodegradation may occur simultaneously in different parts of the contaminated area. The occurrence and types of the biodegradation mechanisms present can be evaluated by analyzing the oxidation-reduction potential, pH, temperature, alkalinity, and conductivity of groundwater, as well as the dissolved-phase concentrations of the BTEX compounds, electron acceptors, and metabolic by-products.

TtEC obtained site-specific chemical and geochemical data during nine rounds of groundwater sampling conducted during the PSA and RI from July 1997 through February 2008 to assess the groundwater quality and obtain data to evaluate NAP potentially occurring at the Site and near-Site area. This MNA evaluation does not include the off-site study areas and background areas also evaluated during the Ilion PSA and RI process because BTEX concentrations in groundwater samples collected at these locations did not exceed the NYSDEC criteria. Groundwater samples collected during the nine rounds of groundwater sampling were not analyzed for a consistent suite of analytical parameters during each round of groundwater sampling. Details regarding the specific analytical parameters collected during each round of groundwater sampling can be found in Section 2.10 of the June 2008 Revised RI. Groundwater samples collected during the nine rounds of sampling were generally analyzed for the following parameters: TCL VOCs, BTEX, TCL SVOCs, metals, total cyanide, and filtered and unfiltered PAHs.

In addition, groundwater samples collected from MW-03, MW-06 and MW-08 during the September/October 2004 groundwater sampling round were also collected for monitored natural attenuation/water quality (MNA/WQ) laboratory parameters. The MNA/WQ laboratory analytical suite consisted of:

- Water quality parameters:
    - biological oxygen demand (BOD)
    - chemical oxygen demand (COD)
    - total suspended solids (TSS)
    - total dissolved solids (TDS)
    - total organic carbon (TOC)
    - chloride
    - alkalinity
- Dissolved gases:
    - carbon dioxide
    - hydrogen sulfide
    - methane
- General attenuation parameters:
    - micro-toxicity
    - ferrous and total iron
    - manganese
    - potassium
    - nitrate-nitrogen
    - nitrite-nitrogen
    - orthophosphate
    - total phosphorus
    - sulfate
    - total sulfide
    - heterotrophic plate count

Field readings were collected approximately every three to five minutes using appropriate field instrumentation during the groundwater purge process at each well. The field readings collected include: pH, conductivity, DO, oxidation-reduction potential (ORP), and temperature.

Site-specific concentrations of the MNA/WQ and field reading parameters were compared to published screening values to identify whether the concentrations are within ranges generally suitable for biodegradation. Additionally, MNA/WQ concentrations in monitoring wells containing groundwater samples exhibiting elevated concentrations of BTEX were compared to monitoring wells containing groundwater samples exhibiting little or no BTEX contamination.

MNA/WQ and field readings data obtained from the September/October 2004 through the February 2008 groundwater sampling event were utilized for this MNA evaluation. A summary and evaluation of the results is provided below:

- DO and ORP values indicate the conditions present in the aquifer are sufficient for aerobic biodegradation to be present at the Site. Dissolved oxygen concentrations are generally greater than 0.5 mg/l, indicating aerobic conditions. These dissolved oxygen concentrations suggest aerobic biodegradation can occur at the Site, but the general range of concentrations are approximately 0.5 to 2.0 mg/l and not indicative of highly aerobic environments (i.e., not greater than 2.0 mg/l).

- Monitoring well MW-02, which exhibits elevated concentrations of BTEX constituents, does not exhibit depleted concentrations of dissolved oxygen, suggesting that aerobic biodegradation is not occurring at MW-02.

- The range of ORP levels observed at the Site monitoring wells indicates aquifer conditions are suitable for denitrification and ferric iron reduction to occur.

- Groundwater samples collected in September/October 2004 contain concentrations of nitrate at MW-08 greater than the concentrations detected at MW-03 and MW-06. Generally, concentrations of nitrate are depleted at areas where groundwater is affected by concentrations of BTEX, when compared to groundwater that is not affected by BTEX. The site-specific data indicates elevated concentrations of nitrate are present at MW-08, opposite of typical natural attenuation processes, which indicates depleted nitrate concentrations would be expected at areas exhibiting elevated concentrations of BTEX, such as MW-08. No trend is apparent between elevated BTEX concentrations and depleted nitrate concentration and it does not appear that denitrification is a biodegradation process occurring at the Site.

