Little Falls (Mill Street) Non-Owned Former MGP Site

LITTLE FALLS, HERKIMER COUNTY, NEW YORK

Site Management Plan

NYSDEC Site Number: V00470

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SITE MANAGEMENT PLAN

1.0 INTRODUCTION AND DESCRIPTION OF REMEDIAL PROGRAM

1.1 INTRODUCTION

This Site Management Plan (SMP) is required as an element of the remedial program for the Little Falls (Mill Street) non-owned former manufactured gas plant (MGP) Site (hereinafter referred to as the "Site") under the New York State (NYS) Voluntary Cleanup Program (VCP) administered by New York State Department of Environmental Conservation (NYSDEC). The Site was remediated in accordance with the requirements of a multi-site Voluntary Consent Order (VCO Index # D0-0001-011, Site # V00470) between National Grid and the NYSDEC and the NYSDEC-approved *Remedial Action Work Plan* (RAWP) prepared by ARCADIS (December 2007).

1.1.1 General

As part of the multi-site VCO between National Grid and the NYSDEC, National Grid was listed as a responsible party for the Site and was required to investigate and remediate impacted media present in portions of an approximately 6.5 acre property located in Little Falls, Herkimer County, New York. The property is currently owned by Feldmeier Equipment, Inc. (Feldmeier). A Site location map is presented as Figure 1. The layout of the Site and the locations of former MGP operations are shown on Figure 2.

In support of a potential property transfer between SPX Corporation and Feldmeier, several previous investigations (including Phase I and Phase II environmental site assessments [ESAs] and Voluntary Cleanup Program [VCP] investigations) were completed at the current Feldmeier property beginning in 1997. The previous investigation activities were conducted in accordance with a Voluntary Cleanup Agreement (VCA) (Index No. D6-0001-99-11) between SPX Corporation, Feldmeier, and the NYSDEC (NYSDEC 2000). While implementing the Phase I and Phase II investigation activities, suspected MGP-related impacts were identified in the immediate vicinity of former MGP-related operations that historically occurred at the property.

As a result of suspected MGP-related impacts that were identified by the property transfer-related investigation efforts, the Little Falls (Mill Street) non-owned site was included under National Grid's multi-site VCO with the NYSDEC. The NYSDEC has agreed to recognize the eastern property line of parcel Lot 21 as the line of demarcation between the area subject to remedial activities conducted by National Grid and the portion of the property to be addressed by SPX Corporation and Feldmeier under the separate VCA with the NYSDEC. This SMP only applies to the portion of the property west of the line of demarcation, including Tax Parcel No. 114.68-7-54 and the western portion of Property Tax Parcel No. 115.061-1-90 (up to the eastern edge of historic Lot 21). The line of demarcation and the boundaries of the area subject to this SMP are shown in Figure 2.

National Grid completed remedial actions based on the results of previous site investigations and the current and anticipated future use(s) of the Site. The remedial actions are described in further detail below and in the RAWP. After completion of the remedial actions, MGP-related residuals (including impacted subsurface soil, groundwater, and the potential presence of dense non-aqueous phase liquids [DNAPL]) remain in subsurface media at the site. This SMP was prepared to manage remaining MGP-related residuals at the Site until a deed restriction (Appendix A) is no longer required in accordance with ECL Article 71, Title 36. All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State.

This SMP was prepared by ARCADIS of New York, Inc. (ARCADIS), on behalf of National Grid, in accordance with the requirements in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated December 2002 and revised in November 2009, and the guidelines provided by NYSDEC. This SMP addresses the means for implementing Institutional Controls/Engineering Controls (ICs/ECs) that are required by the deed restriction for the Site.

1.1.2 Purpose

MGP-related residuals remain in subsurface media at the Site following completion of the remedial action. ECs have been incorporated into the site remedy to control exposure to remaining impacts during the use of the Site to ensure protection of public health and the environment. A deed restriction granted to the NYSDEC, and recorded with the Herkimer County Clerk, will require compliance with this SMP and all ICs/ECs placed on the Site. The ICs place restrictions on site use, and mandate operation, maintenance, monitoring and reporting measures for ICs/ECs. This SMP specifies the methods necessary to maintain compliance with ICs/ECs required by the deed restriction for MGP-related residuals that remain at the Site. This SMP has been approved by the NYSDEC, and compliance with this SMP is required by the grantor of the deed restriction and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

This SMP provides a detailed description of procedures required to manage remaining MGP-related residuals at the Site after completion of the remedial action, including: (1) implementation and management of all ICs/ECs; (2) periodic monitoring of groundwater and non-aqueous phase liquids (NAPL); and (3) performance of periodic inspections, certification of results, and submittal of Annual Review Reports.

To address these needs, this SMP includes two plans: (1) an Engineering and Institutional Control Plan (EICP) for implementation and management of ECs and ICs; and (2) a Monitoring Plan (MP) for implementation of site monitoring. An Operation and

Maintenance Plan for implementation of remedial collection, containment, treatment, and recovery systems is not required for this SMP, as there are no treatment systems included under the remediation of the Site.

This SMP also includes a description of Annual Review Reports for the periodic submittal of data, information, recommendations, and certifications to NYSDEC.

It is important to note the following:

- This SMP details the site-specific implementation procedures that are required by the deed restriction. National Grid does not maintain a continued presence at this Site. It will ultimately be the responsibility of Feldmeier to identify when ICs/ECs are required pursuant to this SMP and to notify National Grid prior to disturbing remaining MGP-related residuals at the Site. Failure to properly implement the SMP is a violation of the deed restriction, which is grounds for revocation of the Certificate of Completion.

- Failure to comply with this SMP is also a violation of Environmental Conservation Law contained in Title 6 of the Official Compilation of Codes, Rules, and Regulations of the State of New York (6 NYCRR) Part 375 and the VCO (Index #D0-0000-0011; Site #V00470) for the Site.

1.1.3 Revisions

Revisions to this SMP will be proposed in writing to the NYSDEC's project manager. In accordance with the deed restriction for the Site, the NYSDEC will provide a notice of any approved changes to this SMP, and append these notices to the SMP that is retained in its files.

1.2 SITE BACKGROUND

1.2.1 Site Location and Description

The Site is located on the western portion of an approximately 6.5 acre property (currently owned by Feldmeier) located south of East Mill Street in Little Falls, Herkimer County, New York. As shown on Figure 2, the Site is located north of the Mohawk River, east of George Lumber and Building Materials Company (George Lumber), south of East Mill Street, and west of the line of demarcation. The Site is located on the western portion of the approximately 6.5 acre property and is occupied by a paved parking lot and the western portion of a tank manufacturing building owned by Feldmeier. Some grass and vegetated areas are present along the margins of the parking lot and in the area south of the tank manufacturing building along the bank of the Mohawk River. This SMP only applies to the portion of the Feldmeier-owned property located west of the line of demarcation shown on Figure 2.

1.2.2 Site History

Historical MGP operations at the site were primarily conducted within a small (approximately 0.56-acre) area in the central portion of the Site. Historical MGP operations were conducted from approximately 1853 to approximately 1907. Based on available Sanborn Fire Insurance Maps, buildings and structures associated with the former MGP operation included a coal storage shed, horizontal retorts, gas purifiers, maintenance shops, a warehouse, and several smaller unnamed buildings/structures. The buildings and structures were primarily located within the western portion of the footprint of the Feldmeier manufacturing building. The Sanborn Maps show that one 50,000-cubic-foot gas holder (the former onsite gas holder) was formerly located adjacent to the Mohawk River, south of the gas works. The Sanborn Maps indicate that approximately 60% of the former onsite gas holder is located beneath the southwest corner of the tank manufacturing building. The Sanborn Maps also indicate that a second gas holder (the former offsite gas holder) was constructed between 1884 and 1891 in the southeast corner of the current George Lumber Property. The layout of historical MGP structures at the site is shown on Figure 2.

Feldmeier purchased the property from SPX Corporation in 2004. In support of the property transfer, several investigations were completed at the property beginning in 1997. A Phase II ESA identified suspected MGP-related impacts in the vicinity of historical MGP operations at the Site. As a result of the suspected MGP-related impacts identified at the property, National Grid implemented a Site Characterization Investigation and a Remedial Investigation (RI) at the Site under the multi-site VCO with the NYSDEC. As previously mentioned, the NYSDEC has agreed to recognize the eastern property line of parcel Lot 21 (shown on Figure 2) as the line of demarcation between the area subject to remedial activities conducted by National Grid and the portion of the property to be addressed by SPX Corporation and Feldmeier under the separate VCA with the NYSDEC. Previous investigations that have been conducted at the Feldmeier property, including within the limits of the historical MGP operation at the Site, include the following:

- Phase I ESA conducted by Delta Environmental Consultants, Inc. (Delta Environmental) in 1997.
- Phase I ESA conducted by Buck Engineering, LLC (Buck Engineering) in 1998.
- Phase II ESA conducted by Delta Environmental in 1998.
- VCP investigation and supplemental VCP investigations conducted by Buck in 2000, 2001, and 2002.
- Site Characterization Investigation conducted by Foster Wheeler Environmental Corporation in 2002.
- Remedial Investigation conducted by ARCADIS between 2004 and 2006.

1.2.3 Geologic Conditions

The Site is located in the Mohawk River Valley. The United States Department of Agriculture (USDA) Soil Conservation Service document entitled, Soil Survey of Herkimer County, Southern Section (USDA, 1975) identifies surface soil in the vicinity of the Site as cut and fill land (Cu). This soil designation indicates that native soil in the area has been extensively reworked and that imported fill may have been used for Site grading. Fill material was encountered during previous investigations at the Site ranges in depth between 2.3 and 26 feet below grade. The fill material consists of a mixture of sand, silt, gravel, and refuse (e.g., brick, concrete, glass, cinders, wood and slag). In general, the fill unit increases in thickness from north to south across the Site. Alluvium was encountered at a majority of the soil borings installed at the Site, with thicknesses ranging from approximately 0.6 feet to 10 feet. Gneiss bedrock is exposed in several rock outcrops along the banks of the Mohawk River near the Site, and bedrock was encountered during previous Site investigations at depths ranging from 2 feet below ground surface (bgs) (in the northern portion of the Site) to 28.3 feet bgs (in the southwest portion of the Site). The bedrock surface beneath the Site consists of several heterogeneities and undulations. A cross section location map is included as Figure 3, and generalized cross sections are included as Figures 4 and 5.

The groundwater table beneath the Site was encountered at depths ranging from approximately 7.5 to 20 feet below grade during previous investigations. Groundwater was generally encountered within the fill unit or the relatively thin layer of alluvial overburden that overlies the bedrock. Groundwater within overburden near the Site, although locally distorted due to heterogeneities in the top of bedrock, generally flows in a south-southeast direction discharging to the Mohawk River. Because of its nominal thickness, the alluvium overlying bedrock is not likely to yield substantial water. Groundwater at and in the vicinity of the Site is not used for potable water. Groundwater flow patterns in the vicinity of the site are shown on the potentiometric surface contour map included as Figure 6.

1.3 SUMMARY OF REMEDIAL INVESTIGATION FINDINGS

A Remedial Investigation (RI) was performed to characterize the nature and extent of impacts at the Site. The results of the RI are described in detail in the Remedial Investigation Report (ARCADIS, 2005) (RI Report).

Generally, the RI determined that MGP-related impacts are localized to the vicinity of the former onsite gas holder and the area immediately west of and beneath the tank manufacturing building. The results of the RI and previous Site investigations indicate that MGP-related impacts do not appear to be a significant concern in areas located west of the former MGP operation (including in the vicinity of the former offsite gas holder). The highest concentrations of Benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds and polynuclear aromatic hydrocarbons (PAHs) in subsurface soil and groundwater samples were localized to the locations of the former onsite gas holder. Significant MGP-related impacts were not encountered at the former offsite gas holder.

Although select PAHs were detected in surface soil samples at concentrations exceeding NYSDEC-recommended soil cleanup objectives, there is no evidence to suggest that the detected PAH concentrations are associated with the former MGP operations at the Site.

Soil gas investigation results indicate that MGP-related impacts encountered beneath the tank manufacturing building do not appear to represent a source for migration of volatilized MGP-related constituents to indoor air within the tank manufacturing building.

While BETX and PAHs were detected in sediment samples at concentrations that exceed sediment screening levels detailed in the January 25, 1999 NYSDEC document entitled "Technical Guidance for Screening Contaminated Sediments," the overall scarcity of sediment and the limited distribution of sediment deposits mitigate the impacts.

A detailed summary of the results for the RI and other previous investigations is presented in the RI Report. In general, the results of the RI and other previous Site investigations indicate the following:

<u>Soil</u>

- MGP-related impacts appear to be localized to the vicinity of the former onsite gas holder, the area beneath the tank manufacturing building, and the area immediately south and west of the tank manufacturing building.

- BTEX and PAHs are commonly associated with historical MGP operations (as well as certain manufacturing operations) and these constituents have been used to indicate the presence and extent of MGP-related impacts. The highest concentrations of BTEX and PAHs have been detected in soil samples collected in the vicinity of the former onsite gas holder.

- Elevated BTEX and PAH concentrations have also been identified at soil boring locations F-SB-21, F-SB-23, and F-SB-24 located within and immediately west of the tank manufacturing building.

- Visible MGP impacts were reportedly encountered in test pits excavated in the vicinity of the former onsite gas holder and at specific locations in the area thought to be associated with a former underground "MGP pipe gallery" located west of the tank manufacturing building.

- Visible MGP impacts were noted at depths of approximately 10 to 13 feet bgs in test pits excavated within the "MGP pipe gallery" area. Soil samples were collected from the test pits and submitted for laboratory analyses for BTEX and PAHs. BTEX concentrations in soil samples ranged from undetected to 0.13 parts per million (ppm). Total PAH concentrations in soil samples ranged from 1.7 (estimated) to 310 (estimated) ppm.

- Site investigations indicate that MGP-related impacts do not appear to be a significant concern in areas located in the western portion of the Site (including in the vicinity of the former offsite gas holder).

- With the exception of two locations (boring location F-SB-22 and monitoring well location MW-101R) in the vicinity of the former onsite gas holder, bedrock beneath the Site appears generally unaffected by MGP-related materials. Evidence of potential MGP-related sheens were encountered within fractured bedrock at soil boring location F-SB-22. Measurable thicknesses of dense non-aqueous phase liquid (DNAPL) were encountered in bedrock at monitoring well location MW-101R. However, MGP-related impacts were not observed in bedrock at nearby monitoring well locations MW-101RD, MW-102R, and MW-103R installed along the northern bank of the Mohawk River (with the exception of a slight sheen observed at 27 feet bgs in bedrock at monitoring well location MW-101RD).

- Low-level concentrations of PAHs were detected in the surface soil samples.

- Inorganic constituents were detected in surface and subsurface soil samples at concentrations exceeding NYSDEC-recommended soil cleanup objectives. The presence of the detected inorganic constituents does not appear to be linked to former MGP operations at the Site.

Surface and subsurface soil analytical data is presented in Tables 1 through 3. Total BTEX and PAH concentrations in surface and subsurface soil samples collected at the Site are shown on Figure 7.

Groundwater

- The highest concentrations of BTEX and PAHs have been detected in groundwater samples collected in the vicinity of the former onsite gas holder.

- Several chlorinated volatile organic compounds (CVOCs), which are not related to historical MGP operations at the site, were identified in groundwater samples collected from bedrock monitoring well locations MW-101RD and MW-103R at concentrations exceeding NYSDEC Technical and Operational Guidance Series (dated June 1998, updated April 2000 and June 2004) (TOGS 1.1.1).

Groundwater analytical data is presented in Table 4. Groundwater sampling locations and analytical results are also shown on Figure 8.

Site-Related Soil Vapor Intrusion (SVI)

- Soil gas beneath the tank manufacturing building does not appear to represent a potential source for migration of volatilized MGP-related constituents to indoor air within the tank manufacturing building.

- The NYSDEC issued a June 1, 2006 letter to National Grid indicating that no further action is required by National Grid related to the investigation and/or remediation of soil gas at the Site.

Soil gas analytical data is presented in Table 5 and also shown on Figure 9.

Sediment

- Sediment probing within the Mohawk River adjacent to and downgradient from the former MGP Site indicates that sediment is only present in limited isolated deposits that consist of a thin layer of coarse material.

- PAH compounds were detected in sediment samples at concentrations that exceed NYSDEC sediment screening criteria.

Sediment analytical data is included as Table 6. Sediment sampling locations and total BTEX and PAH concentrations detected in sediment samples are shown on Figure 10.

1.4 SUMMARY OF REMEDIAL ACTIONS

The Site was remediated during the summer of 2009 in accordance with the NYSDEC-approved RAWP. Remedial activities implemented at the site included:

1. Excavation of subsurface piping and potentially impacted soil associated with the former “MGP pipe gallery”, to approximately 8 feet bgs.

2. In-situ stabilization/jet grouting (ISS/JG) of accessible impacted subsurface soil in the vicinity of the former onsite gas holder to depths ranging from 2.8 to 24.2 feet bgs

3. Construction and maintenance of a soil cover system consisting of clean backfill, gravel, and asphalt pavement in areas disturbed by remedial activities to prevent human exposure to remaining impacted soil remaining at the Site.

4. Installation of three passive recovery wells (RW-1, RW-2, and RW-3) downgradient of the former onsite gas holder to recover DNAPL.

The above-referenced remedial activities are further described below.

1.4.1 Removal of Subsurface Piping and Potentially Impacted Soil

Subsurface piping associated with a former “MGP pipe gallery” and potentially impacted soil in the immediate vicinity of the piping was removed from the Site. The removal effort focused on two 4-inch diameter pipes that were identified at the west end of test pit F-TP-1 at a depth of approximately 6 feet bgs and soil adjacent to the pipes. The excavation was limited by site conditions (bedrock and groundwater) and by existing facilities, structures, and ongoing operations at the Site. A total of approximately 120 cubic yards (CY) of soil was excavated and transported offsite for disposal as a non-hazardous waste in accordance with applicable rules and regulations. Remnants of subsurface piping, foundations, and other miscellaneous debris were encountered within the excavation. However, no visual staining, odors, or other obvious MGP-related impacts were encountered within the excavation. The extent of the soil excavation effort is shown in Figure 11.

1.4.2 In-Situ Soil Treatment and DNAPL Recovery Wells

Visually impacted subsurface soil in the vicinity of the former onsite gas holder at the Site was stabilized via ISS and jet grouting methods. A figure showing areas where ISS/jet grouting was performed is shown in Figure 11. ISS soil mixing was the primary method of in-situ treatment and was performed utilizing a 10% cement/0.5% bentonite reagent mix (percentage based on total soil weight). ISS columns were mixed with a 5-foot diameter auger with approximately 15% overlap of mixing columns. Prior to performing ISS treatment of soil, three existing groundwater monitoring wells within the treatment area were decommissioned (including monitoring wells FWMW-4, FWMW-6, and MW-101R) and approximately 18 inches of soil was excavated to allow for soil bulking. The actual depth of ISS treatment varied due to auger refusal at several locations. Jet grouting was used to treat soil located immediately adjacent to subsurface structures, underground utilities, and as an alternative treatment method in areas where ISS treatment was not successful. Jet grouting was performed utilizing a 10% cement/4.29% blast furnace slag/0.5% bentonite reagent mix. The depth of soil subject to treatment was based on the depth to bedrock, observed soil impacts, and the floor of the former onsite gas holder structure. A total of approximately 260 cubic yards (CY) of soil was treated via ISS mixing and the remaining soil volume was treated using JG methods. The layout of the ISS/jet grouting columns and the depth of treatment at each column is show on Figure 12.

Following ISS treatment, site restoration activities were completed and three passive DNAPL recovery wells were installed upgradient and downgradient of the ISS treatment area to potentially recover any mobile DNAPL remaining in vicinity of the former onsite gas holder. The DNAPL recovery wells were constructed to depths ranging from 20.5 feet to 34.5 feet in the area south of the former onsite gas holder where DNAPL was observed near the bedrock interface and in upper bedrock fractures. The wells were constructed of 4-inch diameter steel casings with slotted wells screens and a collection sump installed in competent bedrock. The passive DNAPL recovery well locations are shown in Figure 11.

1.4.3 Remaining MGP-Related Residuals

The location and extent of MGP-related residuals remaining at the Site following the implementation of remedial activities is discussed below.

Surface Soil

The remedial activities implemented at the Site did not address surface soil. Approximately 18 inches of surface and shallow subsurface soil (including surface soil sampling location SS-103) was excavated within the ISS/JG treatment area south and west of the tank manufacturing building to facilitate implementation of treatment efforts. Total PAHs and inorganic constituent concentrations that remain in surface soil at the Site are presented in Table 1 and shown on Figure 7 (with the exception of SS-103 which was removed as discussed above).

Subsurface Soil

The remedial activities implemented at the Site did not significantly change the concentrations or extent of total BTEX and PAHs in subsurface soil. The soil excavation activities in the "MGP pipe gallery" area were implemented to address visible MGP-residuals and no pre-excavation soil sampling was conducted in the excavation area (the excavated soil was disposed of as non-hazardous waste based on post-excavation waste characterization sampling). The ISS and JG treatment efforts addressed locations where elevated total BTEX and PAHs were encountered in the area south and west of the tank manufacturing building. Soil samples within the ISS/JG treatment zone are indicated on Figure 7. Although the mobility of constituents within the treated soil matrix would be greatly reduced, the elevated BTEX and PAH concentrations remain within the treated soil.

Soil containing PAHs at concentrations exceeding the industrial use SCOs presented in 6NYCRR Part 375 are primarily encountered beneath the footprint of the Feldmeier tank manufacturing building and in the vicinity of the former onsite gas holder located at the southwestern corner of the building. Lower concentrations of total PAHs are also present in subsurface soil the vicinity of the former offsite gas holder located on the western Site boundary.

Remaining subsurface concentrations of total BTEX and PAHs are listed in Table 7 and shown on Figure 7. Concentrations of inorganic constituents in remaining subsurface soil at the site are presented in Table 8.

Visible evidence of MGP-related residuals (NAPL) was encountered during subsurface investigations completed in the vicinity of the former onsite gas holder and at locations immediately west of the Feldmeier tank manufacturing building. The DNAPL recovery wells were installed to monitor for potential mobility of MGP-related NAPL that may remain in locations that were inaccessible for the ISS and JG treatment, including locations beneath the manufacturing building, in close proximity to building foundations, or in areas where treatment could not be completed to target depths due to subsurface conditions.

Groundwater

The remedial activities did not address dissolved constituents in Groundwater at the site. Similar to conditions that existed prior to the remedial activities, VOCs and SVOCs remain in groundwater at concentrations exceeding NYSDEC standards/guidance values presented in TOGS 1.1.1.

The VOCs and SVOCs exceeding TOGS 1.1.1 standards/guidance values in groundwater were identified at several locations, with the highest concentrations encountered in the southeastern portion of the Site (in the vicinity of the former onsite gas holder). VOCs exceeding standards/guidance values in groundwater at the Site were also identified at lower concentrations in the southwestern portion of the Site (in the vicinity of the former offsite gas holder). Groundwater is generally encountered between approximately 10 to 16 feet bgs in the vicinity of these areas at the Site. Individual VOCs and SVOCs were detected at maximum concentrations of 520 and 720 parts per billion (ppb), respectively.

With the exception of typical mineral constituents that would be expected in turbid shallow groundwater samples (i.e., iron, magnesium, manganese, and sodium), chromium (detected in groundwater sample MW-103R at 59.2 ppb, which slightly exceeds the groundwater standard of 50 ppb) was the only Target Analyte List (TAL) inorganic constituent detected at a concentration exceeding the NYSDEC groundwater standards/guidance values in TOGS 1.1.1. In addition, cyanide was detected at monitoring well location FWMW-6 at a concentration of 270 ppb which exceeds the NYSDEC groundwater standard of 200 ppb. Cyanide could potentially be related to the former MGP operations or to other industrial activities conducted at or in the vicinity of the Site. However, the remaining detected inorganic constituents in groundwater do not appear to be linked to former MGP operations at the Site.

Detected VOCs, SVOCs, and inorganic constituents in remaining groundwater at the Site are provided in Table 4 and shown on Figure 8.

Soil Vapor

The remedial activities did not address potential migration of soil vapor containing volatilized constituents into the tank manufacturing building at the Site. Soil gas analytical data is presented in Table 5 and also shown on Figure 9. The majority of the constituents identified in the soil vapor samples are not typically associated with MGP residual wastes and it is unknown whether the remaining constituents are associated with the former MGP operations or with other manufacturing activities at or in the vicinity of the Site.

Sediment

The remedial activities did not address sediment in the Mohawk River adjacent to or downgradient from the Site. As indicated by the RI results, sediment is only present in limited isolated deposits in the vicinity of the site. Sediment sampling identified PAH compounds at concentrations that exceed NYSDEC sediment screening criteria. Analytical data for remaining sediment in the vicinity of the Site is presented in Table 6 and shown on Figure 10.

2.0 ENGINEERING AND INSTITUTIONAL CONTROL PLAN

2.1 INTRODUCTION

2.1.1 General

Since impacted soil, groundwater, and DNAPL remains at the Site, ECs and ICs have been implemented to protect human health and the environment. This Engineering and Institutional Control Plan (EICP) describes the procedures for the implementation and management of ECs and ICs at the Site. This EICP is one component of the SMP and is subject to revision by NYSDEC.

2.1.2 Purpose

This plan provides:

- A description of all ECs and ICs at the Site.
- The basic implementation and intended role of each EC and IC.
- A description of the key components of the ICs set forth in the deed restriction.
- A description of the features to be evaluated during each required inspection and annual review.
- A description of plans and procedures to be followed for implementation of ECs and ICs, such as the Excavation Work Plan (provided in Appendix B) for the proper handling of remaining MGP-related impacts that may be disturbed during maintenance or redevelopment work on the Site.
- Any other provisions necessary to identify or establish methods for implementing the ECs and ICs required by the site remedy, as determined by the NYSDEC.

2.2 ENGINEERING CONTROLS

2.2.1 Engineering Control Systems

2.2.1.1 Cover System

Exposure to remaining MGP-related impacts in subsurface media at the Site is prevented by the existing Feldmeier manufacturing building and by gravel and asphalt cover in the remaining impacted onsite areas that act as a barrier layer. The extent of the cover system and the different cover system types at the Site are shown on Figure 13. Prior to the remedial activities, the Site consisted primarily of an asphalt parking area with gravel, soil, and vegetation to the south and west of the building. During the remedial activities, portions of the asphalt, gravel, soil, and vegetated areas were removed. All of the asphalt areas were restored to pre-existing conditions and additional gravel and asphalt was used to restore disturbed gravel, soil, and vegetated areas. The Excavation Work Plan outlines procedures that will be implemented in the event the cover system is breached, penetrated, or temporarily removed, and any underlying remaining impacts are disturbed. Procedures for the inspection and maintenance of this cover are provided in Section 3.4 of this SMP.

2.2.2 Criteria for Completion of Remediation

Generally, remedial processes are considered completed when effectiveness monitoring indicates that the remedy has achieved the remedial action objectives identified in the NYSDEC-approved RAWP. The framework for determining when remedial processes are complete is provided in NYSDEC DER-10.

2.2.2.1 Barrier Layer

The barrier layer (including the Feldmeier manufacturing building and the gravel/asphalt pavement cover system) is a permanent control and the quality and integrity of this system will be inspected at regular intervals as discussed in the MP.

2.2.2.2 Monitored Natural Attenuation

Groundwater monitoring activities to assess natural attenuation will continue, as determined by the NYSDEC, until residual groundwater concentrations are found to be consistently below NYSDEC standards or have become asymptotic at an acceptable level over an extended period. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional source removal, treatment and/or control measures will be evaluated.

2.3 INSTITUTIONAL CONTROLS

ICs are required by the RAWP to: (1) implement, maintain and monitor ECs; (2) prevent future exposure to remaining impacts by controlling disturbance of subsurface media; (3) prevent future exposure to remaining impacts by precluding the use of onsite groundwater for potable and industrial uses; and, (4) limit the use and development of the Site to industrial uses only. Adherence to these ICs for the Site is required by the deed restriction and will be implemented under this SMP. These ICs are:

- Compliance with the deed restriction (Appendix A) and this SMP by the Grantor (Feldmeier Equipment) and the Grantor’s successors and assigns.

- The ECs must be maintained as specified in this SMP.

- The ECs at the Site must be inspected at a frequency and in a manner defined in the SMP.

- Groundwater monitoring and other environmental/public health monitoring will be performed as defined in this SMP.

- Data and information pertinent to management of the Site must be reported at the frequency and in a manner defined in this SMP.

ICs identified in the deed restriction may not be discontinued without an amendment to or extinguishment of the deed restriction.

The Site has a series of ICs in the form of site restrictions. Adherence to these ICs is required by the deed restriction. Site restrictions include:

- The property may only be used for restricted industrial use provided that the long-term ECs and ICs included in this SMP are employed.

- The property may not be used for a higher level of use, such as unrestricted and restricted residential, or commercial use without additional remediation and amendment of the deed restriction, as approved by the NYSDEC.

- Future activities at the Site that will disturb remaining impacted material must be conducted in accordance with this SMP.

- The use of the groundwater underlying the property is prohibited without treatment rendering it safe for intended use.

- The potential for vapor intrusion must be evaluated for any buildings developed in the area noted on Figure 9, and any potential impacts that are identified must be monitored or mitigated.

- Vegetable gardens and farming on the property are prohibited.

- National Grid will submit an annual Certification Statement to the NYSDEC which certifies that: (1) controls employed at the Site are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitutes a violation or failure to comply with the SMP. The annual Certification Statement will be qualified to the extent that National Grid does not own the property and National Grid and/or National Grid's representatives are only present at the site on an intermittent basis. Although the property owner has agreed to the ECs and ICs described in this SMP, National Grid does not have direct control over the property owner or the owner's employees.

NYSDEC retains the right to access such controlled property at any time in order to evaluate the continued maintenance of any and all controls. This Certification Statement shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by a licensed New York State Professional Engineer.

2.3.1 Excavation Work Plan

The Site has been remediated for restricted industrial use. Any future intrusive work that will penetrate the cover system, or encounter or disturb the remaining impacts, including any modifications or repairs to the existing barrier layer, will be performed in compliance with the Excavation Work Plan (EWP) that is attached as Appendix B to this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) prepared for the Site. An example HASP and CAMP that cover on-going monitoring activities at the Site are presented in Appendix C and Appendix D, respectively. Prior to conducting any future work covered under the EWP, a project-specific HASP and CAMP will be submitted to the NYSDEC with the notification provided in Section B-1 of the EWP. Any intrusive construction work will be performed in compliance with the EWP, HASP and CAMP, and will be documented in the Annual Review Report (See Section 5).

The site owner and associated parties preparing the remedial documents submitted to the State, and parties performing this work, are completely responsible for the safe performance of all intrusive work, the structural integrity of excavations, proper disposal of water generated by excavation de-watering, control of runoff from open excavations, and for structures that may be affected by excavations (such as building foundations and bridge footings). The site owner is responsible for ensuring that future site development activities will not interfere with, or otherwise impair or compromise, the ECs described in this SMP.

2.3.2 Soil Vapor Intrusion Evaluation

MGP-related constituents were not detected in previous sub-slab soil vapor samples that were collected from locations within the existing Feldmeier manufacturing building. Prior to the future construction of any enclosed structures located over onsite areas where remaining subsurface MGP-related impacts and/or the potential for SVI has been identified (see Figure 9), an SVI evaluation will be performed by National Grid and/or the site owner to determine whether any mitigation measures are necessary to eliminate potential exposure to vapors in the proposed structure. Alternatively, an SVI mitigation system may be installed as an element of the building foundation without first conducting an investigation. This mitigation system will include a vapor barrier and passive sub-slab depressurization system that is capable of being converted to an active system.

Prior to conducting an SVI investigation or installing a mitigation system, a work plan will be developed and submitted to the NYSDEC and NYSDOH for approval. This work plan will be developed in accordance with the most recent NYSDOH *Guidance for*

Evaluating Vapor Intrusion in the State of New York. Measures to be employed to mitigate potential vapor intrusion will be evaluated, selected, designed, installed, and maintained based on the SVI evaluation, the NYSDOH guidance, and construction details of the proposed structure.

Preliminary (unvalidated) SVI sampling data will be forwarded to the NYSDEC and NYSDOH for initial review and interpretation. Upon validation, the final data will be transmitted to the agencies, along with a recommendation for follow-up action, if necessary. Validated SVI data generated by National Grid will be transmitted to the property owner within 30 days of validation. If any indoor air test results exceed NYSDOH guidelines, relevant NYSDOH fact sheets will be provided to all tenants and occupants of the property within 15 days of receipt of validated data.

SVI sampling results, evaluations, and follow-up actions will also be summarized in the next Annual Review Report.

2.4 INSPECTIONS AND NOTIFICATIONS

2.4.1 Inspections

Inspections of remedial components at the Site will be conducted at the frequency specified in the MP schedule. A comprehensive site-wide inspection will be conducted annually. The inspections will determine and document the following:

- Whether ECs continue to perform as designed.

- If these controls continue to be protective of human health and the environment.

- Compliance with requirements of this SMP and the deed restriction.

- Sampling and analysis of appropriate media during monitoring events.

- If site records are complete and up to date.

- Changes, or needed changes, to the monitoring system.

Inspections will be conducted in accordance with the procedures set forth in Section 3 of this SMP. Reporting requirements are outlined in Section 5 of this SMP.

If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs, an inspection of the Site will be conducted within 5 days of the event to verify the continued effectiveness of the EC/ICs implemented at the Site. Inspections will be conducted by a qualified environmental professional as approved by the NYSDEC.

2.4.2 Notifications

Notifications will be submitted by National Grid and/or the property owner to the NYSDEC as needed for the following reasons:

- 60-day advance notice of any proposed changes in site use that are required under the terms of the VCA, 6 NYCRR Part 375, and/or Environmental Conservation Law.

- 15-day advance notice of any proposed ground-intrusive activities pursuant to the Excavation Work Plan.

- Notice within 48-hours of any damage or defect to foundations or structures that reduces or has the potential to reduce the effectiveness of other ECs and likewise any action to be taken to mitigate the damage or defect.

- Notice within 48-hours of any emergency, such as a fire, flood, or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the Site, including a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing response actions shall be submitted to the NYSDEC within 45 days and shall describe and document actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the Site or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser has been provided with a copy of the VCO, and all approved work plans and reports, including this SMP.

- Within 15 days after the transfer of all or part of the Site, the new owner's name, contact representative, and contact information will be confirmed in writing.

2.5 CONTINGENCY PLAN

This Contingency Plan outlines response activities to be implemented in the event of an emergency. Emergencies may include injury to personnel, fire or explosion, environmental release, or serious weather conditions.

2.5.1 Emergency Telephone Numbers

In the event of any environmentally related situation or unplanned occurrence requiring assistance, the Owner or Owner's representative(s) should contact the appropriate party from the contact list below. For emergencies, appropriate emergency response personnel should be contacted. This emergency contact lists must be maintained in an easily accessible location at the Site.

Table 2-1: Emergency Contact Numbers

Medical Fire Police	911 or (315) 823-2233 (Ambulance) or (315) 823-1000 (Hospital) 911 or (315) 823-2233 911 or (315) 823-1122
Utility Markout/Clearance One Call Center (DigSafely NY):	(800) 962-7962 or 811 (3 day notice required for utility markout)
Poison Control Center:	(800) 222-1222
Pollution Toxic Chemical Oil Spills:	(800) 424-8802
NYSDEC Spills Hotline	(800) 457-7362

Table 2-2: Other Contact Numbers

National Grid Project Manager: James Morgan	(315) 428-3101
ARCADIS Project Manager: Michael C. Jones	(315) 446-9120
ARCADIS Task Manager: Allen J. Evans	(530) 949-7144
NYSDEC Project Manager: Bernard Franklin	(518) 402-9662
NYSDOH Project Manager: Scarlett Messier	(800) 458-1158 ext 2-7860

* Note: Contact numbers subject to change and should be updated as necessary

2.5.2 Map and Directions to Nearest Health Facility

Site Location: 525 Mill Street, Little Falls, NY 13365

Nearest Hospital Name: Little Falls Hospital

Hospital Location: 140 Burwell Street, Little Falls, NY 13365

Hospital Telephone: (315) 823-1000

Directions to the Hospital:

1. Travel West on W. Mill Street.
2. Continue on Elizabeth Street.
3. Turn Right onto Lock Street.
4. Turn Right onto W. Main Street.
5. Continue on Albany Street.
6. Bear Left on Waverly Place.
7. Turn Right onto Burwell Street.
8. Arrive at 140 Burwell Street (Little Falls Hospital).

Total Distance: 1.7 miles.

Total Estimated Time: 8 minutes.

Figure 2-1: Map of Route from the Site to the Hospital

2.5.3 Response Procedures

As appropriate, the fire department and other emergency response group will be notified immediately by telephone of the emergency. The emergency telephone number list is found at the beginning of this Contingency Plan (Table 2-1).

Spill Response Plan

Spill response procedures have been developed for responding to unplanned release of oil, products, materials, hazardous waste, etc. to soil, surface water, or groundwater. All spills of materials associated with the remaining MGP-related impacts at the site will be immediately reported to National Grid's Project Manager and the ARCADIS Project Manager (whose names and phone numbers are included in Table 2-2). In addition, reportable spills will be called in to the NYSDEC spills hotline upon discovery. Properly trained personnel will implement the following general spill response procedures (when possible):

1. *Ceasing Operation of the Affected Equipment*: This will consist of shutting off the equipment and/or closing any valves and stopping the leak, if possible.

2. *Containing the Spill*: If the spilled material is floating on a water surface, spill-absorbent pads/booms will be placed across the path of the floating spill. If the spilled material sinks below the water surface, a dam, weir, or other containment method will be used to stop the flow of the spilled material. If the spill occurs on land, a ditch, dam, or other containment unit will be constructed to stop the flow of the spilled material. Absorbent material will be applied as necessary.

3. *Cleaning Up the Spill:* Spills in water will be recovered using pumps, sorbent material, etc. as necessary until the spilled material is recovered (and no sheen or other evidence of the spill is observed on the water surface). Spills on land shall be recovered using pumps, sorbent material, and heavy equipment, as necessary until the spilled material is recovered. Other activities to be conducted during spill cleanup activities include: removing impacted soil/sorbent pads; using rags and cleaning solution to remove excess spilled material from equipment; and collecting verification samples to confirm that the impacted soil has been removed.

4. *Containerizing Spill Materials:* Spill materials, impacted soil, sorbent pads, etc. will be containerized in New York State Department of Transportation- (NYSDOT-) approved containers. The containers will be labeled with the waste type and date of accumulation in accordance with applicable regulations contained in 49 CFR Part 172. Samples will be collected to characterize the spilled materials for disposal (i.e., as a hazardous/non-hazardous waste and/or TSCA/non-TSCA waste, if necessary).

5. *Disposing of Spill Materials:* Impacted materials and spill cleanup debris will be disposed of at a facility permitted to accept the materials. National Grid and/or the property owner shall be responsible for the coordination of the disposal activities.

6. *Performing Post-Spill Maintenance:* Following cleanup of the spill, National Grid and/or the property owner will ensure that all used spill cleanup material and equipment has been disposed of or cleaned, as appropriate. If the equipment that caused the spill (if applicable) cannot be properly repaired, replacement equipment shall be obtained.

In the event that the release is of sufficient magnitude and cannot be controlled by diking, damming, absorbing, or other method, the local fire department, NYSDEC, and National Response Center shall be notified.

Evacuation Plan

Onsite personnel shall evacuate the Site via the nearest safe route and will gather at the northern-most potion of the Site near Mill Street. Attendance will be taken to verify that all onsite personnel are present. In the event of an injury to onsite personnel, emergency procedures outlined in the Health and Safety Plan should be followed. Emergency vehicles entering the Site will enter along the northern perimeter of the Site off of Mill Street.

3.0 MONITORING PLAN

3.1 INTRODUCTION

3.1.1 General

The Monitoring Plan (MP) describes the measures for evaluating the performance and effectiveness of the remedy in reducing or mitigating MGP-related impacts at the Site, the effectiveness of the cover system in controlling exposures to onsite personnel, and the DNAPL monitoring/recovery activities at the site. This MP may only be revised with the approval of NYSDEC.

3.1.2 Purpose and Schedule

This MP describes the methods to be used for:

- Monitoring groundwater quality and flow conditions.
- Monitoring DNAPL in recovery wells and attempting to recover any detected NAPL.
- Assessing compliance with applicable NYSDEC standards, criteria and guidance, particularly ambient groundwater standards.
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.
- Preparing necessary reports for monitoring activities.

To adequately address these issues, this MP provides information on:

- Fluid level monitoring procedures.
- Sampling locations, protocol, and frequency.
- Information on all designed monitoring systems (e.g., well logs).
- Analytical sampling program requirements.
- Reporting requirements.
- Quality Assurance/Quality Control (QA/QC) requirements.
- Inspection and maintenance requirements for monitoring wells.

- Monitoring well decommissioning procedures.

- Annual inspection and periodic certification.

Annual monitoring of the performance of the remedy and overall reduction in onsite impacts will be conducted for the first five years. The frequency thereafter will be determined by NYSDEC. Trends in groundwater impacts in the affected areas, will be evaluated to determine if the remedy continues to be effective in achieving remedial goals. Monitoring programs are summarized below in Table 3-1 and outlined in detail in Sections 3.2 and 3.3.

Table 3-1: Monitoring/Inspection Schedule

Monitoring Program	Frequency*	Matrix	Analysis
1	Bi-Monthly	DNAPL	Fluid Levels in recovery wells and at nearby monitoring wells
2	Annual	Groundwater	Fluid levels at all onsite monitoring wells
3	Annual	Groundwater	Sampling of all onsite monitoring wells for TCL VOCs TCL SVOCs TAL Inorganics Cyanide

1. TCL = Target Compound List.
2. TAL = Target Analyte List.
3. * The frequency of events will be conducted as specified until otherwise approved by NYSDEC and NYSDOH.

3.2 COVER SYSTEM MONITORING

The surface cover of the area subject to this SMP shall be evaluated annually and repaired as needed. Since the remaining MGP-related impacts are only encountered at depths of several feet or more below grade, the annual inspections will focus on maintaining physical separation between on-site workers and the remaining MGP-related impacts. The evaluation will include a visual inspection of the western portion of the Feldmeier manufacturing building and the asphalt/gravel cover system (shown on Figure 13) for any evidence of recent excavation/subsurface utility work, erosion or removal of cover materials (asphalt, gravel. fill, etc.), or other pathways that could potentially result in exposure of on-site workers to subsurface MGP-related impacts. National Grid will not be responsible for maintaining/repairing asphalt pavement at the Site.

Inspection of groundwater monitoring wells and DNAPL recovery wells will also be included as part of the annual inspections until the NYSDEC eliminates the monitoring obligation. The NYSDEC shall be notified of significant items (i.e., items where measures are needed to prevent contact with, or migration of, impacted soils within the Site) promptly following inspection. All observed changes shall be documented in the annual report discussed in Section 5.3. A sample Site Inspection Form is included in Appendix E. Any needed repairs shall be made promptly.

3.3 MEDIA MONITORING PROGRAM

3.3.1 Groundwater Monitoring

Groundwater monitoring will be performed on an annual basis to assess the performance of the remedy. Figure 14 identifies the wells to be sampled during monitoring activities and Table 9 summarizes monitoring well construction details. Monitoring well construction logs are included in Appendix F.

The network of monitoring wells has been installed to monitor both up-gradient and down-gradient groundwater quality and flow conditions at the Site. The network of onsite wells has been designed based on the following criteria:

- Evaluate the groundwater quality of the overburden (fill, sand, silty sand, and silt and sand) at wells which screened from depths of between 1.8 to 23.3 feet bgs, as identified on Figures 4 and 5.

- Evaluate the groundwater quality of the bedrock at wells that are completed in bedrock from depths of between 27 to 48 feet bgs, as identified on Figures 4 and 5.

- Evaluate the onsite post remedial groundwater flow pattern.

- Evaluate the post-remedial groundwater concentrations of COCs.

- Confirm that groundwater quality (VOCs, SVOCs, and inorganics [as defined in Section 3.3.1.1]) is improving and/or does not represent a significant threat to human health or the environment based on the contemplated site use.

The sampling frequency may be modified with approval from the NYSDEC. The SMP will be modified to reflect changes in sampling plans approved by NYSDEC.

Deliverables for the groundwater monitoring program are specified in Section 3.6.

3.3.1.1 Sampling Protocol

All monitoring well sampling activities will be recorded in a field book and documented on groundwater sampling field forms included in the Field Sampling Plan (FSP) presented in Appendix G. Field observations (e.g., well integrity, etc.) will be noted on the well sampling log which will serve as the inspection form for the groundwater monitoring well network.

Groundwater level measurements will be obtained from eight monitoring well locations including FWMW-1, FWMW-2, FWMW-3, FWMW-5, B-MW-3, MW-101RD, MW-102R, and MW-103R and three passive DNAPL recovery well locations including RW-1, RW-2, and RW-3 prior to collecting groundwater samples. Groundwater levels at each well will be measured to the nearest one-hundredth of a foot from the reference point at the top of the inner well casing using the procedures described in the FSP. An interface probe will also be used to determine the presence/absence of DNAPL in the well and the length of the DNAPL column will be measured to the nearest one-hundredth of a foot from the reference point at the top of the inner well casing using the procedures described in the FSP. The measurements will be converted to elevations (referenced to a site-specific datum). The groundwater elevation information will be used in conjunction with the hydraulic conductivity data (presented in the RI Report) to further evaluate horizontal groundwater flow gradients beneath the Site.

Groundwater samples will be collected from the eight monitoring wells listed above for laboratory analysis of TCL VOCs, TCL SVOCs, TAL inorganics, and cyanide. Samples will be submitted to TestAmerica Laboratories, Inc. (TestAmerica) of Shelton, Connecticut for laboratory analysis using NYSDEC Analytical Services Protocol (ASP) methods. QA/QC samples (including trip blank, field duplicates, matrix spike, and matrix spike duplicates) will be collected and submitted for laboratory analysis, as referenced in the Quality Assurance Project Plan (QAPP) presented in Appendix H.

Groundwater samples will be collected using low-flow purging and sampling techniques, as described in the FSP. Field parameters (i.e., pH, conductivity, dissolved oxygen, temperature, and turbidity) will be monitored every 3 to 5 minutes during purging (as appropriate). Groundwater samples will be collected for laboratory analysis following the stabilization of field parameters and the reduction of turbidity levels to less than 50 nephelometric turbidity units (NTUs). Field parameters will be considered to have stabilized after three consecutive readings are within the following ranges:

- pH: +/- 0.1.
- Conductivity: +/- 3%.
- Oxidation/reduction potential (ORP): +/- 10 mV.
- Dissolved oxygen: +/- 10 %.

- Turbidity: less than 50 NTUs.

If the field parameters have not stabilized after the well purging activities (and the groundwater turbidity level is less than 50 NTUs), field personnel will document the field parameters and collect the sample. If the field parameters have stabilized, but the turbidity of the groundwater exceeds the 50 NTU goal, the pump flow rate will be decreased to no more than 100 milliliters per minute (mL/min), and additional purging will be performed. The purging will continue until the 50 NTU turbidity goal is achieved or, if not possible, until reasonable effort has been made to reduce the turbidity to less than 50 NTUs. Following purging, groundwater samples will be collected from all eight wells.