- Groundwater samples collected in September/October 2004 contain concentrations of ferrous iron at MW-08 greater than the concentrations detected at MW-03 and MW-06. Concentrations of ferrous iron are generally elevated at areas where groundwater is affected by concentrations of BTEX, when compared to groundwater that is not affected by BTEX. The elevated concentrations of ferrous iron at MW-08 are consistent with expected data trends as MW-08 contained concentrations of BTEX, slightly above NYSDEC criteria. Ferric iron reduction may be a biodegradation process occurring at the Site.

- Groundwater affected by BTEX compounds will typically exhibit a total alkalinity greater than what is observed within groundwater that is not affected by BTEX compounds. The microbially-mediated reactions causing biodegradation of BTEX compounds increase the total alkalinity of the system. Increased levels of alkalinity were not observed at MW-08, indicating biodegradation of BTEX compounds may not be occurring at the Site.

- Concentrations of benzene detected in the groundwater sample collected at MW-02 during the February 2008 sampling event are higher than the detected concentrations of toluene, ethylbenzene, and total xylenes. Monitored natural attenuation studies indicate higher concentrations of benzene relative to the other BTEX compounds may indicate the amount of dissolved oxygen in the subsurface is not sufficiently adequate to completely biodegrade BTEX (Borden, *et. al.*, 1995).

Evaluation of the MNA capacity of the aquifer at the Site via a review of site-specific chemical and geochemical parameters indicates aerobic biodegradation of the BTEX compounds can occur at the Site but does not appear to be a primary NAP occurring at the Site because of the relatively low dissolved oxygen concentrations and MGP-related constituent concentrations.

TABLE C-1
ALTERNATIVE S-2
CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	ADMINISTRATIVE ACTIONS				
	Environmental Easement	1	LS	10,000	10,000
	Health and Safety Plan	1	LS	15,000	15,000
	Site Management Plan	1	LS	25,000	25,000
				Subtotal	$ 50,000
				Contingency (20%)	$ 10,000
				Engineering (N/A)	$ -
				Legal and Administrative (10%)	$ 5,000
				Grand Total	**$ 65,000**

Notes:
1) Environmental Easement implemented for Site only

TABLE C-2
ALTERNATIVE S-3 (ON-SITE)
CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	MOBILIZATION/DEMOBILIZATION				
	Mobilization	1	LS	80,000	80,000
	SITE PREPARATION				
	Clearing and grading	4697	SY	1.00	4,697
	Debris Removal (Spoil piles)	0	CY	5.00	-
	Debris Removal (Spoil Pile for contingency excavation)	0	CY	5.00	-
	Asphalt removal	0	SY	2.00	-
	SUPPORT FACILITIES				
	Office trailers	1	LS	15,000	15,000
	Decon trailer	1	LS	10,000	10,000
	EROSION & SEDIMENT CONTROL				
	Silt Fence & Installation	1153	LF	10	11,530
	Silt Fence & Installation (contingency)	0	LF	10	-
	EXCAVATION				
	Concrete removal	53	CY	40	2,111
	In -Situ characterization of re-usable soil	4	EA	2,000	8,000
	Soil Excavation (above water table)	1430	CY	20	28,600
	Soil Excavation (below water table)	1400	CY	60	84,000
	Contingency Soil Excavation (above water table)	0	CY	20	-
	Contingency Soil Excavation (below water table)	0	CY	60	-
	Material Handling	2830	CY	4	11,320
	Material Handling (contingency)	0	CY	4	-
	Sheet Piling	1153	LF	300	345,900
	Sheet Piling (for contingency soil excavation)	0	LF	300	-
	SOIL CAPPING				
	Excavation	1323	CY	20	26,456
	Cap Placement	1323	CY	25	33,069
	OFF-SITE TREATMENT & DISPOSAL				
	Concrete	106	Ton	125	13,194
	Non-hazardous soil	2280	Ton	100	228,000
	Non-hazardous soil (from contingency excavation)	0	Ton	100	-
	Hazardous soil	0	Ton	280	-
	Dewatering water treatment	70,700	Gal	1.00	70,700
	Dewatering water treatment (from contingency excavation)	0	Gal	1.00	-
	SITE RESTORATION				
	Reusable Soil	1310	CY	20	26,200
	Clean fill	737	CY	25	18,428
	Clean fill (contingency)	0	CY	25	-
	Top soil	783	CY	30	23,486
	Top soil (contingency)	0	CY	30	-
	Top soil (suitable swale soil)	0	CY	40	-
	Seeding/revegetation of swale	0.0	Acres	1,875	-
	MISCELLANEOUS				
	Pre-Design Investigation	1	LS	100,000	100,000
	Easement, HASP, SMP	1	LS	50,000	50,000
	Wetland Identification/Delineation	0	LS	10,000	-
	Misc. Disposal	1	LS	3,750	3,750
	Health and Safety Oversight	3	MO	15,000	45,000

Subtotal	$ 1,239,442
Contingency (20%)	$ 247,900
Engineering (10%)	$ 123,900
Legal and Administrative (5%)	$ 62,000
Grand Total	**$ 1,673,242**

Assumptions
1. Clearing and grading assumes entire area needs to be cleared
2. Silt fence installed around each excavation area for erosion and sediment control
3. Dewatering volumes do not include infiltration into excavation areas; assumes 25% porosity
4. Depth of water varies by excavation area
5. Depth of soil excavations varies by area
6. In-situ characterization costs for potential re-use includes analytical costs, drilling costs and labor
7. Reusable soil is subtracted from disposal tonnage
8. Sheet piling needed for all soil excavation areas
9. Post excavation would not be required for excavation of NAPL
10. Concrete tonnage based on 2.0 tons/cy unit weight
11. All soil non-hazardous for disposal purposes
12. Unit weight of excavated soil: 1.5 tons/cy
13. Top 6 inches restored with topsoil/seeding for all areas
14. No wetland restoration

TABLE C-3
ALTERNATIVE S-3 (OFF-SITE)
CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	MOBILIZATION/DEMOBILIZATION				
	Mobilization	1	LS	80,000	80,000
	SITE PREPARATION				
	Clearing and grading	2245	SY	1.00	2,245
	Debris Removal (Spoil piles)	90	CY	5.00	450
	Debris Removal (Spoil Pile for contingency excavation)	2000	CY	5.00	10,000
	Asphalt removal	0	SY	2.00	-
	SUPPORT FACILITIES				
	Office trailers	1	LS	15,000	15,000
	Decon trailer	1	LS	10,000	10,000
	EROSION & SEDIMENT CONTROL				
	Silt Fence & Installation	1409	LF	10	14,090
	Silt Fence & Installation (contingency)	577	LF	10	5,770
	EXCAVATION				
	Concrete removal	0	CY	40	-
	In -Situ characterization of re-usable soil	4	EA	2,000	8,000
	Soil Excavation (above water table)	650	CY	20	13,000
	Soil Excavation (below water table)	1980	CY	60	118,800
	Contingency Soil Excavation (above water table)	1500	CY	20	30,000
	Contingency Soil Excavation (below water table)	1200	CY	60	72,000
	Material Handling	2630	CY	4	10,520
	Material Handling (contingency)	2700	CY	4	10,800
	Sheet Piling	1409	LF	300	422,700
	Sheet Piling (for contingency soil excavation)	577	LF	300	173,100
	OFF-SITE TREATMENT & DISPOSAL				
	Concrete	0	Ton	125	-
	Non-hazardous soil	3945	Ton	100	394,500
	Non-hazardous soil (from contingency excavation)	4050	Ton	100	405,000
	Hazardous soil	0	Ton	280	-
	Dewatering water treatment	99,990	Gal	1.00	99,990
	Dewatering water treatment (from contingency excavation)	60,600	Gal	1.00	60,600
	SITE RESTORATION				
	Reusable Soil	940	CY	20	18,800
	Reusable Soil (contingency)	0	CY	20	-
	Clean fill	1442	CY	25	36,056
	Clean fill (contingency)	2574	CY	25	64,340
	Top soil	80	CY	30	2,399
	Top soil (contingency)	126	CY	30	3,792
	Top soil (suitable swale soil)	168	CY	40	6,711
	Seeding/revegetation of swale	0.21	Acres	1,875	390
	MISCELLANEOUS				
	Pre-Design Investigation	1	LS	150,000	150,000
	HASP, SMP	1	LS	40,000	40,000
	Wetland Identification/Delineation	1	LS	10,000	10,000
	Misc. Disposal	1	LS	3,750	3,750
	Health and Safety Oversight	6	MO	15,000	90,000

Subtotal	$ 2,382,803
Contingency (20%)	$ 476,600
Engineering (10%)	$ 238,300
Legal and Administrative (5%)	$ 119,100
Grand Total	**$ 3,216,803**