3.3.1.2 Monitoring Well Repairs, Replacement And Decommissioning

If biofouling or silt accumulation occurs in the onsite monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced (as per the MP), if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning/replacement of monitoring wells, and the repair or decommissioning/replacement process will be documented in the subsequent Annual Review Report. Well decommissioning without replacement will be done only with prior approval of the NYSDEC. Well abandonment will be performed in accordance with NYSDEC's "Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be reinstalled in the nearest available location, unless otherwise approved by the NYSDEC.

3.3.2 DNAPL Monitoring/Recovery

DNAPL monitoring will be performed on a bi-monthly basis to assess the performance of the remedy. The network of onsite DNAPL recovery wells has been designed to recover potentially mobile DNAPL (if present) in the overburden (fill, sand, silty sand, and silt and sand) and bedrock, as identified on the recovery well logs included in Appendix F.

The monitoring/recovery frequency may be modified with the approval NYSDEC. The SMP will also be modified to reflect changes in monitoring/recovery plans approved by NYSDEC.

3.3.2.1 DNAPL Monitoring/Recovery Protocol

All recovery activities will be recorded in a field book. Other observations (e.g., well integrity, etc.) will be noted in the field book. Groundwater level measurements will be obtained from the three passive DNAPL recovery wells (RW-1, RW-2, and RW-3). Groundwater levels at each well will be measured to the nearest one-hundredth of a foot from the reference point at the top of the inner well casing using the procedures described in the FSP. An interface probe will also be used to determine the presence/absence of DNAPL in the well and the length of the DNAPL column will be measured to the nearest one-hundredth of a foot from the reference point at the top of the inner well casing using the procedures described in the FSP. At recovery well locations where DNAPL is identified, recovery of DNAPL will be attempted using manual methods (e.g., manual recovery, periodic pumping, etc.). Any recovered DNAPL will be stored onsite in a DNAPL accumulation drum.

3.3.2.2 Monitoring/Recovery Well Repairs, Replacement And Decommissioning

If biofouling or silt accumulation occurs in the onsite DNAPL recovery wells, the wells will be physically agitated/surged and redeveloped. Additionally, recovery wells will be properly decommissioned and replaced (as per the MP), if an event renders the wells unusable.

Repairs and/or replacement of recovery wells (where necessary) will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning/replacement of recovery wells, and the repair and decommissioning/replacement process will be documented in the subsequent Annual Review Report. Well decommissioning without replacement will be done only with prior approval of the NYSDEC. Well abandonment will be performed in accordance with NYSDEC's "Groundwater Monitoring Well Decommissioning Procedures." Recovery wells that are decommissioned because they have been rendered unusable will be reinstalled in the nearest available location, unless otherwise approved by the NYSDEC.

3.4 SITE-WIDE INSPECTION

Site-wide inspections will be performed on a regular schedule at a minimum of once a year. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an Inspection Form will be completed (Appendix E). The form will compile sufficient information to assess the following:

- Compliance with all ICs, including site usage.

- An evaluation of the condition and continued effectiveness of ECs.

- General site conditions at the time of the inspection.

- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection.

- Confirm that site records are up to date.

3.5 MONITORING QUALITY ASSURANCE/QUALITY CONTROL

All sampling and analyses will be performed in accordance with the requirements of the QAPP prepared for the Site (Appendix H). Main Components of the QAPP include:

- QA/QC Objectives for Data Measurement.

- Sampling Program Requirements, including preparation and handling of sample containers, sample holding times, and field QC requirements.

- Sample Tracking and Custody.

- Calibration Procedures for field and laboratory equipment.

- Analytical Procedures.

- Preparation of a Data Usability Summary Report (DUSR), which will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain of custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.

- Internal QC and Checks.

- QA Performance and System Audits.

- Preventative Maintenance Procedures and Schedules.

- Corrective Action Measures.

3.6 MONITORING REPORTING REQUIREMENTS

Forms and any other information generated during regular monitoring events and inspections will be kept in a central project file. All forms, and other relevant reporting formats used during the monitoring/inspection events, will be (1) subject to approval by NYSDEC and (2) submitted at the time of the Annual Review Report.

All monitoring results will be reported to NYSDEC on an annual basis in the Annual Review Report. The letter report will include, at a minimum:

- Date of event.
- Personnel conducting sampling.
- Description of the activities performed.
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc).
- Copies of all completed field forms (e.g., well sampling logs, chain-of-custody documentation, etc.).
- Sampling results in comparison to appropriate standards/criteria.
- A figure illustrating sample type and sampling locations.
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampling locations (to be submitted electronically with the Annual Review Report).
- Any observations, conclusions, or recommendations.
- A determination as to whether groundwater conditions have changed since the last reporting event.

Data will be reported in hard copy or digital format as determined by NYSDEC. A summary of the monitoring program deliverables are summarized in Table 3-2 below.

Table 3-2: Schedule of Monitoring/Inspection Reports

Task	Reporting Frequency*
Groundwater Monitoring	Annual
DNAPL Monitoring/Recovery	Annual
Site-Wide Inspection	Annual

* The frequency of events will be conducted as specified until otherwise approved by NYSDEC

4.0 OPERATION AND MAINTENANCE PLAN

4.1 INTRODUCTION

The site remedy does not rely on any mechanical systems, such as sub-slab depressurization systems or air sparge/ soil vapor extraction systems to protect public health and the environment. Therefore, the operation and maintenance of such components is not included in this SMP.

5. INSPECTIONS, REPORTING AND CERTIFICATIONS

5.1 GENERAL

This section of the SMP presents a discussion of site inspection, annual certification, and annual reporting requirements in connection with the ECs and ICs for the Site.

5.2 SITE INSPECTIONS

5.2.1 Inspection Frequency

All inspections will be conducted at the frequency specified in Section 3 of the MP. At a minimum, a site-wide inspection will be conducted annually. Inspections of remedial components will also be conducted whenever a severe condition has taken place, such as an erosion or flooding event that may affect the ECs.

5.2.2 Inspection Forms, Sampling Data, and Maintenance Reports

All inspections and monitoring events will be recorded on appropriate forms, including the Site-Wide Inspection Form included in Appendix E and the field sampling forms included in the FSP (Appendix G). These forms are subject to NYSDEC review and revision.

All applicable inspection forms and other records, including all media sampling data and system maintenance reports, generated for the Site during the reporting period will be provided in electronic format in the Periodic Review Report.

5.2.3 Evaluation of Records and Reporting

The results of the inspection and site monitoring data will be evaluated as part of the EC/IC certification to confirm that the:

- EC/ICs are in place, are performing properly, and remain effective.
- The MP is being implemented.
- The site remedy continues to be protective of public health and the environment and is performing as designed in the RAWP.

5.3 CERTIFICATION OF INSTITUTIONAL CONTROLS

Each Annual Review Report (to be prepared as discussed under Section 5.4) will include a Certification Statement signed by a licensed New York State Professional Engineer which will indicate (if applicable):

- The ICs employed at this Site are unchanged from the date the control were put in place, or last approved by the Department.

- Nothing has occurred that would impair the ability of the controls to protect public health and environment.

- Nothing has occurred that would constitute a violation or failure to comply with any requirements for the ICs.

- Access to the Site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of the ICs.

- Use of the Site is compliant with the deed restriction.

- The information presented in this report is accurate and complete.

- That all information and statements in this certification form are true.

The annual Certification Statement will be qualified to the extent that National Grid does not own the property and National Grid and/or National Grid's representatives are only present at the site on an intermittent basis. Although the property owner has agreed to the ECs and ICs described in this SMP, National Grid does not have direct control over the property owner or the owner's employees. The signed Certification Statement will be included in the Periodic Review Report described below in Section 5.4.

5.4 ANNUAL REVIEW REPORT

An Annual Review Report will be submitted to the Department every year, beginning eighteen months after the Certificate of Completion or equivalent document (e.g., Satisfactory Completion Letter) is issued. In the event that the Site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the entire Site. The report will be prepared in accordance with NYSDEC DER-10 and submitted within 45 days of the end of each certification period. Media sampling results will also incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the Site.

- Results of the required annual site inspections and severe condition inspections, if applicable.

- All applicable inspection forms and other records generated for the Site during the reporting period in electronic format.

- Data summary tables and graphical representations of potential COCs by media (groundwater, DNAPL), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.

- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted electronically in a NYSDEC-approved format.

- A site evaluation, which includes the following:

    - Compliance of the remedy with the requirements of the site-specific RAWP.

    - Any new conclusions or observations regarding impacted areas at the Site based on inspections or data generated by the MP.

    - Recommendations regarding any necessary changes to the remedy and/or MP.

    - The overall performance and effectiveness of the remedy.

The Annual Review Report will be submitted, in hard-copy format, to the NYSDEC Central Office and Regional Office in which the Site is located, and in electronic format to NYSDEC Central Office, Regional Office and the NYSDOH Bureau of Environmental Exposure Investigation.

5.5 CORRECTIVE MEASURES PLAN

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an EC or IC, a Corrective Measures Plan will be submitted to the NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Plan until it is approved by the NYSDEC.

Tables

TABLE 1
SURFACE SOIL ANALYTICAL RESULTS FOR TOTAL PAHs AND INORGANIC CONSTITUENTS (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID: Sample Depth(Feet):	SS-101 (0-0.5)	SS-102 (0-0.5)	SS-103 (0-0.5)
SVOCs			
Total PAHs	1.9 J	0.7 J	8.6 J
Detected Inorganic Constituents			
Aluminum	6,560	1,880	2,570
Arsenic	6.5	3.2	6.8
Barium	35.6 B	11.3 B	30 B
Beryllium	0.32 B	0.14 B	0.22 B
Cadmium	1.1 UJ	1.1 UJ	0.09 BJ
Calcium	3,920	50,100	45,100
Chromium	50.2 J	41.3 J	85.4 J
Cobalt	5.9 B	2.7 B	4 B
Copper	74.4	11.9	23.3
Iron	15,200 J	8,300 J	12,400 J
Lead	15.1 J	17 J	33.8 J
Magnesium	2,930 J	13,400 J	14,400 J
Manganese	507 J	320 J	362 J
Mercury	0.05	0.028 UJ	0.07 J
Nickel	34.1	28.2	55.3
Potassium	612 B	270 B	341 B
Vanadium	12.9	11.4	11.3
Zinc	66.8	63.3	536

Notes:

1. Surface soil samples collected by ARCADIS of New York, Inc. (ARCADIS) on October 28, 2004.
2. SVOCs = Semi-volatile organic compound.
3. PAHs = Polynuclear Aromatic Hydrocarbons.
4. Samples were analyzed by Severn Trent Laboratories, Inc. (Edison, New Jersey) for:
   - Target compound list (TCL) SVOCs using United States Environmental Protection Agency (USEPA) SW-846 Method 8270.
   - Target analyte list (TAL) inorganic constituents using USEPA SW-846 Methods 6010, 7471, and 9012.
5. Concentrations reported in parts per million (ppm) or milligrams per kilogram (mg/kg).
6. Data qualifiers are defined as follows:
   B - Indicates a value which is less than the Practical Quantitation Limit, but greater than or equal to the instrument detection limit.
   J - Indicates an estimated value. The result is less than the specified quantitation limit, but greater than or equal to the method detection limit.
   U - Compound was not detected at a concentration exceeding the laboratory detection limit. The listed value represents the laboratory detection limit.
7. Results have been validated in accordance with USEPA National Functional Guidelines of October 1999.

TABLE 2
SUBSURFACE SOIL ANALYTICAL RESULTS FOR TOTAL BTEX AND TOTAL PAHs (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Sample Location	Depth (feet)	Date	Total BTEX	Total PAHs
B-SB-3	6-6.8	4/13/2000	ND	79.8
B-SB-4	8-10	4/13/2000	ND	4.6
B-SB-5	full composite	4/14/2000	ND	99.6
D-SB-1	12-14	5/20/1998	ND	ND
D-SB-2	10-12	5/20/1998	ND	11.0
D-SB-3	12-14	5/20/1998	ND	26.9
D-SB-4	14-16	5/20/1998	ND	14.8
F-SB-15	6-8	10/2/2002	0.014 J	4.9 J
	10-12		0.004 J	347 J
	16-18		ND	0.001 J
F-SB-16	2-4	10/2/2002	0.001 J	8.8 J
	4-6	10/3/2002	0.003 J	150 J
	6-8		0.005 J	70 J
F-SB-17	8-10	10/3/2002	ND [ND]	2.6 J [28.7 J]
	12-14		0.006 J	166 J
	18-20		0.011 J	0.33 J
F-SB-18	6-8	10/4/2002	ND	20.4
	12-14		0.001 J	ND
	14-16		ND	0.047 J
F-SB-19	0-2	10/7/2002	0.005 J	0.40 J
	2-4		ND	23.0 J
F-SB-20	4-6	10/7/2002	0.005 J	12.0
	6-8	10/8/2002	0.002 J	59.7
	10-12		0.008 J	91.3
	14-14.3		2.0 J	2.6
F-SB-21	0-2	10/8/2002	0.016 J	17.2 J
	4-6		0.018 R	11.1
	6-8		0.020 J R	37.5
	8-10		0.23 J	301 J
	10-12		36.7 J	2,125 J
F-SB-22	8-10	10/9/2002	0.089 J	9,682 J
	10-12		5.2 J	2,371 J
	14-16		ND	0.45 J
	16-18		0.004 J	0.55 J
	18-19.1		0.47	6.4 J
F-SB-23	3-5	10/9/2002	0.001 J	1.8 J
	11-13		147 J	NA
	13-15		0.017	309
	15-17		25.7 J	569
F-SB-24	1-3	10/10/2002	0.014 J R	145 J
	3-5		0.005 J	33.9 J
	5-7		0.009 J	NA
	7-9		0.007 J	686
	9-10.8		0.033 J	875 J

TABLE 2
SUBSURFACE SOIL ANALYTICAL RESULTS FOR TOTAL BTEX AND TOTAL PAHs (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Sample Location	Depth (feet)	Date	Total BTEX	Total PAHs
F-SB-25	4-6	10/10/2002	0.19 J	NA
	6-8		0.018 J	1,284 J
	8-10		0.059 J	831 J
	10-12		0.007 J [0.012 J]	405 J [187 J]
	16-16.7		9.5	3,887 J
F-SB-26	0-2	10/11/2002	0.003 J	30.4 J
	4-6		0.002 J	0.87 J
	8-10		0.004 J	7.9 J
	10-12		0.001 J	14.2 J
	14-15.2		39.0 J	583 J
F-SB-27	0-2	10/11/2002	0.004 J	4.2 J
	2-4		0.005 J	4.0 J
	4-6		0.004 J	53.5 J
	10-10.2		0.001 J	45 J
F-SB-29	0-2	10/14/2002	0.016 R	7.7 J
	4-6		0.045 J R	38.5 J
	6-8		0.14 J	312 J
	8-10		0.018 J	13.6
	10-12		0.001 J	3.6 J
F-TP-01	13.5	10/7/2002	0.13	1.7 J
F-TP-02	11	10/7/2002	0.003 J	11.9 J
MW-101R	10 - 12	10/15/2004	0.009 J	788 J
	16 - 18		14.5	1,220
MW-101RD	14 - 16	1/13/2005	0.002 [0.002]	49.1 J [58.7 J]
MW-102R	10-12	10/8/2002	0.003 J	11.9 J
	18 - 22	10/19/2004	0.002 J	4.0 J
MW-103R	8 - 10	1/11/2005	0.001 J	16.8 J
	14 - 16		ND	1.9 J
SB-101	8 - 10	10/22/2004	0.012 J	44.1 J
SB-102	14 - 16	10/22/2004	ND	8.6 J
	16 - 18		ND [ND]	68 J [17 J]
SB-103	14 - 16	10/21/2004	ND	10.7 J
	16 - 18		ND	2.1 J
SB-104	4 - 6	10/28/2004	ND	1.9 J
	10 - 12		0.12 J	168 J
SB-105	2 - 4	10/29/2004	ND	33.2 J
SB-106	4.5 - 6	10/28/2004	0.007 J	98.8 J
	6 - 8		ND	5.3 J
TP-101	2-4	10/29/2004	ND	310 J
TP-102	4-6	10/29/2004	ND	21 J

TABLE 2
SUBSURFACE SOIL ANALYTICAL RESULTS FOR TOTAL BTEX AND TOTAL PAHs (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Notes:

1. Samples were collected by:
   - Delta Environmental Consultants, Inc. (Delta) in May 1998. Results based on information included in the Phase II Environmental Assessment (Delta, not dated).
   - Buck Engineering, LLC (Buck) in April 2000. Results based on information included in the Investigative Report - Voluntary Cleanup Program (Buck, September 2004).
   - Foster Wheeler Environmental Corporation in October 2002. Results based on information included in the Site Characterization Investigation Report (Foster Wheeler, July 2003).
   - ARCADIS of New York, Inc. (ARCADIS) from October 2004 to January 2005. Results based on information included in the Remedial Investigation Report (ARCADIS, July 2005).
2. Concentrations reported in parts per million (ppm) or milligrams per kilogram (mg/kg).
3. Field duplicate sample results are presented in brackets.
4. BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes (total).
5. PAHs = Polynuclear Aromatic Hydrocarbons.
6. Sample designations indicate the following:
   B - Buck Engineering Sample Location;
   D - Delta Environmental Sample Location;
   F - Foster Wheeler Sample Location;
   MW - Monitoring Well;
   SB - Soil boring;
   TP - Test pit; and
   DUP - Duplicate sample.
7. Samples collected by ARCADIS were analyzed by Severn Trent Laboratories, Inc. (Edison, New Jersey) for:
   - Target compound list (TCL) SVOCs using United States Environmental Protection Agency (USEPA) SW-846 Method 8270.
   - Target compound list (TCL) VOCs using United States Environmental Protection Agency (USEPA) SW-846 Method 8260.
8. J = Indicates an estimated value. The result is less than the specified quantitation limit, but greater than or equal to the method detection limit.
9. NA = Not analyzed.
10. ND = Compounds were not detected at a concentration exceeding the laboratory detection limit.

TABLE 3
SUBSURFACE SOIL ANALYTICAL RESULTS FOR AND INORGANIC CONSTITUENTS (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	**6 NYCRR PART 375 SCOs**		**MW-101RD**	**MW-102R**		**MW-103R**		**SB-101**
Sample Depth(Feet):	**Unrestricted**	**Industrial**	**14 - 16**	**10 - 12**	**18 - 22**	**8 - 10**	**14 - 16**	**8 - 10**
Date Collected:	**(Exceedences in bold)**	**(Exceedences shaded)**	**01/13/05**	**10/19/04**	**10/19/04**	**01/11/05**	**01/11/05**	**10/22/04**
Detected Inorganics								
Aluminum	- -	- -	5,410 [5,580]	4,150	5,360	4,610	2,720	2,940
Antimony	- -	- -	2.40 UJ [2.40 UJ]	2.20 UJ	4.60 J	2.40 UJ	2.20 UJ	2.30 U
Arsenic	13	16	4.60 [4.50]	4.60	**13.8 J**	12.5	9.90	**22.3**
Barium	350	10,000	33.7 B [35.2 B]	31.4 B	125	88.9	105	189
Beryllium	7.2	2,700	0.510 [0.510]	0.310 B	0.540 B	0.580	0.430 B	0.920
Cadmium	2.5	60	1.20 U [1.20 U]	1.10 U	0.270 BJ	1.20 U	1.10 U	1.10 U
Calcium	- -	- -	12,800 [13,100]	131,000 J	15,500	54,700	69,900	27,100
Chromium	- -	- -	9.10 [9.10]	7.00	13.2	40.7	12.9	10.3
Cobalt	- -	- -	5.00 B [5.00 B]	4.60 B	3.80 B	4.90 B	3.60 B	6.10 B
Copper	50	10,000	15.3 [15.0]	16.0	**217**	32.9	15.3	**68.4**
Iron	- -	- -	14,200 [14,200]	12,800	16,800	16,300	13,600	19,700
Lead	63	3,900	22.2 J [21.5 J]	4.40	**158**	**106 J**	50.3 J	**94.0**
Magnesium	- -	- -	3,680 [3,340]	7,140	2,500	8,700	11,200	4,890
Manganese	1,600	10,000	442 [526]	391	155	495	561	219
Mercury	0.18	5.7	0.0900 [0.0700]	0.0200 BJ	0.100 BJ	0.130	0.0900	0.280 U
Nickel	30	10,000	11.3 [11.2]	12.9	13.5	14.5	10.7	13.5
Potassium	- -	- -	532 B [496 B]	680 B	958 B	790 B	508 B	492 B
Selenium	3.9	6,800	2.00 [1.20 U]	1.10 U	1.60 U	1.20 U	1.20 U	3.10
Silver	2	6,800	2.50 U [2.50 U]	2.20 U	3.10 U	2.40 U	2.30 U	2.20 U
Sodium	- -	- -	140 B [129 B]	1,100 U	507 B	297 B	176 B	243 B
Thallium	- -	- -	2.60 U [2.60 U]	2.20 U	3.20 U	2.30 U	2.30 U	2.30 U
Total Cyanide	27	10,000	1.00 [1.20]	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U
Vanadium	- -	- -	14.7 [14.1]	11.0	13.9 B	15.4	10.1 B	16.4
Zinc	109	10,000	51.7 [49.3]	40.3	**402**	97.3	37.7	**222**

TABLE 3
SUBSURFACE SOIL ANALYTICAL RESULTS FOR AND INORGANIC CONSTITUENTS (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	**6 NYCRR PART 375 SCOs**		**SB-102**		**SB-103**		**SB-104**		**SB-105**	**SB-106**		**TP-101**	**TP-102**
Sample Depth(Feet):	**Unrestricted**	**Industrial**	**14 - 16**	**16 - 18**	**14 - 16**	**16 - 18**	**4 - 6**	**10 - 12**	**2 - 4**	**4.5 - 6**	**6 - 8**	**2 - 4**	**4 - 6**
Date Collected:	**(Exceedences in bold)**	**(Exceedences shaded)**	**10/22/04**	**10/22/04**	**10/21/04**	**10/21/04**	**10/28/04**	**10/28/04**	**10/29/04**	**10/28/04**	**10/28/04**	**10/29/04**	**10/29/04**
Detected Inorganics													
Aluminum	- -	- -	3,350	3,310 [2,910]	3,940	5,040	4,020	4,190	6,580	3,140	4,140	4,610	5,110
Antimony	- -	- -	2.20 UJ	2.30 UJ [2.30 UJ]	1.20 BJ	2.20 UJ	2.30 UJ	2.50 UJ	2.00 B	2.20 UJ	2.60 UJ	2.40 UJ	0.860 BJ
Arsenic	13	16	7.10	3.20 [2.10]	**13.1**	**14.6**	6.30	5.80	9.40	5.20	5.60	9.50	6.90
Barium	350	10,000	55.0	27.1 B [32.3 B]	143	100	58.8	28.4 B	186	30.3 B	34.7 B	**1,580**	119
Beryllium	7.2	2,700	0.430	0.300 B [0.290 B]	0.270 B	0.500	0.250 B	0.270 B	0.430 B	0.240 B	0.290 B	0.370 B	0.400 B
Cadmium	2.5	60	1.10 U	1.10 U [1.10 U]	0.390 B	0.210 B	1.10 UJ	1.20 UJ	1.20 UJ	1.10 UJ	1.40 UJ	2.50 J	1.10 UJ
Calcium	- -	- -	10,700	3,530 J [4,200 J]	7,490 J	35,700 J	90,300	68,900	63,300	90,700	119,000	56,000	66,100
Chromium	- -	- -	7.90 J	6.90 [6.30]	8.90	16.2	8.00 J	5.70 J	82.4 J	8.60 J	13.7 J	15.7 J	10.6 J
Cobalt	- -	- -	4.50 B	3.60 B [2.90 B]	2.40 B	4.70 B	11.3	3.20 B	23.0	4.40 B	7.20 B	3.70 B	4.80 B
Copper	50	10,000	18.0	18.2 [14.4]	31.8	**52.4**	14.9	15.5	23.3	13.9	15.7	25.3	47.5
Iron	- -	- -	9,620	12,200 [8,460]	6,250	14,300	12,300 J	10,800 J	12,000 J	9,920 J	13,400	11,100	17,600 J
Lead	63	3,900	**74.4**	29.9 [23.5]	**417**	**195**	12.5 J	10.8 J	**85.1 J**	12.7 J	8.90 J	**2,170 J**	53.1 J
Magnesium	- -	- -	3,170	1,790 [1,780]	1,160 B	6,760	25,000 J	22,500 J	11,300 J	17,200 J	18,100 J	7,730 J	7,720 J
Manganese	1,600	10,000	121	90.2 [78.1]	182	316	582 J	388 J	350 J	361 J	509 J	239 J	420 J
Mercury	0.18	5.7	0.0800 BJ	0.0500 J [0.0860 UJ]	**0.470 J**	**0.510 J**	**0.200 J**	**0.360 J**	**0.260 J**	0.0900 J	0.0500 J	0.160 J	0.100 J
Nickel	30	10,000	10.8	9.00 B [8.10 B]	6.30 B	14.0	14.6	7.80 B	**46.9**	9.50	13.3	9.90	15.0
Potassium	- -	- -	581 B	531 B [498 B]	714 B	575 B	709 B	424 B	701 B	519 B	598 B	618 B	613 B
Selenium	3.9	6,800	1.10 U	1.20 U [1.20 U]	1.20 U	2.30	1.20 U	1.30 U	1.20 U	1.10 U	1.30 U	1.20 U	1.10 U
Silver	2	6,800	2.10 U	2.20 U [2.20 U]	2.40 U	0.420 B	0.250 B	2.50 U	**2.90**	2.20 U	2.60 U	0.330 B	2.20 U
Sodium	- -	- -	197 B	100 B [125 B]	336 B	159 B	250 B	300 B	684 B	91.0 B	1,300 U	324 B	147 B
Thallium	- -	- -	2.10 U	2.30 U [2.30 U]	2.50 U	2.20 U	2.30 U	2.50 U	2.30 U	2.20 U	2.70 U	1.10 B	2.20 U
Total Cyanide	27	10,000	0.500 U	0.500 U [0.500 U]	0.500 U	0.500 U	0.500 U	0.680 J	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U
Vanadium	- -	- -	13.9	10.4 B [9.40 B]	9.50 B	16.4	11.5	8.10 B	16.2	8.60 B	11.3 B	20.0	13.5
Zinc	109	10,000	60.1	36.5 [35.3]	**205**	**211**	33.7	34.0	**331**	62.9	62.5	**823**	**113**

TABLE 3
SUBSURFACE SOIL ANALYTICAL RESULTS FOR INORGANIC CONSTITUENTS (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

1. Samples were collected by ARCADIS on the dates indicated.
2. Samples analyzed by Severn Trent Laboratories, Inc. (Edison, NJ) inorganics using United States Environmental Protection Agency (USEPA) SW-846 Method 6010.
3. Only those constituents detected in one or more samples are summarized.
4. All concentrations reported in dry weight parts per million (ppm), which is equivalent to milligrams per kilogram (mg/kg).
5. Field duplicate sample results are presented in brackets.
6. Data qualifiers are defined as follows:
   B (Inorganic) - Indicates a value which is less than the Practical Quantitation Limit, but greater than or equal to the instrument detection limit.
   J - Indicates an estimated value. The result is less than the specified quantitation limit, but greater than or equal to the method detection limit.
   U - Compound was not detected at a concentration exceeding the laboratory detection limit. The listed value represents the laboratory detection limit.
7. 6 NYCRR Part 375 Soil Cleanup Objectives (SCOs) are from Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375-6.8(a) and (b), effective December 14, 2006.
8. Bold font indicates that the result exceeds the 6 NYCRR Part 375 Unrestricted Use SCO.
9. Shading indicates that the result exceeds the 6 NYCRR Part 375 Industrial Use SCO.
10. - - = No 6 NYCRR Part 375 SCO or TAGM 4046 Recommended SCO listed.
11. Results have been validated in accordance with USEPA National Functional Guidelines of October 1999.

TABLE 4
GROUNDWATER ANALYTICAL RESULTS FOR DETECTED VOCs, SVOCs, AND INORGANICS (ppb)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID: Date Collected:	NYSDEC Groundwater Standards and Guidance Values	B-MW-03 02/09/05	FWMW-1 02/09/05	FWMW-2 02/08/05	FWMW-3 02/09/05	FWMW-4 02/08/05	FWMW-5 02/09/05	FWMW-6 02/09/05	MW-101RD 02/07/05	MW-102R 04/11/05	MW-103R 02/07/05
Detected VOCs											
1,1,1-Trichloroethane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U [5.0 U]	5.0 U	5.0 U	20 J	5.0 U [5.0 U]	5.0 U
1,1-Dichloroethane	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U [5.0 U]	5.0 U	5.0 U	28	5.0 U [5.0 U]	4.8 J
1,1-Dichloroethene	5	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U [2.0 U]	2.0 U	2.0 U	3.2 J	2.0 U [2.0 U]	2.0 U
2-Butanone	- -	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U [5.0 U]	5.0 U	5.0 U	25 U	5.0 U [5.0 U]	19
Acetone	50	5.0 UJ	5.0 U	5.0 U	5.0 U	5.0 U [5.0 U]	5.0 U	5.0 UJ	25 U	5.0 UJ [5.0 UJ]	96
Benzene	0.7	1.0 U	4.9	1.0 U	1.0 U	18 [16]	1.0 U	1.0 U	5.2	0.80 J [1.3]	28
Bromodichloromethane	50	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U [1.0 U]	1.0 U	1.0 U	5.0 U	1.0 U [1.0 U]	1.6
Carbon Disulfide	- -	5.0 UJ	5.0 U	5.0 U	5.0 U	5.0 U [5.0 U]	5.0 U	5.0 UJ	2.0 J	5.0 U [5.0 U]	5.0 U
Chloroform	7	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U [5.0 U]	5.0 U	5.0 U	9.6 J	5.0 U [5.0 U]	50
cis-1,2-Dichloroethene	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U [5.0 U]	5.0 U	5.0 U	520	1.0 J [1.4 J]	7.6
Ethylbenzene	5	4.0 U	4.0 U	4.0 U	4.0 U	8.1 [7.1]	4.0 U	4.0 U	31	4.0 U [4.0 U]	32
Styrene	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U [5.0 U]	5.0 U	5.0 U	3.8 J	5.0 U [5.0 U]	5.0 U
Toluene	5	5.0 U	5.0 U	5.0 U	5.0 U	1.1 J [1.0 J]	5.0 U	5.0 U	23 J	5.0 U [5.0 U]	24
Trichloroethene	5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U [1.0 U]	1.0 U	1.0 U	17	1.0 U [1.0 U]	1.0 U
Vinyl Chloride	2	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U [5.0 U]	5.0 U	5.0 U	100	5.0 U [5.0 U]	43
Xylene (Total)	5	5.0 U	5.0 U	5.0 U	5.0 U	6.9 [6.0]	5.0 U	5.0 U	92	5.0 U [5.0 U]	63
Total BTEX	- -	ND	4.9	ND	ND	34 J [30 J]	ND	ND	150 J	0.80 J [1.3]	150
Detected SVOCs											
2,4-Dimethylphenol	50	10 U	10 U	10 U	10 U	10 U [10 U]	10 U	10 U	50 U	10 U [10 U]	1.1 J
2-Methylnaphthalene	- -	10 U	10 U	0.20 J	10 U	10 U [10 U]	10 U	10 U	51	10 U [10 U]	5.8 J
2-Methylphenol	- -	10 U	10 U	10 U	10 U	10 U [10 U]	10 U	10 U	50 U	10 U [10 U]	0.30 J
4-Methylphenol	- -	10 U	10 U	10 U	10 U	10 U [10 U]	10 U	10 U	50 U	10 U [10 U]	0.20 J
Acenaphthene	20	10 U	10 U	10 U	10 U	1.8 J [2.3 J]	10 U	1.4 J	47 J	2.6 J [2.6 J]	6.5 J
Acenaphthylene	- -	10 U	10 U	10 U	10 U	4.2 J [5.7 J]	10 U	1.1 J	22 J	10 U [10 U]	4.0 J
Anthracene	50	10 U	10 U	10 U	10 U	10 U [10 U]	10 U	3.2 J	4.8 J	0.30 J [0.20 J]	10 U
Benzo(a)anthracene	0.002	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U [1.0 U]	1.0 U	4.9	5.0 U	1.0 U [1.0 U]	1.0 U
Benzo(a)pyrene	- -	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U [1.0 U]	1.0 U	4.8	5.0 U	1.0 U [1.0 U]	1.0 U
Benzo(b)fluoranthene	0.002	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U [1.0 U]	1.0 U	2.7	5.0 U	1.0 U [1.0 U]	1.0 U
Benzo(g,h,i)perylene	- -	10 U	10 U	10 U	10 U	10 U [10 U]	10 U	2.1 J	50 U	10 U [10 U]	10 U
Benzo(k)fluoranthene	0.002	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U [1.0 U]	1.0 U	4.8	5.0 U	1.0 U [1.0 U]	1.0 U
bis(2-Ethylhexyl)phthalate	5	10 U	10 U	10 U	10 U	10 U [10 U]	10 U	10 U	50 U	10 U [10 U]	16
Carbazole	- -	10 U	10 U	10 U	10 U	3.4 J [4.0 J]	10 U	1.0 J	27 J	10 U [10 U]	7.2 J
Chrysene	0.002	10 U	10 U	10 U	10 U	10 U [10 U]	10 U	5.3 J	50 U	10 U [10 U]	10 U
Dibenzofuran	- -	10 U	10 U	10 U	10 U	2.1 J [2.8 J]	10 U	1.8 J	31 J	0.30 J [0.30 J]	3.4 J
Fluoranthene	50	10 U	10 U	10 U	10 U	10 U [10 U]	10 U	6.9 J	50 U	1.3 J [1.1 J]	0.40 J
Fluorene	50	10 U	10 U	10 U	10 U	2.4 J [2.4 J]	10 U	2.3 J	32 J	0.80 J [0.80 J]	3.4 J
Indeno(1,2,3-cd)pyrene	0.002	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U [1.0 U]	1.0 U	1.8	5.0 U	1.0 U [1.0 U]	1.0 U
Naphthalene	10	10 U	10 U	10 U	10 U	3.2 J [3.1 J]	10 U	10 U	720	10 U [10 U]	130
Phenanthrene	50	10 U	10 U	10 U	10 U	0.70 J [0.90 J]	10 U	5.5 J	25 J	1.0 J [0.90 J]	2.7 J
Pyrene	50	10 U	10 U	10 U	10 U	10 U [10 U]	10 U	7.3 J	50 U	0.90 J [0.90 J]	0.30 J
Total PAHs	- -	ND	ND	0.20 J	ND	12 J [14 J]	ND	54 J	900 J	6.9 J [6.5 J]	150 J

TABLE 4
GROUNDWATER ANALYTICAL RESULTS FOR DETECTED VOCs, SVOCs, AND INORGANICS (ppb)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID: Date Collected:	NYSDEC Groundwater Standards and Guidance Values	B-MW-03 02/09/05	FWMW-1 02/09/05	FWMW-2 02/08/05	FWMW-3 02/09/05	FWMW-4 02/08/05	FWMW-5 02/09/05	FWMW-6 02/09/05	MW-101RD 02/07/05	MW-102R 04/11/05	MW-103R 02/07/05
Detected Inorganics											
Aluminum	- -	200 U	200 U	285	200 U	200 U [200 U]	634	254	200 U	62.6 U [62.6 U]	222
Arsenic	25	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U [5.00 U]	5.00 U	4.40 B	5.00 U	3.20 U [3.20 U]	5.00 U
Barium	1,000	200 U	123 B	381	52.4 B	81.3 B [79.8 B]	35.6 B	44.8 B	161 B	203 [200 B]	205
Calcium	- -	20,700	87,500	270,000	139,000	144,000 [145,000]	148,000	157,000	179,000	80,500 [79,300]	292,000
Chromium	50	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U [10.0 U]	10.0 U	10.0 U	42.8	3.20 B [1.60 U]	59.2
Copper	200	25.0 U	25.0 U	25.0 U	25.0 U	25.0 U [25.0 U]	25.0 U	17.3 B	4.90 B	3.70 U [3.70 U]	9.70 B
Iron	300	42.9 B	4,730	26,800	146 B	215 [172]	107 B	742	255	2,400 [2,400]	232
Magnesium	35,000	2,050 B	35,200	27,800	12,700	20,400 [20,100]	13,000	19,100	3,600 B	16,800 [16,700]	534 B
Manganese	300	15.0 U	44.9	2,580	168	106 [92.8]	18.7	118	69.3	88.8 [87.1]	4.70 B
Nickel	100	40.0 U	40.0 U	40.0 U	40.0 U	40.0 U [40.0 U]	5.60 B	4.60 B	40.0 U	2.40 U [2.40 U]	40.0 U
Potassium	- -	542 B	5,060	8,800	4,220 B	11,800 [11,600]	2,190 B	6,020	90,300	4,240 B [3,830 B]	69,500
Sodium	20,000	1,980 B	69,200	814,000	62,500	20,800 [20,000]	11,400	24,700	272,000	82,800 [78,400]	51,400
Total Cyanide	200	10.0 U	10.0 U	10.0 U	37.0	84.0 [86.0]	16.0	270	10.0 U	NA	10.0 U
Vanadium	- -	50.0 U	50.0 U	50.0 U	50.0 U	50.0 U [50.0 U]	50.0 U	50.0 U	4.90 B	2.00 U [2.00 U]	2.90 B
Zinc	2,000	7.00 B	9.90 B	11.1 B	15.2 B	11.5 B [8.00 B]	43.4	95.6	15.4 B	5.80 U [5.80 U]	10.1 B

TABLE 4
GROUNDWATER ANALYTICAL RESULTS FOR DETECTED VOCs, SVOCs, AND INORGANICS (ppb)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Notes:
1. Samples were collected by ARCADIS on the dates indicated.
2. VOCs = Target Compound List (TCL) Volatile Organic Compounds.
3. BTEX = Benzene, toluene, ethylbenzene and xylenes.
4. SVOCs = TCL Semi-Volatile Organic Compounds.
5. PAHs = Polynuclear aromatic hydrocarbons.
6. Samples were analyzed by TestAmerica Laboratories, Inc. (TestAmerica) located in Shelton, Connecticut for:
   - VOCs/BTEX using United States Environmental Protection Agency (USEPA) SW-846 Method 8260.
   - SVOCs/PAHs using USEPA SW-846 Method 8270.
   - Inorganics using USEPA SW-846 Methods 6010, 7471, 9012 and 335.4.
7. Only those constituents detected in one or more samples are summarized.
8. Concentrations reported in parts per billion (ppb), which is equivalent to micrograms per liter (ug/L).
9. Field duplicate sample results are presented in brackets.
10. Data qualifiers are defined as follows:
    B - Indicates an estimated value between the instrument detection limit and the Reporting Limit (RL).
    J - Indicates that the associated numerical value is an estimated concentration.
    ND - Constituent not detected at a concentration above the reported detection limit.
11. NYSDEC groundwater standards/guidance values are from the NYSDEC Division of Water, Technical and Operational Guidance Series (TOGS) document titled "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" (TOGS 1.1.1) dated June 1998, revised April 2000 and June 2004.
12. Shading Designates values that exceed the NYSDEC groundwater quality standards/guidance values.
13. - - = No TOGS 1.1.1 Water Quality Standard/Guidance Value listed.
14. NA = Not Analyzed.
15. Results have been validated in accordance with USEPA National Functional Guidelines of October 1999.

TABLE 5
SOIL GAS ANALYTICAL RESULTS FOR DETECTED VOCs (ug/m^3, ppbv)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Parameter	VP-101		VP-102	
	(ug/m^3)	(ppbv)	(ug/m^3)	(ppbv)
Detected VOCs				
1,1,1-Trichloroethane	52	9.6	87	16
1,1-Dichloroethane	8.1	2	2 U	0.5 U
1,2,4-Trimethylbenzene	18	3.7	12	2.4
1,2-Dichloroethene (total)	2.7	0.68	2 U	0.5 U
1,3,5-Trimethylbenzene	9.3	1.9	3.4	0.69
1,3-Butadiene	3.5	1.6	1.3	0.59
2-Butanone	2.3	0.79	1.5 U	0.5 U
2-Hexanone	2.5	0.6	2 U	0.5 U
4-Ethyltoluene	14	2.8	9.3	1.9
Acetone	67	28	12	5.1
Benzene	7.7	2.4	7	2.2
Carbon Disulfide	17	5.4	6.2	2
Chloroform	21	4.3	11	2.2
cis-1,2-Dichloroethene	3.1	0.77	2 U	0.5 U
Cyclohexane	15	4.4	3.3	0.97
Dichlorodifluoromethane	4.9	0.99	17	3.5
Ethylbenzene	13	3	8.7	2
Isopropyl Alcohol	25	10	12 U	5 U
Methyl tert-Butyl Ether	32	8.8	2.7	0.75
Methylene Chloride	8.7	2.5	2.6	0.75
n-Heptane	7	1.7	2 U	0.5 U
n-Hexane	12	3.3	5.6	1.6
Toluene	140	36	87	23
Trichloroethene	12	2.2	2.7 U	0.5 U
Trichlorofluoromethane	3.9	0.7	4.2	0.75
Xylene (o)	21	4.9	11	2.6
Xylene (Total)	65	15	43	10

Notes:

1. Soil-gas samples collected by ARCADIS of New York, Inc. (ARCADIS) on November 3, 2004.
2. VOCs = Volatile organic compound.
3. Samples analyzed by Severn Trent Laboratories, Inc. (Colchester, Vermont) for VOCs using United State Environmental Protection Agency (USEPA) Method TO-15 List plus additional parameters including 2-methylnaphthalene, naphthalene, isopentane, 2,3-diethylpentane, isooctane, indene, indane, and thiopene (as tentatively identified compounds).
4. Only those constituents detected in one or more samples are summarized.
5. Concentrations reported in micrograms per cubic meter (ug/m^3) and parts per billion volume (ppbv).
6. Data qualifiers are defined as follows:
   U - Compound was not detected at a concentration exceeding the laboratory detection limit. The listed value represents the laboratory detection limit.
7. Results have been validated in accordance with USEPA National Functional Guidelines of October 1999.

TABLE 6
SEDIMENT ANALYTICAL RESULTS FOR TOTAL BTEX AND TOTAL PAHs (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Sample Location	Depth(ft)	Total BTEX	Total PAHs
SD-1	0 - 0.6	ND	9.4 J
SD-2	0 - 0.5	ND	14.6 J
SD-3	0 - 0.7	0.0064 J	2.9 J
SD-4	0 - 0.5	0.0027	108 J
	0.5 - 1.1	ND	59.2 J
SD-5	0 - 0.7	ND	3.2 J
SD-6	0 - 0.5	0.13	39.1 J
SD-7	0 - 0.5	0.02 [0.032 J]	28.9 J [35.8 J]
	0.5 - 1.5	0.024 J	54.9 J
	1.5 - 2.1	0.094 J	40.2 J
SD-8	0 - 0.5	ND	5.5 J
	0.5 - 1.5	ND	121 J
	1.5 - 2.8	0.0025 J	4.5 J
SD-9	0 - 0.4	0.0019 J	35.5 J

Notes:

1. Sediment samples collected by ARCADIS of New York, Inc. (ARCADIS) on November 11, 2004.
2. BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes (total).
3. PAHs = Polynuclear Aromatic Hydrocarbons.
4. Concentrations reported in parts per million (ppm) or milligrams per kilogram (mg/kg).
5. Field duplicate sample results are presented in brackets.
6. J = Indicates an estimated value. The result is less than the specified quantitation limit, but greater than or equal to the method detection limit.
7. ND = Compounds were not detected at a concentration exceeding the laboratory detection limit.

TABLE 7
REMAINING SUBSURFACE SOIL ANALYTICAL RESULTS FOR TOTAL BTEX AND TOTAL PAHs (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Sample Location	Depth (feet)	Date	Total BTEX	Total PAHs
B-SB-3	6-6.8	4/13/2000	ND	79.8
B-SB-4	8-10	4/13/2000	ND	4.6
B-SB-5	full composite	4/14/2000	ND	99.6
D-SB-1	12-14	5/20/1998	ND	ND
D-SB-2	10-12	5/20/1998	ND	11.0
D-SB-3	12-14	5/20/1998	ND	26.9
D-SB-4	14-16	5/20/1998	ND	14.8
F-SB-15	6-8	10/2/2002	0.014 J	4.9 J
	10-12		0.004 J	347 J
	16-18		ND	0.001 J
F-SB-16	2-4	10/2/2002	0.001 J	8.8 J
	4-6	10/3/2002	0.003 J	150 J
	6-8		0.005 J	70 J
F-SB-17	8-10	10/3/2002	ND [ND]	2.6 J [28.7 J]
	12-14		0.006 J	166 J
	18-20		0.011 J	0.33 J
F-SB-18	6-8	10/4/2002	ND	20.4
	12-14		0.001 J	ND
	14-16		ND	0.047 J
F-SB-19	0-2	10/7/2002	0.005 J	0.40 J
	2-4		ND	23.0 J
F-SB-20	4-6	10/7/2002	0.005 J	12.0
	6-8	10/8/2002	0.002 J	59.7
	10-12		0.008 J	91.3
	14-14.3		2.0 J	2.6
F-SB-21	0-2	10/8/2002	0.016 J	17.2 J
	4-6		0.018 R	11.1
	6-8		0.020 J R	37.5
	8-10		0.23 J	301 J
	10-12		36.7 J	2,125 J
F-SB-22	16-18	10/9/2002	0.004 J	0.55 J
	18-19.1		0.47	6.4 J
F-SB-23	3-5	10/9/2002	0.001 J	1.8 J
	11-13		147 J	NA
	13-15		0.017	309
	15-17		25.7 J	569
F-SB-24	1-3	10/10/2002	0.014 J R	145 J
	3-5		0.005 J	33.9 J
	5-7		0.009 J	NA
	7-9		0.007 J	686
	9-10.8		0.033 J	875 J

TABLE 7
REMAINING SUBSURFACE SOIL ANALYTICAL RESULTS FOR TOTAL BTEX AND TOTAL PAHs (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Sample Location	Depth (feet)	Date	Total BTEX	Total PAHs
F-SB-25	16-16.7	10/10/2002	9.5	3,887 J
F-SB-26	14-15.2	10/11/2002	39.0 J	583 J
F-SB-27	0-2	10/11/2002	0.004 J	4.2 J
	2-4		0.005 J	4.0 J
	4-6		0.004 J	53.5 J
	10-10.2		0.001 J	45 J
F-SB-29	0-2	10/14/2002	0.016 R	7.7 J
	4-6		0.045 J R	38.5 J
	6-8		0.14 J	312 J
	8-10		0.018 J	13.6
	10-12		0.001 J	3.6 J
F-TP-01	13.5	10/7/2002	0.13	1.7 J
F-TP-02	11	10/7/2002	0.003 J	11.9 J
MW-101RD	14 - 16	1/13/2005	0.002 [0.002]	49.1 J [58.7 J]
MW-102R	10-12	10/8/2002	0.003 J	11.9 J
	18 - 22	10/19/2004	0.002 J	4.0 J
MW-103R	8 - 10	1/11/2005	0.001 J	16.8 J
	14 - 16		ND	1.9 J
SB-101	8 - 10	10/22/2004	0.012 J	44.1 J
SB-102	14 - 16	10/22/2004	ND	8.6 J
	16 - 18		ND [ND]	68 J [17 J]
SB-103	14 - 16	10/21/2004	ND	10.7 J
	16 - 18		ND	2.1 J
SB-104	4 - 6	10/28/2004	ND	1.9 J
	10 - 12		0.12 J	168 J
SB-105	2 - 4	10/29/2004	ND	33.2 J
SB-106	4.5 - 6	10/28/2004	0.007 J	98.8 J
	6 - 8		ND	5.3 J
TP-101	2-4	10/29/2004	ND	310 J
TP-102	4-6	10/29/2004	ND	21 J

TABLE 7
REMAINING SUBSURFACE SOIL ANALYTICAL RESULTS FOR TOTAL BTEX AND TOTAL PAHs (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Notes:

1. Samples were collected by:
   - Delta Environmental Consultants, Inc. (Delta) in May 1998. Results based on information included in the Phase II Environmental Assessment (Delta, not dated).
   - Buck Engineering, LLC (Buck) in April 2000. Results based on information included in the Investigative Report - Voluntary Cleanup Program (Buck, September 2004).
   - Foster Wheeler Environmental Corporation in October 2002. Results based on information included in the Site Characterization Investigation Report (Foster Wheeler, July 2003).
   - ARCADIS of New York, Inc. (ARCADIS) from October 2004 to January 2005. Results based on information included in the Remedial Investigation Report (ARCADIS, July 2005).
2. Concentrations reported in parts per million (ppm) or milligrams per kilogram (mg/kg).
3. Field duplicate sample results are presented in brackets.
4. BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes (total).
5. PAHs = Polynuclear Aromatic Hydrocarbons.
6. Sample designations indicate the following:
   B - Buck Engineering Sample Location;
   D - Delta Environmental Sample Location;
   F - Foster Wheeler Sample Location;
   MW - Monitoring Well;
   SB - Soil boring;
   TP - Test pit; and
   DUP - Duplicate sample.
7. Samples collected by ARCADIS were analyzed by Severn Trent Laboratories, Inc. (Edison, New Jersey) for:
   - Target compound list (TCL) SVOCs using United States Environmental Protection Agency (USEPA) SW-846 Method 8270.
   - Target compound list (TCL) VOCs using USEPA SW-846 Method 8260.
8. J = Indicates an estimated value. The result is less than the specified quantitation limit, but greater than or equal to the method detection limit.
9. NA = Not analyzed.
10. ND = Compounds were not detected at a concentration exceeding the laboratory detection limit.
11. Shaded values indicate Total BTEX concentrations greater than 10 ppm or Total PAH concentrations greater than 500 ppm.