Assumptions
1. Clearing and grading assumes entire area needs to be cleared
2. Silt fence installed around each excavation area for erosion and sediment control
3. Dewatering volumes do not include infiltration into excavation areas; assumes 25% porosity
4. Depth of water varies by excavation area
5. Depth of soil excavations varies by area
6. In-situ characterization costs for potential re-use includes analytical costs, drilling costs and labor
7. Reusable soil is subtracted from disposal tonnage
8. Sheet piling needed for all soil excavation areas
9. Post excavation would not be required for excavation of NAPL
10. Concrete tonnage based on 2.0 tons/cy unit weight
11. All soil non-hazardous for disposal purposes
12. Unit weight of excavated soil: 1.5 tons/cy
13. Top 6 inches restored with topsoil/seeding for all areas
14. No wetland restoration

TABLE C-4
ALTERNATIVE S-4 (ON-SITE)
CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	MOBILIZATION/DEMOBILIZATION				
	Mobilization	1	LS	80,000	80,000
	SITE PREPARATION				
	Clearing and grading	4697	SY	1.00	4,697
	Debris Removal (Spoil piles)	0	CY	5.00	-
	Debris Removal (Spoil Pile for contingency excavation)	0	CY	5.00	-
	Asphalt removal	0	SY	2.00	-
	SUPPORT FACILITIES				
	Office trailers	1	LS	15,000	15,000
	Decon trailer	1	LS	10,000	10,000
	EROSION & SEDIMENT CONTROL				
	Silt Fence & Installation	1184	LF	10	11,840
	Silt Fence & Installation (contingency)	0	LF	10	-
	EXCAVATION				
	Concrete removal	53	CY	40	2,111
	In -Situ characterization of re-usable soil	4	EA	2,000	8,000
	Soil Excavation (above water table)	2530	CY	20	50,600
	Soil Excavation (below water table)	2000	CY	60	120,000
	Contingency Soil Excavation (above water table)	0	CY	20	-
	Contingency Soil Excavation (below water table)	0	CY	60	-
	Material Handling	4530	CY	4	18,120
	Material Handling (contingency)	0	CY	4	-
	Sheet Piling	1184	LF	300	355,200
	Sheet Piling (for contingency soil excavation)	0	LF	300	-
	SOIL CAPPING				
	Excavation	2321	CY	20	46,427
	Cap Placement	2321	CY	25	58,033
	OFF-SITE TREATMENT & DISPOSAL				
	Concrete	106	Ton	125	13,194
	Non-hazardous soil	3915	Ton	100	391,500
	Non-hazardous soil (from contingency excavation)	0	Ton	100	-
	Hazardous soil	0	Ton	280	-
	Dewatering water treatment	101,000	Gal	1.00	101,000
	Dewatering water treatment (from contingency excavation)	0	Gal	1.00	-
	SITE RESTORATION				
	Reusable Soil	1920	CY	20	38,400
	Clean fill	1827	CY	25	45,678
	Clean fill (contingency)	0	CY	25	-
	Top soil	783	CY	30	23,486
	Top soil (contingency)	0	CY	30	-
	Top soil (suitable swale soil)	0	CY	40	-
	Seeding/revegetation of swale	0.0	Acres	1,875	-
	MISCELLANEOUS				
	Pre-Design Investigation	1	LS	150,000	150,000
	Easement, HASP, SMP	1	LS	50,000	50,000
	Wetland Identification/Delineation	0	LS	10,000	-
	Misc. Disposal	1	LS	3,750	3,750
	Health and Safety Oversight	3	MO	15,000	45,000

Subtotal	$	1,642,037
Contingency (20%)	$	328,400
Engineering (20%)	$	328,407
Legal and Administrative (5%)	$	82,100
Grand Total	**$**	**2,380,945**

Assumptions
1. Clearing and grading assumes entire area needs to be cleared
2. Silt fence installed around each excavation area for erosion and sediment control
3. Dewatering volumes do not include infiltration into excavation areas; assumes 25% porosity
4. Depth of water varies by excavation area
5. Depth of soil excavations varies by area
6. In-situ characterization costs for potential re-use includes analytical costs, drilling costs and labor
7. Reusable soil is subtracted from disposal tonnage
8. Sheet piling needed for all soil excavation areas
9. Post excavation would not be required for excavation of NAPL
10. Concrete tonnage based on 2.0 tons/cy unit weight
11. All soil non-hazardous for disposal purposes
12. Unit weight of excavated soil: 1.5 tons/cy
13. Top 6 inches restored with topsoil/seeding for all areas
14. No wetland restoration