TABLE 8
REMAINING SUBSURFACE SOIL ANALYTICAL RESULTS FOR INORGANIC CONSTITUENTS (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	**6 NYCRR PART 375 SCOs**		**MW-101RD**	**MW-102R**		**MW-103R**		**SB-101**
Sample Depth(Feet):	**Unrestricted**	**Industrial**	**14 - 16**	**10 - 12**	**18 - 22**	**8 - 10**	**14 - 16**	**8 - 10**
Date Collected:	**(Exceedences in bold)**	**(Exceedences shaded)**	**01/13/05**	**10/19/04**	**10/19/04**	**01/11/05**	**01/11/05**	**10/22/04**
Detected Inorganics								
Aluminum	- -	- -	5,410 [5,580]	4,150	5,360	4,610	2,720	2,940
Antimony	- -	- -	2.40 UJ [2.40 UJ]	2.20 UJ	4.60 J	2.40 UJ	2.20 UJ	2.30 U
Arsenic	13	16	4.60 [4.50]	4.60	**13.8 J**	12.5	9.90	**22.3**
Barium	350	10,000	33.7 B [35.2 B]	31.4 B	125	88.9	105	189
Beryllium	7.2	2,700	0.510 [0.510]	0.310 B	0.540 B	0.580	0.430 B	0.920
Cadmium	2.5	60	1.20 U [1.20 U]	1.10 U	0.270 BJ	1.20 U	1.10 U	1.10 U
Calcium	- -	- -	12,800 [13,100]	131,000 J	15,500	54,700	69,900	27,100
Chromium	- -	- -	9.10 [9.10]	7.00	13.2	40.7	12.9	10.3
Cobalt	- -	- -	5.00 B [5.00 B]	4.60 B	3.80 B	4.90 B	3.60 B	6.10 B
Copper	50	10,000	15.3 [15.0]	16.0	**217**	32.9	15.3	**68.4**
Iron	- -	- -	14,200 [14,200]	12,800	16,800	16,300	13,600	19,700
Lead	63	3,900	22.2 J [21.5 J]	4.40	**158**	**106 J**	50.3 J	**94.0**
Magnesium	- -	- -	3,680 [3,340]	7,140	2,500	8,700	11,200	4,890
Manganese	1,600	10,000	442 [526]	391	155	495	561	219
Mercury	0.18	5.7	0.0900 [0.0700]	0.0200 BJ	0.100 BJ	0.130	0.0900	0.280 U
Nickel	30	10,000	11.3 [11.2]	12.9	13.5	14.5	10.7	13.5
Potassium	- -	- -	532 B [496 B]	680 B	958 B	790 B	508 B	492 B
Selenium	3.9	6,800	2.00 [1.20 U]	1.10 U	1.60 U	1.20 U	1.20 U	3.10
Silver	2	6,800	2.50 U [2.50 U]	2.20 U	3.10 U	2.40 U	2.30 U	2.20 U
Sodium	- -	- -	140 B [129 B]	1,100 U	507 B	297 B	176 B	243 B
Thallium	- -	- -	2.60 U [2.60 U]	2.20 U	3.20 U	2.30 U	2.30 U	2.30 U
Total Cyanide	27	10,000	1.00 [1.20]	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U
Vanadium	- -	- -	14.7 [14.1]	11.0	13.9 B	15.4	10.1 B	16.4
Zinc	109	10,000	51.7 [49.3]	40.3	**402**	97.3	37.7	**222**

TABLE 8
REMAINING SUBSURFACE SOIL ANALYTICAL RESULTS FOR INORGANIC CONSTITUENTS (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Location ID:	**6 NYCRR PART 375 SCOs**		**SB-102**		**SB-103**		**SB-104**		**SB-105**	**SB-106**		**TP-101**	**TP-102**
Sample Depth(Feet):	**Unrestricted**	**Industrial**	**14 - 16**	**16 - 18**	**14 - 16**	**16 - 18**	**4 - 6**	**10 - 12**	**2 - 4**	**4.5 - 6**	**6 - 8**	**2 - 4**	**4 - 6**
Date Collected:	**(Exceedences in bold)**	**(Exceedences shaded)**	**10/22/04**	**10/22/04**	**10/21/04**	**10/21/04**	**10/28/04**	**10/28/04**	**10/29/04**	**10/28/04**	**10/28/04**	**10/29/04**	**10/29/04**
Detected Inorganics													
Aluminum	- -	- -	3,350	3,310 [2,910]	3,940	5,040	4,020	4,190	6,580	3,140	4,140	4,610	5,110
Antimony	- -	- -	2.20 UJ	2.30 UJ [2.30 UJ]	1.20 BJ	2.20 UJ	2.30 UJ	2.50 UJ	2.00 B	2.20 UJ	2.60 UJ	2.40 UJ	0.860 BJ
Arsenic	13	16	7.10	3.20 [2.10]	**13.1**	**14.6**	6.30	5.80	9.40	5.20	5.60	9.50	6.90
Barium	350	10,000	55.0	27.1 B [32.3 B]	143	100	58.8	28.4 B	186	30.3 B	34.7 B	**1,580**	119
Beryllium	7.2	2,700	0.430	0.300 B [0.290 B]	0.270 B	0.500	0.250 B	0.270 B	0.430 B	0.240 B	0.290 B	0.370 B	0.400 B
Cadmium	2.5	60	1.10 U	1.10 U [1.10 U]	0.390 B	0.210 B	1.10 UJ	1.20 UJ	1.20 UJ	1.10 UJ	1.40 UJ	2.50 J	1.10 UJ
Calcium	- -	- -	10,700	3,530 J [4,200 J]	7,490 J	35,700 J	90,300	68,900	63,300	90,700	119,000	56,000	66,100
Chromium	- -	- -	7.90 J	6.90 [6.30]	8.90	16.2	8.00 J	5.70 J	82.4 J	8.60 J	13.7 J	15.7 J	10.6 J
Cobalt	- -	- -	4.50 B	3.60 B [2.90 B]	2.40 B	4.70 B	11.3	3.20 B	23.0	4.40 B	7.20 B	3.70 B	4.80 B
Copper	50	10,000	18.0	18.2 [14.4]	31.8	**52.4**	14.9	15.5	23.3	13.9	15.7	25.3	47.5
Iron	- -	- -	9,620	12,200 [8,460]	6,250	14,300	12,300 J	10,800 J	12,000 J	9,920 J	13,400	11,100	17,600 J
Lead	63	3,900	**74.4**	29.9 [23.5]	**417**	**195**	12.5 J	10.8 J	**85.1 J**	12.7 J	8.90 J	**2,170 J**	53.1 J
Magnesium	- -	- -	3,170	1,790 [1,780]	1,160 B	6,760	25,000 J	22,500 J	11,300 J	17,200 J	18,100 J	7,730 J	7,720 J
Manganese	1,600	10,000	121	90.2 [78.1]	182	316	582 J	388 J	350 J	361 J	509 J	239 J	420 J
Mercury	0.18	5.7	0.0800 BJ	0.0500 J [0.0860 UJ]	**0.470 J**	**0.510 J**	**0.200 J**	**0.360 J**	**0.260 J**	0.0900 J	0.0500 J	0.160 J	0.100 J
Nickel	30	10,000	10.8	9.00 B [8.10 B]	6.30 B	14.0	14.6	7.80 B	**46.9**	9.50	13.3	9.90	15.0
Potassium	- -	- -	581 B	531 B [498 B]	714 B	575 B	709 B	424 B	701 B	519 B	598 B	618 B	613 B
Selenium	3.9	6,800	1.10 U	1.20 U [1.20 U]	1.20 U	2.30	1.20 U	1.30 U	1.20 U	1.10 U	1.30 U	1.20 U	1.10 U
Silver	2	6,800	2.10 U	2.20 U [2.20 U]	2.40 U	0.420 B	0.250 B	2.50 U	**2.90**	2.20 U	2.60 U	0.330 B	2.20 U
Sodium	- -	- -	197 B	100 B [125 B]	336 B	159 B	250 B	300 B	684 B	91.0 B	1,300 U	324 B	147 B
Thallium	- -	- -	2.10 U	2.30 U [2.30 U]	2.50 U	2.20 U	2.30 U	2.50 U	2.30 U	2.20 U	2.70 U	1.10 B	2.20 U
Total Cyanide	27	10,000	0.500 U	0.500 U [0.500 U]	0.500 U	0.500 U	0.500 U	0.680 J	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U
Vanadium	- -	- -	13.9	10.4 B [9.40 B]	9.50 B	16.4	11.5	8.10 B	16.2	8.60 B	11.3 B	20.0	13.5
Zinc	109	10,000	60.1	36.5 [35.3]	**205**	**211**	33.7	34.0	**331**	62.9	62.5	**823**	**113**

TABLE 8
REMAINING SUBSURFACE SOIL ANALYTICAL RESULTS FOR INORGANIC CONSTITUENTS (ppm)

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

1. Samples were collected by ARCADIS on the dates indicated.
2. Samples analyzed by Severn Trent Laboratories, Inc. (Edison, NJ) for inorganics using United States Environmental Protection Agency (USEPA) SW-846 Method 6010.
3. Only those constituents detected in one or more samples are summarized.
4. All concentrations reported in dry weight parts per million (ppm), which is equivalent to milligrams per kilogram (mg/kg).
5. Field duplicate sample results are presented in brackets.
6. Data qualifiers are defined as follows:
    B (Inorganic) - Indicates a value which is less than the Practical Quantitation Limit, but greater than or equal to the instrument detection limit.
    J - Indicates an estimated value. The result is less than the specified quantitation limit, but greater than or equal to the method detection limit.
    U - Compound was not detected at a concentration exceeding the laboratory detection limit. The listed value represents the laboratory detection limit.
7. 6 NYCRR Part 375 Soil Cleanup Objectives (SCOs) are from Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375-6.8(a) and (b), effective December 14, 2006.
8. Bold font indicates that the result exceeds the 6 NYCRR Part 375 Unrestricted Use SCO.
9. Shading indicates that the result exceeds the 6 NYCRR Part 375 Industrial Use SCO.
10. - - = No 6 NYCRR Part 375 SCO or TAGM 4046 Recommended SCO listed.
11. Results have been validated in accordance with USEPA National Functional Guidelines of October 1999.

TABLE 9
MONITORING WELL CONSTRUCTION DETAILS

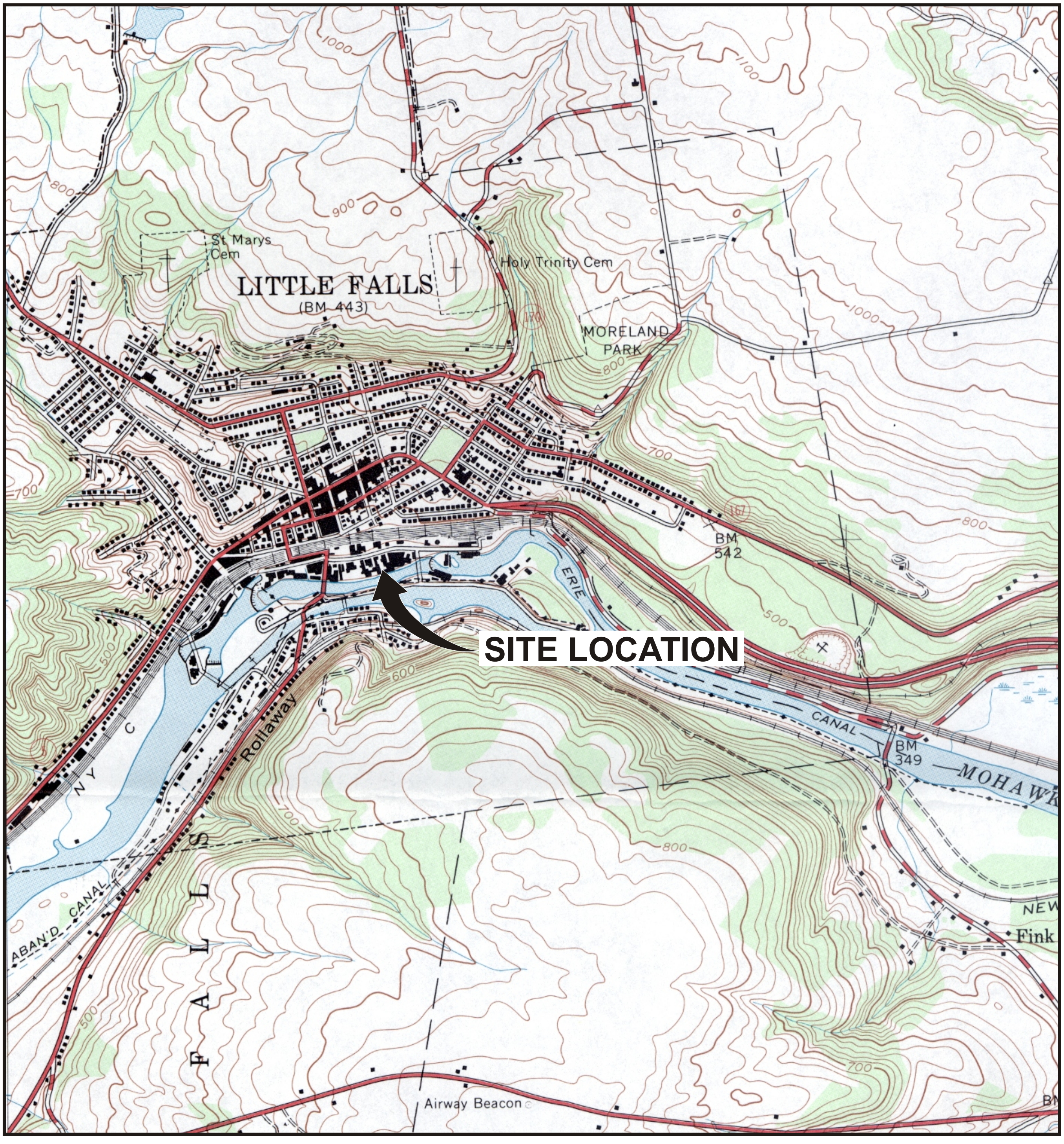
NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

Well ID	Installation Date	Northing (ft.)	Easting (ft.)	Ground Surface Elevation (ft., AMSL)	Top of Inner/Outer Casing Elevation (ft., AMSL)	Surface Completion	Inner Casing	Outer Casing	Screen Slot Size (in.)	Depth to Bedrock (ft. bgs)	Bedrock Elevation (ft., AMSL)	Depth of Outer Casing (ft. bgs)	Elevation of Screened Interval (ft. AMSL)		Depth to Screened Interval (ft. bgs)		Sump Length (ft.)	Well Total Depth (ft. bgs)
													Top	Bottom	Top	Bottom		
B-MW-3	4/14/2000	NA	NA	351.73	351.46/NA	Flushmount	2" PVC	NA	0.02	16.5	335.23	NA	345.23	335.23	6.5	16.5	NA	16.5
FWMW-1 (F-SB-17)	10/3/2002	1,533,059.33	396,557.82	355.75	355.58/NA	Flushmount	2" PVC	8" dia. Steel	0.01	23.8	332.0	0-1	342.45	332.45	13.3	23.3	NA	23.5
FWMW-2 (F-SB-18)	10/4/2002	1,533,241.38	396,547.71	362.13	361.94/362.14	Flushmount	2" PVC	8" dia. Steel	0.01	15.6	346.5	0-1	351.83	346.83	10.3	15.3	NA	15.5
FWMW-3 (F-SB-20)	10/8/2002	1,533,216.55	396,708.01	355.42	354.93/355.35	Flushmount	2" PVC	8" dia. Steel	0.01	14.7	340.7	0-1	350.92	340.92	4.5	14.5	NA	14.7
FWMW-4 (F-SB-22)	10/9/2002	1,533,063.39	396,716.46	354.65	354.32/354.69	Flushmount	2" PVC	8" dia. Steel	0.01	19.0	335.7	0-1	346.05	336.05	8.6	18.6	NA	18.8
FWMW-5 (F-SB-29)	10/14/2002	1,533,170.88	396,711.53	355.43	355.09/355.46	Flushmount	2" PVC	8" dia. Steel	0.01	12.3	343.1	0-1	353.63	343.63	1.8	11.8	NA	11.8
FWMW-6 (F-SB-25)	10/10/2002	1,533,061.34	396,766.47	354.26	353.96/354.26	Flushmount	2" PVC	8" dia. Steel	0.01	16.7	337.6	0-1	348.06	338.06	6.2	16.2	NA	16.7
MW-101R	10/18/2004	1,533,042.07	396,758.92	351.56	351.25/351.21	Flushmount	2" PVC	4" dia. Steel	0.02	26.5	325.1	0-26.5	324.16	321.16	27.4	30.4	1	31.4
MW-101RD	1/25/2005	1,533,042.50	396,746.70	351.89	351.58/351.83	Flushmount	2" PVC	4" dia. Steel	0.02	18.0	333.9	0-35.0	313.89	303.89	38.0	48.0	2	50.0
MW-102R	10/26/2004	1,533,035.80	396,532.60	356.63	356.10/356.26	Flushmount	2" PVC	4" dia. Steel	0.02	24.0	332.6	0-24.2	329.63	319.63	27.0	37.0	2	39.0
MW-103R	1/20/2005	1,533,046.50	396,684.80	354.16	353.83/NA	Flushmount	2" PVC	4" dia. Steel	0.02	22.0	332.2	0-24.0	327.16	317.16	27.0	37.0	2	39.0
PZ-101	10/13/2004	1,533,163.52	396,611.01	358.03	357.61/NA	Flushmount	1" PVC	8" dia. Steel	0.02	26.5	331.5	0-0.5	347.03	332.03	11.0	26.0	2	26.0
PZ-102	10/11/2004	1,533,088.93	396,595.59	356.32	356.1/NA	Flushmount	1" PVC	8" dia. Steel	0.02	12.5	343.8	0-0.5	349.02	344.02	7.3	12.3	2	12.3
PZ-103	10/14/2004	1,533,157.51	396,580.58	358.25	357.85/NA	Flushmount	1" PVC	8" dia. Steel	0.02	17.2	341.1	0-0.5	351.25	341.25	7.0	17.0	2	17.0
PZ-104	10/19/2004	1,533,171.80	396,637.43	358.51	358.18/NA	Flushmount	1" PVC	8" dia. Steel	0.02	13.8	344.7	0-0.5	350.11	345.11	8.4	13.4	2	13.4
PZ-105	10/12/2004	1,533,088.31	396,568.06	356.27	355.9/NA	Flushmount	1" PVC	8" dia. Steel	0.02	28.3	328.0	0-0.5	345.27	333.27	11.0	23.0	2	23.0
PZ-106	10/13/2004	1,533,098.37	396,616.52	356.19	355.85/NA	Flushmount	1" PVC	8" dia. Steel	0.02	NA	NA	0-0.5	345.19	340.19	11.0	16.0	2	16.0
RW-01	8/17/2009	1,533,067.10	396,771.52	354.14	354.03/NA	Flushmount	4" PVC	8" dia. Steel	0.02	14.5	339.6	0-1	344.1	334.14	10.0	20.0	4	24.0
RW-02	8/20/2009	1,533,044.86	396,736.32	353.7	353.30/NA	Flushmount	4" PVC	8" dia. Steel	0.02	10.5	343.2	0-1	347.2	337.2	6.5	16.5	4	20.5
RW-03	8/25/2009	1,533,040.72	396,763.44	353.5	352.41/NA	Flushmount	4" PVC	8" dia. Steel	0.02	24.5	329	0-1	335.0	323	18.5	30.5	4.35	34.5

Notes:

1. ft - feet.
2. in - inches.
3. ASML - above mean sea level.
4. Elevations referenced to NGVD 1988.
5. bgs - below ground surface.
6. PVC - polyvinyl chloride.
7. NA - No Available/Applicable.
8. dia. - diameter.

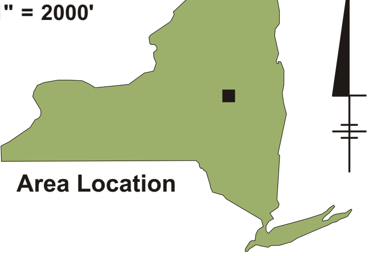
Figures



REFERENCE: BASE MAP USGS 7.5 MIN. QUAD., LITTLE FALLS, NY, 1943.

2000' 0 2000'

Approximate Scale: 1" = 2000'



Area Location

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

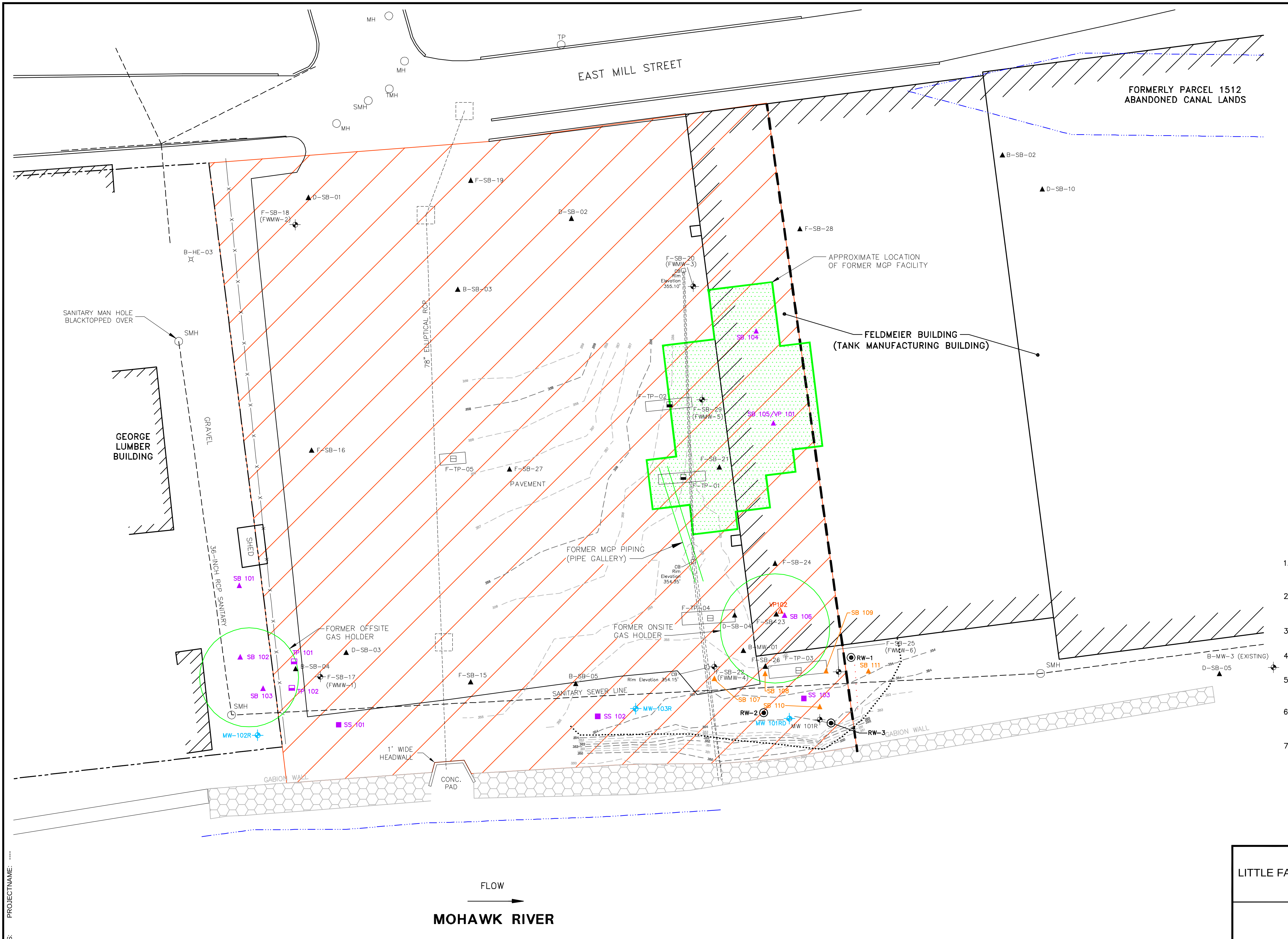
SITE MANAGEMENT PLAN

SITE LOCATION MAP

ARCADIS

FIGURE
1

04/15/2010 SYRACUSE-NY-141ENV-DJHOWES
B0036673\0000\00013\CDR\36673N01.CDR



LEGEND:

— - —	PROPERTY LINE
▨	BUILDING
- - -	EDGE OF WATER
— — —	SANITARY SEWER
SMH ○	SANITARY MANHOLE
- - - -	STORM SEWER
🟩	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
🟥	BOUNDARIES OF AREA SUBJECT TO SITE MANAGEMENT PLAN
━ ━ ━	LINE OF DEMARCATION
·······	LIMIT OF GRAVEL
-----352-----	CONTOUR ELEVATION
RW-1 ◉	DNAPL RECOVERY WELL LOCATION
SB 102 ▲	RI SOIL BORING LOCATION
MW 102R ⊕	RI MONITORING WELL LOCATION
TP 101 ⊟	RI TEST PIT SAMPLE LOCATION
VP102 △	RI SOIL/GAS MONITORING LOCATION
SS 103 ■	RI SURFACE SOIL SAMPLE LOCATION
D-SB-01 ▲	PREVIOUS SOIL BORING LOCATION
TP ⊟	PREVIOUS TEST PIT SAMPLE LOCATION
F-TP-03 ⊟	PREVIOUS TEST PIT LOCATION – NO SAMPLE COLLECTED
SB-18 ⊕	PREVIOUS MONITORING WELL LOCATION
HE ⌧	PREVIOUS BACKGROUND SOIL SAMPLE LOCATION
D	DELTA ENVIRONMENTAL CONSULTANTS SAMPLE LOCATION
B	BUCK ENGINEERING, LLC SAMPLE LOCATION
F	FOSTER WHEELER SAMPLE LOCATION

NOTES:

1. BASE MAP INFORMATION TAKEN FROM A DRAWING TITLED SOIL BORING AND MONITORING WELL LOCATIONS BY C.T.MALE ASSOCIATES, P.C. DATED 2/8/05.
2. APPROXIMATE LINE OF DEMARCATION BASED ON HISTORIC TAX LOTS AND CURRENT FEATURES LITTLE FALLS (MILL ST.) SITE, FIGURE 1 (FOSTER WHEELER, JULY 2003).
3. LINE OF DEMARCATION SEPARATES THE MGP (VCO) PORTION OF THE PROPERTY FROM THE NON-MGP (VCA) PORTION OF THE PROPERTY.
4. LOCATION OF HISTORICAL MGP STRUCTURES ARE BASED ON HISTORICAL SANBORN MAPS AND ARE APPROXIMATE.
5. APPROXIMATE LOCATION OF THE PIPE GALLERY IS BASED ON PREVIOUS INVESTIGATIONS AND TEST PITTING ACTIVITIES CONDUCTED BY FOSTER WHEELER ENVIRONMENTAL CORPORATION.
6. RI SAMPLE LOCATIONS BASED ON SURVEY PERFORMED BY C.T. MALE ASSOCIATES, P.C. (DATED 2/8/05) AND SURVEY PERFORMED BY BLASLAND, BOUCK & LEE, INC. IN 11/2004 AND 4/2005.
7. LIMIT OF ASPHALT, AND EXTENT OF GRAVEL, AND RECOVERY WELL LOCATIONS WERE BASED ON SURVEY PERFORMED BY THEW ASSOCIATES PE-LS, PLLC (DATED 9/23/09).

0 20' 40'
GRAPHIC SCALE

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

SITE PLAN

ARCADIS

FIGURE
2

CITY:SYRACUSE,N.Y. DIV/GROUP:ENVCAD-141 DB:NES, R.ALLEN A.Schilling LD:(Opt) PIC:(Opt) PM:M.JONES TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0036673\0000\00013\DWG\36673B01.DWG LAYOUT: 2SAVED: 4/19/2010 3:54 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 4/19/2010 3:54 PM BY: SCHILLING, ADAM
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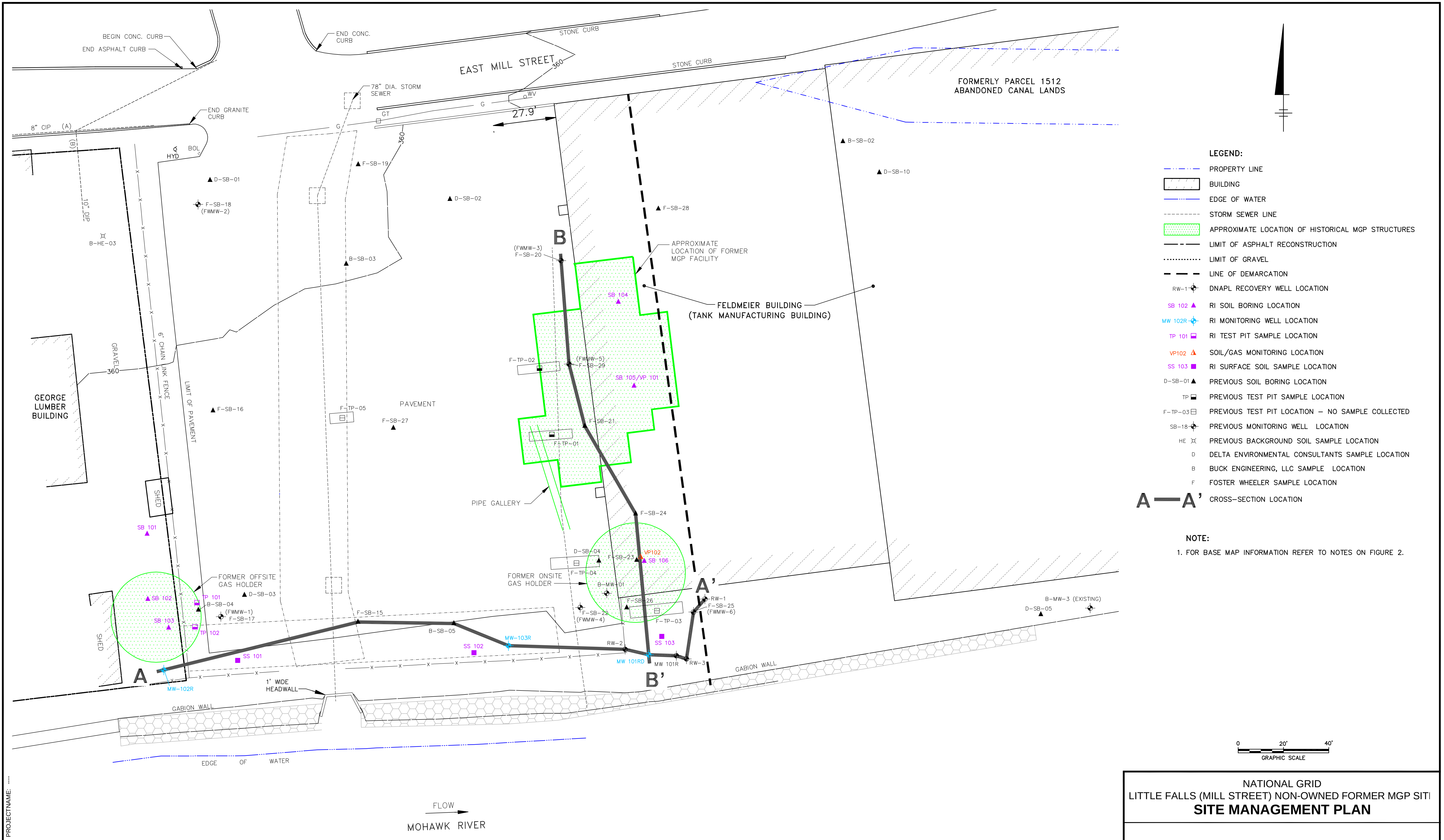
36673X02
36673XDL



LEGEND:

	PROPERTY LINE
	BUILDING
	EDGE OF WATER
	STORM SEWER LINE
🟩	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
	LIMIT OF ASPHALT RECONSTRUCTION
	LIMIT OF GRAVEL
	LINE OF DEMARCATION
RW-1	DNAPL RECOVERY WELL LOCATION
SB 102 ▲	RI SOIL BORING LOCATION
MW 102R	RI MONITORING WELL LOCATION
TP 101	RI TEST PIT SAMPLE LOCATION
VP102 △	SOIL/GAS MONITORING LOCATION
SS 103 ■	RI SURFACE SOIL SAMPLE LOCATION
D-SB-01 ▲	PREVIOUS SOIL BORING LOCATION
TP	PREVIOUS TEST PIT SAMPLE LOCATION
F-TP-03	PREVIOUS TEST PIT LOCATION – NO SAMPLE COLLECTED
SB-18	PREVIOUS MONITORING WELL LOCATION
HE	PREVIOUS BACKGROUND SOIL SAMPLE LOCATION
D	DELTA ENVIRONMENTAL CONSULTANTS SAMPLE LOCATION
B	BUCK ENGINEERING, LLC SAMPLE LOCATION
F	FOSTER WHEELER SAMPLE LOCATION
A — A'	CROSS-SECTION LOCATION

NOTE:

1. FOR BASE MAP INFORMATION REFER TO NOTES ON FIGURE 2.

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE

SITE MANAGEMENT PLAN

CROSS-SECTION LOCATION MAP

ARCADIS

FIGURE
3

CITY:SYRACUSE, N.Y. DIV/GROUP:ENVCAD-141 DB:NES, W.JONES A.Schilling LD:(Opt) PIC:(Opt) PM:M.JONES TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0036673\0000\00013\DWG\36673B02.DWG LAYOUT: 3 SAVED: 4/15/2010 9:39 AM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 4/15/2010 9:39 AM BY: SCHILLING, ADAM
IMAGES: PROJECTNAME: ----
XREFS: 36673XDL 36673X04

LEGEND:

▨	FILL
▭	SILT
▨	SAND
▨	SILT AND SAND
▭	BEDROCK (GNEISS)
(339.6) ▼	GROUNDWATER ELEVATION POTENTIOMETRIC SURFACE IN FEET (ABOVE MEAN SEA LEVEL)
―	LITHOLOGY (DASHED WHERE INFERRED)

MW-103R WELL/BORING ID

NAPL, TAR, OR SHEEN

BORING

SCREENED INTERVAL

SUMP

BOTTOM OF BORING

VERTICAL EXAGGERATION = 2X

0 10' 20'
VERTICAL SCALE

0 20' 40'
HORIZONTAL SCALE

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

GENERALIZED CROSS-SECTION A-A'

ARCADIS

FIGURE
4

CITY:SYRACUSE, N.Y. DIV/GROUP:ENVCAD-141 DB:RCA, W.JONES, A.Schilling LD:(Opt) PIC:(Opt) PM:M.JONES TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
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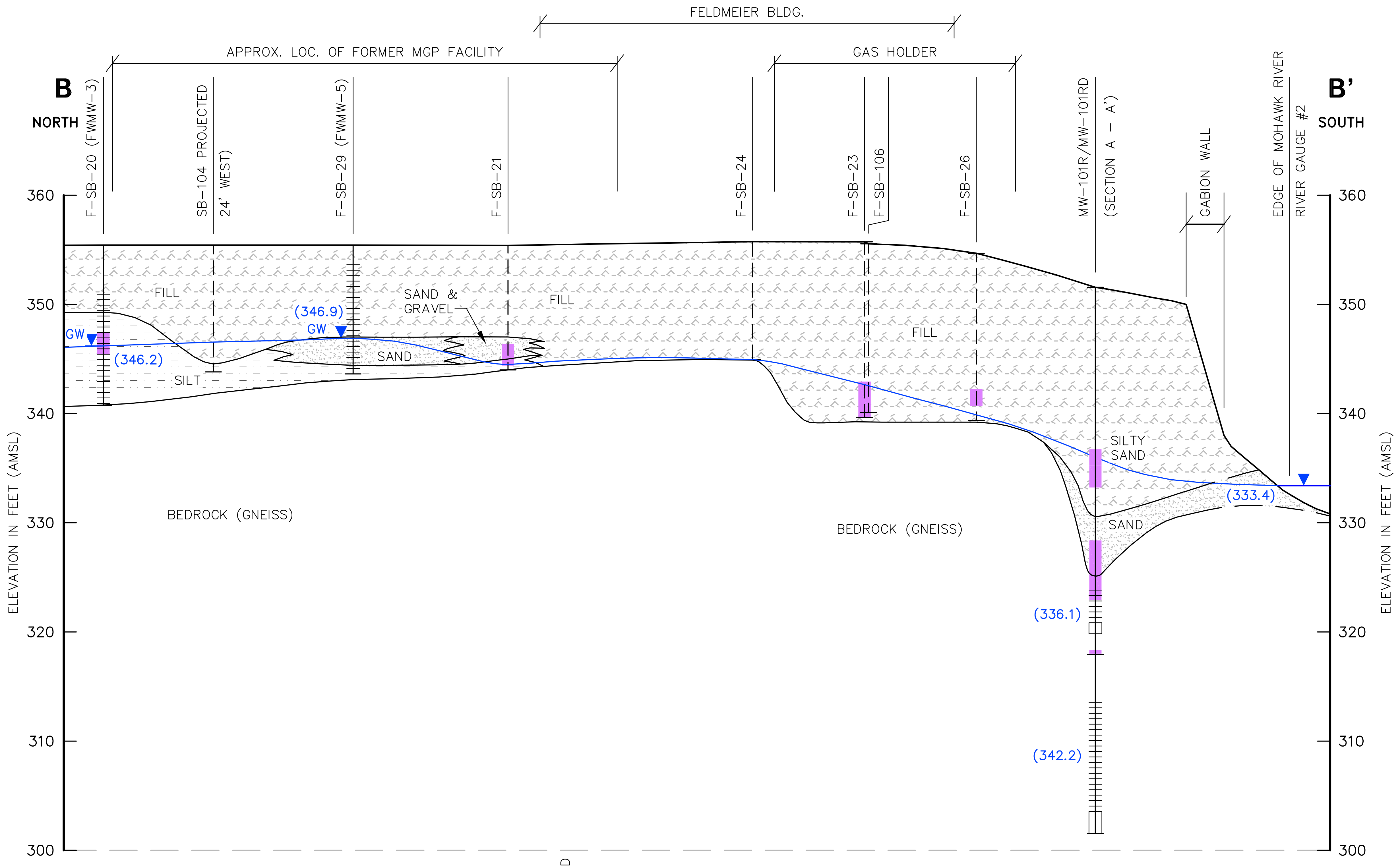

LEGEND:

▨	FILL
▭	SILT
▨	SAND
▨	SILT AND SAND
▭	BEDROCK (GNEISS)
(346.2) ▼	GROUNDWATER ELEVATION POTENTIOMETRIC SURFACE IN FEET (ABOVE MEAN SEA LEVEL)
—	LITHOLOGY (DASHED WHERE INFERRED)

MW-101RD — WELL/BORING ID
NAPL, TAR OR SHEEN
BORING
SCREENED INTERVAL
SUMP
BOTTOM OF BORING

VERTICAL EXAGGERATION = 2X

0 10' 20'
VERTICAL SCALE

0 20' 40'
HORIZONTAL SCALE

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

GENERALIZED CROSS-SECTION B-B'

ARCADIS

FIGURE
5

CITY:SYRACUSE, N.Y. DIV/GROUP:ENVCAD-141 DB:RCA, R.ALLEN, A.Schilling LD:(Opt) PIC:(Opt) PM:M.JONES TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
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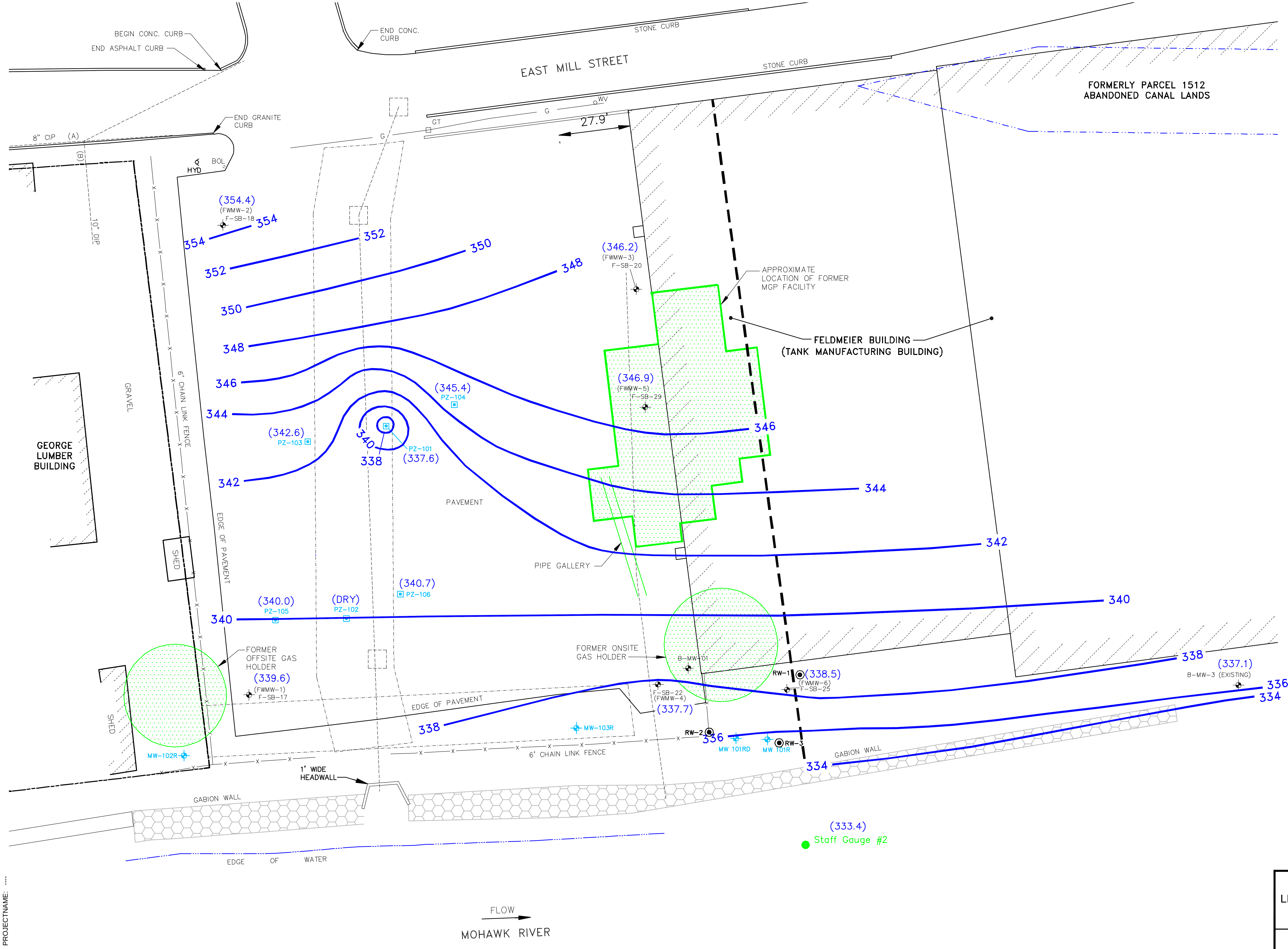

LEGEND:

-·-·-	PROPERTY LINE
▨	BUILDING
—·—	EDGE OF WATER
- - -	STORM SEWER LINE
🟩	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
— —	LINE OF DEMARCATION
RW-1 ◉	DNAPL RECOVERY WELL LOCATION
MW 102R ⌖	RI MONITORING WELL LOCATION
PZ-104 ▣	FORMER RI PIEZOMETER LOCATION
SB-18 ⌖	PREVIOUS MONITORING WELL LOCATION
D	DELTA ENVIRONMENTAL CONSULTANTS SAMPLE LOCATION
B	BUCK ENGINEERING, LLC SAMPLE LOCATION
F	FOSTER WHEELER SAMPLE LOCATION
(346.2)	GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
346 ——	INFERRED GROUNDWATER ELEVATION CONTOUR

NOTE:

1. FOR BASE MAP INFORMATION REFER TO NOTES ON FIGURE 2.

0 20' 40'
GRAPHIC SCALE

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

OVERBURDEN POTENTIOMETRIC SURFACE MAP - APRIL 11, 2005

ARCADIS

FIGURE
6

CITY:SYRACUSE, N.Y. DIV/GROUP:ENVCAD-141 DB:NES, R.ALLEN A.Schilling LD:(Opt) PIC:(Opt) PM:M.JONES TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
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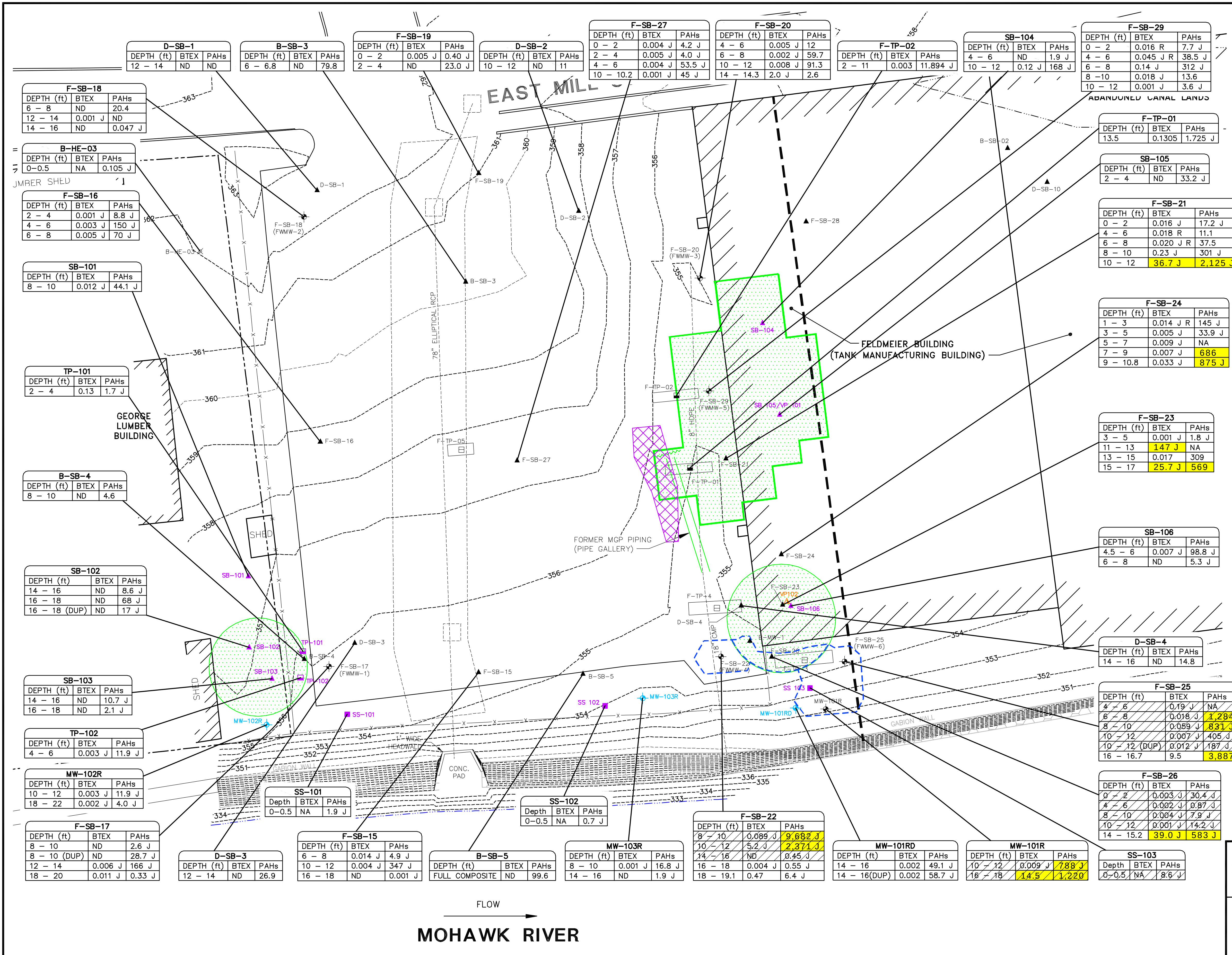

D-SB-1

DEPTH (ft)	BTEX	PAHs
12 – 14	ND	ND

B-SB-3

DEPTH (ft)	BTEX	PAHs
6 – 6.8	ND	79.8

F-SB-19

DEPTH (ft)	BTEX	PAHs
0 – 2	0.005 J	0.40 J
2 – 4	ND	23.0 J

D-SB-2

DEPTH (ft)	BTEX	PAHs
10 – 12	ND	11

F-SB-27

DEPTH (ft)	BTEX	PAHs
0 – 2	0.004 J	4.2 J
2 – 4	0.005 J	4.0 J
4 – 6	0.004 J	53.5 J
10 – 10.2	0.001 J	45 J

F-SB-20

DEPTH (ft)	BTEX	PAHs
4 – 6	0.005 J	12
6 – 8	0.002 J	59.7
10 – 12	0.008 J	91.3
14 – 14.3	2.0 J	2.6

F-TP-02

DEPTH (ft)	BTEX	PAHs
2 – 11	0.003	11.894 J

SB-104

DEPTH (ft)	BTEX	PAHs
4 – 6	ND	1.9 J
10 – 12	0.12 J	168 J

F-SB-29

DEPTH (ft)	BTEX	PAHs
0 – 2	0.016 R	7.7 J
4 – 6	0.045 J R	38.5 J
6 – 8	0.14 J	312 J
8 –10	0.018 J	13.6
10 – 12	0.001 J	3.6 J

F-SB-18

DEPTH (ft)	BTEX	PAHs
6 – 8	ND	20.4
12 – 14	0.001 J	ND
14 – 16	ND	0.047 J

B-HE-03

DEPTH (ft)	BTEX	PAHs
0–0.5	NA	0.105 J

F-SB-16

DEPTH (ft)	BTEX	PAHs
2 – 4	0.001 J	8.8 J
4 – 6	0.003 J	150 J
6 – 8	0.005 J	70 J

SB-101

DEPTH (ft)	BTEX	PAHs
8 – 10	0.012 J	44.1 J

TP-101

DEPTH (ft)	BTEX	PAHs
2 – 4	0.13	1.7 J

B-SB-4

DEPTH (ft)	BTEX	PAHs
8 – 10	ND	4.6

SB-102

DEPTH (ft)	BTEX	PAHs
14 – 16	ND	8.6 J
16 – 18	ND	68 J
16 – 18 (DUP)	ND	17 J

SB-103

DEPTH (ft)	BTEX	PAHs
14 – 16	ND	10.7 J
16 – 18	ND	2.1 J

TP-102

DEPTH (ft)	BTEX	PAHs
4 – 6	0.003 J	11.9 J

MW-102R

DEPTH (ft)	BTEX	PAHs
10 – 12	0.003 J	11.9 J
18 – 22	0.002 J	4.0 J

F-SB-17

DEPTH (ft)	BTEX	PAHs
8 – 10	ND	2.6 J
8 – 10 (DUP)	ND	28.7 J
12 – 14	0.006 J	166 J
18 – 20	0.011 J	0.33 J

D-SB-3

DEPTH (ft)	BTEX	PAHs
12 – 14	ND	26.9

SS-101

Depth	BTEX	PAHs
0–0.5	NA	1.9 J

F-SB-15

DEPTH (ft)	BTEX	PAHs
6 – 8	0.014 J	4.9 J
10 – 12	0.004 J	347 J
16 – 18	ND	0.001 J

B-SB-5

DEPTH (ft)	BTEX	PAHs
FULL COMPOSITE	ND	99.6

SS-102

Depth	BTEX	PAHs
0–0.5	NA	0.7 J

MW-103R

DEPTH (ft)	BTEX	PAHs
8 – 10	0.001 J	16.8 J
14 – 16	ND	1.9 J

F-SB-22

DEPTH (ft)	BTEX	PAHs
8 – 10	0.089 J	**9,682 J**
10 – 12	5.2 J	**2,371 J**
14 – 16	ND	0.45 J
16 – 18	0.004 J	0.55 J
18 – 19.1	0.47	6.4 J

MW-101RD

DEPTH (ft)	BTEX	PAHs
14 – 16	0.002	49.1 J
14 – 16(DUP)	0.002	58.7 J

MW-101R

DEPTH (ft)	BTEX	PAHs
10 – 12	0.009 J	**788 J**
16 – 18	**14.5**	**1,220**

SS-103

Depth	BTEX	PAHs
0–0.5	NA	8.6 J

F-TP-01

DEPTH (ft)	BTEX	PAHs
13.5	0.1305	1.725 J

SB-105

DEPTH (ft)	BTEX	PAHs
2 – 4	ND	33.2 J

F-SB-21

DEPTH (ft)	BTEX	PAHs
0 – 2	0.016 J	17.2 J
4 – 6	0.018 R	11.1
6 – 8	0.020 J R	37.5
8 – 10	0.23 J	301 J
10 – 12	**36.7 J**	**2,125 J**

F-SB-24

DEPTH (ft)	BTEX	PAHs
1 – 3	0.014 J R	145 J
3 – 5	0.005 J	33.9 J
5 – 7	0.009 J	NA
7 – 9	0.007 J	**686**
9 – 10.8	0.033 J	**875 J**

F-SB-23

DEPTH (ft)	BTEX	PAHs
3 – 5	0.001 J	1.8 J
11 – 13	**147 J**	NA
13 – 15	0.017	309
15 – 17	**25.7 J**	**569**

SB-106

DEPTH (ft)	BTEX	PAHs
4.5 – 6	0.007 J	98.8 J
6 – 8	ND	5.3 J

D-SB-4

DEPTH (ft)	BTEX	PAHs
14 – 16	ND	14.8

F-SB-25

DEPTH (ft)	BTEX	PAHs
4 – 6	0.19 J	NA
6 – 8	0.018 J	**1,284 J**
8 – 10	0.059 J	**831 J**
10 – 12	0.007 J	405 J
10 – 12 (DUP)	0.012 J	187 J
16 – 16.7	9.5	**3,887 J**

F-SB-26

DEPTH (ft)	BTEX	PAHs
0 – 2	0.003 J	30.4 J
4 – 6	0.002 J	0.87 J
8 – 10	0.004 J	7.9 J
10 – 12	0.001 J	14.2 J
14 – 15.2	**39.0 J**	**583 J**

LEGEND:

— - - —	PROPERTY LINE
▨	BUILDING
—··—··—	EDGE OF WATER
- - - - - -	STORM SEWER
🟩	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
SS-103 (Depth 0–0.5, BTEX NA, PAHs 8.6 J) ▨	SOIL SAMPLE INTERVAL WHERE SOIL WAS TREATED WITH ISS
▬ ▬ ▬	LINE OF DEMARCATION
352 ---------	CONTOUR ELEVATION
SB 102 ▲	RI SOIL BORING LOCATION
MW 102R ⌖	RI MONITORING WELL LOCATION
TP 101 ⬓	RI TEST PIT SAMPLE LOCATION
VP102 △	RI SOIL/GAS MONITORING LOCATION
SS 103 ■	RI SURFACE SOIL SAMPLE LOCATION
PZ-104 ▣	RI PIEZOMETER LOCATION
D-SB-01 ▲	PREVIOUS SOIL BORING LOCATION
TP ⬓	PREVIOUS TEST PIT SAMPLE LOCATION
F-TP-03 ⊟	PREVIOUS TEST PIT LOCATION – NO SAMPLE COLLECTED
SB-18 ⌖	PREVIOUS MONITORING WELL LOCATION
HE ⌘	PREVIOUS BACKGROUND SOIL SAMPLE LOCATION
D	DELTA ENVIRONMENTAL CONSULTANTS SAMPLE LOCATION
B	BUCK ENGINEERING, LLC SAMPLE LOCATION
F	FOSTER WHEELER SAMPLE LOCATION
▨	EXTENT OF MGP PIPING GALLERY REMOVAL
⬚	EXTENT OF ISS TREATMENT

NOTES:

1. FOR BASE MAP INFORMATION REFER TO NOTES ON FIGURE 2.
2. BTEX AND PAH CONCENTRATIONS REPORTED IN PARTS PER MILLION (PPM).
3. BTEX – BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENE (TOTAL).
4. PAHs – POLYNUCLEAR AROMATIC HYDROCARBONS (TOTAL).
5. J – INDICATES AN ESTIMATED VALUE.
6. DUP – DUPLICATE SAMPLE.
7. ND – NOT DETECTED.
8. R – TOTAL CONCENTRATION INCLUDES REJECTED ANALYTICAL DATA.
9. NA – NOT AVAILABLE/ NOT ANALYZED.
10. SHADED AND BOLDED VALUES INDICATE TOTAL BTEX CONCENTRATIONS GREATER THAN 10 ppm AND TOTAL PAH CONCENTRATIONS GREATER THAN 500 ppm.

0 20' 40'
GRAPHIC SCALE

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

TOTAL BTEX AND PAH CONCENTRATIONS IN SOIL SAMPLES (ppm)

ARCADIS

FIGURE
7

CITY:SYRACUSE, N.Y. DIV/GROUP:ENVCAD-141 DB:NES, W.JONES, A.Schilling LD:(Opt) PIC:(Opt) PM:M.JONES TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
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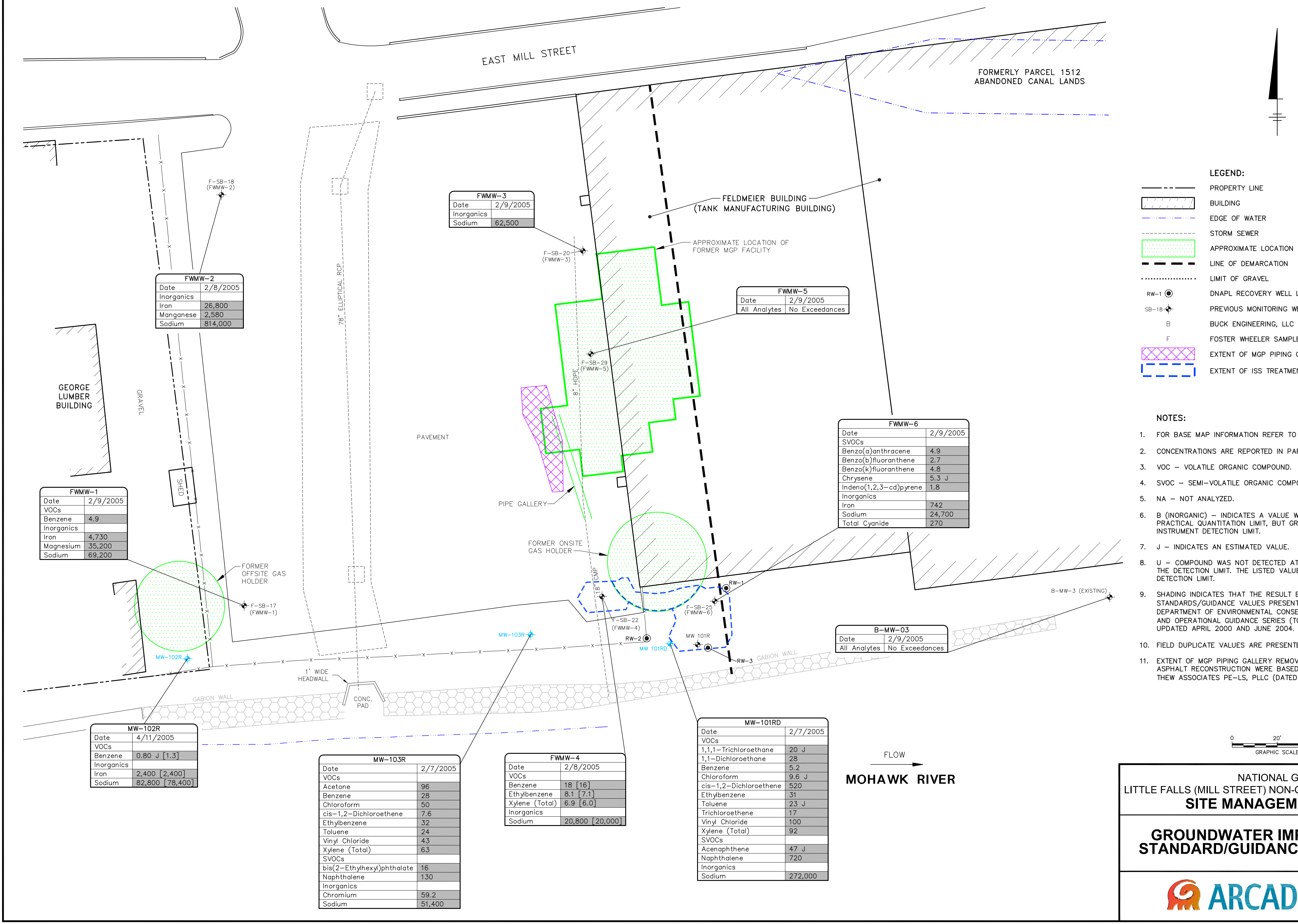

FWMW-1

Date	2/9/2005
VOCs	
Benzene	4.9
Inorganics	
Iron	4,730
Magnesium	35,200
Sodium	69,200

FWMW-2

Date	2/8/2005
Inorganics	
Iron	26,800
Manganese	2,580
Sodium	814,000

FWMW-3

Date	2/9/2005
Inorganics	
Sodium	62,500

FWMW-5

Date	2/9/2005
All Analytes	No Exceedances

FWMW-6

Date	2/9/2005
SVOCs	
Benzo(a)anthracene	4.9
Benzo(b)fluoranthene	2.7
Benzo(k)fluoranthene	4.8
Chrysene	5.3 J
Indeno(1,2,3-cd)pyrene	1.8
Inorganics	
Iron	742
Sodium	24,700
Total Cyanide	270

B-MW-03

Date	2/9/2005
All Analytes	No Exceedances

MW-102R

Date	4/11/2005
VOCs	
Benzene	0.80 J [1.3]
Inorganics	
Iron	2,400 [2,400]
Sodium	82,800 [78,400]

MW-103R

Date	2/7/2005
VOCs	
Acetone	96
Benzene	28
Chloroform	50
cis-1,2-Dichloroethene	7.6
Ethylbenzene	32
Toluene	24
Vinyl Chloride	43
Xylene (Total)	63
SVOCs	
bis(2-Ethylhexyl)phthalate	16
Naphthalene	130
Inorganics	
Chromium	59.2
Sodium	51,400

FWMW-4

Date	2/8/2005
VOCs	
Benzene	18 [16]
Ethylbenzene	8.1 [7.1]
Xylene (Total)	6.9 [6.0]
Inorganics	
Sodium	20,800 [20,000]

MW-101RD

Date	2/7/2005
VOCs	
1,1,1-Trichloroethane	20 J
1,1-Dichloroethane	28
Benzene	5.2
Chloroform	9.6 J
cis-1,2-Dichloroethene	520
Ethylbenzene	31
Toluene	23 J
Trichloroethene	17
Vinyl Chloride	100
Xylene (Total)	92
SVOCs	
Acenaphthene	47 J
Naphthalene	720
Inorganics	
Sodium	272,000

LEGEND:

—·—	PROPERTY LINE
▨	BUILDING
─··─	EDGE OF WATER
- - -	STORM SEWER
🟩	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
▬ ▬	LINE OF DEMARCATION
········	LIMIT OF GRAVEL
RW-1 ◉	DNAPL RECOVERY WELL LOCATION
SB-18 ⊕	PREVIOUS MONITORING WELL LOCATION
B	BUCK ENGINEERING, LLC SAMPLE LOCATION
F	FOSTER WHEELER SAMPLE LOCATION
▩	EXTENT OF MGP PIPING GALLERY REMOVAL
▭	EXTENT OF ISS TREATMENT

NOTES:

1. FOR BASE MAP INFORMATION REFER TO NOTES ON FIGURE 2.
2. CONCENTRATIONS ARE REPORTED IN PARTS PER BILLION (ppb).
3. VOC – VOLATILE ORGANIC COMPOUND.
4. SVOC – SEMI-VOLATILE ORGANIC COMPOUND.
5. NA – NOT ANALYZED.
6. B (INORGANIC) – INDICATES A VALUE WHICH IS LESS THAN THE PRACTICAL QUANTITATION LIMIT, BUT GREATER THAN OR EQUAL TO THE INSTRUMENT DETECTION LIMIT.
7. J – INDICATES AN ESTIMATED VALUE.
8. U – COMPOUND WAS NOT DETECTED AT A CONCENTRATION EXCEEDING THE DETECTION LIMIT. THE LISTED VALUE REPRESENTS THE LABORATORY DETECTION LIMIT.
9. SHADING INDICATES THAT THE RESULT EXCEEDS THE CLASS GA STANDARDS/GUIDANCE VALUES PRESENTED IN THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) TECHNICAL AND OPERATIONAL GUIDANCE SERIES (TOGS) 1.1.1, DATED JUNE 1998, UPDATED APRIL 2000 AND JUNE 2004.
10. FIELD DUPLICATE VALUES ARE PRESENTED IN BRACKETS [ ].
11. EXTENT OF MGP PIPING GALLERY REMOVAL, ISS TREATMENT AREA, AND ASPHALT RECONSTRUCTION WERE BASED ON SURVEY PERFORMED BY THEW ASSOCIATES PE-LS, PLLC (DATED 9/23/09).

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

GROUNDWATER IMPACTS ABOVE STANDARD/GUIDANCE VALUES (ppb)

ARCADIS

FIGURE
8

CITY:SYRACUSE, N.Y. DIV/GROUP:ENVCAD-141 DB W.JONES, A.Schilling, R.BASSETT LD:(Opt) PIC:(Opt) PM:M.JONES TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
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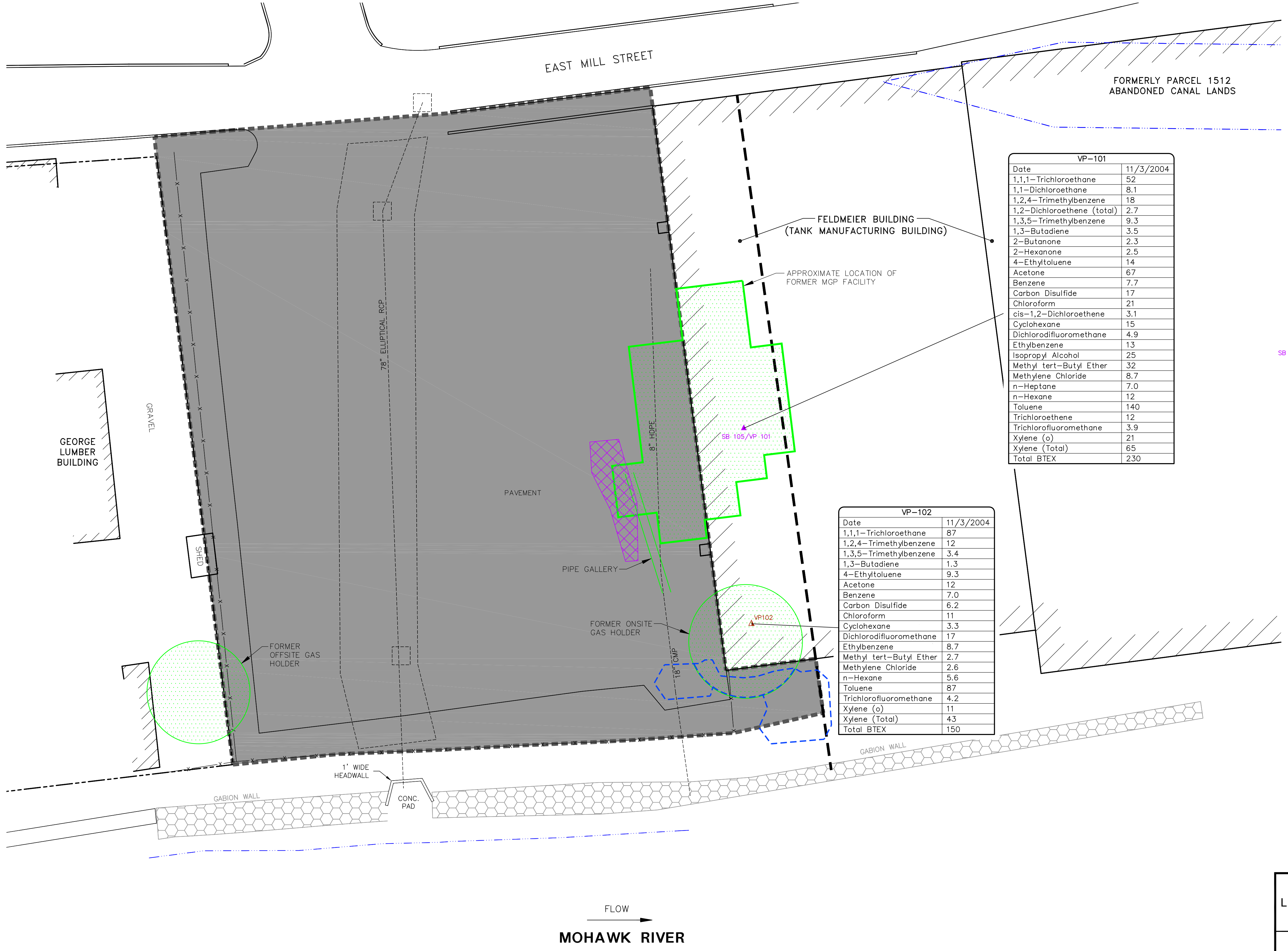


VP-101	
Date	11/3/2004
1,1,1-Trichloroethane	52
1,1-Dichloroethane	8.1
1,2,4-Trimethylbenzene	18
1,2-Dichloroethene (total)	2.7
1,3,5-Trimethylbenzene	9.3
1,3-Butadiene	3.5
2-Butanone	2.3
2-Hexanone	2.5
4-Ethyltoluene	14
Acetone	67
Benzene	7.7
Carbon Disulfide	17
Chloroform	21
cis-1,2-Dichloroethene	3.1
Cyclohexane	15
Dichlorodifluoromethane	4.9
Ethylbenzene	13
Isopropyl Alcohol	25
Methyl tert-Butyl Ether	32
Methylene Chloride	8.7
n-Heptane	7.0
n-Hexane	12
Toluene	140
Trichloroethene	12
Trichlorofluoromethane	3.9
Xylene (o)	21
Xylene (Total)	65
Total BTEX	230

VP-102	
Date	11/3/2004
1,1,1-Trichloroethane	87
1,2,4-Trimethylbenzene	12
1,3,5-Trimethylbenzene	3.4
1,3-Butadiene	1.3
4-Ethyltoluene	9.3
Acetone	12
Benzene	7.0
Carbon Disulfide	6.2
Chloroform	11
Cyclohexane	3.3
Dichlorodifluoromethane	17
Ethylbenzene	8.7
Methyl tert-Butyl Ether	2.7
Methylene Chloride	2.6
n-Hexane	5.6
Toluene	87
Trichlorofluoromethane	4.2
Xylene (o)	11
Xylene (Total)	43
Total BTEX	150

LEGEND:

▨	AREA OF VAPOR INTRUSION CONCERN
—·—	PROPERTY LINE
▨	BUILDING
-·-·-	EDGE OF WATER
- - -	STORM SEWER
🟩	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
— —	LINE OF DEMARCATION
······	LIMIT OF GRAVEL
SB 105/VP 101 ▲	RI SOIL BORING LOCATION
VP102 ▲	RI SOIL/GAS MONITORING LOCATION
▨	EXTENT OF MGP PIPING GALLERY REMOVAL
- - -	EXTENT OF ISS TREATMENT

NOTES:

1. FOR BASE MAP INFORMATION REFER TO NOTES ON FIGURE 2.
2. CONCENTRATIONS ARE REPORTED IN MICROGRAMS PER CUBIC METER ($\mu g/m^3$).
3. VOC – VOLATILE ORGANIC COMPOUND.
4. ONLY THOSE CONSTITUENTS DETECTED ARE SUMMARIZED.
5. J – INDICATES AN ESTIMATED VALUE.

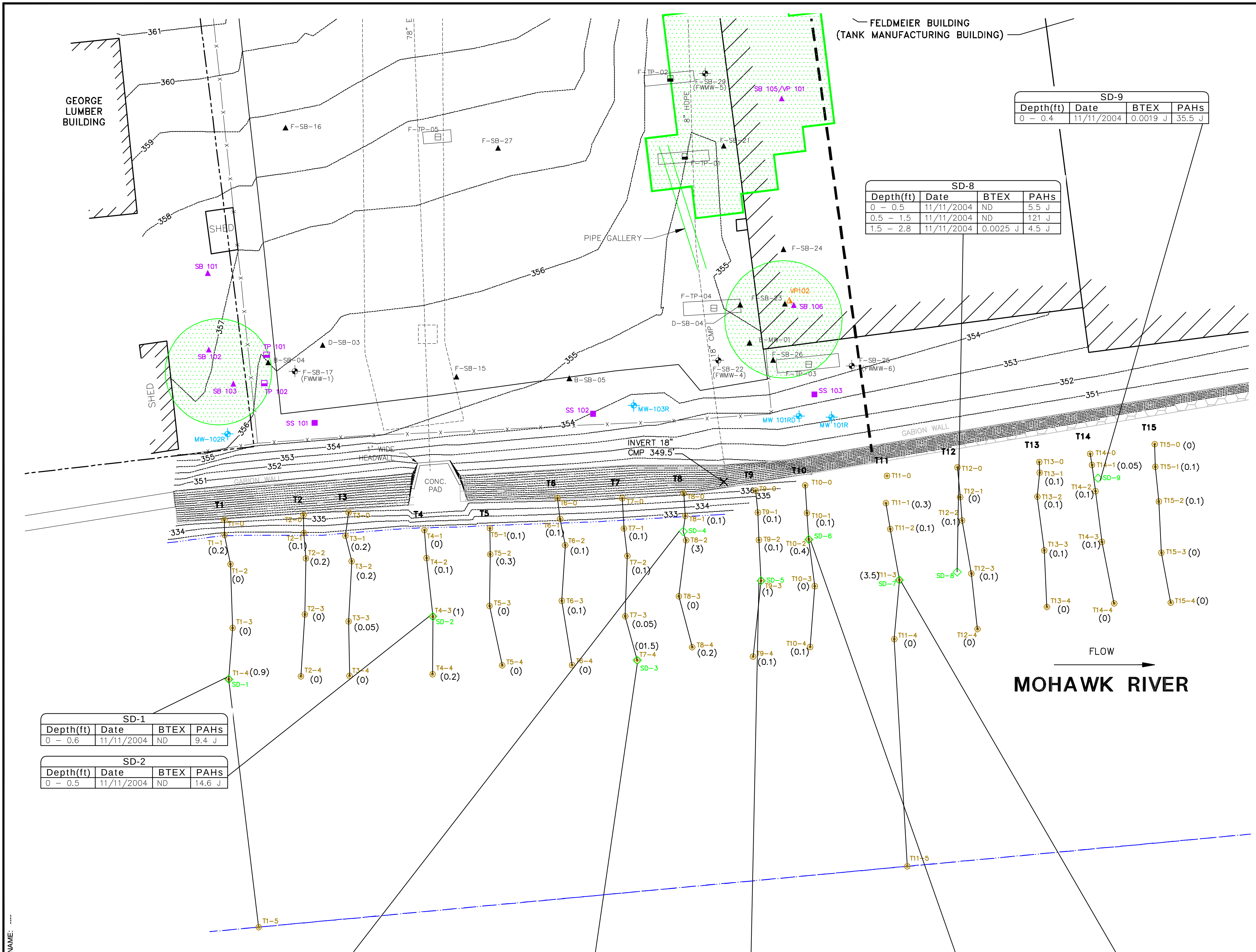
0 20' 40'
GRAPHIC SCALE

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

SOIL GAS ANALYTICAL DETECTED RESULTS AND AREA OF POTENTIAL VAPOR INTRUSION CONCERN

ARCADIS

FIGURE
9



SD-1

Depth(ft)	Date	BTEX	PAHs
0 – 0.6	11/11/2004	ND	9.4 J

SD-2

Depth(ft)	Date	BTEX	PAHs
0 – 0.5	11/11/2004	ND	14.6 J

SD-3

Depth(ft)	Date	BTEX	PAHs
0 – 0.7	11/11/2004	0.0064 J	2.9 J

SD-4

Depth(ft)	Date	BTEX	PAHs
0 – 0.5	11/11/2004	0.0027	108 J
0.5 – 1.1	11/11/2004	ND	59.2 J

SD-5

Depth(ft)	Date	BTEX	PAHs
0 – 0.7	11/11/2004	ND	3.2 J

SD-6

Depth(ft)	Date	BTEX	PAHs
0 – 0.5	11/11/2004	0.13	39.1 J

SD-7

Depth(ft)	Date	BTEX	PAHs
0 – 0.5	11/11/2004	0.02	28.9 J
0 – 0.5 DUP	11/11/2004	0.032 J	35.8 J
0.5 – 1.5	11/11/2004	0.024 J	54.9 J
1.5 – 2.1	11/11/2004	0.094 J	40.2 J

SD-8

Depth(ft)	Date	BTEX	PAHs
0 – 0.5	11/11/2004	ND	5.5 J
0.5 – 1.5	11/11/2004	ND	121 J
1.5 – 2.8	11/11/2004	0.0025 J	4.5 J

SD-9

Depth(ft)	Date	BTEX	PAHs
0 – 0.4	11/11/2004	0.0019 J	35.5 J

LEGEND:

—·—·—	PROPERTY LINE
▨	BUILDING
—··—··—	EDGE OF WATER
- - - - -	STORM SEWER
🟩	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
▬ ▬ ▬	LINE OF DEMARCATION
352 - - - - -	CONTOUR ELEVATION
SB 102 ▲	RI SOIL BORING LOCATION
MW 102R ⌖	RI MONITORING WELL LOCATION
TP 101 ⬓	RI TEST PIT SAMPLE LOCATION
VP102 △	RI SOIL/GAS MONITORING LOCATION
SS 103 ■	RI SURFACE SOIL SAMPLE LOCATION
T1	SEDIMENT PROBING TRANSECT ID
D-SB-01 ▲	PREVIOUS SOIL BORING LOCATION
TP ⬓	PREVIOUS TEST PIT SAMPLE LOCATION
F-TP-03 ⊟	PREVIOUS TEST PIT LOCATION – NO SAMPLE COLLECTED
SB-18 ⌖	PREVIOUS MONITORING WELL LOCATION
HE ⌧	PREVIOUS BACKGROUND SOIL SAMPLE LOCATION
D	DELTA ENVIRONMENTAL CONSULTANTS SAMPLE LOCATION
B	BUCK ENGINEERING, LLC SAMPLE LOCATION
F	FOSTER WHEELER SAMPLE LOCATION
(0.1)	DEPTH OF SEDIMENT MEASURED DURING PROBING (11/2004) (FEET)

NOTES:

1. FOR BASE MAP INFORMATION REFER TO NOTES ON FIGURES 2.
2. BTEX AND PAH CONCENTRATIONS REPORTED IN MILLIGRAMS PER KILOGRAM (MG/KG) OR PARTS PER MILLION (ppm).
3. BTEX – BENZENE, TOLUENE, ETHYLBENZENE AND XYLENES (TOTAL)
4. PAHs – POLYNUCLEAR AROMATIC HYDROCARBONS
5. DUP – DUPLICATE SAMPLE
6. ND – NOT DETECTED AT CONCENTRATIONS EXCEEDING LABORATORY DETECTION LIMITS
7. J – INDICATES AN ESTIMATED VALUE

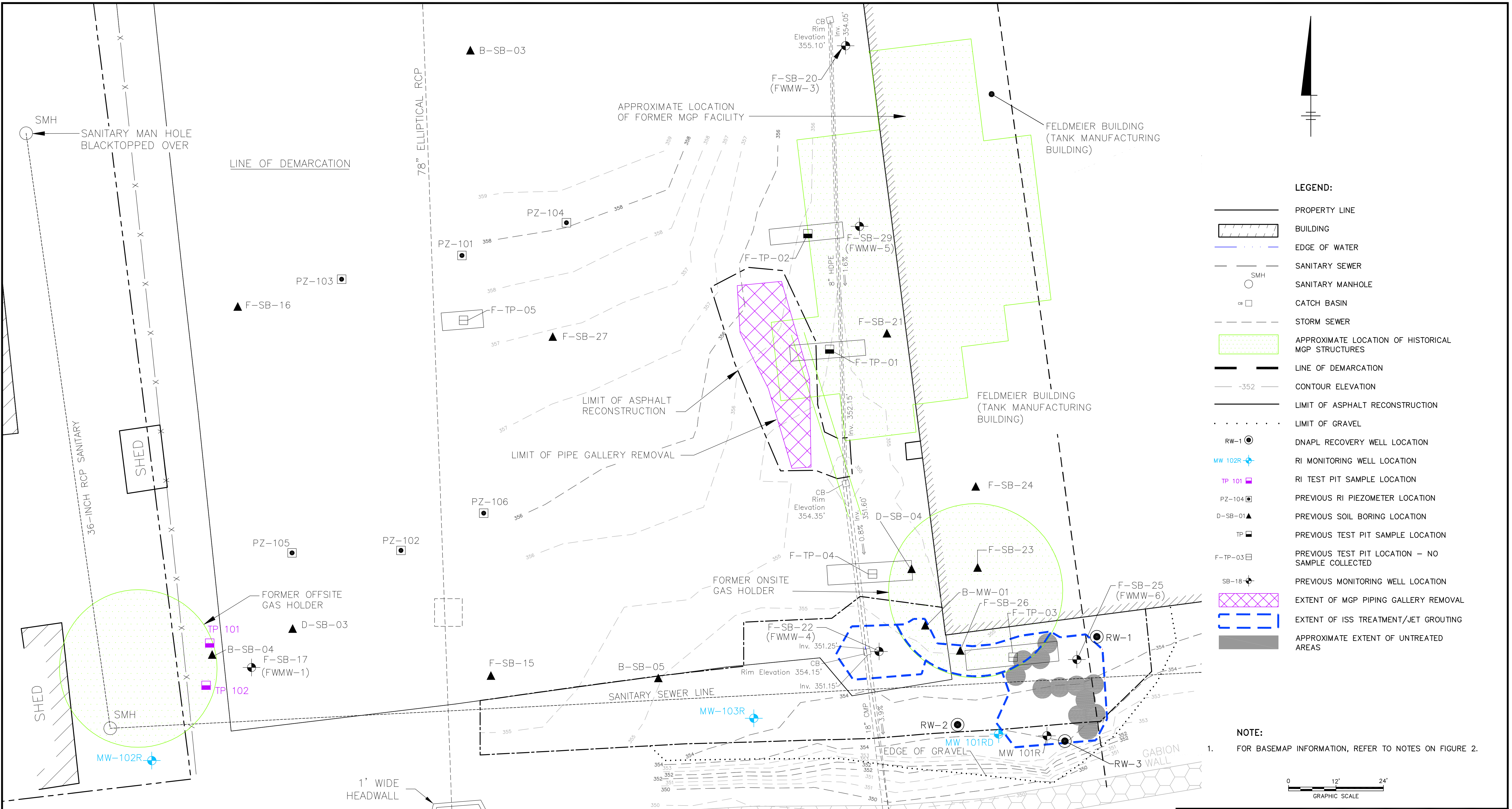
NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

TOTAL BTEX AND PAH CONCENTRATIONS IN SEDIMENT SAMPLES (ppm)

ARCADIS

FIGURE
10

CITY:Syracuse DIV/GROUP:Env-141 DB:N.Smithgall K.Sartori A.Schilling LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0036673\0000\00013\DWG\36673C07.DWG LAYOUT: 10SAVED: 4/19/2010 4:03 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: ----PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 4/19/2010 4:03 PM BY: SCHILLING, ADAM
XREFS: IMAGES: PROJECTNAME: ----
36673X03
36673XDL



LEGEND:

▬	PROPERTY LINE
▨	BUILDING
- · · -	EDGE OF WATER
— — —	SANITARY SEWER
SMH ○	SANITARY MANHOLE
CB □	CATCH BASIN
- - - -	STORM SEWER
🟩	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
▬ ▬	LINE OF DEMARCATION
-352	CONTOUR ELEVATION
▬	LIMIT OF ASPHALT RECONSTRUCTION
· · · · · · ·	LIMIT OF GRAVEL
RW-1 ◉	DNAPL RECOVERY WELL LOCATION
MW 102R ⊕	RI MONITORING WELL LOCATION
TP 101 ⬓	RI TEST PIT SAMPLE LOCATION
PZ-104 ▣	PREVIOUS RI PIEZOMETER LOCATION
D-SB-01 ▲	PREVIOUS SOIL BORING LOCATION
TP ⬓	PREVIOUS TEST PIT SAMPLE LOCATION
F-TP-03 ⊟	PREVIOUS TEST PIT LOCATION – NO SAMPLE COLLECTED
SB-18 ⊕	PREVIOUS MONITORING WELL LOCATION
▩	EXTENT OF MGP PIPING GALLERY REMOVAL
▭	EXTENT OF ISS TREATMENT/JET GROUTING
■	APPROXIMATE EXTENT OF UNTREATED AREAS

NOTE:

1. FOR BASEMAP INFORMATION, REFER TO NOTES ON FIGURE 2.

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SIT
SITE MANAGEMENT PLAN

EXTENT OF REMEDIAL ACTIVITIES AND DNAPL RECOVERY WELL LOCATIONS

ARCADIS

FIGURE
11

CITY:SYRACUSE, NY GROUP:ENVCAD DB:W.JONES, P. LISTER A.Schilling , R. Bassett PM/TM/TR: M. JONES LYR:ON=*;OFF=REF, (FRZ)
G:\ENVCAD\SYRACUSE\ACT\B0036673\0000\00013\DWG\36673G01.DWG LAYOUT: 11 SAVED: 4/21/2011 1:31 PM ACADVER: 18.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 4/21/2011 1:32 PM BY: LISTER, PAUL
XREFS: IMAGES: PROJECTNAME: ----
36673X00
36673X02

CITY:SYRACUSE, NY GROUP:ENVCAD DB: W.JONES, P. LISTER A.Schilling PM/TM/TR: M. JONES LYR:ON=*;OFF=REF, (FRZ)
G:\ENVCAD\SYRACUSE\ACT\B0036673\0000\00013\DWG\36673G02.DWG LAYOUT: 12 SAVED: 3/16/2011 11:52 AM ACADVER: 18.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 3/16/2011 11:52 AM BY: BASSETT, RICHARD
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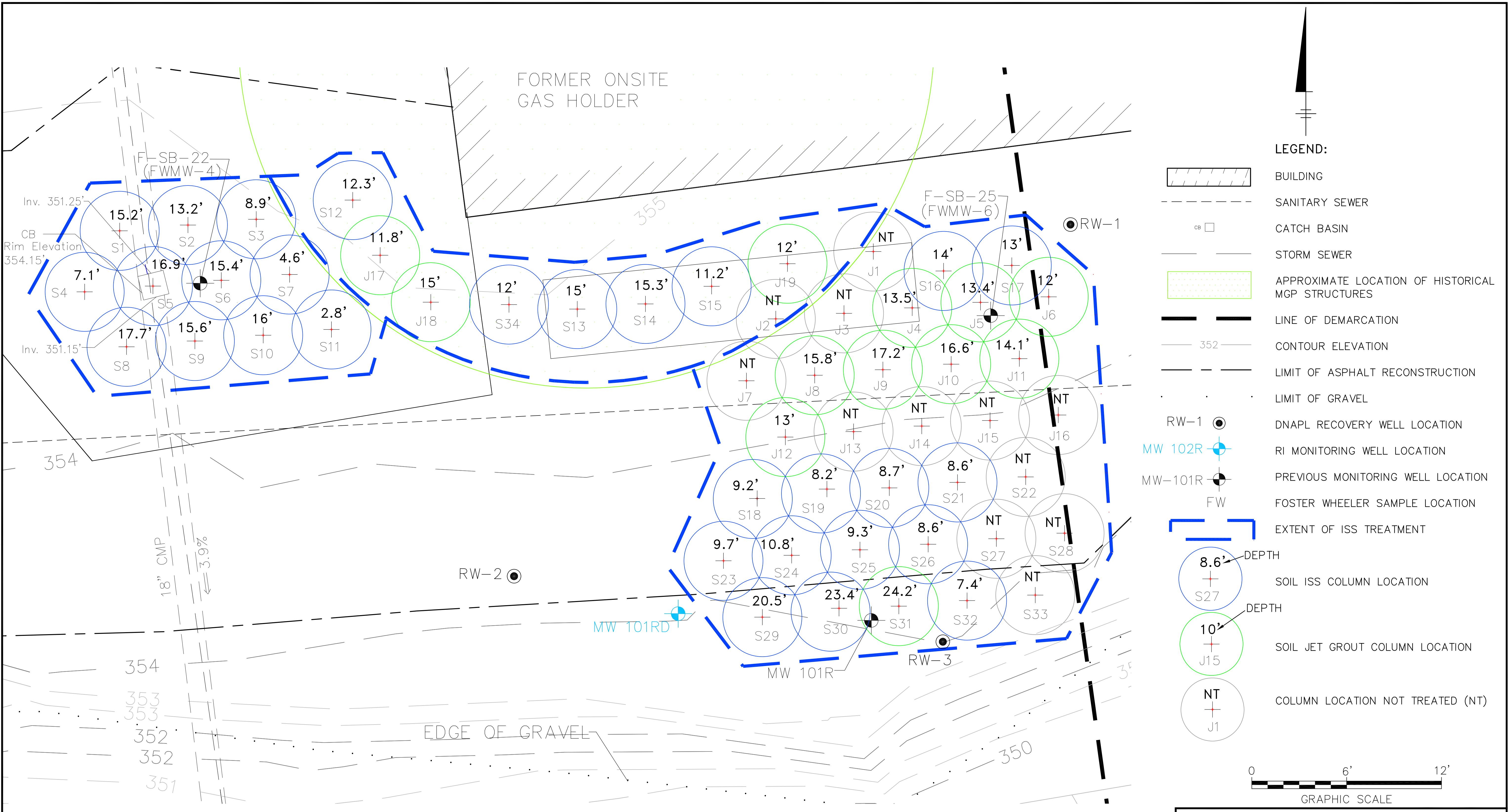


NOTE:

1. FOR BASEMAP INFORMATION, REFER TO NOTES ON FIGURE 2.

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

ISS TREATMENT AND JET GROUT COLUMN LOCATIONS

ARCADIS

FIGURE
12

LEGEND:

▆	ASPHALT COVER
▆	GRAVEL COVER
🟩	VEGETATIVE COVER
— - —	PROPERTY LINE
▨	EXISTING BUILDING
- · - · -	EDGE OF WATER
— — —	SANITARY SEWER
- - - -	STORM SEWER
▬ ▬ ▬	LINE OF DEMARCATION
OHW ———	OVERHEAD WIRES
MH ○	MANHOLE
SMH ○	SANITARY MANHOLE
GT □	GAS VALVE
WV ○	WATER VALVE
———	GAS LINE
CIP	CAST IRON PIPE
RCP	REINFORCED CONCRETE PIPE
CMP	CORRUGATED METAL PIPE
DIP	DUCTILE IRON PIPE
NM 14 1/2 ⌀	NUMBER OF OVERHEAD WIRE POLE
HYD ⊄	HYDRANT
- · · - · ·	APPROXIMATE LOCATION OF SHORELINE

NOTE:

1. FOR BASE MAP INFORMATION REFER TO NOTES ON FIGURE 1 AND 7.

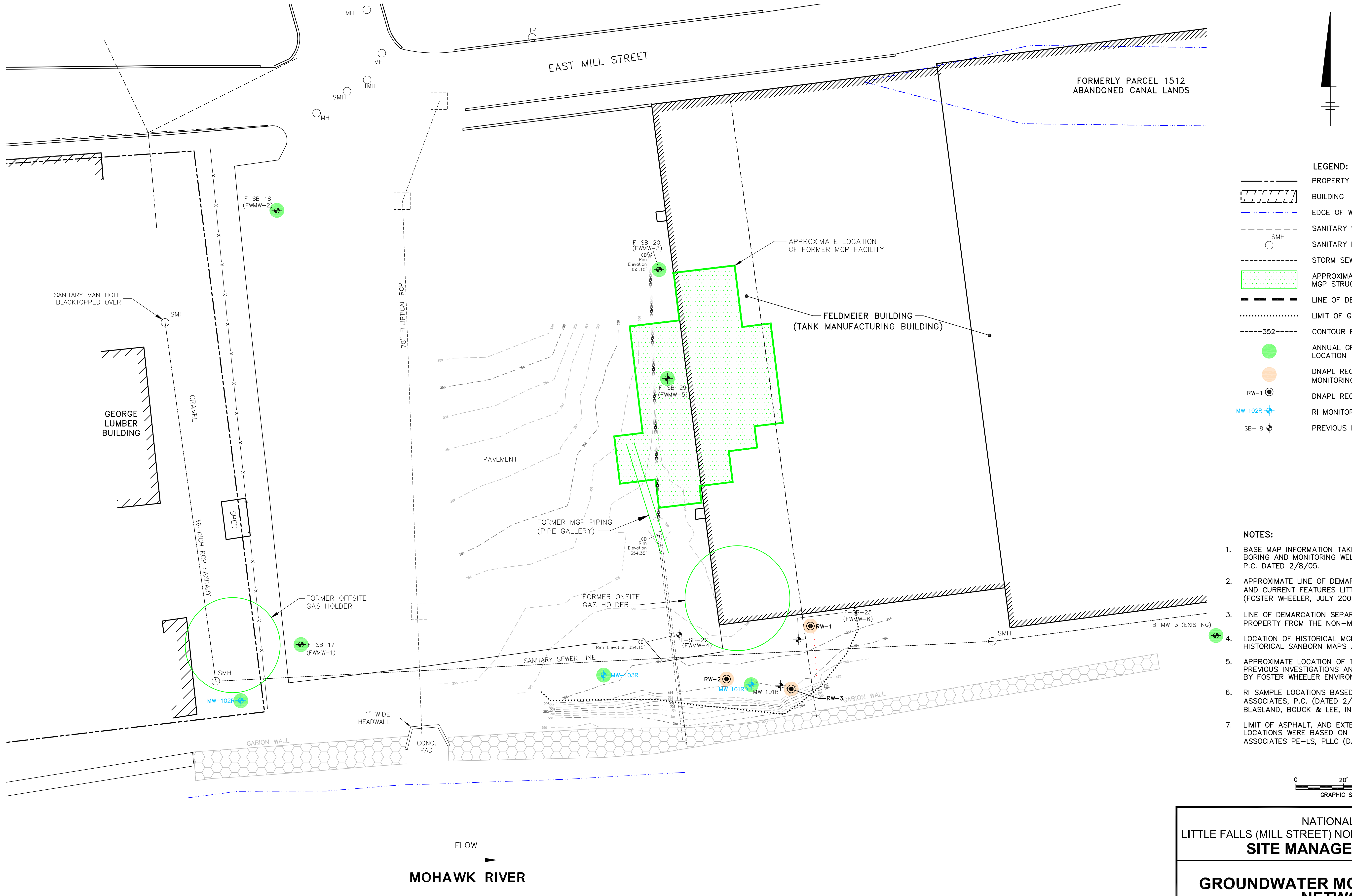
NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

LOCATION OF COVER SYSTEM TYPES

ARCADIS

FIGURE
13

CITY:SYRACUSE,N.Y. DIV/GROUP:ENVCAD-141 DB: W.JONES, A.Schilling, R. BASSETT LD:(Opt) PIC:(Opt) PM:M.JONES TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0036673\0000\00013\DWG\36673T01.DWG LAYOUT: 13 SAVED: 3/16/2011 11:54 AM ACADVER: 18.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 3/16/2011 11:55 AM BY: BASSETT, RICHARD



LEGEND:

— · — · —	PROPERTY LINE
▨	BUILDING
— · · — · ·	EDGE OF WATER
– – – – –	SANITARY SEWER
SMH ○	SANITARY MANHOLE
- - - - - -	STORM SEWER
🟩	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
▬ ▬ ▬	LINE OF DEMARCATION
··········	LIMIT OF GRAVEL
-----352-----	CONTOUR ELEVATION
●	ANNUAL GROUNDWATER SAMPLING LOCATION
●	DNAPL RECOVERY WELL MONITORING/RECOVERY LOCATION
RW-1 ◉	DNAPL RECOVER WELL LOCATION
MW 102R ⌖	RI MONITORING WELL LOCATION
SB-18 ⌖	PREVIOUS MONITORING WELL LOCATION

NOTES:

1. BASE MAP INFORMATION TAKEN FROM A DRAWING TITLED SOIL BORING AND MONITORING WELL LOCATIONS BY C.T.MALE ASSOCIATES, P.C. DATED 2/8/05.
2. APPROXIMATE LINE OF DEMARCATION BASED ON HISTORIC TAX LOTS AND CURRENT FEATURES LITTLE FALLS (MILL ST.) SITE, FIGURE 1 (FOSTER WHEELER, JULY 2003).
3. LINE OF DEMARCATION SEPARATES THE MGP (VCO) PORTION OF THE PROPERTY FROM THE NON-MGP (VCA) PORTION OF THE PROPERTY.
4. LOCATION OF HISTORICAL MGP STRUCTURES ARE BASED ON HISTORICAL SANBORN MAPS AND ARE APPROXIMATE.
5. APPROXIMATE LOCATION OF THE PIPE GALLERY IS BASED ON PREVIOUS INVESTIGATIONS AND TEST PITTING ACTIVITIES CONDUCTED BY FOSTER WHEELER ENVIRONMENTAL CORPORATION.
6. RI SAMPLE LOCATIONS BASED ON SURVEY PERFORMED BY C.T. MALE ASSOCIATES, P.C. (DATED 2/8/05) AND SURVEY PERFORMED BY BLASLAND, BOUCK & LEE, INC. IN 11/2004 AND 4/2005.
7. LIMIT OF ASPHALT, AND EXTENT OF GRAVEL, AND RECOVERY WELL LOCATIONS WERE BASED ON SURVEY PERFORMED BY THEW ASSOCIATES PE-LS, PLLC (DATED 9/23/09).