TABLE C-5
ALTERNATIVE S-4 (OFF-SITE)
CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	MOBILIZATION/DEMOBILIZATION				
	Mobilization	1	LS	80,000	80,000
	SITE PREPARATION				
	Clearing and grading	2245	SY	1.00	2,245
	Debris Removal (Spoil piles)	90	CY	5.00	450
	Debris Removal (Spoil Pile for contingency excavation)	2000	CY	5.00	10,000
	Asphalt removal	0	SY	2.00	-
	SUPPORT FACILITIES				
	Office trailers	1	LS	15,000	15,000
	Decon trailer	1	LS	10,000	10,000
	EROSION & SEDIMENT CONTROL				
	Silt Fence & Installation	1409	LF	10	14,090
	Silt Fence & Installation (contingency)	577	LF	10	5,770
	EXCAVATION				
	Concrete removal	0	CY	40	-
	In -Situ characterization of re-usable soil	4	EA	2,000	8,000
	Soil Excavation (above water table)	650	CY	20	13,000
	Soil Excavation (below water table)	1980	CY	60	118,800
	Contingency Soil Excavation (above water table)	1500	CY	20	30,000
	Contingency Soil Excavation (below water table)	1200	CY	60	72,000
	Material Handling	2630	CY	4	10,520
	Material Handling (contingency)	2700	CY	4	10,800
	Sheet Piling	1409	LF	300	422,700
	Sheet Piling (for contingency soil excavation)	577	LF	300	173,100
	OFF-SITE TREATMENT & DISPOSAL				
	Concrete	0	Ton	125	-
	Non-hazardous soil	3945	Ton	100	394,500
	Non-hazardous soil (from contingency excavation)	4050	Ton	100	405,000
	Hazardous soil	0	Ton	280	-
	Dewatering water treatment	99,990	Gal	1.00	99,990
	Dewatering water treatment (from contingency excavation)	60,600	Gal	1.00	60,600
	SITE RESTORATION				
	Reusable Soil	940	CY	20	18,800
	Reusable Soil (contingency)	0	CY	20	-
	Clean fill	1442	CY	25	36,056
	Clean fill (contingency)	2574	CY	25	64,340
	Top soil	80	CY	30	2,399
	Top soil (contingency)	126	CY	30	3,792
	Top soil (suitable swale soil)	168	CY	40	6,711
	Seeding/revegetation of swale	0.21	Acres	1,875	390
	MISCELLANEOUS				
	Pre-Design Investigation	1	LS	150,000	150,000
	HASP, SMP	1	LS	40,000	40,000
	Wetland Identification/Delineation	1	LS	10,000	10,000
	Misc. Disposal	1	LS	3,750	3,750
	Health and Safety Oversight	6	MO	15,000	90,000

Subtotal	$ 2,382,803
Contingency (20%)	$ 476,600
Engineering (10%)	$ 238,300
Legal and Administrative (5%)	$ 119,100
Grand Total	**$ 3,216,803**

Assumptions
1. Clearing and grading assumes entire area needs to be cleared
2. Silt fence installed around each excavation area for erosion and sediment control
3. Dewatering volumes do not include infiltration into excavation areas; assumes 25% porosity
4. Depth of water varies by excavation area
5. Depth of soil excavations varies by area
6. In-situ characterization costs for potential re-use includes analytical costs, drilling costs and labor
7. Reusable soil is subtracted from disposal tonnage
8. Sheet piling needed for all soil excavation areas
9. Post excavation would not be required for excavation of NAPL
10. Concrete tonnage based on 2.0 tons/cy unit weight
11. All soil non-hazardous for disposal purposes
12. Unit weight of excavated soil: 1.5 tons/cy
13. Top 6 inches restored with topsoil/seeding for all areas
14. No wetland restoration