0 20' 40'
GRAPHIC SCALE

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
SITE MANAGEMENT PLAN

GROUNDWATER MONITORING WELL NETWORK

ARCADIS

FIGURE
14

CITY:SYRACUSE,N.Y. DIV/GROUP:ENVCAD-141 DB:NES, R.ALLEN A.Schilling LD:(Opt) PIC:(Opt) PM:M.JONES TM:(Opt) LYR:(Opt)ON=*;OFF=*REF* PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 3/16/2011 11:28 AM BY: BASSETT, RICHARD
G:\ENVCAD\SYRACUSE\ACT\B0036673\0000\00013\DWG\36673B03.DWG LAYOUT: 14 SAVED: 3/16/2011 11:28 AM ACADVER: 18.0S (LMS TECH) PAGESETUP: ----

Appendix A

Deed Restriction (to be supplied later)

Appendix B

Excavation Work Plan

APPENDIX B – EXCAVATION WORK PLAN

B-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining MGP-impacted areas, the site owner or their representative will notify the Department. Currently, this notification will be made to:

Mr. Bernard Franklin
Environmental Engineer
Remedial Action Bureau C
Division of Environmental Remediation
NYSDEC
625 Broadway – 11th Floor
Albany, New York 12233-7014

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent, plans for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an EC.
- A summary of environmental conditions anticipated in the work areas, including the nature and concentration levels of COCs, potential presence of impacted media, and plans for any pre-construction sampling.
- A schedule for the work, detailing the start and completion of all intrusive work.
- A summary of the applicable components of this EWP.
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120.
- A copy of the contractor's health and safety plan, in electronic format, if it differs from the HASP provided in Appendix C of this document.
- Identification of disposal facilities for potential waste streams.

- Identification of sources of any anticipated backfill, along with all required chemical testing results.

B-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based soil screening will be performed by a qualified environmental professional during all remedial and development excavations into known or potentially impacted material (remaining impacts). Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the Certificate of Completion.

Soils will be segregated based on previous environmental data and screening results into material that requires offsite disposal, material that requires testing, material that can be returned to the subsurface, and material that can be used as cover soil.

Stockpiled potentially impacted soil/fill shall be sampled and analyzed to evaluate whether the material can be replaced beneath a soil cover at the Site or must be transported for offsite disposal. Samples will be collected and analyzed as described in Section A-7.

B-3 STOCKPILE METHODS

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be covered using polyethylene sheeting to reduce potential infiltration of precipitation, migration of wind-blown dust, and direct contact exposures. Stockpiles will be routinely inspected and damaged polyethylene sheeting will be promptly replaced. During future activities that may disturb the ground surface, erosion and sedimentation control measures shall be employed in accordance with site-specific plans (e.g., stormwater pollution prevention plans [Appendix J of the SMP]) prepared in conformance with applicable laws and regulations. Proven soil conservation practices shall be incorporated in any such plans in order to mitigate soil erosion, offsite sediment migration, and water pollution from erosion. Appropriate temporary erosion control measures (e.g., silt fencing, hay bales) shall be implemented and maintained around all impacted and potentially impacted soil/fill stockpiles and unvegetated soil surfaces at the Site during such activities. Such stockpiles shall be graded and compacted as necessary for positive surface water runoff and dust control.

Stockpiles will be inspected at a minimum frequency of once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC.

B-4 MATERIALS EXCAVATION AND LOAD OUT

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of excavated material.

The owner of the property and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the Site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the Site.

Loaded vehicles leaving the Site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

Where necessary, a truck wash will be operated onsite. The qualified environmental professional will monitor that all outbound trucks loaded with potentially MGP-impacted material will be washed at the truck wash before leaving the Site until the activities performed under this section are complete.

Locations where vehicles enter or exit the Site shall be inspected daily for evidence of offsite soil tracking.

The qualified environmental professional will be responsible for monitoring that all egress points for truck and equipment transport from the Site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

B-5 MATERIALS TRANSPORT OFFSITE

All transport of materials designated for off-site disposal will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the Site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

All trucks loaded with potentially MGP-impacted material will be washed prior to leaving the Site. Truck wash waters will be collected and disposed of offsite in an appropriate manner.

Truck transport routes for soil disposed of as a non-hazardous waste at the Oneida-Herkimer Solid Waste Authority (OHSWA) regional landfill are as follows:

- Leave the Site heading west on East Mill Street.
- Turn right onto Mill Street.
- Turn left onto Elizabeth Street.
- Turn right onto NY-167 North.
- Turn right onto Albany Street.
- Turn left onto South Ann Street.
- Slight left onto West Monroe Street/NY-169 North.
- Continue onto North Main Street/NY-28 North.
- Turn left at New York 12D North/Schuyler Street.
- Turn left at Post Street.
- Turn right onto Ford Street/NY-294 West.
- Arrive at 7044 New York 294, Boonville, NY 13309.

Truck transport routes for groundwater/decontamination water disposed of as a non-hazardous waste at the Industrial Oil Tank Services Corporation are as follows:

- Leave the Site heading west on East Mill Street.
- Turn right onto Elizabeth Street.
- Turn right onto NY-167 South.
- Turn right at NY-5S West.
- Turn right onto East Main Street/NY-28 North.
- Turn right onto I-90 West.
- Take exit 32 toward NY-233/Westmoreland/Rome.
- Turn left at Cider Street.
- Turn left at County Road 40/Judd Road.

- Continue on County Road 90/Sutliff Road.
- Turn left at Dry Road.
- Arrive at 120 Dry Road, Oriskany, NY 13424.

All trucks loaded with site materials will exit the vicinity of the Site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting offsite queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport; and (g) community input [where necessary].

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

Egress points for truck and equipment transport from the Site will be kept clean of dirt and other materials during site remediation and development.

Queuing of trucks will be performed onsite in order to minimize offsite disturbance. Offsite queuing will be prohibited.

B-6 MATERIALS DISPOSAL OFFSITE

All soil/fill/solid waste excavated and removed from the Site will be treated as impacted and regulated material and will be transported and disposed in accordance with all local, State (including 6 NYCRR Part 360) and Federal regulations. If disposal of soil/fill from this Site is proposed for unregulated offsite disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated offsite management of materials from this Site will not occur without formal NYSDEC approval.

Offsite disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate (i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C/D recycling facility, etc.). Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and impacted soils taken offsite will be handled, at minimum, as a Municipal Solid Waste per 6 NYCRR Part 360-1.2. Material that does not meet Track 1 unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6 NYCRR Part 360-16 Registration Facility).

B-7 MATERIALS REUSE ONSITE

Excavated soil/fill that is visibly stained or exhibits an obvious odor shall be considered potentially impacted and stockpiled onsite for further assessment. Potentially impacted soil/fill shall be placed on polyethylene sheeting in stockpiles not to exceed 250 cubic yards (CY). The stockpiled potentially impacted soil/fill shall be covered whenever soils are not actively being placed into or removed from the stockpile, during overnight/weekend hours, during periods of precipitation, or whenever dust action levels are exceeded. This material shall be covered using polyethylene sheeting to reduce potential infiltration of precipitation, migration of wind-blown dust, and direct contact exposures.

Stockpiled potentially impacted soil/fill shall be sampled and analyzed to evaluate whether the material can be replaced beneath soil cover at the Site or must be transported for offsite disposal. One composite sample shall be collected for each 250 CY of potentially impacted soils. One duplicate sample shall also be collected for every 20 samples, with a minimum of one duplicate per sample delivery group (SDG). Each composite sample shall be formed using individual grab samples collected from five locations within each stockpile (i.e., five discrete grab samples per composite). The composite sample shall be formed by placing equal portions of soil from each of the five discrete grab sampling locations into a pre-cleaned, stainless steel bowl (or dedicated container). The composite sample shall be thoroughly homogenized using a stainless steel scoop or trowel before being transferred into the sample containers provided by the laboratory. The filled sample containers shall be labeled and transported to the laboratory using a chain-of-custody form. Each sample will be submitted for the following:

- TCL VOCs using USEPA Method 8260.

- TCL SVOCs using USEPA Method 8270.

- TAL inorganics and cyanide using USEPA Methods 6010, 7041, and 9012.

Chemical criteria for onsite reuse of material will be the industrial SCOs presented in 6 NYCRR Part 375. The qualified environmental professional will document that procedures defined for material reuse in this SMP are followed and that unacceptable material does not remain onsite. Impacted onsite material, including historic fill and impacted soil, that is acceptable for re-use onsite will be placed below the cover system, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Any demolition material proposed for reuse onsite will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing onsite will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the Site will not be reused onsite.

B-8 FLUIDS MANAGEMENT

Efforts shall be made to minimize the amount of water that could enter the excavation (e.g., installing a berm around the excavation or covering the excavation to prevent runoff from entering during precipitation). Water accumulated in excavations within the Site shall be pumped out during or after precipitation events (as appropriate), containerized, and characterized as discussed below.

At a minimum, water encountered in excavations shall be sampled and analyzed for the COCs known to be in the area as determined by previous analytical results, which may include VOCs, SVOCs, and/or inorganic constituents. Results shall be compared to the groundwater standards/guidance values set forth in TOGS 1.1.1. If the water meets the groundwater quality standards, it may be discharged to the ground surface. If the water does not meet the groundwater quality standards, it shall be discharged to the local sewer authority (if authorized), transported offsite for proper disposal, or treated onsite via a treatment system that has been approved by the NYSDEC, as appropriate. Runoff from surface discharges (if any) shall be controlled. No discharges shall enter a surface water body without proper permits.

All liquids to be removed from the Site, including excavation dewatering and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the Site, without NYSDEC approval.

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed under a SPDES permit.

B-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the RAWP. If the type of cover system changes from that which exists prior to the excavation (i.e., asphalt is replaced by soil cover), this will constitute a modification of the cover element of the remedy and the upper surface of the ‘remaining impacted areas’. A figure showing the modified surface will be included in the subsequent Annual Review Report and in any updates to the SMP.

B-10 BACKFILL FROM OFFSITE SOURCES

In the event fill material is imported from offsite sources to backfill subsurface excavations or provide a soil cover layer at the Site, imported material shall meet the following criteria:

- Offsite borrow soils shall be documented as having originated from locations having no evidence of disposal or release of hazardous, toxic or radioactive substances, wastes or petroleum products.

- Offsite borrow soils cannot otherwise be defined as a solid waste in accordance with 6 NYCRR Part 360-1.2(a).

- If an offsite source is designated as “virgin” soil, it shall be further documented in writing to be native soil material from areas not having supported any known prior industrial or commercial development or agricultural use.

- Virgin soils shall be subjected to collection of one representative composite sample (formed using individual grab samples collected from five locations) and one representative discrete sample per source. The composite sample shall be analyzed for PCBs, pesticides, TCL SVOCs, and TAL inorganic constituents (including cyanide). The discrete sample shall be analyzed for TCL VOCs. The soil shall be acceptable for use as soil cover material provided that no chemical constituents are identified at concentrations above applicable SCOs (e.g., 6 NYCRR Part 375 – Unrestricted Use). The material shall be acceptable for use as subsurface fill provided that no chemical constituents are identified at concentrations above the industrial use SCOs presented in 6 NYCRR Part 375 – 6.8.

- Non-virgin soils shall be tested via collection of one composite sample per 500 CY of material from each source area. If more than 1,000 CY of soil are borrowed from a given offsite non-virgin soil source area and both samples of the first 1,000 CY meet appropriate comparison criteria (e.g., 6 NYCRR Part 375 – Unrestricted or Industrial Use), the sample collection frequency shall be reduced to one composite for every 2,500 CY of additional soils from the same source, up to 5,000 CY. For borrow sources greater than 5,000 CY, sampling frequency may be reduced to one sample per 5,000 CY, provided all earlier samples met appropriate comparison criteria. The soil shall be acceptable for use as soil cover material provided that no chemical constituents are identified at concentrations above the unrestricted use SCOs presented in 6 NYCRR Part 375. The material shall be acceptable for use as subsurface fill provided that no chemical constituents are identified at concentrations above the industrial use SCOs presented in 6 NYCRR Part 375.

- Topsoil used for the final cover of the barrier layer shall be fertile, friable, natural loam surface soil, capable of sustaining plant growth, and free of clods or hard earth, plants or roots, sticks or other extraneous material that could discourage plant growth. Topsoil shall be seeded with a sustainable perennial mixture and appropriate erosion control measures shall be taken until the perennial grass is established.

All materials proposed for import onto the Site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the Site.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially impacted sites will not be imported to the Site.

All imported soils will meet the backfill and cover soil quality standards established in 6 NYCRR 375-6.7(d). Soils that meet ‘exempt’ fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this Site, will not be imported onto the Site without prior approval by NYSDEC. Solid waste will not be imported onto the Site.

Trucks entering the Site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

B-11 STORMWATER POLLUTION PREVENTION

The Stormwater Pollution Prevention Plan (SWPPP) is included as Appendix I. Minimum requirements under the SWPPP include:

- Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. All necessary repairs shall be made immediately.

- Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.

- All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.

- Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

- Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

- Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

B-12 CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL inorganics; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected impacted media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the periodic reports prepared pursuant to Section 5 of the SMP.

B-13 COMMUNITY AIR MONITORING PLAN

Air monitoring will be performed in accordance with the a project-specific CAMP. An example CAMP for on-going monitoring at the Site is included as Appendix D to the SMP.

Real-time air monitoring will be implemented at representative locations in the vicinity of the remedial activities for organic vapors. Upwind and downwind locations will be determined through observation of a wind sock that will be installed at the Site. Perimeter monitoring will include the use of a real-time organic vapor monitoring instruments. A summary of air monitoring procedures to be conducted are described below.

Organic vapors monitoring station locations will be determined daily based on the predominant wind direction indicated by the wind sock. An upwind location for organic vapors monitoring will be selected at the start of each workday. Two to three downwind (based on predominant wind direction) locations for volatile organic compounds (VOCs) monitoring will also be selected. The organic vapor monitoring stations will be deployed each day before the start of remedial activities. If wind direction shifts radically during the workday and for an extended period of time, such that the upwind location and both of the downwind locations no longer fall within acceptable guidelines (+/- 60° compass change from the original wind direction), the monitoring stations will be relocated so that the upwind and downwind locations are maintained. Air monitoring location changes will be documented in a field logbook.

Because real-time monitors for polycyclic aromatic hydrocarbons (PAHs) do not exist, the real-time VOC monitors will also serve as surrogate indicators of PAH emissions at the Site. As required by the NYSDOH Generic CAMP, VOCs will be monitored continuously during implementation of intrusive activities (e.g., excavation and materials handling activities) using instrumentation equipped with electronic data-logging capabilities. A real-time VOC monitor (MiniRAE 2000 [or equivalent]), equipped with either a photo-ionization detector (PID) calibrated to 10 ppm Isobutylene, or a flame-ionization detector (FID), will be used to conduct the monitoring for VOCs (and PAHs). All running average (15-minute intervals) concentrations and any instantaneous readings that support decisions regarding the remedial activities will be recorded using an electronic data logger and/or in the field logbook.

Action Levels

As outlined in the NYSDOH Generic CAMP, if the ambient air concentration of total VOCs at any one (or more) of the downwind perimeter locations exceeds 5 ppm above the background (upwind location) concentrations for a 15-minute average, intrusive activities will be temporarily halted while monitoring continues. If the total VOC concentration readily decreases (through observation of instantaneous readings) below 5 ppm above background, then intrusive activities can resume with continuous monitoring.

If the ambient air concentrations of total VOCs at any one (or more) of the downwind perimeter locations persist (despite cessation of work activities) at levels in excess of 5 ppm above background but less than 25 ppm above background, intrusive activities will be halted, the potential source(s) of the elevated VOC concentrations will be identified, corrective actions to reduce or abate the emissions will be undertaken, and air monitoring will be continued. Once these actions have been performed, intrusive activities can resume provided that the total organic vapor (TOV) level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

If the ambient air concentrations of total VOCs at one (or more) of the downwind perimeter locations are above 25 ppm above background, the intrusive activities must cease, and emissions control measures must be implemented.

Exceedances of action levels listed in the project-specific CAMP will be reported to NYSDEC and NYSDOH Project Managers.

B-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors offsite and onsite. Specific odor control methods to be used on a routine basis may include water/BioSolve® spray, polyethylene sheeting (for covering excavation faces, material stockpiles, etc.), minimizing excavation surface area to be exposed at any given time, and vapor suppression foam. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the property owner's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

All necessary means will be employed to prevent on- and offsite nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for offsite disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to onsite conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

B-15 DUST CONTROL PLAN

Dust monitoring will be performed in accordance with the project-specific CAMP.

Real-time air monitoring will be implemented at representative locations in the vicinity of the remedial activities for particulate matter less than 10 microns in diameter (PM_{10}). Upwind and downwind locations will be determined through observation of a wind sock that will be installed at the Site. Perimeter monitoring will include the use of a real-time particulate monitoring instrument. A summary of dust monitoring procedures to be conducted are described below.

PM_{10} monitoring station locations will be determined daily based on the predominant wind direction indicated by the wind sock. An upwind location for PM_{10} monitoring will be selected at the start of each workday. Two to three downwind (based on predominant wind direction) locations for PM_{10} monitoring will also be selected. The PM_{10} monitoring stations will be deployed each day before the start of remedial activities. If wind direction shifts radically during the workday and for an extended period of time, such that the upwind location and both of the downwind locations no longer fall within acceptable guidelines (+/- 60° compass change from the original wind direction), the monitoring stations will be relocated so that the upwind and downwind locations are maintained. Dust monitoring location changes will be documented in a field logbook.

Fugitive dust migration will be visually assessed during work activities, and reasonable dust suppression techniques will be used during Site activities that may generate fugitive dust.

As required by the NYSDOH Generic CAMP, real-time airborne particulate monitoring will be conducted continuously during intrusive activities, including soil excavation, backfilling, and related soil handling. Particulate monitoring will be conducted using instrumentation equipped with electronic data-logging capabilities. Particulate monitoring will also serve as a surrogate indicator of PAH emissions at the Site. A MIE DataRAM (or equivalent) will be used to conduct the real-time PM_{10} monitoring. Concentration readings will be recorded using an electronic data logger and/or in the field logbook.

Action Levels

As required by the NYSDOH Generic CAMP, if the ambient 15-minute average PM_{10} air concentration at any one (or more) of the downwind perimeter locations is noted at levels in excess of 100 micrograms per cubic meter (µg/m3) above the background concentration, or if airborne dust is visually observed leaving the work area, then dust suppression activities will be implemented, and air monitoring will continue. Work may continue following the implementation of dust-suppression techniques provided the PM_{10} levels do not exceed 150 $\mu g/m^3$ above background, and no visible dust is observed migrating from the work areas.

If, after implementation of dust-suppression techniques, the downwind PM_{10} levels are greater than 150 $\mu g/m^3$ above background, work must be stopped and Site activities must be re-evaluated. Once additional actions have been implemented, work may resume only if dust-suppression measures and other controls are successful in reducing the 15-minute average PM_{10} levels to less than 150 µg/m3 above background at the downwind perimeter of the Site and if no visible dust is observed migrating from the work area.

A dust suppression plan that addresses dust management during invasive onsite work will include, at a minimum, the items listed below:

- Dust suppression will be achieved though the use of a dedicated onsite water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.

- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.

- Gravel will be used on roadways to provide a clean and dust-free road surface.

- Onsite roads will be limited in total area to minimize the area required for water truck sprinkling.

Appendix C

Health and Safety Plan

ARCADIS
Infrastructure, environment, facilities

Imagine the result

National Grid

Health and Safety Plan

Little Falls (Mill Street) Non-Owned Former MGP
Site, Little Falls, New York

February 2004
(Revised April 2010)

ARCADIS

Health and Safety Plan

Little Falls (Mill Street) Non-Owned Former MGP Site

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Our Ref.:
B0036673.0000

Date:
April 2010

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Approvals and Acknowledgements

I have read and approved this Health and Safety Plan (HASP) with respect to project hazards, regulatory requirements, and ARCADIS procedures.

Project Name: National Grid – Little Falls, New York – Remedial Investigation/Feasibility Study and Remedial Construction.
Project Number: B0036673.0000

Project Manager/Date

Health and Safety Officer/Date

Health and Safety Supervisor/Date

The final approved version of this HASP has been provided to the site supervisor. I acknowledge my responsibility to provide the site supervisor with the equipment, materials and qualified personnel to implement fully all safety requirements in this HASP. I will formally review this plan with the Health and Safety Staff every 6 months until project completion.

Project Manager/Date

I acknowledge receipt of this HASP from the project manager, and that it is my responsibility to explain its contents to all site personnel and cause these requirements to be fully implemented. Any change in conditions, scope of work, or other change that might affect worker safety requires me to notify the project manager and/or the health and safety officer.

Project Manager/Date

Health and Safety Plan Acknowledgement

I have read this Site-Specific Health and Safety Plan, or its contents have been presented to me, and I understand the contents and I agree to abide by its requirements.

Name (print)	Signature	Representing	Date

1. Introduction

1.1 Objective

This Health and Safety Plan (HASP) supports the Site Management Plan (SMP) prepared by ARCADIS for the implementation of ongoing groundwater monitoring and Dense Non-aqueous Phase Liquid (DNAPL) monitoring/recovery activities at the Little Falls (Mill Street) non-owned former manufactured gas plant (MGP) Site (hereinafter referred to as the “Site”). Field activities will include the following tasks:

- Mobilization.
- Annual Site-Wide Inspection.
- Fluid Level Monitoring.
- Groundwater Sampling.
- DNAPL Monitoring/Recovery.
- Monitoring Well/Recovery Well Repairs, Replacement, and Decommissioning.
- Decontamination.
- Demobilization.

The objective of this HASP is to provide a mechanism for establishing safe working conditions at the site. The safety organization, procedures, and protective equipment have been established based on an analysis of potential physical, chemical, and biological hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of injury, illness, or other hazardous incident.

1.2 Site and Facility Description

The Little Falls non-owned former MGP site is located on the south side of East Mill Street in Little Falls, New York. Historical MGP operations at the site were primarily located within a 0.56-acre parcel that comprises the westernmost portion of an approximately 6.5-acre property owned by Feldmeier Equipment, Inc (Feldmeier). The 0.56-acre parcel that contains the former MGP operation is occupied by a paved parking area and the western portion of a tank manufacturing building utilized by

Feldmeier. The tank manufacturing building consists of a slab on grade, structural steel frame building with metal walls and roof. The interior of the building consists of an open, single-story, high-bay manufacturing shop area with a ceiling height of approximately 25 feet. The building was reportedly constructed in the mid-1980s. Although most of the former MGP site is either paved or covered by the tank manufacturing building, some grass and vegetated areas are present along the margins of the parking lot and in the area south of the building along the bank of the Mohawk River. The former MGP site is bordered by East Mill Street to the north, George Lumber and Building Materials Company (George Lumber) to the west, the Mohawk River to the south, and the tank manufacturing building to the east. All of the adjacent properties located to the north (across East Mill Street), east, and west of the former MGP site appear to be currently utilized for industrial or commercial purposes.

Several previous investigations of the property have been completed since 1998 in support of Phase I and Phase II environmental site assessments that were conducted in support of a potential property transfer from SPX Corporation, Inc. to Feldmeier. The investigation activities have been conducted in accordance with a Voluntary Consent Agreement between SPX, Feldmeier, and the New York State Department of Environmental Conservation (NYSDEC). In the course of implementing the Phase I and Phase II investigation activities, suspected MGP-related impacts were identified in the immediate vicinity of the historical MGP operation at the site. As a result of the suspected MGP-related impacts that were identified at the property, National Grid entered into a separate Voluntary Consent Order with the NYSDEC to evaluate the site.

The site is currently owned by Feldmeier and occupied by an industrial manufacturing facility (operated by Feldmeier) that fabricates stainless-steel tanks for the pharmaceutical and cosmetic industries.

1.3 Policy Statement

ARCADIS policy is to provide a safe and healthful work environment. No aspect of operations is of greater importance than injury and illness prevention. A fundamental principle of safety management is that all injuries, illnesses, and incidents are preventable. ARCADIS will take every reasonable step to eliminate or control hazards to minimize the possibility of injury, illness, or incident.

This HASP prescribes the procedures that must be followed while performing site activities. Operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without prior approval of the project manager (PM) and the health and safety officer (HSO). This document will be reviewed periodically to confirm that it is current and technically correct. Any changes in site conditions and/or the scope of work will require a review of and modification to this HASP. Such changes will be completed in the form of an addendum or a revision to the HASP.

The provisions of this HASP are mandatory for all ARCADIS personnel and ARCADIS subcontractors assigned to the project. Subcontractors may prepare their own site-specific HASPs that must meet the basic requirements of this HASP. All visitors to ARCADIS work areas at the site must abide by the requirements of this HASP.

This HASP complies with applicable Occupational Safety and Health Administration (OSHA) regulations, United States Environmental Protection Agency (USEPA) Standard Operating Safety Guidelines (USEPA, 1992) and ARCADIS' Health and Safety Policies Manual (ARCADIS, 2003). This HASP follows the guidelines established in the references listed in Section 11.

1.4 Definitions

The following definitions (listed alphabetically) are applicable to this HASP:

- *Contamination-Reduction Zone (CRZ)* —Area between the exclusion zone and support zone that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone.

- *Emergency*—Any occurrence (including any failure of hazard control or monitoring equipment) or event (internal or external) to the permit space that could endanger confined space entrants.

- *Exclusion Zone (EZ)*—Any portions of the site where hazardous substances are present, or are reasonably suspected to be present, and pose an exposure hazard to on-site personnel.

- *Incident*—All losses, including first-aid cases, injuries, illnesses, near misses, spills/leaks, equipment and property damage, motor vehicle accidents, regulatory violations, fires, and business interruptions.

- *Near Miss*—An incident in which no injury, illness, motor vehicle accident, equipment or property damage, etc., occurred, but under slightly different circumstances could have occurred.

- *Project*—All on-site work performed under the scope of work.

- *Site*—The area described in Section 1.2, Site and Facility Description, where the work is to be performed by ARCADIS personnel and subcontractors.

- *Subcontractor*—Includes contractor personnel hired by ARCADIS.

- *Support Zone (SZ)*—All areas of the site, except the EZ and CRZ. The SZ surrounds the CRZ and EZ. Support equipment and break areas are located in this zone.

- Visitor—All other personnel, except the on-site personnel.

- *Work Area*—The portion of the site where work activities are actively being performed. This area may change daily as work progresses and includes the SZ, CRZ, and EZ. If the work area is located in an area on site that is not contaminated, or suspected of being contaminated, the entire work area may be an SZ.

1.5 References

This HASP complies with applicable Occupational Safety and Health Administration (OSHA) regulations, United States Environmental Protection Agency (USEPA) regulations, and ARCADIS health and safety policies and procedures. This plan follows the guidelines established in the following:

- *Standard Operating Safety Guides*, USEPA (Publication 9285.1-03, June 1992).

- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH, OSHA, USCG, USEPA (86116, October 1985).

- *Title 29 of the Code of Federal Regulations* (CFR), Part 1910.

- *Title 29 of the Code of Federal Regulations* (CFR), Part 1926.

- *Pocket Guide to Chemical Hazards*, DHHS, PHS, CDC, NIOSH (2005).

- *Threshold Limit Values,* ACGIH (2007).

- *Guide to Occupational Exposure Values*, ACGIH (2007).
- *Quick Selection Guide to Chemical Protective Clothing*, Forsberg, K. and S.Z. Mansdorf, 5th Ed. (2005).
- *Health and Safety Policies Manual*, ARCADIS (2003).
- *National Grid Employee Safety Manual, January 2007*

2. Roles and Responsibilities

2.1 All Personnel

All ARCADIS and subcontractor personnel must adhere to the procedures outlined in this HASP during the performance of their work. Each person is responsible for completing tasks safely and reporting any unsafe acts or conditions to their supervisor. No person may work in a manner conflicting with these procedures. After due warnings, the PM will dismiss from the site any person who violates safety procedures.

All ARCADIS personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. In addition, all personnel will attend an initial hazard briefing prior to beginning work at the site.

The roles of ARCADIS personnel are outlined in the following subsections. A summary table for key project personnel and contacts is provided as Table 2-1.

Table 2-1
Key Personnel

	Client	
Role	**Name**	**Address/Telephone No.**
Lead Senior Environmental Engineer	James F. Morgan	National Grid 300 Erie Blvd West Syracuse, NY 13202 315.428.3101
	ARCADIS Personnel	
Role	**Name**	**Address/Telephone No.**
Project Officer	James M. Nuss, P.E.	ARCADIS 6723 Towpath Road PO Box 66 Syracuse, NY 13214-0066 315. 446.9120
Project Manager	Michael C. Jones	ARCADIS 6723 Towpath Road PO Box 66 Syracuse, NY 13214-0066 315. 446.9120
	ARCADIS Personnel	
Role	**Name**	**Address/Telephone No.**
Site Supervisor/Health and Safety Supervisor	Staff	ARCADIS 6723 Towpath Road PO Box 66 Syracuse, NY 13214-0066 315. 446.9120
Health and Safety Manager	Charles P. Webster, CSP	ARCADIS 6723 Towpath Road PO Box 66 Syracuse, NY 13214-0066 315. 446.9120
	Subcontractors	
Subcontractor/Role	**Name**	**Address/Telephone No.**
Parratt Wolff, Inc. (drilling subcontractor, if needed)	William Morrow	P.O. Box 56 5879 Fisher Road East Syracuse, NY 13057 315.437.1429
	Feldmeier Equipment, Inc.	
Role	**Name**	**Address/Telephone No.**
Feldmeier Equipment, Inc. Site Contact	Kyle Brown	545 East Mill Street Little Falls, NY 13365 315.823.2000

2.2 ARCADIS Personnel

2.2.1 Health and Safety Manager

The Health and Safety Manager has overall responsibility for the technical health and safety aspects of the project, including review and approval of this HASP. Inquiries regarding ARCADIS health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The Health and Safety Manager must approve changes or addenda to this HASP.

2.2.2 Project Manager

The PM is responsible for verifying that project activities are completed in accordance with the requirements of this HASP. The PM is responsible for confirming that the site supervisor (SS) has the equipment, materials, and qualified personnel to fully implement the safety requirements of this HASP. It is also the responsibility of the PM to perform the following duties:

- Consult with the HSO on site health and safety issues;
- Review Loss Prevention Observation (LPO) reports (Attachment A);
- Verify that all incidents are thoroughly investigated;
- Approve, in writing, addenda or modifications to this HASP; and
- Suspend work or modify work practices, as necessary, for personal safety, protection of property, and regulatory compliance.

2.2.3 Health and Safety Supervisor

The health and safety supervisor (HSS) is responsible for field health and safety issues, including the execution of this HASP. Questions in the field regarding health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSS will advise the PM on health and safety issues, and will establish and coordinate the project air monitoring program if one is deemed necessary (see Section 6.1, Air Monitoring). The HSS is the primary site contact on health and safety matters. It is the responsibility of the HSS to perform the following duties:

- Provide on-site technical assistance, if necessary;
- Participate in all incident investigations (IIs) (Attachment B), and confirm that they are reported to the Client, HSM/HSO, PIC and PM within 24 hours;
- Coordinate site and personal air monitoring, as required, including equipment maintenance and calibration;
- Conduct site safety orientation training and safety meetings (see Attachment C);
- Verify that ARCADIS personnel have received the required physical examinations and medical certifications;
- Review site activities with respect to compliance with this HASP;
- Maintain required health and safety documents and records;
- Assist the SS in instructing field personnel on project hazards and protective procedures; and
- Review LPO forms.

2.2.4 Site Supervisor

The SS is responsible for implementing this HASP, including communicating requirements to on-site personnel. The SS will be responsible for informing the PM of changes in the work plan, procedures, or site conditions so that those changes may be addressed in this HASP. Other responsibilities are to perform the following duties:

- Consult with the HSS on site health and safety issues
- Conduct LPOs at the site (Attachment A)
- Stop work, as necessary, for personal safety, protection of property, and regulatory compliance

- Obtain a site map, determine and post routes to medical facilities, and post emergency telephone numbers

- Notify local public emergency representatives (as appropriate) of the nature of the site operations and post their telephone numbers (e.g., local fire department personnel who would respond for a confined-space rescue)

- Observe on-site project personnel for signs of ill-health effects

- Investigate and report any incidents to the HSS

- Verify that all on-site personnel have completed applicable training

- Verify that on-site personnel are informed of the physical, chemical, and biological hazards associated with the site activities and the procedures and protective equipment necessary to control the hazards

- Issue/obtain any required work permits (hot work, confined space, etc.)

2.3 All On-Site Personnel

All on-site personnel must read and acknowledge their understanding of this HASP before commencing work, and abide by the requirements of the HASP. All on-site personnel must sign the HASP Acknowledgement Form after reviewing this HASP.
All ARCADIS personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. In addition, all on-site personnel will attend an initial hazard briefing (prior to beginning work at the site) and the daily safety meetings.
All on-site personnel must perform TRACK prior to beginning each work activity. Safety issues should be either eliminated or mitigated prior to starting work. TRACK must also be performed after any near-miss or other incident to determine if it is safe to proceed. On-site personnel will immediately report the following to the SS or HSS:

- Personal injuries and illnesses, no matter how minor

- Unexpected or uncontrolled release of chemical substances

- Symptoms of chemical exposure

- Unsafe or hazardous situations
- Unsafe or malfunctioning equipment
- Changes in site conditions that may affect the health and safety of project personnel
- Damage to equipment or property
- Situations or activities for which they are not properly trained
- Near misses

2.4 Visitors

All visitors to ARCADIS work areas must check in with the SS. Visitors will be cautioned to avoid contact with any materials that may be, or are suspected to be, impacted by constituents of concern (COCs). Visitors requesting to observe work at the site must don appropriate personal protective equipment (PPE) prior to entering the work area, and must have the appropriate training and medical clearances to do so.

2.5 Short Service Employee Program

Recognizing that employees who are new to ARCADIS are at a greater risk for incidents, the following guidelines are established to identify those employees and ease their transition. Short Service Employees (SSEs) will have an assigned field mentor to assist them in adjusting to the project requirements and procedures. SSEs will be identified in the field by wearing an orange hardhat or baseball-type cap.

- ARCADIS employees new to the industry and new to ARCADIS will be designated SSEs for 6 months
- ARCADIS employees experienced in the industry but new to ARCADIS will be designated SSEs for 3-months

Additionally, the following apply:

- a crew of 2-3 may have 1 SSE on site
- a crew of 5 may have 2 SSEs on site

- a crew of 10 or more may have no more than 3 SSEs on site

2.6 Near-Miss Reporting Hotline

In an effort to streamline near-miss reporting, especially for employees conducting field work who do not have real-time access to the web, ARCADIS has established a toll-free Near-Miss Reporting Hotline. The hotline will be checked daily and data will be entered into the ARCADIS Loss Prevention System (LPS) Database with the caller listed as the primary contact for the event. All entries will be saved as initial and can be accessed by the caller when they return to their computers. Entry into the database does not relieve the caller from the responsibility of following through with the near-miss investigation or of notifying other employees in the office or project team of the occurrence.

THE NEAR-MISS REPORTING NUMBER IS 1-866-242-4304

Callers will be prompted to provide the following information:

- Name and phone number
- Date of near-miss
- Location
- Project Number (if applicable)
- A brief description of what happened
- Name of division or office Vice President
- What you think could have happened if this situation had resulted in an injury or damage
- Any other information you think may be important

The intent of this service is to enable employees to phone in near-misses immediately and have the events entered into the ARCADIS LPS Database. Following all near-misses employees are expected to immediately conduct an SPSA in accordance with Section 4.2.1 to ensure that it is safe to continue with the task.

2.7 Stop Work Authority

Every ARCADIS employee and subcontractor is empowered, expected and has the responsibility to stop the work of another co-worker if the working conditions or behaviors are considered unsafe.

3. Project Hazards and Control Measures

3.1 Introduction

Field activities will include the following tasks:

- Mobilization.
- Annual Site-Wide Inspection.
- Fluid Level Monitoring.
- Groundwater Sampling.
- DNAPL Monitoring/Recovery.
- Monitoring Well/Recovery Well Repairs, Replacement, and Decommissioning.
- Decontamination.
- Demobilization.

The following job safety analyses (JSAs) identify potential health, safety, and environmental hazards associated with each type of field activity listed above. Because of the complex and changing nature of field projects, supervisors must continually inspect the site to identify hazards that may affect on-site personnel, the community, or the environment. The SS must be aware of these changing conditions and discuss them with the PM whenever these changes impact employee health, safety, the environment, or performance of the project. The SS will keep on-site personnel informed of the changing conditions and the PM will write and/or approve addenda or revisions to this HASP as necessary.

Each field activity is described below, and potential hazards and control measures for each activity are discussed.

3.2 Mobilization

This task will consist of the following activities:

- Determine the location of any overhead or other physical hazards
- Establish work areas
- Staging of equipment and materials

A break area will be set up outside of regulated work areas. Mobilization may involve clearing areas for the SZ and CRZ. During this initial phase, project personnel will walk the site to confirm the existence of anticipated hazards and identify safety and health issues that may have arisen since the writing of this HASP.

3.2.1 Hazards

The hazards of this phase of activity are associated with:

- Manual materials handling
- Installing temporary on-site facilities
- Manual site preparation

Manual materials handling and manual site preparation may cause blisters, sore muscles, and joint and skeletal injuries; manual materials handling may also present eye, contusion, and laceration hazards. Installing temporary field office and support facilities may expose personnel to electrical hazards, underground and overhead utilities, and physical injury due to manually lifting and moving materials. Conducting a subsurface structure investigation presents slip/trip/fall exposures as well as the potential for contact with various flora and fauna. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil.

Environmental hazards include:

- Plants, such as poison ivy and poison oak
- Aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes
- Weather, such as sunburn, lightning, rain, and heat- or cold-related illnesses
- Pathogens, such as rabies, Lyme disease, and blood-borne pathogens

3.2.2 Control

Control procedures for these hazards are discussed in Section 4, General Safety Practices.

3.3 Annual Site-Wide Inspection

This task will consist of completing an annual walk-through of the Site to inspect cover conditions (asphalt, soil, gravel, and vegetation), monitoring well/recovery well conditions, and site security (fencing and gates). This task may involve a potential for exposure to physical and health hazards. Hazards may be associated with the site, including Feldmeier trucks/equipment being used at the Site, traffic, and environmental conditions.

3.3.1 Hazards

There exists a potential for incidents involving ARCADIS personnel being struck by or struck against equipment or objects resulting in fractures, lacerations, punctures, or abrasions. Walking and working surfaces during activities may involve slip, trip, or fall hazards. Slippery walking/working surfaces can increase the possibility of back injuries, overexertion injuries, and slips and falls. Noise may also present a hazard. Feldmeier may be using equipment at the Site which may result in high noise levels.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather such as sunburn, lightning, rain, and heat-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

3.3.2 Control

Prior to initiating any field activity, the site conditions will be discussed with all employees. Hazards will be identified and protective measures will be explained. Control procedures for these hazards are discussed in Section 4, General Safety Practices. Decisions regarding PPE will be based on the potential chemical and physical hazards on the site, and measurements and observations made prior to and during work activities. A minimum of Level D protection will be worn by ARCADIS personnel conducting observation activities. See Section 5, Personal Protective Equipment, for a description of PPE requirements.

3.4 Fluid Level Monitoring and Groundwater Sampling

This task will consist of the following:

- Fluid level monitoring from groundwater monitoring wells
- Groundwater sampling from groundwater monitoring wells

The fluid level monitoring will involve uncapping monitoring wells at the Site and measuring fluid levels (groundwater and NAPL) with a water and oil/water interface probe. Groundwater sampling will involve uncapping, purging (pumping water out of the well), sampling, and monitoring existing monitoring wells. A mechanical pump may be used to purge the wells and can be hand-, gas-, or electric-operated. Water samples taken from the wells are then placed in containers and shipped to analytical laboratory for analysis. The physical hazards of these operations are primarily associated with the sample collection methods and procedures used.

3.4.1.1 Hazards

Inhalation and absorption of COCs are the primary routes of entry associated with groundwater monitoring and sampling, due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. During this project, several different groundwater sampling methodologies may be used based on equipment accessibility and the types of materials to be sampled. These sampling methods may include hand or mechanical bailing. The primary hazards associated with these specific sampling procedures are not potentially serious; however, other operations in the area, or the conditions under which samples must be collected may present chemical and physical hazards. The hazards directly associated with groundwater monitoring and sampling procedures are generally limited to strains or sprains from hand bailing, and potential eye hazards. Exposure to water/NAPL containing COCs is also possible.

The flora and fauna of the site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

3.4.1.2 Control

To control dermal exposure during groundwater monitoring and sampling activities, a minimum of Modified Level D protection will be worn. If necessary, based on field observations and site conditions, air monitoring may be conducted during groundwater monitoring and sampling to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors at a concentration causing concern, personnel will upgrade to Level C protection. Section 6.1 - Air Monitoring describes air monitoring requirements and action levels. Each level of personal protection is described in Section 5 - Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4 - General Site Safety Procedures.

3.5 DNAPL Monitoring/Recovery

This task will consist of the following:

- Monitoring recovery wells for the presence of DNAPL
- Recovering DNAPL from the recovery wells (if present)

The DNAPL monitoring/recovery activities will involve uncapping, monitoring using an oil-water indicator probe, and recovering DNAPL (if present) using a mechanical pump or hand bailer. The mechanical pump may be hand-, gas-, or electric-operated. The recovered DNAPL will be placed in appropriate storage containers for offsite transportation and disposal by others. The physical hazards of these operations are primarily associated with the DNAPL monitoring/recovery methods and procedures used.

3.5.1.1 Hazards

Inhalation and absorption of COCs are the primary routes of entry associated with DNAPL monitoring/recovery activities, due to the purging of DNAPL and equipment, manual transfer of the DNAPL into containers, and proximity of operations to the breathing zone. During this project, several different DNAPL recovery methodologies may be used based on equipment accessibility and the physical properties of the DNAPL. These sampling methods may include hand or mechanical bailing. The primary hazards associated with these specific recovery procedures are not potentially serious; however, other operations in the area, or the conditions under which DNAPL is recovered may present chemical and physical hazards. The hazards directly associated with DNAPL monitoring/recovery are generally limited to strains or sprains from hand bailing, and potential splashing hazards. Exposure to purge water containing COCs is also possible.

The flora and fauna of the site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders, and snakes. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

3.5.1.2 Control

To control dermal exposure during DNAPL monitoring/recovery activities, a minimum of Modified Level D protection will be worn. In addition, splash shields and Tyvek® may be worn during DNAPL recovery, as deemed necessary by the field crew and Site Supervisor. If necessary, based on field observations and site conditions, air monitoring may be conducted during DNAPL monitoring/recovery to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Section 6.1 - Air Monitoring describes air monitoring requirements and action levels. Each level of personal protection is described in

Section 5 - Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4 - General Site Safety Procedures.

3.6 Monitoring Well/Recovery Well Repairs, Replacement, and Decommissioning

This task may consist of the following activities:

- Monitoring well/recovery well repairs (if necessary)
- Monitoring well/recovery well replacement (if necessary)
- Monitoring well/recovery well decommissioning (if necessary)

This task may consist of repairing existing monitoring wells/recovery wells at the Site, including repairing caps/surface completions and redeveloping the wells. This task may also include the decommissioning of monitoring wells/recovery wells that are rendered unusable. In addition, this task may include the installation of new monitoring wells/recovery wells if an event renders the well unusable.

The repair, replacement, and/or decommissioning activities may involve the use of conventional drill rig or direct-push-type boring equipment (Geoprobe® or equivalent). The equipment poses a hazard if it is not properly operated. Direct-push equipment is hydraulically powered and uses static force and dynamic percussion force to advance small-diameter sampling tools. The presence of overhead utilities and underground obstacles poses a hazard if boring equipment contacts them. As the hazards are similar to those encountered when using a conventional drill rig, the required control procedures are also the same as a conventional rig and are included in the following sections.

3.6.1 Drilling Hazards

The primary physical hazards for this activity are associated with the use of drilling equipment, since tools and equipment (such as elevators, cat lines, and wire rope) have the potential for striking, pinning, or cutting personnel.

- *Cat Lines* — Cat lines are used on drilling rigs to hoist material. Accidents that occur during cat-line operations may injure the employee doing the rigging, as well as the operator. Minimal hoisting control causes sudden and erratic load movements, which may result in hand and foot injuries.

- *Materials Handling* — The most common type of accident that occurs in material handling operations is the “caught between” situation when a load is being handled and a finger or toe gets caught between two objects. Rolling stock can shift and/or fall from a pipe rack or truck bed.

- *Rig Accidents* — Rig accidents can occur as a result of improperly placing the rig on uneven or unstable terrain, or failing to adequately secure the rig prior to starting operations.

- *Utility Lines* — Underground and overhead utility lines can create hazardous conditions if contacted by drilling equipment.

- *Wire Rope* — Worn or frayed wire rope presents a laceration hazard if loose wires protrude from the main bundle.

- *Working Surfaces* — Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls.

3.6.2 Controls

The following control procedures are required for this activity:

- *Drill Crews* — All drillers must possess required state or local licenses to perform drilling work. All members of the drill crew must receive site-specific training prior to beginning work. The driller is responsible for the safe operation of the drill rig, as well as the crew’s adherence to the requirements of this HASP. The driller must confirm that all safety equipment is in proper condition and is properly used. The members of the crew must follow all instructions of the driller, wear appropriate PPE, and be aware of all hazards and control procedures. The drill crews must participate in the daily safety meetings and be aware of all emergency procedures.

- *Rig Inspection* — Each day, prior to starting work, the drill rig and associated equipment must be inspected by the driller and/or drill crew. Inspections must be documented. The following items must be inspected:
    - Vehicle condition;
    - Proper storage of equipment;
    - Condition of all wire rope and hydraulic lines;

  - Condition of all drill rods and internal threads;
  - Fire extinguisher; and
  - First-aid kit.

- *Drill Rig Set Up* — The drill rig must be properly blocked and leveled prior to raising the derrick. The wheels that remain on the ground must be chocked even if the rig's parking brake has been applied. The leveling jacks must not be raised until the derrick is lowered. The rig should be moved only after the derrick has been lowered.

- *Site Drilling Rules* — Before drilling activities commence, the existence and location of underground pipe, electrical equipment, and gas lines must be determined. The Underground Facility Protection Organization (UFPO) must be contacted at least 1 week, but no more than 2 weeks, prior to subsurface activities. ARCADIS' SS will meet with electrical and natural gas locators on site prior to marking out the underground utilities. During this meeting, ARCADIS' SS will provide the electrical and natural gas locators with a site figure showing the locations where excavation and drilling activities will be completed. ARCADIS' SS will conduct a site walkover with the electrical and natural gas locators to visually identify each location where excavation and drilling activities are to be completed during site operations. The ARCADIS Subsurface Utility Procedure and the Underground/Overhead Utility Checklist (see Attachment D) will be used to document that nearby utilities have been marked on the ground and that the excavation and drilling areas have been cleared. The completed Underground/Overhead Utility Checklist will be in the possession of the SS prior to commencing any intrusive investigation.

The following additional site drilling rules apply to project sites:

  - Combustible gas readings of the general work area will be made regularly (see Section 6).
  - Operations must be suspended and corrective action taken if the airborne flammable concentration reaches 10% of the LEL in the immediate area (a 1-foot radius) of the point of drilling, or near any other ignition sources.
  - Under no circumstances will personnel be permitted to ride the traveling block or elevators, nor will the cat line be used as a personnel carrier.

- *Overhead Electrical Clearances* — If drilling activities are conducted in the vicinity of overhead power lines, the power to the lines must be de-energized, tested de-energized, marked up, and guaranteed, or the equipment must be positioned such that no part (including the excavation boom) can come within the minimum clearances as shown below. See Table 3-1 (Minimum Overhead Electrical Clearances (All Equipment)).

TABLE 3-1
Minimum Overhead Electrical Clearances (All Equipment)

Nominal System Voltage	Minimum Required Clearance
0-50kV	10 feet
51-100kV	12 feet
101-200kV	15 feet
201-300kV	20 feet
301-500kV	25 feet
501-750kV	35 feet
751-1,000kV	45 feet

When the drill rig is in transit, with the boom lowered and no load, the equipment clearance must be at least 4 feet for voltages less than 50kV, 10 feet for voltages of 50kV to 345kV, and 16 feet for voltages above 345kV.

- *Rig Set Up* — Three control procedures apply to rig set up:
  - All well sites will be inspected by the driller prior to establishing the location of the rig to verify that a stable surface exists. This is especially important in areas where soft, unstable terrain is common.
  - All rigs will be properly blocked and leveled prior to raising the derrick. Blocking provides a more stable drilling structure by evenly distributing the weight of the rig. Proper blocking confirms that differential settling of the rig does not occur. Wheels remaining on the ground will be chocked and the parking brake will be applied.
  - When the ground surface is soft or otherwise unstable, wooden blocks at least 24 inches by 24 inches and 4 inches to 8 inches thick must be placed between the jack swivels and the ground. The emergency brake must be engaged and the wheels that are on the ground must be chocked.
- *Hoisting Operations* — The following control procedures apply to hoisting operations:
  - Drillers should never engage the rotary clutch without watching the rotary table so that it is clear of personnel and equipment.
  - Unless the drawworks is equipped with an automatic-feed control, the brake should not be left unattended without first being tied down.
  - Auger strings or casing should be picked up slowly.

  - During instances of unusual loading of the derrick or mast, such as when making an unusually hard pull, only the driller should be on the rig floor; no one else should be on the rig or derrick.
  - The brakes on the drawworks of the drill rig should be tested by the driller each day. The brakes should be thoroughly inspected by a competent individual each week.
  - A hoisting line with a load imposed should not be permitted to be in direct contact with any derrick member or stationary equipment unless it has been specifically designed for line contact.
  - Workers should never stand near the borehole whenever any wire-line device is being run.
  - Hoisting control stations should be kept clean and controls labeled as to their functions.

- *Cat-Line Operations* - The following control procedures apply to cat-line operations:
  - Only experienced workers will be allowed to operate the cathead controls. The kill switch must be clearly labeled and operational prior to operating the cat line. The cathead area must be kept free of obstructions and entanglements.
  - The operator should not use more wraps than necessary to pick up the load. More than one layer of wrapping is not permitted.
  - Personnel should not stand near, step over, or go under a cable or cat line that is under tension.
  - Employees rigging loads on cat lines must:
    - Keep out from under the load;
    - Keep fingers and feet where they will not be crushed;
    - Be sure to signal clearly when the load is being picked up;
    - Use standard visual signals only and not depend on shouting to co-workers for communication; and
    - Make sure the load is properly rigged, since a sudden jerk in the cat line will shift or drop the load.

- *Wire Rope* — The following control procedures apply to the use of wire rope:
  - When two wires are broken or rust or corrosion is found adjacent to a socket or end fitting, the wire rope must be removed from service or resocketed. Special attention must be given to the inspection of end fittings on boom support, pendants, and guy ropes.
  - Wire rope removed from service due to defects must be cut up or plainly marked as being unfit for further use as rigging.

  - Wire rope clips attached with U-bolts must have the U-bolts on the dead or short end of the rope; the clip nuts must be retightened immediately after initial load carrying use and at frequent intervals thereafter.
  - When a wedge socket fastening is used, the dead or short end of the wire rope must have a clip attached to it or looped back and secured to itself by a clip; the clip must not be attached directly to the live end.
  - Protruding ends of strands in splices on slings and bridles must be covered or blunted.
  - Except for eye splices in the ends of wires and for endless wire rope slings, wire rope used in hoisting, lowering, or pulling loads must consist of one continuous piece without knot or splice.
  - An eye splice made in any wire rope must have not less than five full tucks.
  - Wire rope must not be secured by knots. Wire rope clips must not be used to splice rope.
  - Eyes in wire rope bridles, slings, or bull wires must not be formed by wire clips or knots.

- **Auger Handling** — The following control procedures apply to auger handling:
  - Auger sections must be transported by cart or carried by two persons. Individuals should not carry auger sections without assistance.
  - Workers should not be permitted on top of the load while loading, unloading, or transferring rolling stock.
  - When equipment is being hoisted, personnel should not stand where the bottom end of the equipment could whip and strike them.
  - Augers stored in racks, catwalks, or on flatbed trucks should be secured to prevent rolling.

3.6.3 Monitoring Well/Recovery Well Development Hazards

The physical hazards of monitoring well/recovery well development are primarily associated with manipulating and operating the pump and its associated equipment. Other physical hazards of this phase of activity are associated with site conditions and manual materials handling. Equipment operation may present noise and vibration hazards, and the potential for employee contact with hot surfaces. Manual materials handling may cause blisters, sore muscles, and joint and/or skeletal injuries. The work area may present slip, trip, and fall hazards from scattered debris and wet or irregular walking surfaces. Wet weather may cause wet, muddy, and/or slick walking surfaces. Exposure to soil and water containing COCs is also possible.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

3.6.4 Monitoring Well/Recovery Well Control

To control dermal exposure during monitoring well/recovery well development activities, a minimum of Modified Level D protection will be worn. If necessary, based on field observations and site conditions, air monitoring may be conducted during groundwater sampling and monitoring activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Section 6.1, Air Monitoring, describes air monitoring requirements and action levels. Each level of personal protection is described in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Safety Practices.

Additional Safety Requirements

To protect on-site personnel against hazards associated with materials handling, and to prevent injury due to unsafe heavy equipment operation, only properly trained and authorized personnel will be allowed to operate heavy equipment. All materials handling equipment will be maintained in a safe operating condition and inspected daily prior to use.

Additional heavy equipment safety requirements include, but are not limited to:

- Prior to operating any heavy equipment, the authorized operator must conduct a pre-operation inspection to determine if the heavy equipment is in safe operating condition prior to each work shift.
- All mobile equipment shall be equipped with an audible back-up alarm.
- Personnel will not be allowed to stand or pass under the elevated portion of any heavy equipment, whether loaded or empty.
- Personnel will not place arms and legs between pinch or scissor points of the equipment or outside the operator enclosure.
- A safe distance shall be maintained from the edge of excavations, ditches, ramps, or platforms.

- Operators will maintain sufficient clearance under overhead utilities, installations, lights, pipes, etc.
- Heavy equipment must never be used for lifting or transporting personnel.
- The operator is required to look in the direction of, and maintain a clear view of the path of travel.
- Heavy equipment shall not be operated without an overhead guard and roll-over protection to protect the operator against falling objects and equipment roll-over.
- Heavy equipment must not be driven up to anyone standing in front of any object.
- Stunt driving and horseplay are strictly prohibited.
- Operators will yield the right-of-way to other site vehicles.
- Other heavy equipment traveling in the same direction, at intersections, blind spots, or other dangerous locations must not be passed.
- A safe distance must be maintained from other heavy equipment, and the equipment must be kept under control at all times.
- The heavy equipment operator must slow down for wet and slippery conditions. Under all travel conditions the equipment will be operated at a speed that will permit it to be brought to a stop in a safe manner.
- Operators will avoid running over loose objects on operating surfaces.
- Grades and ramps must be ascended and descended slowly.
- On all grades, the load will be tilted back, and raised only as for as necessary to clear the operating surface.
- The operator will slow down and sound the horn at intersections, when entering buildings, and other locations where vision may be obstructed.
- If the load being carried obstructs forward view, the operator will travel with the load trailing.

- While negotiating turns, speed will be reduced to a safe rate, and turning will be in a smooth, sweeping motion to avoid abrupt turns and potential equipment or load upset.

- Authorized operators will only handle stable or safely arranged loads that are within the rated capacity of the heavy equipment and will not affect the stability of the heavy equipment.

When a piece of heavy equipment is left unattended, hydraulics will be fully lowered, controls will be neutralized, power will be shut off, and brakes set. Wheels will be blocked or chocked if the heavy equipment is parked on an incline. When internal combustion engine-powered heavy equipment is utilized indoors, near confined spaces, or near excavations, carbon monoxide levels shall be monitored to prevent personnel exposure.

3.7 Decontamination

All equipment will be decontaminated before leaving the site using visual inspection to verify that COCs have been removed. Personnel involved in decontamination activities may be exposed to skin contact with contaminated materials and chemicals brought to the site as part of the project work. In addition all operations that have the potential to generate or release hazardous material will be conducted in a controlled area using the appropriate engineering controls. Specific decontamination techniques will be established based on site conditions.

Decontamination procedures will be reviewed with all personnel on-site. We anticipate conducting decon activities using 5-gallon buckets with a soap and water wash. Pressure washing with manual scrub brushing as needed will be used to decon equipment. COC impacted equipment will be determined “clean” by using visual inspection of all equipment.

Personnel involved in decontamination activities must wear PPE that is one level below the level worn by personnel working in the EZ.

3.8 Demobilization

Demobilization involves the removal of all tools, equipment, supplies, and vehicles brought to the site. The hazards of this phase of activity are associated with heavy equipment operation and manual materials handling.

Manual materials handling may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Heavy equipment operation presents noise and vibration hazards, and hot surfaces, to operators. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise levels. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

Control procedures for these hazards are discussed in Section 4, General Safety Practices.

3.9 Chemical Hazards

The chemical hazards associated with site operations are related to inhalation, ingestion, and skin exposure to site COCs. Concentrations of airborne COCs during site tasks may be measurable, and will require air monitoring during intrusive operations. Air monitoring requirements for site tasks are outlined in Section 6.1.

Site COCs may include polynuclear aromatic hydrocarbons PAHs (coal tar pitch volatiles) benzene, toluene, ethylbenzene, xylene (BTEX) and cyanide.

Hexane, Nitric Acid, Hexanol, detergents and degreasers will be used to decontaminate equipment and sampling apparatus.

The potential for inhalation of site COCs is moderate. The potential for dermal contact with soil containing site COCs during soil sampling operations is moderate. The Chemical Hazard Information Table located at Attachment E lists the chemical, physical, and toxicological properties of major site COCs. Material Safety Data Sheets (MSDS) for the COCs are included in Attachment F.

4. General Safety Practices

4.1 General Safety Rules

General safety rules for site activities include, but are not limited to, the following:

- At least one copy of this HASP must be in a location at the site that is readily available to personnel, and all project personnel shall review the plan prior to starting work.
- Consume or use food, beverages, chewing gum, and tobacco products only in the SZ or other designated area outside the EZ and CRZ. Cosmetics shall not be applied in the EZ or CRZ.
- Wash hands before eating, drinking, smoking, or using toilet facilities.
- Wear all PPE as required, and stop work and replace damaged PPE immediately.
- Secure disposable coveralls, boots, and gloves at the wrists and legs and ensure closure of the suit around the neck.
- Upon skin contact with materials that may be impacted by COC, remove contaminated clothing and wash the affected area immediately. Contaminated clothing must be changed. Any skin contact with materials potentially impacted by COC must be reported to the SS or HSS immediately. If needed, medical attention should be sought.
- Practice contamination avoidance. Avoid contact with surfaces either suspected or known to be impacted by COC, such as standing water, mud, or discolored soil. Equipment must be stored on elevated or protected surfaces to reduce the potential for incidental contamination.
- Remove PPE as required in the CRZ to limit the spread of COC-containing materials.
- At the end of each shift or as required, dispose of all single-use coveralls, soiled gloves, and respirator cartridges in designated receptacles designated for this purpose.

- Removing soil containing site COC from protective clothing or equipment with compressed air, shaking, or any other means that disperses contaminants into the air is prohibited.

- Inspect all non-disposable PPE for contamination in the CRZ. Any PPE found to be contaminated must be decontaminated or disposed of appropriately.

- Recognize emergency signals used for evacuation, injury, fire, etc.

- Report all injuries, illnesses, near misses, and unsafe conditions or work practices to the SS or HSS.

- Use the “buddy system” during all operations requiring Level C PPE, and when appropriate, during Modified Level D operations.

- Obey all warning signs, tags, and barriers. Do not remove any warnings unless authorized to do so.

- Use, adjust, alter, and repair equipment only if trained and authorized to do so, and in accordance with the manufacturer’s directions.

- Personnel are to perform only tasks for which they have been properly trained and will advise their supervisor if they have been assigned a task for which they are not trained.

- The presence or consumption of alcoholic beverages or illicit drugs during the workday is strictly prohibited. Notify your supervisor if you must take prescription or over-the-counter drugs that could cause drowsiness or other side effects that could impair judgment.

- Remain upwind during site activities whenever possible.

4.2 Loss Prevention System (LPS)

The LPS is a behavior based safety system meant to prevent or reduce the occurrence of injury, illness, or other incident. This program seeks the prevention or reduction of losses by:

- emphasizing proactive activities

- capitalizing on the on-the-job expertise of field employees
- maximizing the use of positive reinforcement
- integrating with daily field operations
- solving problems from the bottom up while providing direction from the top down

Prior to assignment on a project in the field, ARCADIS personnel that will be performing or overseeing work on this project must attend an LPS training session. This training session explains the objectives, elements, and requirements of LPS. Elements of the LPS program are briefly outlined below in Sections 4.2.1 and 4.2.2.

4.2.1 Safe Performance Self Assessment

All on-site personnel are required to perform an SPSA using TRACK prior to beginning any activity. This three-step process requires each individual to:

- *Assess* the risk of the task to be performed. Ask the following questions:
  - What could go wrong?
  - What is the worst thing that could happen if something does go wrong?
- *Analyze the ways the risk can be reduced. Ask the following questions:*
  - Do I have all the necessary training and knowledge to do this task safely?
  - Do I have all the proper tools and PPE?
- *Act to control the risk and perform the task safely.*
  - Take the necessary action to perform the job safely.
  - Follow written procedures, and ask for assistance if necessary.

This process must be performed prior to beginning any activity and must be performed after any near miss or other incident in order to determine if it is safe to proceed.

4.2.2 Loss Prevention System Reporting

Optimization of LPS depends upon timely reporting both internally and externally of all types of LPS tools (near misses, observations, and incidents). Detailed descriptions of LPS tools are discussed in detail in the sections below.

4.2.3 Incident Investigation

An incident is any of the following events: first-aid cases, injuries, illnesses, near misses, spills/leaks, equipment and property damage, motor vehicle accidents, regulatory violations, fires, and business interruptions. All incidents shall be reported to the PM, the PO, the HSM/HSO and the client immediately and investigated within 24 hours. In the event that one of those individuals cannot be contacted, a voice message should be left and the next individual in the chain should be contacted. Follow-up with the absent individual should occur as soon as possible.

The purpose of an II is to prevent the recurrence of a similar hazardous event. An II investigates all incidents in the same manner. Using the information gathered during an II, appropriate measures will be taken to protect personnel from the hazard in question. The II form is included in Attachment B.

The flowchart on the following page outlines steps to be taken in the event of an incident or near miss.

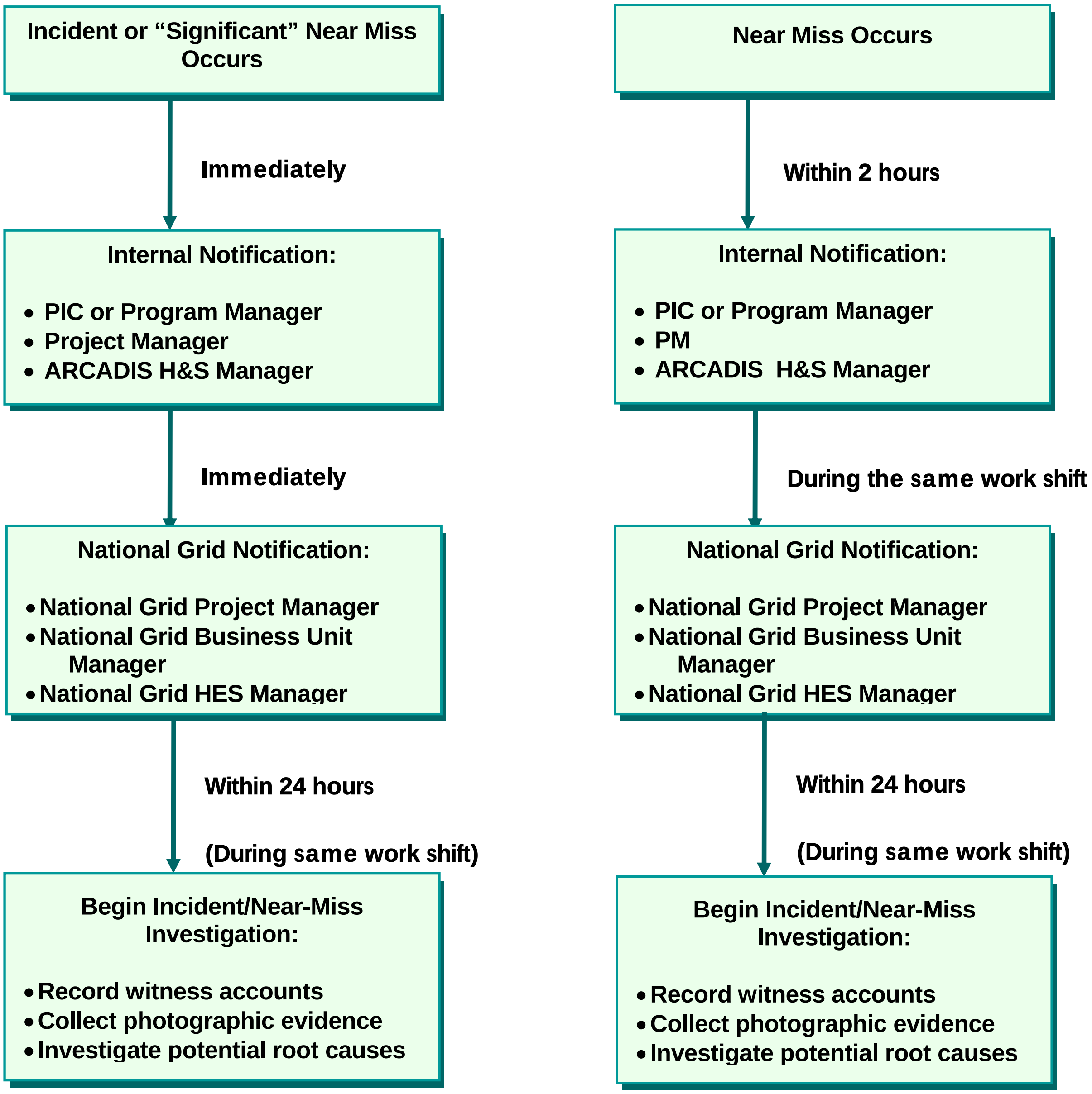
4.2.4 Loss Prevention Observation

The HSS or designee will perform the LPO. An LPO form is provided in Attachment A. The purpose of the LPO is to identify and correct potential hazards and to positively reinforce behaviors and practices that are correct. The HSS must identify potential deviations from safe work practices that could possibly result in an incident and take prompt corrective action. A minimum of one observation will be performed per 500 hours for a specific task and one per 200 hours for higher risk tasks. The LPO process steps are:

- Identify tasks that have the greatest potential for hazardous incidents
- Review the standard procedure for completing the task
- Discuss with the observed employee the task and the HSS role in observing the task
- Observe the employee completing the task
- Reference the LPO form for criteria. Complete the form, documenting positive, as well as areas in need of improvement

- Discuss the results of the LPO with the employee. Discuss corrective action necessary
- Implement corrective action
- Communicate the results of the LPO and corrective action to the PM and the HSO
- Verify and validate corrective actions are implemented

Incident and Near-Miss Reporting Process Flowchart



Incident or "Significant" Near Miss Occurs

Immediately

Internal Notification:

- PIC or Program Manager
- Project Manager
- ARCADIS H&S Manager

Immediately

National Grid Notification:

- National Grid Project Manager
- National Grid Business Unit Manager
- National Grid HES Manager

Within 24 hours

(During same work shift)

Begin Incident/Near-Miss Investigation:

- Record witness accounts
- Collect photographic evidence
- Investigate potential root causes

Near Miss Occurs

Within 2 hours

Internal Notification:

- PIC or Program Manager
- PM
- ARCADIS H&S Manager

During the same work shift

National Grid Notification:

- National Grid Project Manager
- National Grid Business Unit Manager
- National Grid HES Manager

Within 24 hours

(During same work shift)

Begin Incident/Near-Miss Investigation:

- Record witness accounts
- Collect photographic evidence
- Investigate potential root causes

4.2.5 Job Safety Analysis

A JSA is a tool used to identify potential hazards and develop corrective or protective systems to eliminate the hazard. A JSA lists all the potential hazards associated with a task or activity and can include site-specific concerns associated with the task or activity. Hazards may be physical, such as lifting hazards or eye hazards, or environmental, such as weather or biological (e.g., stinging insects, snakes). Following the identification of the hazards associated with an activity, control measures are evaluated and protective measures or procedures are then instituted. JSAs are reviewed daily to confirm that the procedures and protective equipment specified for each task or activity are current and technically correct. Any changes in site conditions and/or the scope of work will require a review and modification to the JSA in question. During this review process, comments on the JSA and its procedures should be obtained from personnel associated with the activity being analyzed. At a minimum a JSA will outline the safety requirements for a corresponding specific task as detailed in Section 3 of this HASP.

4.3 Contact Lenses

Based on OSHA's rulemaking record (29 CFR Part 1910, Federal Register # 59:16334-16364), OSHA believes that contact lenses do not pose additional hazards to the wearer and has determined that additional regulation addressing the use of contact lenses is unnecessary. OSHA does want to be clear that contact lenses are not eye protective devices. If eye hazards are present, appropriate eye protection must be worn instead of, or in conjunction with, contact lenses.

According to NIOSH, wearing contact lenses does not appear to require enhanced eye and face protection. For chemical vapor, liquid, or caustic dust hazards, the minimum protection consists of well-fitting non-vented or indirectly vented goggles or full-face piece respirators. Close-fitting safety glasses with side protection provide limited chemical protection but do not prevent chemicals from bypassing the protection. Workers should wear face shields over other eye protection when needed for additional face protection but they should not wear face shields instead of goggles or safety glasses – regardless of contact lens wear.

Routine tasks identified at this site do not contraindicate the use of contact lens when appropriate eye protection is utilized. As a result, all ARCADIS personnel are permitted to wear contact lens at this site when performing routine tasks identified in this HASP.

4.4 Motor Vehicle Safety

All ARCADIS and subcontractor personnel will be aware of the ARCADIS Driver Safety Program. All ARCADIS personnel must receive the Smith System online class and the hands-on Smith System class for drivers of company vehicles. All ARCADIS and subcontractor drivers must have a valid driving license.

4.5 Buddy System

On-site personnel must use the buddy system as required by operations. Use of the “buddy system” is required during all operations requiring Level C to Level A PPE, and when appropriate, during Level D/Modified D operations. Crewmembers must observe each other for signs of chemical exposure, and heat or cold stress. Indications of adverse effects include, but are not limited to:

- Changes in complexion and skin coloration
- Changes in coordination
- Changes in demeanor
- Excessive salivation and pupillary response
- Changes in speech pattern

Crewmembers must also be aware of the potential exposure to possible safety hazards, unsafe acts, or non-compliance with safety procedures.

Field personnel must inform their partners or fellow crewmembers of non-visible effects of exposure to toxic materials that they may be experiencing. The symptoms of such exposure may include, but are not limited to:

- Headaches
- Dizziness
- Nausea
- Blurred vision
- Cramps
- Irritation of eyes, skin, or respiratory tract

If protective equipment or noise levels impair communications, prearranged hand signals must be used for communication. Personnel must stay within line of sight of another team member.

4.6 Cold Stress

Cold stress normally occurs in temperatures at or below freezing, or under certain circumstances in temperatures of 40°F. Extreme cold for a short time may cause severe injury to exposed body surfaces or result in profound generalized cooling, causing death. Areas of the body that have high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible. Two factors influence the development of a cold-weather injury: ambient temperature and the velocity of the wind. For instance, 10°F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at 18°F. An equivalent chill temperature chart relating the actual dry-bulb temperature and wind velocity is presented in Table 4-1.

Table 4-1

Chill Temperature Chart

Estimated Wind Speed (in mph)	**Actual Temperature Reading (ºF)**											
	50	**40**	**30**	**20**	**10**	**0**	**-10**	**-20**	**-30**	**-40**	**-50**	**-60**
	Equivalent Chill Temperature (ºF)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	**Little Danger** **Maximum danger of false sense of security.**				**Increasing Danger** **Danger from freezing of exposed flesh within one minute.**			**Great Danger** **Flesh may freeze within 30 seconds.**				
	Trench foot and immersion foot may occur at any point on this chart.											

(This chart was developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA [Source: ACGIH *TLV Handbook*]).

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of tissue damage associated with frostbite. Frostbite of the extremities can be categorized into:

- Frost Nip or Incipient Frostbite - Characterized by sudden blanching or whitening of skin.

- Superficial Frostbite - Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.

- Deep Frostbite - Tissues are cold, pale, and solid; extremely serious injury.

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. It can be fatal. Its symptoms are usually exhibited in five stages:

1) Shivering

2) Apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F

3) Unconsciousness, glassy stare, slow pulse, and slow respiratory rate

4) Freezing of the extremities

5) Death.

Trauma sustained in freezing or sub-zero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues in addition to providing for first-aid treatment. To avoid cold stress, site personnel must wear protective clothing appropriate for the level of cold and physical activity. In addition to protective clothing, preventive safe work practices, additional training, and warming regimens may be used to prevent cold stress.

4.6.1 Cold Stress Safety Precautions

The following safety precautions should be followed to prevent cold stress:

- For air temperature of 0°F or less, mittens should be used to protect the hands. For exposed skin, continuous exposure should not be permitted when air speed and temperature results in a wind chill temperature of -25°F.

- At air temperatures of 36°F or less, field personnel who become immersed in water or whose clothing becomes wet must be immediately provided with a change of clothing and be treated for hypothermia.

- If work is done at normal temperature or in a hot environment before entering the cold, the field personnel must confirm that their clothing is not wet as a consequence of sweating. If wet, field personnel must change into dry clothes prior to entering the cold area.

- If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work must be modified or suspended until adequate clothing is made available or until weather conditions improve.

- Field personnel handling evaporative liquid (e.g., gasoline, alcohol, or cleaning fluids) at air temperatures below 40°F must take special precaution to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

4.7 Heat Stress

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Since heat stress is one of the most common illnesses associated with heavy outdoor work conducted with direct solar load and, in particular, because wearing PPE can increase the risk of developing heat stress, workers must be capable of recognizing the signs and symptoms of heat-related illnesses. Personnel must be aware of the types and causes of heat-related illnesses and be able to recognize the signs and symptoms of these illnesses in both themselves and their co-workers.

Heat rashes are one of the most common problems in hot work environments. Commonly known as prickly heat, a heat rash is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

Heat cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused both by too much or too little salt.

Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution (plus or minus 0.3% NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Drinking commercially available carbohydrate electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

Heat exhaustion occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include pale, cool, moist skin; heavy sweating; dizziness; nausea; headache, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment.

Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, which is a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment, be given fluid replacement, and be encouraged to get adequate rest.

Heat stroke is the most serious form of heat stress. Heat stroke occurs when the body’s system of temperature regulation fails and the body’s temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict.

Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature, e.g., a rectal temperature of 41°C (105.8°F). If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of workload and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protestations, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries.

4.7.1 Heat Stress Safety Precautions

Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. A minimum work rest regimen and procedures for calculating ambient adjusted temperature are described in Table 4-2.

TABLE 4-2
WORK/REST SCHEDULE

Adjusted Temperature[b]	**Work/Rest Regimen Normal Work Ensemble**[c]	**Work/Rest Regimen Impermeable Ensemble**
90ºF (32.2ºC) or above	After each 45 minutes of work	After each 15 minutes of work
87.5º - 90ºF (30.8º-32.2ºC)	After each 60 minutes of work	After each 30 minutes of work
82.5º - 87.5ºF (28.1º - 30.8ºC)	After each 90 minutes of work	After each 60 minutes of work
77.5º - 82.5ºF (25.3º - 28.1ºC)	After each 120 minutes of work	After each 90 minutes of work
72.5º - 77.5ºF (30.8º - 32.2ºC)	After each 150 minutes of work	After each 120 minutes of work

a. For work levels of 250 kilocalories/hour (Light-Moderate Type of Work)

b. Calculate the adjusted air temperature (ta adj) by using this equation: ta adj ºF = ta ºF + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

c. A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

d. The information presented above was generated using the information provided in the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) Handbook.

In order to determine if the work rest cycles are adequate for the personnel and specific site conditions, additional monitoring of individual heart rates will be conducted during the rest cycle. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one third and maintain the same rest period.

Additionally, one or more of the following control measures can be used to help control heat stress and are mandatory if any site worker has a heart rate (measure immediately prior to rest period) exceeding 115 beats per minute:

- Site workers will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day

- On-site drinking water will be kept cool (50 to 60°F)

- A work regimen that will provide adequate rest periods for cooling down will be established, as required

- All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps

- Cooling devices, such as vortex tubes or cooling vests, should be used when personnel must wear impermeable clothing in conditions of extreme heat

- Employees should be instructed to monitor themselves and co-workers for signs of heat stress and to take additional breaks as necessary

- A shaded rest area must be provided. All breaks should take place in the shaded rest area

- Employees must not be assigned to other tasks during breaks

- Employees must remove impermeable garments during rest periods. This includes white Tyvek®-type garments

All employees must be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress disorders.

4.8 Biological Hazards

Biological hazards may include poison ivy, snakes, thorny bushes and trees, ticks, mosquitoes, scorpions, and other pests.

4.8.1 Tick Borne Diseases

Lyme Disease: The disease commonly occurs in summer and is transmitted by the bite of infected ticks. "Hot spots" in the United States include New York, New Jersey, Pennsylvania, Massachusetts, Connecticut, Rhode Island, Minnesota, and Wisconsin.

Erlichiosis: The disease also commonly occurs in summer and is transmitted by the bite of infected ticks. "Hot spots" in the United States include New York, Massachusetts, Connecticut, Rhode Island, Minnesota, and Wisconsin.

These diseases are transmitted primarily by the deer tick, which is smaller and redder than the common wood tick. The disease may be transmitted by immature ticks, which are small and hard to see. The tick may be as small as a period on this page.

Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull's eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, and swelling and pain in the joints, and eventually, arthritis. Symptoms of erlichiosis include muscle and joint aches, flu-like symptoms, but there is typically no skin rash.

Rocky Mountain Spotted Fever (RMSF): This disease is transmitted via the bite of an infected tick. The tick must be attached 4 to 6 hours before the disease-causing organism (Rickettsia rickettsii) becomes reactivated and can infect humans. The primary symptom of RMSF is the sudden appearance of a moderate-to-high fever. The fever may persist for two to three weeks. The victim may also have a headache, deep muscle pain, and chills. A rash appears on the hands and feet on about the third day and eventually spreads to all parts of the body. For this reason, RMSF may be confused with measles or meningitis. The disease may cause death, if untreated, but if identified and treated promptly, death is uncommon.

Control: Tick repellant containing diethyltoluamide (DEET) should be used when working in tick-infested areas, and pant legs should be tucked into boots. In addition, workers should search the entire body every three or four hours for attached ticks. Ticks should be removed promptly and carefully without crushing, since crushing can squeeze the disease-causing organism into the skin. A gentle and steady pulling action should be used to avoid leaving the head or mouth parts in the skin. Hands should be protected with surgical gloves when removing ticks.

4.8.2 Poisonous Plants

Poisonous plants may be present in the work area. Personnel should be alerted to its presence, and instructed on methods to prevent exposure.

Control: The main control is to avoid contact with the plant, cover arms and hands, and frequently wash potentially exposed skin. Particular attention must be given to avoiding skin contact with objects or protective clothing that have touched the plants. Treat every surface that may have touched the plant as contaminated, and practice contamination avoidance. If skin contact is made, the area should be washed immediately with soap and water, and observed for signs of reddening.

4.8.3 Snakes

The possibility of encountering snakes exists, specifically for personnel working in wooded/vegetated areas. Snake venoms are complex and include proteins, some of which have enzymatic activity. The effects produced by venoms include neurotoxic effects with sensory, motor, cardiac, and respiratory difficulties; cytotoxic effects on red blood cells, blood vessels, heart muscle, kidneys, and lungs; defects in coagulation; and effects from local release of substances by enzymatic actions. Other noticeable effects of venomous snakebites include swelling, edema, and pain around the bite, and the development of ecchymosis (the escape of blood into tissues from ruptured blood vessels).

Control: To minimize the threat of snakebites, all personnel walking through vegetated areas must be aware of the potential for encountering snakes, and the need to avoid actions potentiating encounters, such as turning over logs, etc. If a snakebite occurs, an attempt should be made to obtain snake markings, size and color for identification. The victim must be transported to the nearest hospital within 30 minutes; first aid consists of applying a constriction band, and washing the area around the wound to remove any unabsorbed venom.

4.8.4 Spiders

Personnel may encounter spiders during work activities. Two spiders are of concern, the black widow and the brown recluse. Both prefer dark sheltered areas such as basements, equipment sheds and enclosures, and around woodpiles or other scattered debris. The black widow is shiny black, approximately one inch long, and found throughout the United States. There is a distinctive red hourglass marking on the underside of the black widows body. The bite of a black widow is seldom fatal to healthy adults, but effects include respiratory distress, nausea, vomiting, and muscle spasms. The brown recluse is smaller than the black widow and gets its name from its brown coloring and behavior. The brown recluse is more prevalent in the southern United States. The brown recluse has a distinctive violin shape on the top of its body. The bite of the brown recluse is painful and the bite site ulcerates and takes many weeks to heal completely.

Control: To minimize the threat of spider bites, all personnel walking through vegetated areas must be aware of the potential for encountering these arachnids. Personnel need to avoid actions that may result in encounters, such as turning over logs, and placing hands in dark places such as behind equipment or in corners of equipment sheds or enclosures. If a spider bite occurs, the victim must be transported to the nearest hospital as soon as possible; first aid consists of applying ice packs and washing the area around the wound to remove any unabsorbed venom.

4.8.5 Mosquitoes

Personnel may be exposed to mosquitoes during work activities. Typical exposure to mosquitoes does not present a significant hazard. However, if West Nile virus is prevalent in the area exposure to this virus is increased. West Nile virus results in flu-like symptoms and can be serious if not treated or in immune compromised individuals.

Control: To minimize the threat of mosquito bites all personnel working outside must be aware of the potential for encountering mosquitoes and implement the basic precautions listed below:

- Avoid working at dawn or dusk when mosquitoes are most active
- Prevent accumulation of standing water at the work-site
- Apply an insect repellent that contains DEET to exposed skin

- Wear light colored clothes, preferably with long-sleeves and full-length pants
- Do not touch any dead birds or animals that you encounter

If dead birds are detected near the site, report to the local County Health Department. If flu-like symptoms are present, contact your Doctor or the Health and Safety Officer for more information.

4.9 Noise

Exposure to noise over the OSHA action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on site.

Control: All personnel must wear hearing protection, with a Noise Reduction Rating (NRR) of at least 20, when noise levels exceed 85 dBA. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA, and hearing protection is necessary. All site personnel who may be exposed to noise must also receive baseline and annual audiograms and training as to the causes and prevention of hearing loss.

Noise monitoring is discussed in Section 6.2, Noise Monitoring.

Whenever possible, equipment that does not generate excessive noise levels will be selected for this project. If the use of noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

4.10 Spill Control

All personnel must take every precaution to minimize the potential for spills during site operations. All on-site personnel shall immediately report any discharge, no matter how small, to the SS.

Spill control equipment and materials will be located on the site at locations that present the potential for discharge. All sorbent materials used for the cleanup of spills will be containerized and labeled appropriately. In the event of a spill, the SS will follow the provisions in Section 9, Emergency Procedures, to contain and control released materials and to prevent their spread to off-site areas.

4.11 Sanitation

Site sanitation will be maintained according to appropriate federal, state, and local requirements and the guidance provided below.

4.11.1 Break Area

Breaks must be taken in the SZ, away from the active work area after site personnel go through decontamination procedures. There will be no smoking, eating, drinking, or chewing gum or tobacco in any area other than the SZ.

4.11.2 Potable Water

The following rules apply to all field operations:

- An adequate supply of potable water will be provided at each project site. Potable water must be kept away from hazardous materials or media, and contaminated clothing or equipment.

- Portable containers used to dispense drinking water must be capable of being tightly closed, and must be equipped with a tap dispenser. Water must not be consumed directly from the container (drinking from the tap is prohibited) nor may it be removed from the container by dipping.

- Containers used for drinking water must be clearly marked and shall not be used for any other purpose.

- Disposable drinking cups must be provided. A sanitary container for dispensing cups and a receptacle for disposing of used cups is required.

4.11.3 Sanitary Facilities

Access to facilities for washing before eating, drinking, or smoking, or alternate methods such as waterless hand-cleaner and paper towels will be provided.

4.11.4 Lavatory

If permanent toilet facilities are not available, an appropriate number of portable chemical toilets will be provided.

This requirement does not apply to mobile crews or to normally unattended site locations so long as employees at these locations have transportation immediately available to nearby toilet facilities.

4.12 Emergency Equipment

Adequate emergency equipment for the activities being conducted on site and as required by applicable sections of 29 CFR 1910 and 29 CFR 1926 will be on site prior to the commencement of project activities. Personnel will be provided with access to emergency equipment, including, but not limited to, the following:

- Fire extinguishers of adequate size, class, number, and location as required by applicable sections of 29 CFR 1910 and 1926
- Industrial first aid kits of adequate size for the number of personnel on site
- Emergency eyewash and/or shower if required by operations being conducted on site

4.13 Lockout/Tagout Procedures

Only fully qualified and trained personnel will perform maintenance procedures. Before maintenance begins, lockout/tagout procedures per OSHA 29 CFR 1910.147 will be followed.

Lockout is the placement of a device that uses a positive means, such as lock, to hold an energy or material-isolating device such that the equipment cannot be operated until the lockout device is removed. If a device cannot be locked out, a tagout system shall be used. Tagout is the placement of a warning tag on an energy or material isolating device indicating that the equipment controls may not be operated until the tag is removed by the personnel who attached the tag.

4.14 Electrical Safety

Electricity may pose a particular hazard to site workers due to the use of portable electrical equipment. If wiring or other electrical work is needed, a qualified electrician must perform it.

General electrical safety requirements include:

- All electrical wiring and equipment must be a type listed by Underwriters Laboratories (UL), Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency

- All installations must comply with the National Electrical Safety Code (NESC), the National Electrical Code (NEC), or USCG regulations

- Portable and semi-portable tools and equipment must be grounded by a multi-conductor cord having an identified grounding conductor and a multi-contact polarized plug-in receptacle

- Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double insulated tools must be distinctly marked and listed by UL or FM

- Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them

- Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching

- All circuits must be protected from overload

- Temporary power lines, switchboxes, receptacle boxes, metal cabinets, and enclosures around equipment must be marked to indicate the maximum operating voltage

- Plugs and receptacles must be kept out of water unless of an approved submersible construction

- All extension cord outlets must be equipped with ground fault circuit interrupters (GFCI)

- Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment

- Extension cords or cables must be inspected prior to each use, and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire

- Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician

4.15 Lifting Safety

Using proper lifting techniques may prevent back strain or injury. The fundamentals of proper lifting include:

- Consider the size, shape, and weight of the object to be lifted. A mechanical lifting device or additional persons must be used to lift an object if it cannot be lifted safely alone.

- The hands and the object should be free of dirt or grease that could prevent a firm grip.

- Gloves must be used, and the object inspected for metal slivers, jagged edges, burrs, or rough or slippery surfaces.

- Fingers must be kept away from points that could crush or pinch them, especially when putting an object down.

- Feet must be placed far enough apart for balance. The footing should be solid and the intended pathway should be clear.

- The load should be kept as low as possible, close to the body with the knees bent.

- To lift the load, grip firmly and lift with the legs, keeping the back as straight as possible.

- A worker should not carry a load that he or she cannot see around or over.

- When putting an object down, the stance and position are identical to that for lifting; the legs are bent at the knees, and the back is straight as the object is lowered.

4.16 Department of Transportation (DOT) Dangerous Good Shipping Requirements

Hazardous materials and dangerous goods (re: Canadian regulatory term) are those materials that have one or more of the following characteristics: explosives, compressed and liquefied gases, flammable liquids and solids, oxidizing materials, and other substances that are poisonous, infectious, radioactive or corrosive. It is the handling, loading, packing or placing of hazardous materials (dangerous goods) in or from a container or vehicle at any facility for the purpose of transportation (including storing) in the course of transportation. This also includes the packing and transporting for air and ground shipment of laboratory analysis samples.

Regulations governing hazardous materials and dangerous goods exist to protect people, the environment, or property when these goods are being transported by road, rail, sea, or air. Given the increased emphasis of federal (i.e., Federal Aviation Administration and US Department of Transportation, and the Transportation of Dangerous Goods Act) attention to the transport of hazard material-containing goods, it is imperative that all shipments are packaged and transported such that they adhere to all federal requirements. ARCADIS has strict policies in place, whether shipping via ground or air, designed to meet the associated federal requirements. As such, only ARCADIS staff that have been trained in the proper methods to prepare and ship hazardous materials are authorized to do so. If you have not received training on the appropriate preparation and shipping protocols, you are to contact your supervisor or health and safety representative prior to packaging and/or shipping any material that is, or suspected to be, hazardous. Employees who ship by air must have taken an IATA training course.

5. Personal Protective Equipment

5.1 Levels of Protection

PPE is required to safeguard site personnel from various hazards. Varying levels of protection may be required depending on the levels of COC and the degree of physical hazard. This section presents the various levels of protection and defines the conditions of use for each level. A summary of the levels is presented in Table 5 in this section.