TABLE C-6
ALTERNATIVE S-5 (ON-SITE)
CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	MOBILIZATION/DEMOBILIZATION				
	Mobilization	1	LS	120,000	120,000
	SITE PREPARATION				
	Clearing and grading	7945	SY	1.00	7,945
	Debris Removal (Spoil piles)	0	CY	5.00	-
	Debris Removal (Spoil Pile for contingency excavation)	0	CY	5.00	-
	Asphalt/Concrete Road/Driveway/Curb Removal	0	SY	4.00	-
	SUPPORT FACILITIES				
	Office trailers	1	LS	60,000	60,000
	Decon trailer	1	LS	40,000	40,000
	EROSION & SEDIMENT CONTROL				
	Silt Fence & Installation	1600	LF	10	16,000
	Silt Fence & Installation (contingency)	0	LF	10	-
	EXCAVATION				
	Concrete Holder Slab Removal	117	CY	40	4,671
	Soil Excavation (above water table)	8,200	CY	20	164,000
	Soil Excavation (below water table)	3,900	CY	60	234,000
	Contingency Soil Excavation (above water table)	0	CY	20	-
	Contingency Soil Excavation (below water table)	0	CY	60	-
	Material Handling	12,100	CY	4	48,400
	Material Handling (contingency)	0	CY	4	-
	Sheet Piling	1130	LF	300	339,000
	Sheet Piling (for contingency soil excavation)	0	LF	300	-
	POST EXCAVATION SAMPLING				
	Post-excavation sampling	117	EA	450	52,701
	Post-excavation sampling (contingency)	0	EA	450	-
	OFF-SITE TREATMENT & DISPOSAL				
	Concrete from holders	234	Ton	125	29,194
	Concrete/asphalt from roads/driveways/curbs	0	Ton	70	-
	Non-hazardous soil	18150	Ton	100	1,815,000
	Non-hazardous soil (from contingency excavation)	0	Ton	100	-
	Hazardous soil	0	Ton	280	-
	Dewatering water treatment	196,950	Gal	1.00	196,950
	Dewatering water treatment (from contingency excavation)	0	Gal	1.00	-
	SITE RESTORATION				
	Clean fill	10776	CY	25	269,397
	Clean fill (contingency)	0	CY	25	-
	Top soil	1324	CY	30	39,723
	Top soil (contingency)	0	CY	30	-
	Top soil (suitable swale soil)	0	CY	40	-
	Asphalt/Concrete Road/Driveway/Curb Restoration	0	SY	12.00	-
	Seeding/revegetation of swale	0.0	Acres	1,875	-
	MISCELLANEOUS				
	Pre-Design Investigation	1	LS	100,000	100,000
	Wetland Identification	0	LS	10,000	-
	Misc. Disposal	1	LS	15,000	15,000
	Health and Safety Oversight	6	MO	15,000	90,000

Subtotal	$	3,641,982
Contingency (20%)	$	728,400
Engineering (10%)	$	364,200
Legal and Administrative (5%)	$	182,100
Grand Total	**$**	**4,916,682**

Assumptions
1. Clearing and grading assumes all areas need to be cleared
2. Silt fence installed around each excavation area for erosion and sediment control
3. Dewatering volumes do not include infiltration into excavation areas; assumes 25% porosity
4. Depth of water table in excavation areas other than swale areas: 5 feet bgs
5. Swale areas include SED-05 and any locations to the north.
6. Water at ground surface in swale areas.
7. Surface soil excavations to 2 ft. bgs
8. Sheet piling needed for all subsurface soil excavation areas
9. Post excavation sampling - 1 sample per 30 LF sidewall, 1 sample per 900 sf excavation bottom
10. Concrete tonnage based on 2.0 tons/cy unit weight
11. All soil non-hazardous for disposal purposes
12. Unit weight of excavated soil: 1.5 tons/cy
13. Top 6 inches restored with topsoil/seeding for all areas
14. No wetland restoration
15. Topsoil (suitable swale soil) used as backfill in swale area
16. All excavated soil transported off-site for disposal
17. Asphalt/concrete roads, driveways, and curbs are restored with 6 inches of concrete or asphaltic concrete

TABLE C-7
ALTERNATIVE S-5 (OFF-SITE)
CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	MOBILIZATION/DEMOBILIZATION				
	Mobilization	1	LS	120,000	120,000
	SITE PREPARATION				
	Clearing and grading	13525	SY	1.00	13,525
	Debris Removal (Spoil piles)	800	CY	5.00	4,000
	Debris Removal (Spoil Pile for contingency excavation)	2000	CY	5.00	10,000
	Asphalt/Concrete Road/Driveway/Curb Removal	4300	SF	4.00	17,200
	SUPPORT FACILITIES				
	Office trailers	1	LS	120,000	120,000
	Decon trailer	1	LS	80,000	80,000
	EROSION & SEDIMENT CONTROL				
	Silt Fence & Installation	4219	LF	10	42,190
	Silt Fence & Installation (contingency)	500	LF	10	5,000
	EXCAVATION				
	Concrete Holder Slab Removal	0	CY	40	-
	Soil Excavation (above water table)	16,000	CY	20	320,000
	Soil Excavation (below water table)	43,500	CY	60	2,610,000
	Contingency Soil Excavation (above water table)	3400	CY	20	68,000
	Contingency Soil Excavation (below water table)	7800	CY	60	468,000
	Material Handling	59500	CY	4	238,000
	Material Handling (contingency)	11200	CY	4	44,800
	Sheet Piling	4099	LF	300	1,229,700
	Sheet Piling (for contingency soil excavation)	500	LF	300	150,000
	POST EXCAVATION SAMPLING				
	Post-excavation sampling	255	EA	450	114,784
	Post-excavation sampling (contingency)	33	EA	450	15,065
	OFF-SITE TREATMENT & DISPOSAL				
	Concrete from holders	0	Ton	125	-
	Concrete/asphalt from roads/driveways/curbs	38700	Ton	70	2,709,000
	Non-hazardous soil	89250	Ton	100	8,925,000
	Non-hazardous soil (from contingency excavation)	16800	Ton	100	1,680,000
	Hazardous soil	0	Ton	280	-
	Dewatering water treatment	2,196,750	Gal	1.00	2,196,750
	Dewatering water treatment (from contingency excavation)	393,900	Gal	1.00	393,900
	SITE RESTORATION				
	Clean fill	57526	CY	25	1,438,149
	Clean fill (contingency)	10920	CY	25	272,995
	Top soil	1543	CY	30	46,301
	Top soil (contingency)	280	CY	30	8,406
	Top soil (suitable swale soil)	431	CY	40	17,227
	Asphalt/Concrete Road/Driveway/Curb Restoration	4300	SF	12.00	51,600
	Seeding/revegetation of swale	0.5	Acres	1,875	1,001
	MISCELLANEOUS				
	Pre-Design Investigation	1	LS	150,000	150,000
	Wetland Identification	1	LS	10,000	10,000
	Misc. Disposal	1	LS	3,750	10,000
	Health and Safety Oversight	24	MO	7,500	180,000
				Subtotal	$ 23,760,593
				Contingency (20%)	$ 4,752,100
				Engineering (10%)	$ 2,376,100
				Legal and Administrative (5%)	$ 1,188,000
				Grand Total	**$ 32,076,793**

Assumptions
1. Clearing and grading assumes all areas need to be cleared
2. Silt fence installed around each excavation area for erosion and sediment control
3. Dewatering volumes do not include infiltration into excavation areas; assumes 25% porosity
4. Depth of water table in excavation areas other than swale areas: 5 feet bgs
5. Swale areas include SED-05 and any locations to the north.
6. Water at ground surface in swale areas
7. Surface soil excavations to 2 ft. bgs
8. Sheet piling needed for all subsurface soil excavation areas
9. Post excavation sampling - 1 sample per 30 LF sidewall, 1 sample per 900 sf excavation bottom
10. Concrete tonnage based on 2.0 tons/cy unit weight
11. All soil non-hazardous for disposal purposes
12. Unit weight of excavated soil: 1.5 tons/cy
13. Top 6 inches restored with topsoil/seeding for all areas
14. No wetland restoration
15. Topsoil (suitable swale soil) used as backfill in swale area
16. All excavated soil transported off-site for disposal
17. Asphalt/concrete roads, driveways, and curbs are restored with 6 inches of concrete or asphaltic concrete

TABLE C-8
ALTERNATIVE GW-2
CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	ADMINISTRATIVE ACTIONS				
	Institutional Controls	1	LS	20,000	20,000
				Subtotal	$ 20,000
				Contingency (20%)	$ 4,000
				Engineering (N/A)	$ -
				Legal and Administrative (10%)	$ 2,000
				Grand Total	**$ 26,000**

Notes:
1) Institutional Controls implemented for Site and area just east of Site,near MW-10

TABLE C-9
ALTERNATIVE GW-3
CAPITAL COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Cost
	ADMINISTRATIVE ACTIONS				
	Institutional Controls	1	LS	20,000	20,000
	MONITORING NETWORK				
	System Design: Establishment of Monitoring Network and Protocols	1	EA	7,500	7,500
				Subtotal	$ 52,250
				Contingency (20%)	$ 10,500
				Engineering (N/A)	$ -
				Legal and Administrative (10%)	$ 5,200
				Grand Total	**$ 67,950**

Notes and Assumptions:
1.) No new monitoring wells added to monitoring network

TABLE C-10
ALTERNATIVE S-2
OPERATION AND MAINTENANCE COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	MISCELLANEOUS				
	Maintenance	-	% of Capital	-	-
	Contingency	-	% of O&M	-	-
	5-year reviews	6	EA	20,000	N/A
			Annual O&M (excl. 5-yr reviews)		$ -
			Project duration (years)		30
			Interest rate		5%
			NPV Annual O&M		$ -
			NPV Reviews		$ 55,600
			Total NPV O&M		**$ 55,600**

Assumptions:
1) Periodic reviews would occur every five years.