5.1.1 Level D Protection

The minimum level of protection that will be required of ARCADIS personnel and subcontractors at the site will be Level D, which will be worn when no dermal hazard exists and air monitoring indicates no inhalation hazard exists. The following equipment will be used:

- Work clothing as prescribed by weather
- Steel toe work boots, meeting ANSI Z41
- Safety glasses or goggles, meeting ANSI Z87
- PFD if working on or near the water
- Hard hat, meeting ANSI Z89, when falling object hazards are present
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used).
- Reflective safety vest

5.1.2 Modified Level D Protection

Modified Level D will be used when airborne contaminants are not present at levels of concern, but site activities present a potential for skin contact with contaminated materials. Modified Level D consists of:

- Nitrile gloves worn over nitrile surgical gloves

- Latex/PVC overboots when contact with COC-impacted media is anticipated
- Steel toe work boots, meeting ANSI Z41
- Safety glasses or goggles, meeting ANSI Z87
- PFD if working on or near the water
- Face shield in addition to safety glasses or goggles when projectiles or splash hazards exist
- Hard hat, meeting ANSI Z89 when falling object hazards are present
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used)
- Tyvek® suit (polyethylene coated Tyvek® suits for handling liquids) when body contact with COC-impacted media is anticipated.
- Reflective safety vest

5.1.3 Level C Protection

Level C protection will be required when the airborne concentration of COC reaches one-half of the OSHA Permissible Exposure Limit (PEL) or American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV). The following equipment will be used for Level C protection:

- Full-face, air-purifying respirator with combination organic vapor and HEPA cartridges
- Polyethylene-coated Tyvek® suit, with ankles and cuffs taped to boots and gloves
- Nitrile gloves worn over nitrile surgical gloves
- PFD if working on or near the water
- Steel toe work boots, meeting ANSI Z41

- Chemical resistant boots with steel toes or latex/PVC overboots over steel toe boots

- Hard hat, meeting ANSI Z89

- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used)

- Reflective safety vest

5.2 Selection of PPE

Equipment for personal protection will be selected based on the potential for contact, site conditions, ambient air quality, and the judgment of supervising site personnel and health and safety professionals. The PPE used will be chosen to be effective against the COC present on the site.

5.3 Site Respiratory Protection Program

Respiratory protection is an integral part of employee health and safety at the site due to potentially hazardous concentrations of airborne COC. The site respiratory protection program will consist of the following (as a minimum):

- All on-site personnel who may use respiratory protection will have an assigned respirator.

- All on-site personnel who may use respiratory protection will have been fit tested and trained in the use of a full-face air-purifying respirator within the past 12 months.

- All on-site personnel who may use respiratory protection must within the past year have been medically certified as being capable of wearing a respirator. Documentation of the medical certification must be provided to the HSS, prior to commencement of site work.

- Only cleaned, maintained, NIOSH-approved respirators will be used.

- If respirators are used, the respirator cartridge is to be properly disposed of at the end of each work shift, or when load-up or breakthrough occurs.

- Contact lenses are not to be worn when a respirator is worn.

- All on-site personnel who may use respiratory protection must be clean-shaven. Mustaches and sideburns are permitted, but they must not touch the sealing surface of the respirator.

- Respirators will be inspected, and a negative pressure test performed prior to each use.

- After each use, the respirator will be wiped with a disinfectant, cleansing wipe. When used, the respirator will be thoroughly cleaned at the end of the work shift. The respirator will be stored in a clean plastic bag, away from direct sunlight in a clean, dry location, in a manner that will not distort the face piece.

5.4 Using PPE

Depending upon the level of protection selected, specific donning and doffing procedures may be required. The procedures presented in this section are mandatory if Modified Level D or Level C PPE is used. All personnel entering the EZ must put on the required PPE in accordance with the requirements of this HASP. When leaving the EZ, PPE will be removed in accordance with the procedures listed, to minimize the spread of COC.

5.4.1 Donning Procedures

These procedures are mandatory only if Modified Level D or Level C PPE is used on the site:

- Remove bulky outerwear

- Remove street clothes and store in clean location

- Put on work clothes or coveralls

- Put on the required chemical protective coveralls

- Put on the required chemical protective boots or boot covers

- Tape the legs of the coveralls to the boots with duct tape

- Put on the required chemical protective gloves

- Tape the wrists of the protective coveralls to the gloves

- Don the required respirator and perform appropriate fit check (Level C); Put hood or head covering over head and respirator straps and tape hood to facepiece (Level C)

- Don remaining PPE, such as safety glasses or goggles and hard hat

When these procedures are instituted, one person must remain outside the work area to ensure that each person entering has the proper protective equipment.

5.4.2 Doffing Procedures

The following procedures are only mandatory if Modified Level D or Level C PPE is required for the site. Whenever a person leaves the work area, the following decontamination sequence will be followed:

- Upon entering the CRZ, rinse contaminated materials from the boots or remove contaminated boot covers

- Clean reusable protective equipment

- Remove protective garments, equipment, and respirator (Level C). All disposable clothing should be placed in plastic bags, which are labeled with contaminated waste labels

- Wash hands, face, and neck (or shower if necessary)

- Proceed to clean area and dress in clean clothing

- Clean and disinfect respirator for next use

All disposable equipment, garments, and PPE must be bagged in plastic bags and labeled for disposal. See Section 7, Decontamination, for detailed information on decontamination stations.

5.5 Selection Matrix

The level of personal protection selected will be based on air monitoring of the work environment and an assessment by the SS and HSS of the potential for skin contact with COC. The PPE selection matrix is presented in Table 5-1. This matrix is based on information available at the time this plan was written. The Airborne Contaminant Action Levels in Table 5-1 should be used to verify that the PPE prescribed in these matrices is appropriate.

TABLE 5-1
PPE SELECTION MATRIX

Task	Level of Protection
Mobilization	Level D
Annual Site-Wide Inspection	Level D
Fluid Level Monitoring	Modified Level D/Level C
Groundwater Sampling	Modified Level D/Level
DNAPL Monitoring/Recovery	Modified Level D/Level C
Monitoring Well/Recovery Well Repairs, Replacement, and Decommissioning	Level D/Modified Level D/Level C
Decontamination	Modified Level D
Demobilization	Level D

6. Air Monitoring

6.1 Worker Breathing Zone Air Monitoring

Air monitoring will be conducted to evaluate airborne levels of COCs. The monitoring results will dictate work procedures and the selection of PPE for ARCADIS employees and ARCADIS visitors only. The monitoring devices to be used in the worker breathing zone, at a minimum, are an MIE Personal Data RAM particulate monitor (or equivalent) and a combination lower explosive limit/oxygen/hydrogen sulfide/carbon monoxide/photoionization detector (PID) with an 11.7 eV lamp. The RAE Systems MultiRae is an example of this type of instrument.

Monitoring for organic vapors and particulates will be conducted in the exclusion zone during all ground intrusive activities. Monitoring data will be recorded on the Air Monitoring Form (Attachment G).

6.2 Noise Monitoring

Noise monitoring may be conducted as required. Hearing protection is mandatory for all employees in noise hazardous areas, such as around heavy equipment. As a general rule, sound levels that cause speech interference at normal conversation distance should require the use of hearing protection.

6.3 Monitoring Equipment Maintenance and Calibration

All direct-reading instrumentation calibrations should be conducted under the approximate environmental conditions the instrument will be used. Instruments must be calibrated before and after use, noting the reading(s) and any adjustments that are necessary. All air monitoring equipment calibrations, including the standard used for calibration, must be documented on a calibration log or in the field notebook. All completed HS documentation/forms must be reviewed by the HSS and maintained by the SS.

All air monitoring equipment will be maintained and calibrated in accordance with the specific manufacturer’s procedures. Preventive maintenance and repairs will be conducted in accordance with the respective manufacturer’s procedures. When applicable, only manufacturer-trained and/or authorized personnel will be allowed to perform instrument repairs or preventive maintenance.

If an instrument is found to be inoperative or suspected of giving erroneous readings, the HSS must be responsible for immediately removing the instrument from service and obtaining a replacement unit. If the instrument is essential for safe operation during a specific activity, that activity must cease until an appropriate replacement unit is obtained. The HSS will be responsible for ensuring a replacement unit is obtained and/or repairs are initiated on the defective equipment.

6.4 Onsite Monitoring Plan and Response Activities

Soil borings may be completed as part of monitoring well/recovery well replacement/decommissioning activities at onsite locations. These activities have the potential to generate organic vapors and particulates. As mentioned above, air monitoring will be conducted in the worker breathing zone to determine the level of protection required for personnel observing the completion of all intrusive work. If action levels in the worker breathing zone are exceeded for organic vapors or particulates listed in Table 6-1, work will stop. Additional monitoring (and appropriate response activities) to be implemented if the total organic vapor and particulate levels in the worker breathing zone exceed action levels as discussed below.

Total Organic Vapors

If the sustained level of total organic vapors in the worker breathing zone exceeds 1 ppm above background, then the level of total organic vapors will be manually recorded at the downwind perimeter of the work area (i.e., exclusion zone) at 15 minute intervals. If the sustained level of total organic vapors at the downwind perimeter of the work area exceeds 1 ppm above background, then work activities will be halted and additional downwind monitoring will be performed. Efforts will be undertaken to mitigate the source of organic vapors. The exclusion zone will be enlarged, if necessary, to mitigate the potential for people who are not involved with the investigation from being exposed to organic vapor levels exceeding 1 ppm above background.

During the activities, it is possible that the downwind perimeter of the work area will coincide with the site perimeter. If, at any time, the sustained level of total organic vapors adjacent to the downwind site perimeter reaches 5 ppm above background, then the level of total organic vapors adjacent to the nearest downwind occupied building or property from the work zone will be monitored. If after 30 minutes, the total organic vapor level adjacent to the nearest occupied building or property has not subsided below 1 ppm above background, then the HSS will inform the local emergency response contacts [in addition to project managers from Nation Grid, the

NYSDEC, the New York State Department of Health (NYSDOH), and ARCADIS] listed in Section 9.8 and persons who may be exposed will be notified to evacuate occupied buildings or properties. These persons will not be permitted to return to the properties until after the level of total organic vapors on the properties subsides to below 1 ppm above background.

Particulates Monitoring

If the level of particulates in the worker breathing zone exceeds 100 µg/m3 above background for 1 minute, then the level of particulates will be manually recorded at the downwind perimeter of the work area at 15 minute intervals. If the level of particulates at the downwind perimeter of the work area is 150 µg/m3 or greater, then work activities will cease and dust suppression techniques must be employed to maintain particulate levels below 150 µg/m3. In addition, the exclusion zone will be enlarged if necessary to keep the public from being exposed to particulate levels greater than 150 µg/m3.

6.5 Perimeter Air Monitoring

Perimeter community air monitoring for VOCs and dust particulates will be conducted during monitor well/recovery well replacement/installation activities (if completed). Community air monitoring will comply with the New York State Department of Health (NYSDOH) generic Community Air Monitoring Plan (CAMP) which can be found at Attachment H and in accordance with the site-specific CAMP which can be found in the Site Management Plan. At the start of work, air-monitoring stations will be established upwind of the work activities and at the downwind perimeter of the work zone.

All perimeter community air monitoring equipment will be maintained and calibrated in accordance with Section 6.3 of this HASP.

Volatile Organic Compounds

Monitoring for volatile organic compounds (VOCs) will be conducted using a PID. The PID will be capable of calculating 15-minute running average concentrations and equipped with an audible alarm to indicate the exceedance of an action level. Monitoring for VOCs at the upwind station will be conducted at the start of each workday and every time the wind direction changes to establish background conditions. Monitoring for VOCs at the downwind station will be conducted at a minimum frequency of once every two hours during soil boring and monitoring well installation and on a continuous basis during test pit activities. Background readings and any readings that trigger response actions will be recorded in the project logbook, which will be available on site for NYSDEC/NYSDOH review. The VOC action levels and required responses are listed in Table 6-1.

Particulate Monitoring

Monitoring for dust particulates will be conducted using a real time particulate monitor that measures the concentration of airborne respirable particulates less than 10 micrometers in size (PM10). The monitor will be capable of calculating 15-minute running average concentrations and equipped with an audible alarm to indicate exceedance of action levels. Monitoring for particulates at the upwind location will be conducted at the start of each workday and every time the wind direction changes to establish background conditions. Monitoring at the downwind station will be conducted at a minimum frequency of once every two hours. Background readings and any readings that trigger response actions will be recorded in the project logbook, which will be available on site for NYSDEC/NYSDOH review. The dust particulate action levels and required responses are listed in Table 6-1.

6.6 Odor Control

If any odor complaints are received from members of the surrounding community and are related to the field investigation activities described herein, then the potentially odor-causing activity will be suspended, subsurface openings will be covered, and onsite personnel (in consultation with National Grid and ARCADIS project managers) will evaluate an alternative course of action

Action Levels

Table 6-1 presents airborne contaminant action levels that will be used to determine the procedures and protective equipment necessary based on conditions as measured at the site.

TABLE 6-1
AIRBORNE CONTAMINANT ACTION LEVELS

Parameter	Reading in Breathing Zone (BZ)	Action
Total Hydrocarbons	0 ppm to ≤ 0.5 ppm > 0.5 ppm to 5 ppm ≥ 5 ppm to ≤ 25 ppm > 25 ppm	Normal operations; continue hourly breathing zone monitoring Increase monitoring frequency to every 15 minutes and use benzene colorimetric tube to screen for the presence of benzene Upgrade to Level C PPE; continue screening for benzene and contact PM Stop work; investigate cause of reading
Benzene (from colorimetric tube	≥ 0.5 ppm to 5 ppm > 5 ppm	Upgrade to Level C PPE Stop work; investigate cause of reading and contact PM
Total Particulate	0 to 0.100 mg/m^3 above background > 0.100 mg/m^3 above background > 0.15 mg/m^3 in breathing zone or at downwind perimeter of work area	Normal operations Initiate wetting of work area to control dust; upgrade to Level C if dust control measures do not control dust within 15 minutes, monitor downwind impacts. Stop work; investigate cause of reading; contact PM and HSO
Carbon Monoxide	< 25 ppm > 25 ppm	Normal operations. Stop work; evacuate and ventilate area; investigate source of vapors.
Flammable Vapors (LEL)	< 10% LEL ≥ 10% LEL	Normal operations Stop work, ventilate area, investigate source of vapors
Oxygen	> 19.5%, < 23.5% < 19.5%, > 23.5%	Normal operations, acceptable entry condition Stop work; evacuate confined space; ventilate; re-sample
Hydrogen Sulfide	0 ppm to < 5 ppm > 5 ppm	Normal operations. Stop work; evacuate confined spaces/work area, investigate cause of reading; ventilate area; contact J. Keough or C. Webster.

7. Work Zones and Decontamination

7.1 Work Zones

7.1.1 Authorization to Enter

Only personnel with the appropriate training and medical certifications (if respirators are required) will be allowed to work at the project site. The SS will maintain a list of authorized persons; only personnel on the authorized persons list will be allowed to enter the site work areas.

7.1.2 Site Orientation and Hazard Briefing

No person will be allowed in the work area during site operations without first being given a site orientation and hazard briefing. This orientation will be presented by the SS or HSS, and will consist of a review of this HASP. This review must cover the chemical, physical, and biological hazards, protective equipment, safe work procedures, and emergency procedures for the project. Following this initial meeting, daily safety meetings will be held each day before work begins.

All people entering the site work areas, including visitors, must document their attendance at this briefing, as well as the daily safety meetings on the forms included with this plan.

7.1.3 Certification Documents

A training and medical file may be established for the project and kept on site during all site operations. Specialty training, such as first aid/cardiopulmonary resuscitation (CPR) certificates, as well as current medical clearances for all project field personnel required to wear respirators, will be maintained within that file. All ARCADIS and subcontractor personnel must provide their training and medical documentation to the HSS prior to starting work.

7.1.4 Entry Log

A log-in/log-out sheet will be maintained at the site by the SS. Personnel must sign in and out on a log sheet as they enter and leave the work area, and the SS may document entry and exit in the field notebook.

7.1.5 Entry Requirements

In addition to the authorization, hazard briefing, and certification requirements listed above, no person will be allowed in any ARCADIS work area unless they are wearing the minimum PPE as described in Section 5, Personal Protective Equipment.

7.1.6 Emergency Entry and Exit

People who must enter the work area on an emergency basis will be briefed of the hazards by the SS. All activities will cease in the event of an emergency. People exiting the work area because of an emergency will gather in a safe area for a head count. The SS is responsible for ensuring that all people who entered the work area have exited in the event of an emergency.

7.1.7 Contamination Control Zones

Contamination control zones are maintained to prevent the spread of contamination and to prevent unauthorized people from entering hazardous areas.

7.1.7.1 Exclusion Zone

An EZ may consist of a specific work area, or may be the entire area of potential contamination. All employees entering an EZ must use the required PPE, and must have the appropriate training and medical clearance for hazardous waste work. The EZ is the defined area where there is a possible respiratory and/or contact health hazard. Cones, caution tape, or a site diagram will identify the location of each EZ.

7.1.7.2 Contamination Reduction Zone

The CRZ or transition area will be established, if necessary, to perform decontamination of personnel and equipment. All personnel entering or leaving the EZ will pass through this area to prevent any cross-contamination. Tools, equipment, and machinery will be decontaminated in a specific location. The decontamination of all personnel will be performed on site adjacent to the EZ. Personal protective outer garments and respiratory protection will be removed in the CRZ and prepared for cleaning or disposal. This zone is the only appropriate corridor between the EZ and the SZ.

7.1.7.3 Support Zone

The SZ is a clean area outside the CRZ located to prevent employee exposure to hazardous substances. Eating and drinking will be permitted in the support area only after proper decontamination. Smoking may be permitted in the SZ, subject to site requirements.

7.1.8 Posting

Work areas will be prominently marked and delineated using cones, caution tape, or a site diagram.

7.1.9 Site Inspections

The SS will conduct a daily inspection of site activities, equipment, and procedures to verify that the required elements are in place. The Health and Safety Inspection Form in Attachment I may be used as a guide for daily inspections. LPOs will be predetermined by the PM, conducted in the field and input into the LPS database for auctioning and review.

7.2 Decontamination

7.2.1 Personnel Decontamination

All personnel wearing Modified Level D or Level C protective equipment in the EZ must undergo personal decontamination prior to entering the SZ. The personnel decontamination area will consist of the following stations at a minimum:

- *Station 1:* Personnel leaving the contaminated zone will remove the gross contamination from their outer clothing and boots.

- *Station 2:* Personnel will remove their outer garment and gloves and dispose of it in properly labeled containers. Personnel will then decontaminate their hard hats, and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items are then hand carried to the next station.

- *Station 3:* Personnel will thoroughly wash their hands and face before leaving the CRZ. Respirators will be sanitized and then placed in a clean plastic bag.

7.2.2 Equipment Decontamination

All vehicles that have entered the EZ will be decontaminated at the decontamination pad prior to leaving the zone. If the level of vehicle contamination is low, decontamination may be limited to rinsing of tires and wheel wells with water. If the vehicle is significantly contaminated, steam cleaning or pressure washing of vehicles and equipment may be required.

7.2.3 Personal Protective Equipment Decontamination

Where and whenever possible, single-use, external protective clothing must be used for work within the EZ or CRZ. This protective clothing must be disposed of in properly labeled containers. Reusable protective clothing will be rinsed at the site with detergent and water. The rinsate will be collected for disposal.

When removed from the CRZ, the respirator will be thoroughly cleaned with soap and water. The respirator face piece, straps, valves, and covers must be thoroughly cleaned at the end of each work shift and ready for use prior to the next shift. Respirator parts may be disinfected with a solution of bleach and water, or by using a spray disinfectant.

8. Training and Medical Surveillance

8.1 Training

8.1.1 General

All on-site project personnel who work in areas where they may be exposed to site contaminants must be trained as required by OSHA Regulation 29 CFR 1910.120 (HAZWOPER). Field employees also must receive a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor. Personnel who completed their initial training more than 12 months prior to the start of the project must have completed an eight-hour refresher course within the past 12 months. The SS must have completed an additional eight hours of supervisory training, and must have a current first-aid/CPR certificate.

8.1.2 Basic 40-Hour Course

The following is a list of the topics typically covered in a 40-hour HAZWOPER training course:

- General safety procedures
- Physical hazards (fall protection, noise, heat stress, cold stress)
- Names and job descriptions of key personnel responsible for site health and safety
- Safety, health, and other hazards typically present at hazardous waste sites
- Use, application, and limitations of PPE
- Work practices by which employees can minimize risks from hazards
- Safe use of engineering controls and equipment on site
- Medical surveillance requirements
- Recognition of symptoms and signs which might indicate overexposure to hazards
- Worker right-to-know (Hazard Communication OSHA 1910.1200)
- Routes of exposure to contaminants
- Engineering controls and safe work practices
- Components of a health and safety program and a site-specific HASP
- Decontamination practices for personnel and equipment
- Confined-space entry procedures
- General emergency response procedures

8.1.3 Supervisor Course

Management and supervisors must receive an additional eight hours of training, which typically includes:

- General site safety and health procedures
- PE programs
- Air monitoring techniques

8.1.4 Site-Specific Training

Site-specific training will be accomplished by on-site personnel reading this HASP or through a thorough site briefing by the PM, SS, or HSS on the contents of this HASP before work begins. The review must include a discussion of the chemical, physical, and biological hazards; the protective equipment and safety procedures; and emergency procedures.

8.1.5 Daily Safety Meetings

Twice daily safety meetings will be held to cover the work to be accomplished, the hazards anticipated, the PPE and procedures required to minimize site hazards, and emergency procedures. The SS or HSS should present these meetings prior to beginning the day's fieldwork and again after lunch. No work will be performed in an EZ before a safety meeting has been held. A safety meeting must also be held prior to new tasks, and repeated if new hazards are encountered. The Daily Safety Meeting Log is included in Attachment C.

8.1.6 First Aid and CPR

At least one employee current in first aid/CPR will be assigned to the work crew and will be on the site during operations. Refresher training in first aid (triennially) and CPR (annually) are required to keep the certificate current. These individuals must also receive training regarding the precautions and protective equipment necessary to protect against exposure to blood-borne pathogens.

8.2 Medical Surveillance

8.2.1 Medical Examination

All personnel who are potentially exposed to site contaminants must participate in a medical surveillance program as defined by OSHA at 29 CFR 1910.120 (f).

8.2.2 Pre-placement Medical Examination

All potentially exposed personnel must have completed a comprehensive medical examination prior to assignment, and periodically thereafter as defined by applicable regulations. The pre-placement and periodic medical examinations typically include the following elements:

- Medical and occupational history questionnaire
- Physical examination
- Complete blood count, with differential
- Liver enzyme profile
- Chest X-ray, at a frequency determined by the physician
- Pulmonary function test
- Audiogram
- Electrocardiogram for persons older than 45 years of age, or if indicated during the physical examination
- Drug and alcohol screening, as required by job assignment
- Visual acuity
- Follow-up examinations, at the discretion of the examining physician or the corporate medical director.

The examining physician provides the employee with a letter summarizing his findings and recommendations, confirming the worker's fitness for work and ability to wear a respirator. Documentation of medical clearance will be available for each employee during all project site work.

Subcontractors will certify that all their employees have successfully completed a physical examination by a qualified physician. The physical examinations must meet the requirements of 29 CFR 1910.120 and 29 CFR 1910.134. Subcontractors will supply copies of the medical examination certificate for each on-site employee.

8.2.3 Other Medical Examinations

In addition to pre-employment, annual, and exit physicals, personnel may be examined:

- At employee request after known or suspected exposure to toxic or hazardous materials

- At the discretion of the HSS, HSO, or occupational physician in anticipation of, or after known or suspected exposure to toxic or hazardous materials.

8.2.4 Periodic Exam

Following the placement examination, all employees must undergo a periodic examination, similar in scope to the placement examination. For employees potentially exposed over 30 days per year, the frequency of periodic examinations will be annual. For employees potentially exposed less than 30 days per year, the frequency for periodic examinations will be 18 months.

8.2.5 Medical Restriction

When the examining physician identifies a need to restrict work activity, the employee's supervisor must communicate the restriction to the employee and the HSS. The terms of the restriction will be discussed with the employee and the supervisor.

9. Emergency Procedures

9.1 General

Prior to the start of operations, the work area will be evaluated for the potential for fire, contaminant release, or other catastrophic event. Unusual conditions or events, activities, chemicals, and conditions will be reported to the SS/HSS immediately.

The SS/HSS will establish evacuation routes and assembly areas for the site. All personnel entering the site will be informed of this route and the assembly area.

9.2 Emergency Response

If an incident occurs, the SS or HS should take the following steps:

- Evaluate the incident and assess the need for assistance and/or evacuation
- Call for outside assistance as needed
- Confirm that the PM is notified promptly of the incident
- Take appropriate measures to stabilize the incident scene

9.3 Fire

In the case of a fire on site, the SS/HSS will assess the situation and direct firefighting activities. The SS/HSS will confirm that the PM is immediately notified of any fires. Site personnel will attempt to extinguish the fire with available extinguishers, if safe to do so. In the event of a fire that site personnel are unable to safely extinguish with one fire extinguisher, the local fire department will be summoned.

9.4 Contaminant Release

In the event of a contaminant release, the following steps will be taken:

- Notify SS/HSS immediately
- Evacuate immediate area of release
- Conduct air monitoring to determine needed level of PPE
- Don required level of PPE and prepare to implement control procedures

The SS/HSS has the authority to commit resources as needed to contain and control released material, and to prevent its spread to off-site areas.

9.5 Medical Emergency

- All employee injuries must be promptly reported to the HSS/SS, who will:

- Confirm that the injured employee receives prompt first aid and medical attention.

- In emergency situations, the worker is to be transported by appropriate means to the nearest urgent care facility (normally a hospital emergency room).

If the injured person is a ARCADIS employee, notify the ARCADIS Workers Comp administrator at 720.344.3844 as soon as possible after the injured employee has been safely evacuated from the site.

9.6 Emergency Care Steps

Upon entering an accident area, site personnel must follow these emergency care steps:

- Survey the scene. Determine if it is safe to proceed. Try to determine if the conditions that caused the incident are still a threat. Protect yourself from exposure before attempting to rescue the victim.

- Do a primary survey of the victim. Check for airway obstruction, breathing, and pulse. Assess likely routes of chemical exposure by examining the eyes, mouth, nose, and skin of the victim for symptoms.

- Phone emergency medical services (EMS). Give the location, telephone number used, caller’s name, what happened, number of victims, victim’s condition, and help being given.

- Maintain airway and perform rescue breathing as necessary.

- Perform CPR as necessary.

- Do a secondary survey of the victim. Check vital signs and do a head-to-toe exam.

- Treat other conditions as necessary. If the victim can be moved, take him or her to a location away from the work area where EMS can gain access.

9.7 First Aid—General

All persons must report any injury or illness to their immediate supervisor or the SS. Trained personnel will provide first aid. Injuries and illnesses requiring medical treatment must be documented. The SS and HSS must conduct an II as soon as emergency conditions no longer exist, and first aid and/or medical treatment has been confirmed. It must be completed and submitted to the PM within 24 hours after the incident.

If first-aid treatment is required, first-aid kits are kept at the CRZ. If treatment beyond first aid is required, the injured person(s) should be transported to the medical facility. If the injured person is not ambulatory or shows any sign of not being in a comfortable and stable condition for transport, then an ambulance and/or paramedics should be summoned. If there is any doubt as to the injured worker’s condition, it is best to let the local paramedic or ambulance service examine and transport the worker.

9.7.1 First Aid—Inhalation

Any employee complaining of symptoms of chemical overexposure as described in Section 4, General Safety Practices, will be removed from the work area and transported to the designated medical facility for examination and treatment.

9.7.2 First Aid—Ingestion

Call EMS and consult a poison control center for advice. If available, refer to the MSDS for treatment information. If the victim is unconscious, keep them on their side and clear the airway if vomiting occurs.

9.7.3 First Aid—Skin Contact

Project personnel, who have had skin contact with contaminants will, unless the contact is severe, proceed through the CRZ to the wash area. Personnel will remove any contaminated clothing and then flush the affected area with water for at least 15 minutes. The worker should be transported to the medical facility if he or she shows any sign of skin reddening, irritation, or if he or she requests a medical examination.

9.7.4 First Aid—Eye Contact

Project personnel who have had contaminants splashed in their eyes, or who have experienced eye irritation while in the EZ, must immediately proceed to the eyewash station in the CRZ. Do not decontaminate prior to using the eyewash. Remove whatever protective clothing is necessary to use the eyewash. Flush the eye with clean running water for at least 15 minutes. Arrange prompt transport to the designated medical facility.

9.7.5 Reporting Injuries, Illnesses, and Near-Miss Incidents

Injuries and illnesses, however minor, will be reported to the SS immediately. The SS will notify James Morgan of National Grid immediately upon learning of a near-miss, injury or illness. The SS will complete an injury report and submit it to the HSO/HSO, PIC and the PM within 24 hours.

Near-miss incidents are situations in which no injury or property damage occurred, but under slightly different circumstances an injury or property damage could have occurred. Near misses are caused by the same factors as injuries; therefore, they must be reported and investigated in the same manner. An investigation must be done immediately after an injury, illness, near miss, or other incident to determine if it is safe to proceed with the work.

9.8 Non-Emergency, Non-Life Threatening Work Related Injury or Illness

For minor illnesses or injuries that may be work-related and are not life threatening or emergencies (e.g., you’re in your hotel room and your lower back tightens up, earlier in the day you hand-augured 50 borings; you cut your hand in the office, put a band-aid on the cut, and go back to work, but when you get home you realize the cut is deep and is still bleeding; you hit your head on a cabinet while loading paper, and later on that day you suddenly feel dizzy.) employees will take the following steps **before** seeking medical treatment at a medical treatment facility:

As soon as possible, contact WorkCare at 1.800.455.6155 (Once you've spoken with WorkCare, you can let your supervisor know).

- WorkCare will discuss the medical issues with you and provide appropriate medical guidance.

- If WorkCare feels that you should see a physician:

    - They will help you locate a physician/clinic and will contact the clinic to discuss the treatment plan. If they have a concern about the treatment plan, one of the WorkCare physicians will attempt to contact the treating physician to discuss the plan and will keep you advised.

If WorkCare feels that first-aid/self-treatment is medically appropriate:

- They will provide the treatment information to you and will follow up with you to determine effectiveness
- If the medical issue persists, WorkCare will advise alternative treatment or will refer you to a physician.
- Keep your supervisor informed on what action you will be taking. If you are seen by a physician, keep them advised as to your work status and upcoming medical appointments.

If an injury or illness is life-threatening or an emergency, please seek medical attention immediately. As soon as possible, notify your supervisor.

9.9 Emergency Information

The means to summon local public response agencies such as police, fire, and ambulance will be reviewed in the daily safety meeting. These agencies are identified in Table 9-1.

TABLE 9-1
EMERGENCY CONTACTS

Agency/Name	Telephone No.
Police	315.823.1122 / 911
Fire	315.823.2233 / 911
Ambulance	315.823.2233 / 911
Little Falls Hospital	315.823.1000
ARCADIS Project Manager: Michael C. Jones	315.671.9211 Cell: 315.247.3244
Site Supervisor: TBD	TBD
National Grid Project Manager: James Morgan	315-428-3101

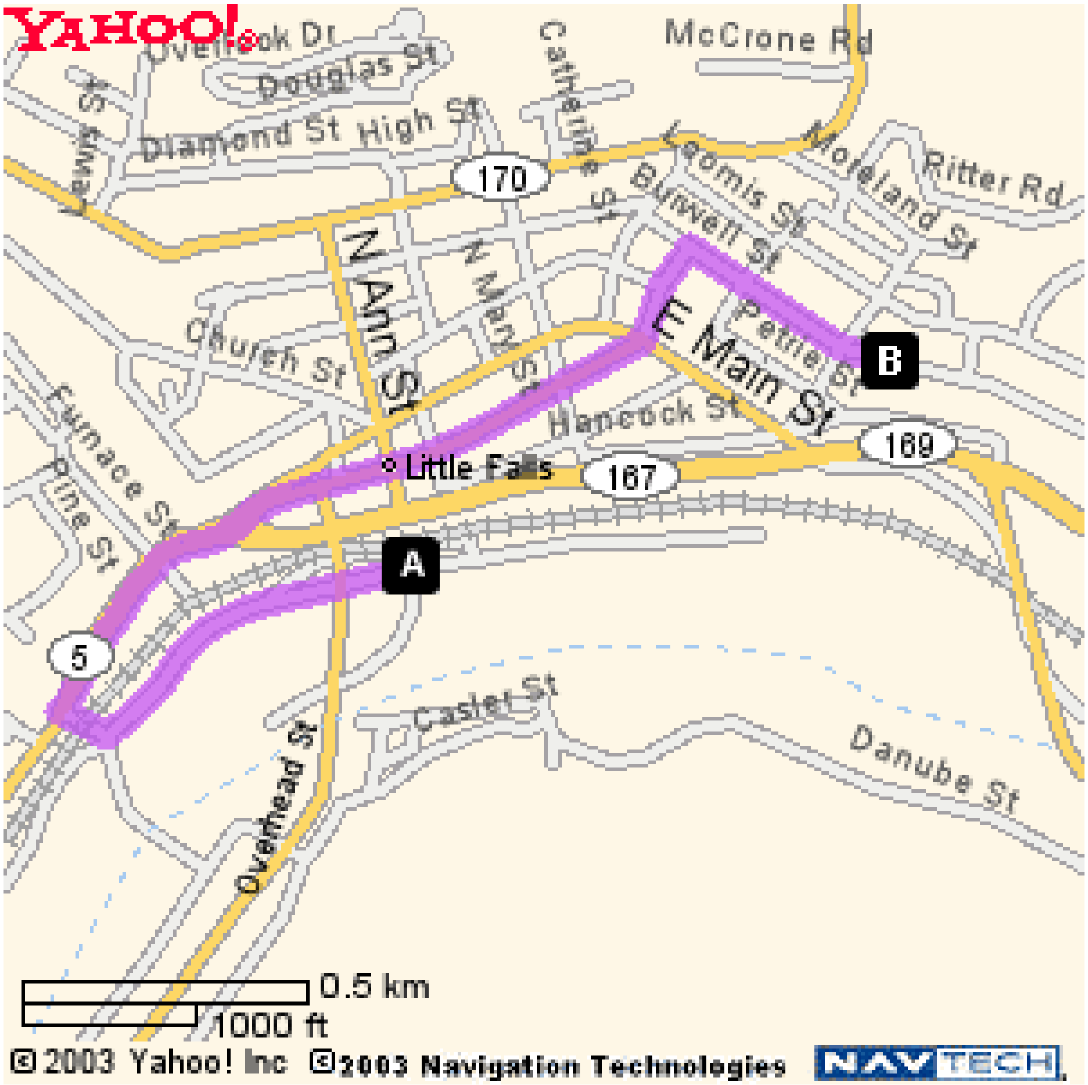
The Hospital Route Map is on the following page. It is the responsibility of the HSS to verify the hospital directions prior to the start of work.

DIRECTIONS TO THE HOSPITAL

Directions to Little Falls Hospital, 140 Burwell Street, Little Falls, New York 13365:

1. Travel West on W. Mill Street;
2. Continue on Elizabeth Street;
3. Turn Right onto Lock Street;
4. Turn Right onto W. Main Street;
5. Continue on Albany Street;
6. Bear Left on Waverly Place;
7. Turn Right onto Burwell;
8. Arrive at 140 Burwell Street (Little Falls Hospital).

See the following page for a map to the Little Falls Hospital.


YAHOO!
Overlook Dr
Douglas St
Diamond St
High St
Catherine St
McCrone Rd
170
Loomis St
Moreland St
Ritter Rd
Burwell St
N Ann St
N Mary St
Church St
E Main St
Petrie St
B
Hancock St
Furnace St
Pine St
Little Falls
167
169
A
5
Casler St
Danube St
Overhead St
0.5 km
1000 ft
© 2003 Yahoo! Inc
©2003 Navigation Technologies
NAVTECH

10. Acronyms and Abbreviations

The following acronyms and abbreviations (listed alphabetically) are applicable to this HASP:

ACGIH	American Conference of Governmental Industrial Hygienists
CFR	Code of Federal Regulations
COC(s)	Constituent(s) of Concern
CPR	Cardiopulmonary Resuscitation
CRZ	Contamination-Reduction Zone
DEET	diethyltoluamide
DOT	Department of Transportation
EMS	Emergency Medical Services
EZ	Exclusion Zone
FID	Flame Ionization Detector
FM	Factory Mutual Engineering Corporation
GFCI	Ground-Fault-Circuit Interrupter
HASP	Health and Safety Plan
HSO	Health and Safety Officer
HSS	Health and Safety Supervisor
II	Incident Investigation
JSA	Job Safety Analysis
kV	Kilovolts
LEL	Lower Explosive Limit
LFL	Lower Flammable Limit
LPO	Loss Prevention Observation
mph	Miles Per Hour
MSDS	Material Safety Data Sheet
NEC	National Electrical Code
NESC	National Electrical Safety Code
NIOSH	National Institute for Occupational Safety and Health
NRR	Noise Reduction Rating
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PFD	Personal Flotation Device
PID	Photoionization Detector
PM	Project Manager
PO	Project Officer
PPE	Personal Protective Equipment
RMSF	Rocky Mountain Spotted Fever

SS	Site Supervisor
SZ	Support Zone
Ta adj	Adjusted Air Temperature
TLV	Threshold Limit Value
TRACK	Think, Recognize, Act, Control, Keep H&S First
UFPO	Underground Facility Protection Organization
UL	Underwriters Laboratory
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency

11. References

This HASP follows the guidelines established in the references listed below.

ACGIH. 2007a. *Threshold Limit Values Handbook*.

ACGIH. 2007b. *Guide to Occupational Exposure Values*.

ARCADIS. 2003. *Health and Safety Policies Manual*.

Forsberg, K. and S.Z. Mansdorf. 2005. *Quick Selection Guide to Chemical Protective Clothing*, 5th Edition.

NIOSH*.* 2005. Pocket Guide to Chemical Hazards.

NIOSH, OSHA, USCG, and USEPA. 1985. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*. 86116.

Title 29 of the Code of Federal Regulations (CFR), Parts 1910 and 1926.

USEPA. 1992. *Standard Operating Safety Guides*. Publication 9285.1-03.

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Attachment A

Loss Prevention Observation Form

ARCADIS
Infrastructure, environment, facilities

Loss Prevention Observation (LPO) Form

(page 1 – LPO Information)

Observer Name:	**Observer Title:**	**Project / Project Number:**
Date / Time:	**Project Type / Task Observed:**	

Background Information

List Critical Work Procedures

List Issue / Items Requiring Corrective Action

Explanation of Root Cause(s) Analysis Numbers (RCA No):

1. Lack of SKILL or KNOWLEDGE (XOM#1)	2. Lack of or inadequate operational PROCEDURES or work standards (XOM#5)
3. Inadequate COMMUNICATION OF EXPECTATIONS regarding procedures or acceptable practices (XOM#6)	4. Inadequate TOOLS or EQUIPMENT (XOM#7)
5. Doing the job according to procedures or acceptable practices takes more TIME or EFFORT (XOM#2)	6. Short-cutting procedures or acceptable practices is POSITIVELY REINFORCED or TOLERATED, rewarded or appreciated (XOM#3)
7. IN THE PAST, did not follow procedures or acceptable practices and NO INCIDENT occurred (XOM#4)	8. EXTERNAL factors (XOM#8)

Criterion #	RCA #	Corrective Action Identified	Responsible Individual	Due Date	Closure Date

Results of Corrective Action

Reviewed by:	Date:	Reviewed by:	Date:

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Loss Prevention Observation (LPO) Form

(page 2 - Environmental Operations)

Pre-Task Preparation		**Correct**	**Questionable**	**Comments**
1.	Health and Safety Plan / MSDSs on site	☐	☐	
2.	Employee familiar / trained on task	☐	☐	
3.	OSHA-required training/medical surveillance	☐	☐	
4.	Utility mark out / check performed	☐	☐	
5.	Traffic hazard addressed / work area marked	☐	☐	
6.	Walking / working surfaces free of hazards	☐	☐	
7.	Tailgate safety meeting performed	☐	☐	
8.	Impact on nearby residence / business evaluated	☐	☐	
9.	Communicates intentions to other personnel	☐	☐	
10.	Knowledge of emergency procedures	☐	☐	
11.	Distance between equipment and power lines	☐	☐	
12.	Personal protective equipment	☐	☐	
13.	Air monitoring equipment on site, calibrated	☐	☐	
14.	First aid kit / fire extinguisher on site	☐	☐	
15.	One person trained in first aid / CPR	☐	☐	
16.	Work zones established and marked	☐	☐	
Performing Task		**Correct**	**Questionable**	**Comments**
17.	Employee trained in task to be performed	☐	☐	
18.	Correct body positioning	☐	☐	
19.	Proper lifting / pushing / pulling techniques	☐	☐	
20.	Keep hands / body away from pinch points	☐	☐	
21.	Walking / working surfaces kept clear of debris	☐	☐	
22.	Faces traffic as appropriate	☐	☐	
23.	Vehicles / barricades to protect against traffic	☐	☐	
24.	Drill rig located properly, blocked / chocked	☐	☐	
25.	Drill rig moved only with derrick lowered	☐	☐	
26.	Excavator located on stable ground	☐	☐	
27.	Eye contact made with equipment operator	☐	☐	
28.	Spoil at least 2 feet back from edge of excavation	☐	☐	
29.	Excavation shored / sloped / benched	☐	☐	
30.	Excavation entry controlled	☐	☐	
31.	Equipment / tools used properly	☐	☐	
32.	Electrical equipment connected through GFCI	☐	☐	
33.	Power tools handled properly	☐	☐	
34.	Electrical cords inspected / in good condition	☐	☐	
35.	Follows lockout / tagout procedures	☐	☐	
36.	Air monitoring conducted / action levels understood	☐	☐	
37.	Equipment decontaminated properly	☐	☐	
38.	Personnel decon prior to eating / drinking / smoking	☐	☐	
39.	Decontamination effective	☐	☐	
Post-Task		**Correct**	**Questionable**	**Comments**
40.	Procedures / JSA adequate	☐	☐	
41.	Equipment / tools stored properly	☐	☐	
42.	Proper storage of soil / water / waste material	☐	☐	
43.	Work area secured	☐	☐	
44.	Other	☐	☐	

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Attachment B

Incident/Near Miss Investigation Report

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Incident/Near-Miss Investigation Report

☐ OSHA Recordable	☐ First Aid Injury	☐ Fire	Date of Incident:
☐ Lost Workday Injury	☐ Vehicle Accident	☐ Spill / Leak	
☐ Restricted Duty Injury	☐ Equipment Damage	☐ Near Miss	Incident Number:

Every employee injury, accident, and near miss must be reported within 24 hours of the injury. If the incident results in hospitalization, an immediate report must be made by telephone to the Project Manager and the Health and Safety Officer.

Project Information

Project Name:	Project #:

Location of Incident:

Employee

Name:	Employee Number:
Employment Status: ☐ Regular ☐ Part Time	How long in present job?

Injury or Illness Information

Where did the incident / near miss occur? (number, street, city, state, zip):

Employee’s specific activity at the time of the incident / near miss:

Equipment, materials, or chemicals the employee was using when the incident / near miss occurred (e.g., the equipment employee struck against or that struck the employee; the vapor inhaled or material swallowed; what the employee was lifting, pulling, etc.):

Describe the specific injury or illness (e.g., cut, strain, fracture, etc.):

Body part(s) affected (e.g., back, left wrist, right eye, etc.):

Name and address of treatment provider (e.g., physician or clinic):	Phone No.:
If hospitalized, name and address of hospital:	Phone No.:
Date of injury or onset of illness: / /	Time of event or exposure: ☐ AM ☐ PM

Did employee miss at least one full shift’s work? ☐ No ☐ Yes, 1st date absent (MM/DD/YYYY) / /

Has employee returned to work? ☐ Regular Work ☐ Restricted Work ☐ No

☐ Yes, date returned (MM/DD/YYYY) / /

To whom reported:	Other workers injured / made ill in this event? ☐ Yes ☐ No

Description of Incident / Near Miss: (Describe what happened and how it happened.)

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Incident/Near-Miss Investigation Report

Motor Vehicle Accident (MVA)				Company Vehicle?	☐ Yes ☐ No		
Accident Location (street, city, state)							
Vehicle Towed?	☐ Yes ☐ No	Other Vehicle?	☐ Yes ☐ No	# Vehicles Towed:		# of Injuries:	

Spill		
Material Spilled:	Quantity:	Source:
Agency Notifications:		
Cost of Incident $		

Third-Party Incidents		
Name of Owner:	Address:	Telephone:
Description of Damage:		
Witness Name:	Address:	Telephone:
Witness Name:	Address:	Telephone:

#	Root Cause and Contributing Factors: Conclusion (Describe in Detail Why Incident / Near Miss Occurred)
1	
2	
3	
4	
5	

Explanation of Root Cause(s) Analysis Numbers (RCA No):

1. Lack of SKILL or KNOWLEDGE (XOM#1)	2. Lack of or inadequate operational PROCEDURES or work standards (XOM#5)
3. Inadequate COMMUNICATION OF EXPECTATIONS regarding procedures or acceptable practices (XOM#6)	4. Inadequate TOOLS or EQUIPMENT (XOM#7)
5. Doing the job according to procedures or acceptable practices takes more TIME or EFFORT (XOM#2)	6. Short-cutting procedures or acceptable practices is POSITIVELY REINFORCED or TOLERATED, rewarded or appreciated (XOM#3)
7. IN THE PAST, did not follow procedures or acceptable practices and NO INCIDENT occurred (XOM#4)	8. EXTERNAL factors (XOM#8)

#	RCA #	Solution(s): How to Prevent Incident / Near Miss From Reoccurring	Person Responsible	Due Date	Closure Date

Investigation Team Members

Name:	Job Title:	Date:

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Incident/Near-Miss Investigation Report

Results of Solution Verification and Validation

Reviewed By

Name:	Job Title:	Date:
	Project Manager	
	Health and Safety Reviewer	

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Attachment C

Safety Meeting Log

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Safety Meeting Log

Project:	**Location:**
Date / Time:	**Activity:**

1. Work Summary

2. Physical / Chemical Hazards: Has JSA been reviewed / modified to address changing conditions?

3. Protective Equipment / Procedures

4. Emergency Procedures

Is there anyone with any medical conditions that they would like the team to know about? For example: Medic Alert, allergic to bee stings, nitro for chest pains, etc.

Location of medical equipment: fire extinguishers, first aid kit, route to hospital, auto-injectors, etc.

5. Signatures of Attendees

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Health and Safety Plan Acknowledgment

I have read the Site-Specific Health and Safety Plan, or its contents have been presented to me, and I understand the contents and I agree to abide by its requirements.

Name (Print)	Signature	Representing	Date

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Attachment D

Underground/Overhead Utility Checklist

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Underground / Overhead Utility Checklist

Project Name:	**Date:**
Project Number:	**Location:**
Prepared By:	**Project Manager:**

This checklist must be completed for any intrusive subsurface work such as excavation or drilling. It documents that overhead and underground utilities in the work area are identified and located. The Project Manager shall request utility markouts before the start of field operations to allow the client and utility companies sufficient time to provide them. If complete information is not available, a magnetometer or other survey shall be performed to locate obstacles prior to intrusive subsurface activities.