TABLE C-11
ALTERNATIVE S-3 (ON-SITE)
OPERATION AND MAINTENANCE COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	MISCELLANEOUS				
	Maintenance	10%	% of Capital	33,069	3,300
	Contingency	-	% of O&M	3,300	-
	5-year reviews	6	EA	20,000	N/A

Annual O&M (excl. 5-yr reviews)	$ 3,300
Project duration (years)	30
Interest rate	5%
NPV Annual O&M	$ 50,700
NPV Reviews	$ 55,600
Total NPV O&M	**$ 106,300**

Assumptions:
1) Periodic reviews would occur every five years.

TABLE C-12
ALTERNATIVE S-3 (OFF-SITE)
OPERATION AND MAINTENANCE COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	MISCELLANEOUS				
	Maintenance	-	% of Capital	-	-
	Contingency	-	% of O&M	-	-
	5-year reviews	6	EA	20,000	N/A

Annual O&M (excl. 5-yr reviews)	$ -
Project duration (years)	30
Interest rate	5%
NPV Annual O&M	$ -
NPV Reviews	$ 55,600
Total NPV O&M	**$ 55,600**

Assumptions:
1) Periodic reviews would occur every five years.

TABLE C-13
ALTERNATIVE S-4 (ON-SITE)
OPERATION AND MAINTENANCE COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	MISCELLANEOUS				
	Maintenance	10%	% of Capital	58,033	5,800
	Contingency	-	% of O&M	5,800	-
	5-year reviews	6	EA	20,000	N/A
			Annual O&M (excl. 5-yr reviews)		$ 5,800
			Project duration (years)		30
			Interest rate		5%
			NPV Annual O&M		$ 89,200
			NPV Reviews		$ 55,600
			Total NPV O&M		**$ 144,800**

Assumptions:
1) Periodic reviews would occur every five years.

TABLE C-14
ALTERNATIVE S-4 (OFF-SITE)
OPERATION AND MAINTENANCE COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	MISCELLANEOUS				
	Maintenance	-	% of Capital	-	-
	Contingency	-	% of O&M	-	-
	5-year reviews	6	EA	20,000	N/A
				Annual O&M (excl. 5-yr reviews)	$ -
				Project duration (years)	30
				Interest rate	5%
				NPV Annual O&M	$ -
				NPV Reviews	$ 55,600
				Total NPV O&M	**$ 55,600**

Assumptions:
1) Periodic reviews would occur every five years.

TABLE C-15
ALTERNATIVE GW-2
OPERATION AND MAINTENANCE COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	MISCELLANEOUS				
	5-year reviews	6	EA	20,000	N/A
				Annual O&M (excl. 5-yr reviews)	$ -
				Project duration (years)	30
				Interest rate	5%
				NPV Annual O&M	$ -
				NPV Reviews	$ 55,600
				Total NPV O&M	**$ 55,600**

Assumptions:
1) Periodic reviews would occur every five years.

TABLE C-16
ALTERNATIVE GW-3
OPERATION AND MAINTENANCE COST ESTIMATE

Item #	Description	Estimated Quantity	Unit of Measure	Unit Cost (material and labor)	Estimated Annual Cost
	MONITORING				
	Groundwater sampling (labor)	80	hr/yr	80	6,400
	Groundwater analysis	24	/yr	500	12,000
	Data Analysis/Reporting	1	/yr	10,000	10,000
	MISCELLANEOUS				
	5-year reviews	6	EA	20,000	N/A
				Annual O&M (excl. 5-yr reviews)	$ 28,400
				Project duration (years)	5
				Interest rate	5%
				NPV Annual O&M	$ 123,000
				NPV Reviews	$ 55,600
				Total NPV O&M	**$ 178,600**

Notes and Assumptions:
1. Monitoring and sampling would be performed until clean-up levels are achieved- this is assumed to be long-term for cost estimate purposes
2. Up to 10 wells would be monitored semi-annually for up to 5 years, after which monitoring will no longer be required.
3. Two people for two 10-hr days to complete monitoring (biannually) of 10 wells
4. Periodic reviews would occur every five years.