Procedure: A diagram of the work area depicting the proposed location of intrusive subsurface work sites (i.e., boring locations, excavation locations) must be attached to this form. The diagram must clearly indicate the areas checked for underground structures / utilities, and overhead power lines. This form and the diagram must be signed by the ARCADIS Project Manager (if present), the ARCADIS Site Supervisor, and the client representative.

Type of Structure	Present	Not Present	Method of Markout
Electric Power Line			
Natural Gas Line			
Telephone Line			
Water Line			
Product Line			
Sewer Line			
Steam Line			
Drain Line			
Underground Tank			
Underground Cable			
Overhead Power Line			
Overhead Product Line			
Other (Specify)			

Reviewed By

Name	Job Title	Date
	Client Representative	
	ARCADIS Project Manager	
	ARCADIS Site Supervisor	

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Attachment E

Chemical Hazard Information

TABLE 3-1 (CONT'D)
CHEMICAL HAZARD INFORMATION

Substance [CAS Number]	IP[1] (eV)	Odor Threshold (ppm)	Route[2]	Symptoms of Exposure	Treatment	TWA[3]	STEL[4]	Source[5]	IDLH (NIOSH)[6]
Benzene [71-43-2]	9.24	34-119	Inh Abs Ing Con	Irritated eyes, nose, and respiratory system; giddiness; headache; nausea; staggered gait; fatigue; anorexia, lassitude; dermatitis; bone marrow depression – carcinogenic	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	1 ppm (0.5 ppm) NIC-0.1 skin 0.1 ppm	 2.5 ppm	PEL TLV REL	Ca (500 ppm)* *OSHA 29 CFR 1910.1028
Benzo(a)pyrene 50-32-8	ND	ND	Inh Ing Con	Eye and skin irritation, respiratory tract irritation. Potential cancer causing chemical	Eye: Irrigate immediately Skin: Soap wash, seek medical attention Breath: Move to fresh air, give respiratory support if needed, seek medical aid Swallow: Rinse mouth, drink milk or water, seek medical aid	0.2 mg/m3 (as benzene soluble aerosol) ACGIH .1 mg/m3 NIOSH		PEL TLV REL	
Ethylbenzene [100-41-4]	8.76	0.09-0.6	Inh Ing Con	Irritated eyes, mucous membranes; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush immediately Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 100 ppm 100 ppm	125 ppm 125 ppm 125 ppm	PEL TLV REL	800 ppm
Gasoline [8006-61-9]	<10.6	NA	Inh Abs Ing Con	Irt eyes, skin, muc memb; derm; head, ftg, blurred vision, dizz, slurred speech, conf; chem pneu; possible liver, kidney damage; – **carcinogenic**	Eye: Irrigate immediately Skin: Soap flush immediately Breath: Respiratory support Swallow: Immediate medical attention	NE 300 ppm NE	NE 500 ppm NE	PEL TLV REL	**Ca** (N.D.)
n-Hexane 110-54-3	10.18	NA	Inh Abs Ing Con	Irritated eyes, nose; li-head; nausea, headache; numb extremities, muscular weakness; dermatitis; giddiness; chemical pneumonia (aspir liq)	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	500 ppm 50 ppm 50 ppm		PEL TLV REL	1100 ppm (LEL)
Lead, inorganic dusts and fumes (as Pb) [7439-92-1]	NA	NA	Inh Ing Con	Weakness, lassitude, insomnia; facial pallor; eye pallor; anorexia, low weight, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremors; wrist and ankle paralysis; brain damage; kidney damage; irritated eyes; hypotension	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	0.05 mg/m^3 0.05 mg/m^3 <0.1 mg/m^3 See 29 CFR 1910.1025		PEL TLV REL	100 mg/m^3
Coal-tar-pitch volatiles (benzene-soluble fraction) (polynuclear aromatic hydrocarbons [PAH]) [65996-93-2]	ND	ND	Ing Con	Eye sensitivity to light; eye and skin irritation, dermatitis, bronchitis; carcinogenic	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	0.2 mg/m^3 0.2 mg/m^3 0.1 mg/m^3		PEL TLV REL	Ca [80 mg/m^3]
Toluene [108-88-3]	8.82	0.16-37	Inh Abs Ing Con	Fatigue, weakness; confusion, euphoria, dizziness; headache; dilated pupils, lacrimation; nervousness, muscular fatigue, insomnia; paralysis; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 50 ppm (skin) 100 ppm	150 ppm 150 ppm	PEL TLV REL	500 ppm
Xylene (o-, m-, and p-isomers) [1330-20-7; 95-47-6; 108-38-3; 106-42-3]	8.56 8.56 8.44	1.1-20	Inh Abs Ing Con	Dizziness, excitement, drowsiness, incoordination, staggering gait; irritated eyes, nose, throat; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 100 ppm 100 ppm	150 ppm 150 ppm 150 ppm	PEL TLV REL	900 ppm

[1]IP = Ionization potential (electron volts).
[2]Route = Inh, Inhalation; Abs, Skin absorption; Ing, Ingestion; and Con, Skin and/or eye contact.
[3]TWA = Time-weighted average. The TWA concentration for a normal workday (usually 8 or 10 hours) and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day without adverse effect.
[4]STEL = Short-term exposure limit. A 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the TWA is not exceeded.
[5]PEL = Occupational Safety and Health Administration (OSHA) permissible exposure limit (29 CFR 1910.1000, Table Z).
[5]TLV = American Conference of Governmental Industrial Hygiene (ACGIH) threshold limit value – TWA.
[5]REL = National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit.
[6]IDLH (NIOSH) = Immediately dangerous to life or health (NIOSH). Represents the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.
NE = None established. No evidence could be found for the existence of an IDLH (NIOSH Pocket Guide to Chemical Hazards, Pub. No. 90-117, 1990, 1997).
C = Ceiling limit value which should not be exceeded at any time.
Ca = Carcinogen.
NA = Not applicable.
ND = Not Determined.
LEL = Lower explosive limits.
LC_{50} = Lethal concentration for 50 percent of population tested.
LD_{50} = Lethal dose for 50 percent of population tested.
NIC = Notice of intended change (ACGIH).

References:
American Conference of Governmental Industrial Hygienists Guide to Occupational Exposure Values, 2003, compiled by the American Conference of Governmental Industrial Hygienists.
American Conference of Governmental Industrial Hygienists Threshold Limit Values, 2003, compiled by the American Conference of Governmental Industrial Hygienists
Amoore, J. and E. Hautula, "Odor as an Aid to Chemical Safety," Journal of Applied Toxicology, 1983.
Clayton, George D. and F.E. Clayton, Patty's Industrial Hygiene and Toxicology, 3rd ed., John Wiley & Sons, New York.
Documentation of TLVs and BEIs, American Conference of Governmental Industrial Hygienists, 5th ed., 1986.
Fazzuluri, F.A., Compilation of Odor and Taste Threshold Values Data, American Society for Testing and Materials, 1978.
Gemet, L. and J. Van, Compilation of Odor Threshold Values in Air and Water, CIVO, Netherlands, 1977.
Gemet, L. and J. Van, Compilation of Odor Threshold Values in Air and Water, Supplement IV, CIVO, Netherlands, 1977.
Lewis, Richard J., Sr., 1992, Sax's Dangerous Properties of Industrial Materials, 8th ed., Van Nostrand Reinhold, New York.
Micromedex Tomes Plus (R) System, 1992, Micromedex, Inc.
National Institute for Occupational Safety and health Pocket Guide to Chemicals, Pub. 1990, No. 97-140, National Institute for Occupational Safety and Health, 2003.
Odor Threshold for Chemicals with Established Occupational Health Standards, American industrial Hygiene Association, 1989.
Respirator Selection Guide, 3M Occupational Health and Safety Division, 1993.
Verschuseren, K., Handbook of Environmental Data on Organic Chemicals, Van Nostrand and Reinhold, 1977.
Warning Properties of Industrial Chemicals – Occupational Health Resource Center, Oregon Lung Association.
Workplace Environmental Exposure Levels, American Industrial Hygiene Association, 1992.

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Attachment F

Material Safety Data Sheets

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2002-02

Benzene
BEN2200

Section 1 - Chemical Product and Company Identification

Material Name: Benzene **CAS Number:** 71-43-2
Chemical Formula: C_6H_6
Structural Chemical Formula: C_6H_6
Synonyms: Benzene; BENZENE; (6)ANNULENE; BENZEEN; BENZEN; BENZIN; BENZINE; BENZOL; BENZOL 90; BENZOLE; BENZOLENE; BENZOLO; BICARBURET OF HYDROGEN; CARBON OIL; COAL NAPHTHA; CYCLOHEXATRIENE; EPA PESTICIDE CHEMICAL CODE 008801; FENZEN; MINERAL NAPHTHA; MOTOR BENZOL; NITRATION BENZENE; PHENE; PHENYL HYDRIDE; POLYSTREAM; PYROBENZOL; PYROBENZOLE
General Use: Manufacture of chemicals including styrene, dyes, and many other organic chemicals. Has been used in artificial leather, linoleum, oil cloth, airplane dopes, lacquers; as solvent for waxes, resins, oils etc.
May also be a minor component of gasoline, petrol.
Exposure should be minimized by use in closed systems.
Handling procedures and control measures should be evaluated for exposure before commencement of use in plant operations.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
benzene	71-43-2	99.9

OSHA PEL
TWA: 1 ppm; 3 mg/m^3; STEL: 5 ppm.

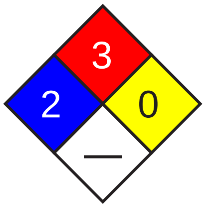
ACGIH TLV
TWA: 0.5 ppm, 1.6 mg/m^3; STEL: 2.5 ppm, 8 mg/m^3; skin.

NIOSH REL
TWA: 0.1 ppm; STEL: 1 ppm.

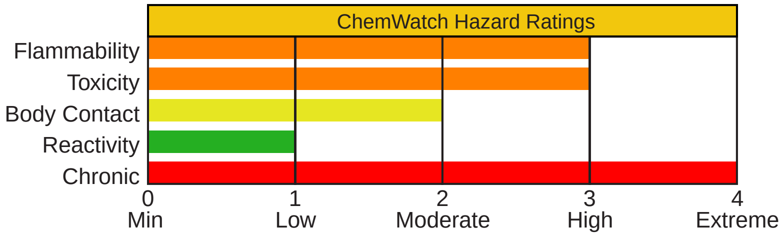
IDLH Level
500 ppm.

DFG (Germany) MAK
Skin

Section 3 - Hazards Identification



Fire Diamond



HMIS
3 Health
3 Flammability
0 Reactivity

ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Toxic. Also causes: headache, dizziness, drowsiness. Absorbed through the skin. Chronic: dermatitis, leukemia, bone marrow damage. Carcinogen. Reproductive effects. Flammable.

Potential Health Effects

Target Organs: blood, central nervous system (CNS), bone marrow, eyes, upper respiratory system, skin
Primary Entry Routes: inhalation, skin contact
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract and lungs and may be harmful if inhaled.
If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

Inhalation hazard is increased at higher temperatures.

The symptoms of acute exposure to high vapor concentrations include confusion, dizziness, tightening of the leg muscles and pressure over the forehead followed by a period of excitement. If exposure continues the casualty quickly becomes stupefied and lapses into a coma with narcosis.

Effects of inhalation may include nausea, vomiting headache, dizziness, drowsiness, weakness, sometimes preceded by brief periods of exhilaration, or euphoria, irritability, malaise, confusion, ataxia, staggering, weak and rapid pulse, chest pain and tightness with breathlessness, pallor, cyanosis of the lips and fingertips and tinnitus. Severe exposures may produce blurred vision, shallow, rapid breathing, delirium, cardiac arrhythmias, unconsciousness, deep anesthesia, paralysis and coma characterized by motor restlessness, tremors and hyperreflexia (occasionally preceded by convulsions). Polyneuritis and persistent nausea, anorexia, muscular weakness, headache, drowsiness, insomnia and agitation may also occur. Two-three weeks after the exposure, nervous irritability, breathlessness and unsteady gait may still persist; cardiac distress and an unusual dicoloration of the skin may be evident for up to four weeks.

Hemotoxicity is not normally a feature of acute exposures although anemia, thrombocytopenia, petechial hemorrhage, and spontaneous internal bleeding have been reported. Fatal exposures may result from asphyxia, central nervous system depression, cardiac and respiratory failure and circulatory collapse; sudden ventricular fibrillation may also be fatal.

Death may be sudden or may be delayed for 24 hours. Central nervous system, respiratory or hemorrhagic complications may occur up to five days after the exposure and may be lethal; pathological findings include respiratory inflammation with edema, and lung hemorrhage, renal congestion, cerebral edema and extensive petechial hemorrhage in the brain, pleurae, pericardium, urinary tract, mucous membrane and skin.

Exposure to toxic levels has also produced chromosome damage.

Eye: The liquid is highly discomforting to the eyes, may be harmful following absorption and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is moderately discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis. Open cuts, abraded or irritated skin should not be exposed to this material.

Toxic effects may result from skin absorption.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: The liquid is discomforting to the gastrointestinal tract and may be harmful if swallowed.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Class 1, Known to be a carcinogen; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class A, Human carcinogen; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

Chronic Effects: Liquid is an irritant and may cause burning and blistering of skin on prolonged exposure.

Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes.

Benzene is a myelotoxicant known to suppress bone-marrow cell proliferation and to induce hematologic disorders in humans and animals.

Signs of benzene-induced aplastic anemia include suppression off leukocytes (leukopenia), red cells (anemia), platelets (thromocytopenia) or all three cell types (pancytopenia). Classic symptoms include weakness, purpura, and hemorrhage. The most significant toxic effect is insidious and often irreversible injury to the blood forming tissue.

Leukemia may develop.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.

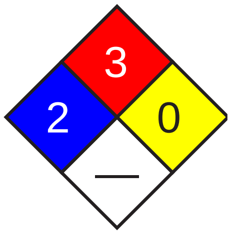
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:
1.Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
3.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
4.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.
Consider complete blood count. Evaluate history of exposure.

Section 5 - Fire-Fighting Measures

Flash Point: -11 °C Closed Cup
Autoignition Temperature: 562 °C
LEL: 1.3% v/v
UEL: 7.1% v/v

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Pollutant - contain spillage. Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.
Storage Requirements: Store in original containers in approved flame-proof area.
No smoking, bare lights, heat or ignition sources.
DO NOT store in pits, depressions, basements or areas where vapors may be trapped. Keep containers securely sealed.
Store away from incompatible materials in a cool, dry well ventilated area.
Protect containers against physical damage and check regularly for leaks.
Observe manufacturer's storing and handling recommendations.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation usually required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area.
Personal Protective Clothing/Equipment
Eyes: Chemical goggles. Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Nitrile gloves; Neoprene gloves.
Safety footwear.
Do NOT use this product to clean the skin.
Respiratory Protection:
Exposure Range >1 to 10 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >10 to 100 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range >100 to 1000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range >1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Note: must change cartridge at beginning of each shift
Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.
Glove Selection Index:

PE/EVAL/PE	Best selection
PVA	Best selection
TEFLON	Best selection
VITON	Best selection
VITON/NEOPRENE	Best selection
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion

BUTYL	Poor to dangerous choice for other than short-term immersion
NITRILE	Poor to dangerous choice for other than short-term immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion
NATURAL RUBBER	Poor to dangerous choice for other than short-term immersion
BUTYL/NEOPRENE	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, highly flammable liquid; floats on water. Characteristic aromatic odor. Highly volatile. Mixes with alcohol, chloroform, ether, carbon disulfide, carbon tetrachloride, glacial acetic acid, acetone and oils.

Physical State: Liquid
Vapor Pressure (kPa): 9.95 at 20 °C
Vapor Density (Air=1): 2.77
Formula Weight: 78.12
Specific Gravity (H_2O=1, at 4 °C): 0.879 at 20 °C
Water Solubility: 0.18 g/100 g of water at 25 °C
Evaporation Rate: Fast

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 80.1 °C (176 °F)
Freezing/Melting Point Range: 5.5 °C (41.9 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

TOXICITY
Oral (man) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 930 mg/kg
Inhalation (rat) LC_{50}: 10000 ppm/7h
Inhalation (human) LC_{Lo}: 2000 ppm/5m
Inhalation (man) TC_{Lo}: 150 ppm/1y - I
Inhalation (human) TC_{Lo}: 100 ppm
Reproductive effector in rats

IRRITATION
Skin (rabbit): 20 mg/24 hr - mod
Eye (rabbit): 2 mg/24 hr - SEVERE

See NIOSH, *RTECS* CY 1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be subject to rapid volatilization near the surface and that which does not evaporate will be highly to very highly mobile in the soil and may leach to groundwater. It may be subject to biodegradation based on reported biodegradation of 24% and 47% of the initial 20 ppm in a base-rich para-brownish soil in 1 and 10 weeks, respectively. It may be subject to biodegradation in shallow, aerobic groundwaters, but probably not under anaerobic conditions. If released to water, it will be subject to rapid volatilization; the half-life for evaporation in a wind-wave tank with a moderate wind speed of 7.09 m/sec was 5.23 hours; the estimated half-life for volatilization from a model river one meter deep flowing 1 m/sec with a wind velocity of 3 m/sec is estimated to be 2.7 hours at 20 °C. It will not be expected to significantly adsorb to sediment, bioconcentrate in aquatic organisms or hydrolyze. It may be subject to biodegradation based on a reported biodegradation half-life of 16 days in an aerobic river die-away test. In a marine ecosystem biodegradation occurred in 2 days after an acclimation period of 2 days and 2 weeks in the summer and spring, respectively, whereas no degradation occurred in winter. According to one experiment, it has a half-life of 17 days due to photodegradation which could contribute to removal in situations of cold water, poor nutrients, or other conditions less conductive to microbial degradation. If released to the atmosphere, it will exist predominantly in the vapor phase. Gas-phase will not be subject to direct photolysis but it will react with photochemically produced hydroxyl radicals with a half-life of 13.4 days calculated using an experimental rate constant for the reaction. The reaction time in polluted atmospheres which contain nitrogen oxides or sulfur dioxide is accelerated with the half-life being reported as 4-6 hours. Products of photooxidation include phenol, nitrophenols, nitrobenzene, formic acid, and peroxyacetyl nitrate. It is fairly soluble in water and is removed from the atmosphere in rain.

Ecotoxicity: LC_{50} Clawed toad (3-4 wk after hatching) 190 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (bass) 5.8 to 10.9 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Poecilia reticulata (guppy) 63 ppm/14 days /Conditions of bioassay not specified; LC_{50} Salmo trutta (brown trout yearlings) 12 mg/l/1 hr (static bioassay); LD_{50} Lepomis macrochirus (bluegill sunfish) 20 mg/l/24 to 48 hr /Conditions of bioassay not specified; LC_{100} Tetrahymena pyriformis (ciliate) 12.8 mmole/l/24 hr /Conditions of bioassay not specified; LC_{50} Cancer magister (crab larvae) stage 1, 108 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 20 ppm/96 hr /Conditions of bioassay not specified

Henry's Law Constant: 5.3 x10^{-3}
BCF: eels 3.5
Biochemical Oxygen Demand (BOD): 1.2 lb/lb, 10 days
Octanol/Water Partition Coefficient: log K_{ow} = 2.13
Soil Sorption Partition Coefficient: K_{oc} = woodburn silt loam 31 to 143

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: BENZENE
Hazard Class: 3.1
ID No.: 1114
Packing Group: II
Label: Flammable Liquid[3]

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U019 Toxic Waste, Ignitable Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a), per CAA Section 112 10 lb (4.535 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification

Material Name: Ethylbenzene **CAS Number:** 100-41-4
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_5{\bullet}C_2H_5$
Synonyms: AETHYLBENZOL; BENZENE,ETHYL-; EB; ETHYL BENZENE; ETHYLBENZEEN; ETHYLBENZENE; ETHYLBENZOL; ETILBENZENE; ETYLOBENZEN; PHENYLETHANE
General Use: Used in the manufacture of cellulose acetate, styrene and synthetic rubber; solvent or diluent; component of automotive and aviation gasoline.
Component of many petroleum hydrocarbon solvents, thinners.
The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
ethylbenzene	100-41-4	>95

OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 100 ppm; 435 mg/m^3;
STEL: 125 ppm; 545 mg/m^3.

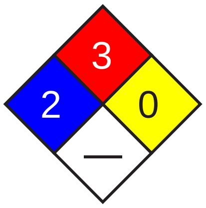
ACGIH TLV
TWA: 100 ppm, 434 mg/m^3;
STEL: 125 ppm, 543 mg/m^3.

NIOSH REL
TWA: 100 ppm, 435 mg/m^3;
STEL: 125 ppm, 545 mg/m^3.

IDLH Level
800 ppm; 10% LEL.

DFG (Germany) MAK
Skin

Section 3 - Hazards Identification



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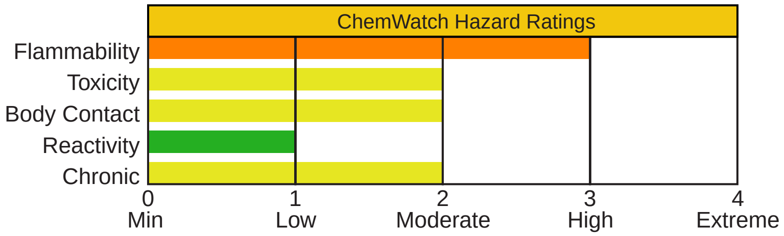


HMIS	
2	Health
3	Flammability
0	Reactivity

ANSI Signal Word
Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; pungent odor. Irritating to eyes/skin/respiratory tract. Also causes: chest constriction, vertigo, narcosis, cramps, respiratory paralysis. Chronic: fatigue, sleepiness, headache, blood disorders, lymphocytosis. Flammable.

Potential Health Effects

Target Organs: eyes, respiratory system, skin, central nervous system (CNS), blood
Primary Entry Routes: inhalation, skin contact, eye contact
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract.
Inhalation hazard is increased at higher temperatures.
Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Inhalation of vapor may aggravate a pre-existing respiratory condition such as asthma, bronchitis, emphysema.

When humans were exposed to the 100 and 200 ppm for 8 hours about 45-65% is retained in the body. Only traces of unchanged ethyl benzene are excreted in expired air following termination of inhalation exposure.

Humans exposed to concentrations of 23-85 ppm excreted most of the retained dose in the urine (mainly as metabolites).

Guinea pigs that died from exposure had intense congestion of the lungs and generalized visceral hyperemia. Rats exposed for three days at 8700 mg/m^3 (2000 ppm) showed changes in the levels of dopamine and noradrenaline in various parts of the brain.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Two drops of the material in to the conjunctival sac produced only slight irritation of the conjunctival membrane but no corneal injury.

Skin: The liquid is discomforting to the skin if exposure is prolonged and is capable of causing skin reactions which may lead to dermatitis.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

The mean rate of absorption of liquid ethyl benzene applied to 17.3 cm2 area of the forearm of seven volunteers for 10-15 minutes was determined to be 38 mg/cm2/hr. Immersion of the whole hand in aqueous solutions of ethyl benzene (112-156 mg/l) for 1 hour yielded mean absorption rates of 118 and 215.7 ug/cm2/hr. The rate of absorption is thus greater than that of aniline, benzene, nitrobenzene, carbon disulfide and styrene.

Repeated application of the undiluted product to the abdominal area of rabbits (10-20 applications over 2-4 weeks) resulted in erythema, edema and superficial necrosis. The material did not appear to be absorbed through the skin in sufficient quantity to produce outward signs of toxicity.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid may produce considerable gastrointestinal discomfort and may be harmful or toxic if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Industrial workers exposed to a maximum level of ethyl benzene of 0.06 mg/l (14 ppm) reported headaches and irritability and tired quickly. Functional nervous system disturbances were found in some workers employed for over 7 years whilst other workers had enlarged livers.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Rinse mouth out with plenty of water. DO NOT induce vomiting.

Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink.

Transport to hospital or doctor without delay.

After first aid, get appropriate in-plant, paramedic, or community medical support.

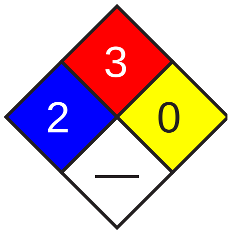
Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.

2.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
3.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance
4.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

Section 5 - Fire-Fighting Measures

Flash Point: 12.8 °C Closed Cup
Autoignition Temperature: 432 °C
LEL: 1.6% v/v
UEL: 7% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
May emit clouds of acrid smoke.



Fire Diamond

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Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
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Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area.
General exhaust is adequate under normal operating conditions.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment

Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream with polyethylene gloves or Nitrile gloves.
Protective footwear.

Respiratory Protection:
Exposure Range >100 to <800 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 800 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black

Other: Overalls. Eyewash unit.

Glove Selection Index:

VITON	Best selection
TEFLON	Best selection

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid; floats on water. Aromatic solvent odor. Soluble in alcohol, benzene, carbon tetrachloride and ether.

Physical State: Liquid
Vapor Pressure (kPa): 1.333 at 25.9 °C
Vapor Density (Air=1): 3.66
Formula Weight: 106.17
Specific Gravity (H_2O=1, at 4 °C): 0.8670 at 20 °C
Water Solubility: 0.01% by weight
Evaporation Rate: Fast

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 136.2 °C (277 °F) at 760 mm Hg
Freezing/Melting Point Range: -95 °C (-139 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

TOXICITY	IRRITATION
Oral (rat) LD_{50}: 3500 mg/kg	Skin (rabbit): 15 mg/24h mild
Inhalation (human) TC_{Lo}: 100 ppm/8h	Eye (rabbit): 500 mg - SEVERE
Inhalation (rat) LC_{Lo}: 4000 ppm/4h	
Intraperitoneal (mouse) LD_{50}: 2642 mg/kg~	
Dermal (rabbit) LD_{50}: 17800 mg/kg~	

Liver changes, utheral tract, effects on fertility, specific developmental abnormalities (musculoskeletal system) recorded.

NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

See NIOSH, *RTECS* DA 0700000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, it exist predominantly in the vapor phase based on its vapor pressure where it will photochemically degrade by reaction with hydroxyl radicals (half-life 0.5 to 2 days) and partially return to earth in rain. It will not be subject to direct photolysis. Releases into water will decrease in concentration by evaporation and biodegradation. The time for this decrease and the primary loss processes will depend on the season, and the turbulence and microbial populations in the particular body of water. Representative half-lives are several days to 2 weeks. Some may be adsorbed by sediment but significant bioconcentration in fish is not expected to occur based upon its octanol/water partition coefficient. It is only adsorbed moderately by soil. It will not significantly hydrolyze in water or soil.

Ecotoxicity: LC_{50} Cyprinodon variegatus (sheepshead minnow) 275 mg/l 96 hr in a static unmeasured bioassay; LC_{50} Pimephales promelas (fathead minnow) 12.1 mg/l/96 hr (confidence limit 11.5 - 12.7 mg/l), flow-through bioassay with measured concentrations, 26.1 °C, dissolved oxygen 7.0 mg/l, hardness 45.6 mg/l calcium carbonate, alkalinity 43.0 mg/l; Toxicity threshold (cell multiplication inhibition test): Pseudomonas putida (bacteria) 12 mg/l ; LC_{50} Palaemonetes pugio (grass shrimp, adult) 14,400 ug/l/24 hr in a static unmeasured bioassay; LC_{50} Palaemonetes pugio (grass shrimp, larva) 10,200 ug/l/24 hr in a static unmeasured bioassay; Toxicity threshold (cell multiplication inhibition test): Microcystis aeruginosa (algae) 33 mg/l; Scenedesmus quadricauda (green algae) > 160 mg/l

Henry's Law Constant: 8.44×10^{-3}

BCF: goldfish 1.9

Biochemical Oxygen Demand (BOD): theoretical 2.8%, 5 days

Octanol/Water Partition Coefficient: $\log K_{ow} = 3.15$

Soil Sorption Partition Coefficient: $K_{oc} = 164$

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: ETHYLBENZENE
Hazard Class: 3.1
ID No.: 1175
Packing Group: II
Label: Flammable Liquid [3]

Additional Shipping Information: PHENYL ETHANE

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per CWA Section 307(a) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
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Xylene
XYL2260

Section 1 - Chemical Product and Company Identification 54

Material Name: Xylene **CAS Number:** 1330-20-7
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_4(CH_3)_2$
Synonyms: BENZENE,DIMETHYL-; COMPONENT 1 (83%): XYLENES; COMPONENT 2 (17%): ETHYL BENZENE; DIMETHYLBENZENE; DIMETHYLBENZENES; EPA PESTICIDE CHEMICAL CODE 086802; KSYLEN; METHYL TOLUENE; METHYLTOLUENE; VIOLET 3; XILOLI; XYLENE; XYLENEN; XYLOL; XYLOLE
General Use: A strong solvent for general use in the manufacture of paints, varnishes, lacquers, thinners, inks, rubber, pesticides, herbicides and paint strippers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
xylene	1330-20-7	> 95

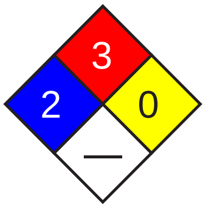
OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

ACGIH TLV
TWA: 100 ppm, 434 mg/m^3;
STEL: 150 ppm, 651 mg/m^3.

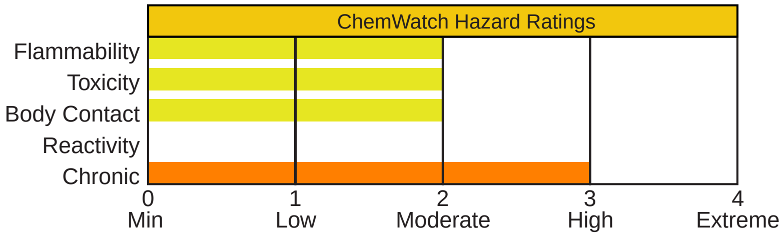
NIOSH REL
TWA: 100 ppm, 435 mg/m^3;
STEL: 150 ppm, 655 mg/m^3.

DFG (Germany) MAK
TWA: 100 ppm, 440 mg/m^3;
PEAK: 200 ppm, 880 mg/m^3;
skin, simple asphyxiant, substances with systemic effects, onset of effect within 2 hours.

Section 3 - Hazards Identification



Fire Diamond



HMIS
② Health
③ Flammability
⓪ Reactivity

ANSI Signal Word

Warning!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear, sweet smelling liquid. Irritating to the eyes/skin/respiratory tract. Also causes: dizziness, nausea, and drowsiness. Chronic: dermatitis, kidney/liver/peripheral nerve damage. May cause birth defects based on animal data. Flammable.

Potential Health Effects

Target Organs: central nervous system (CNS), eyes, gastrointestinal (GI) tract, liver, kidneys, skin
Primary Entry Routes: inhalation, skin absorption (slight), eye contact, ingestion
Acute Effects
Inhalation: Xylene is a central nervous system depressant. The vapor is discomforting to the upper respiratory tract and may be harmful if inhaled.
Inhalation hazard is increased at higher temperatures.
Toxic effects are increased by consumption of alcohol.
Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.
If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Headache, fatigue, lassitude, irritability and gastrointestinal disturbances (e.g., nausea, anorexia and flatulence) are the most common symptoms of xylene overexposure. Injury to the heart, liver, kidneys and nervous system has also been noted among workers. Transient memory loss, renal impairment, temporary confusion and some evidence of disturbance of liver function was reported in three workers overcome by gross exposure to xylene (10000 ppm). One worker died and autopsy revealed pulmonary congestion, edema, and focal alveolar hemorrhage.

Volunteers inhaling xylene at 100 ppm for 5 to 6 hours showed changes in manual coordination, reaction time and slight ataxia. Tolerance developed during the workweek but was lost over the weekend. Physical exercise may antagonize this effect. Xylene body burden in humans exposed to 100 or 200 ppm xylene in air depends on the amount of body fat with 4% to 8% of total absorbed xylene accumulating in human adipose tissues.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is highly discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Corneal changes have been reported in furniture polishers exposed to xylene.

Skin: The liquid is highly discomforting to the skin and may cause drying of the skin, which may lead to dermatitis and it is absorbed by the skin.

Toxic effects may result from skin absorption.

Open cuts, abraded or irritated skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Small excess risks of spontaneous abortion and congenital malformation was reported amongst women exposed to xylene in the first trimester of pregnancy. In all cases however the women had also been exposed to other substances.

Evaluation of workers chronically exposed to xylene has demonstrated a lack of genotoxicity. Exposure to xylene has been associated with increased risks of hemopoietic malignancies but, again simultaneous exposure to other substances (including benzene) complicate the picture. A long-term gavage study of mixed xylenes (containing 17% ethyl benzene) found no evidence of carcinogenic activity in rats and mice of either sex.

Exposure to the material for prolonged periods may cause physical defects in the developing embryo (teratogenesis).

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to xylene:

1.Gastrointestinal absorption is significant with ingestions.

For ingestions exceeding 1-2 mL (xylene)/kg, intubation and lavage with cuffed endotracheal tube is recommended.

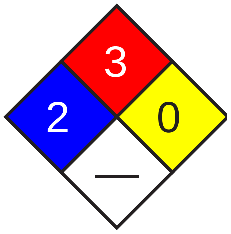
The use of charcoal and cathartics is equivocal.

2.Pulmonary absorption is rapid with about 60-65% retained at rest.

3.Primary threat to life from ingestion and/or inhalation is respiratory failure.
4.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
5.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
6.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
7.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Methylhippuric acids in urine	1.5 gm/gm creatinine	End of shift	
	2 mg/min	Last 4 hrs of shift.	

Section 5 - Fire-Fighting Measures



Fire Diamond

Flash Point: 25.6 °C
Autoignition Temperature: 241 °C
LEL: 1.0% v/v
UEL: 7.0% v/v
Extinguishing Media: Alcohol stable foam; dry chemical powder; carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
Other combustion products include carbon dioxide (CO_2).
Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.

Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of overexposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights or ignition sources.
Avoid generation of static electricity. DO NOT use plastic buckets.
Ground all lines and equipment. Use spark-free tools when handling.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.
Plastic containers may only be used if approved for flammable liquids.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i.e., to keep exposures below required standards; otherwise, PPE is required.
CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in specific circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

Personal Protective Clothing/Equipment

Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream with polyethylene gloves; Butyl rubber gloves or Neoprene gloves or PVC gloves.
Safety footwear.
Do NOT use this product to clean the skin.

Other: Overalls. Impervious protective clothing.
Eyewash unit.
Ensure there is ready access to an emergency shower.

Glove Selection Index:

PE/EVAL/PE	Best selection
PVA	Best selection
VITON	Best selection
TEFLON	Best selection
PVDC/PE/PVDC	Poor to dangerous choice for other than short-term immersion
NATURAL+NEOPRENE	Poor to dangerous choice for other than short-term immersion
NEOPRENE/NATURAL	Poor to dangerous choice for other than short-term immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
HYPALON	Poor to dangerous choice for other than short-term immersion
NAT+NEOPR+NITRILE	Poor to dangerous choice for other than short-term immersion
BUTYL	Poor to dangerous choice for other than short-term immersion
BUTYL/NEOPRENE	Poor to dangerous choice for other than short-term immersion
NITRILE	Poor to dangerous choice for other than short-term immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear colorless flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid
Vapor Pressure (kPa): 0.5 at 15 °C
Vapor Density (Air=1): 3.66 at 15 °C
Formula Weight: 106.18
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 15 °C
Water Solubility: Practically insoluble in water
Evaporation Rate: 0.7 Bu Ac=1
pH: Not applicable

pH (1% Solution): Not applicable.
Boiling Point Range: 137 °C (279 °F) to 140 °C (284 °F)
Freezing/Melting Point Range: -47 °C (-53 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

TOXICITY
Oral (human) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 4300 mg/kg
Inhalation (human) TC_{Lo}: 200 ppm
Inhalation (man) LC_{Lo}: 10000 ppm/6h
Inhalation (rat) LC_{50}: 5000 ppm/4h
Reproductive effector in rats

IRRITATION
Skin (rabbit):500 mg/24h moderate
Eye (human): 200 ppm irritant
Eye (rabbit): 87 mg mild
Eye (rabbit): 5 mg/24h SEVERE

See NIOSH, *RTECS* ZE 2100000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Most of the xylenes are released into the atmosphere where they may photochemically degrade by reaction with hydroxyl radicals (half-life 1-18 hr). The dominant removal process in water is volatilization. Xylenes are moderately mobile in soil and may leach into groundwater where they are known to persist for several years, despite some evidence that they biodegrade in both soil and groundwater. Bioconcentration is not expected to be significant.
Ecotoxicity: LC_{50} Rainbow trout 13.5 mg/l/96 hr /Conditions of bioassay not specified; LD_{50} Goldfish 13 mg/l/24 hr /Conditions of bioassay not specified
Henry's Law Constant: 0.22
BCF: estimated at 2.14 to 2.20
Octanol/Water Partition Coefficient: log K_{ow} = 3.12 to 3.20
Soil Sorption Partition Coefficient: K_{oc} = 48 to 68

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: XYLENES
Hazard Class: 3.2
ID No.: 1307
Packing Group: III
Label: Flammable Liquid[3]

Additional Shipping Information: XYLOLS

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U239 Ignitable Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001 100 lb (45.35 kg)
SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Section 1 - Chemical Product and Company Identification

Material Name: Lead **CAS Number:** 7439-92-1
Chemical Formula: Pb
Structural Chemical Formula: Pb
Synonyms: C.I. 77575; C.I. PIGMENT METAL 4; GLOVER; KS-4; LEAD; LEAD FLAKE; LEAD INORGANIC; LEAD METAL; LEAD S2; LEAD SZ; OLOW; OMAHA & GRANT; PB-S 100; PLUMBUM
General Use: Used as a construction material in chemical reaction equipment (tank piping,etc.); manufacture of tetraethyl lead; pigments for paints.
Used in pottery glazes, glass, ceramics, bearing metal and alloys, solder and other lead alloys.
Also used in metallurgy of steel and other metals, cable sheathing, storage batteries, radiation shielding and ammunition.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
lead	7439-92-1	>99

OSHA PEL
TWA: 0.05 mg/m^3; as Pb inorganic.

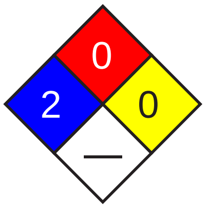
ACGIH TLV
TWA: 0.05 mg/m^3.

NIOSH REL
TWA: 0.05 mg/m^3.

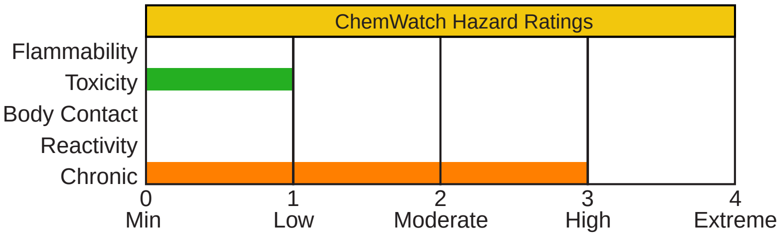
IDLH Level
100 mg/m^3; as Pb.

DFG (Germany) MAK
TWA: 0.1 mg/m^3; measured as inhalable fraction of the aerosol, substances with systemic effects, onset of effect greater than 2 hours, half-life greater than shift length, strongly cumulative.

Section 3 - Hazards Identification



Fire Diamond



HMIS
③ Health
① Flammability
⓪ Reactivity

ANSI Signal Word
Danger!

Poison

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Bluish-white, silvery, or gray metal. Cumulative poison. Repeated low exposures causes: severe neurological effects, blood/kidney damage. Possible cancer hazard. Reproductive damage (sterility, decreased fertility) and developmental damage to fetus.

Potential Health Effects

Target Organs: blood, central nervous system (CNS), peripheral nervous system, kidneys, gastrointestinal (GI) tract
Primary Entry Routes: inhalation, ingestion
Acute Effects
Inhalation: The dust may be discomforting to the upper respiratory tract and may be harmful if inhaled.
Eye: The dust may be discomforting to the eyes.
Skin: The material may be mildly discomforting to the skin.
Prolonged exposure may cause skin reactions.
Skin absorption is not considered a significant route of exposure.
Ingestion: The material is moderately discomforting to the gastrointestinal tract and may be harmful if swallowed.
In rats intestinal lead absorption is bidirectional and does not follow a linear relationship with oral dose.

Acute effects of exposure are generally minor because of its relative insolubility and physical form. Unusual instances of exposure have been reported in inadequately ventilated indoor firing ranges (as fume), in the application of surma, a mascara-like cosmetic agent, to the conjunctival surfaces in Asian countries and in lead-smelting and associated occupations.

In humans lead metabolism fits into a three compartment model. The first compartment in which lead has a half-life of about 35 days includes the blood; it receives blood from the gut and delivers some of it to the urine and communicates with the other two pools. The second compartment in which lead has a similar half-life includes the soft tissues which contain about half the blood level; they share lead with hair, nails, sweat, saliva, bile and other digestive secretions. The skeleton is the third compartment and contains the vast bulk of the total body burden, possesses a very long half-life and demonstrates a difference between the dense and less dense components to bind lead.

Carcinogenicity: NTP - Not listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Not listed.

Chronic Effects: Symptoms of exposure include headache, fatigue, sleep disturbances, abdominal pains and decreased appetite. Overexposure to lead in the form of dust has toxic effects on the lungs and kidneys and on the nervous system resulting in mental disturbances and anemia.

Skin absorption is not considered to be a significant route of exposure.

Worker exposure to lead must be kept to a minimum, especially in cases where lead is worked at temperatures whereby lead vapors are evolved e.g. metal refining.

Lead is an accumulative poison and exposure even to small amounts can raise the body's content to toxic levels.

Potential adverse effects on the offspring of pregnant workers have been cited in the literature.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Rinse mouth out with plenty of water.

Seek medical attention if irritation or discomfort persist.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians:

1.Gastric acids solubilize lead and its salts and lead absorption occurs in the small bowel.

2.Particles of less than 1um diameter are substantially absorbed by the alveoli following inhalation.

3.Lead is distributed to the red blood cells and has a half-life of 35 days.

It is subsequently redistributed to soft tissue & bone-stores or eliminated.The kidney accounts for 75% of daily lead loss; integumentary and alimentary losses account for the remainder.

4.Neurasthenic symptoms are the most common symptoms of intoxication.

Lead toxicity produces a classic motor neuropathy.

Acute encephalopathy appears infrequently in adults.

Diazepam is the best drug for seizures.

5.Whole-blood lead is the best measure of recent exposure; free erythrocyte protoporphyrin (FEP) provides the best screening for chronic exposure. Obvious clinical symptoms occur in adults when whole-blood lead exceeds 80 ug/dL.

6.British Anti-Lewisite is an effective antidote and enhances fecal and urinary excretion of lead. The onset of action of BAL is about 30 minutes and most of the chelated metal complex is excreted in 4-6 hours, primarily in the bile.

Adverse reaction appears in up to 50% of patients given BAL in doses exceeding 5 mg/kg. CaNa2EDTA has also been used alone or in concert with BAL as an antidote.

D-penacillamine is the usual oral agent for mobilization of bone lead; its use in the treatment of lead poisoning remains investigational.

2-3-dimercapto-1-propanesulfonic acid (DMPS) and dimercaptosuccinic acid (DMSA) are water soluble analogues of BAL and their effectiveness is undergoing review.

As a rule, stop BAL if lead decreases below 50 ug/dL; stop CaNa2EDTA if blood lead decreases below 40 ug/dL or urinary lead drops below 2 mg/24 hrs.

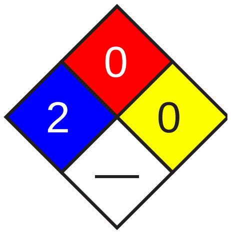
BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker who has been exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Lead in blood	50 ug/100 mL	Not Critical	B
Lead in urine	150 ug/gm creatinine	Not critical	B
Zinc Protoporphyrin in blood	250 ug/100 mL erythrocytes OR 100 ug/100 mL blood	After 1 month exposure	B

B: Background levels occur in specimens collected from subjects NOT exposed.

Section 5 - Fire-Fighting Measures



Fire Diamond

Flash Point: Not available; probably noncombustible
Autoignition Temperature: Not applicable
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: There is no restriction on the type of extinguisher which may be used.
General Fire Hazards/Hazardous Combustion Products: Noncombustible.
Not considered to be a significant fire risk; however, containers may burn.
Moderate fire hazard, in the form of dust, when exposed to heat or flames.
Decomposition products may include toxic lead dust and lead oxide fumes.
Fire Incompatibility: Incompatible with strong acids, oxidants, ammonium nitrate, chlorine trifluoride and sodium azide.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Use fire fighting procedures suitable for surrounding area.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.
If safe to do so, remove containers from path of fire.
Cool fire-exposed containers with water spray from a protected location.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.
Wear protective clothing, gloves, safety glasses and dust respirator.
Use dry clean-up procedures and avoid generating dust.
Vacuum up.
Place spilled material in clean, dry, sealable, labeled container.
Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
Control personal contact by using protective equipment and dust respirator.
Prevent spillage from entering drains, sewers or waterways.
Recover product wherever possible. Avoid generating dust. Sweep / shovel up.
If required, wet with water to prevent dusting.
Put residues in labeled plastic bags or other containers for disposal.
Wash area down with large quantity of water and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Limit all unnecessary personal contact.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling.
Work clothes should be laundered separately.

Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Recommended Storage Methods: Check that containers are clearly labeled.
Packaging as recommended by manufacturer.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions.
If risk of overexposure exists, wear NIOSH-approved dust respirator.
Correct fit is essential to obtain adequate protection.

Personal Protective Clothing/Equipment

Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Impervious gloves; rubber gloves.
Rubber boots.
Protective footwear.

Respiratory Protection:
Exposure Range >0.05 to 0.5 mg/m^3: Air Purifying, Negative Pressure, Half Mask
Exposure Range >0.5 to 2.5 mg/m^3: Air Purifying, Negative Pressure, Full Face
Exposure Range >2.5 to 50 mg/m^3: Powered Air Purifying Respirator, Half or Full Facepiece or Hood
Exposure Range >50 to 100 mg/m^3: Supplied Air Respirator with Full Facepiece, Hood, Helmet, or Suit, operated in a Positive Pressure Mode
Exposure Range >100 to unlimited mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: magenta (P100)
Note: (29CFR 1910.1025) for general industry

Other: Overalls. Eyewash unit. Skin cleansing cream.
Provide adequate ventilation in warehouse or closed storage areas.
General and local exhaust ventilation usually required to maintain airborne dust levels to safety levels.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Bluish-white, silvery-gray metal. Malleable, lustrous when freshly cut and tarnishes when exposed to air. Reacts with strong acids like nitric acid, sulphuric or hydrochloric acid. Attacked by water in presence of oxygen. Poor electrical conductor. Lead fumes are formed at temperatures above 500-700 °C.

Physical State: Divided solid
Vapor Pressure (kPa): 0.24 at 1000 °C
Vapor Density (Air=1): Not applicable
Formula Weight: 207.19
Specific Gravity (H_2O=1, at 4 °C): 11.34
Water Solubility: Insoluble in water
Evaporation Rate: Not applicable
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 1740 °C (3164 °F)
Freezing/Melting Point Range: 327.4 °C (621.32 °F)
Volatile Component (% Vol): Not applicable

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur. Stable under normal storage conditions.

Storage Incompatibilities: Avoid storage with strong acids, oxidants, ammonium nitrate, chlorine trifluoride and sodium azide.

Section 11 - Toxicological Information

TOXICITY	IRRITATION
Oral (woman) TD_{Lo}: 450 mg/kg/6 years	Nil Reported
Inhalation (human) TC_{Lo}: 0.01 mg/m^3	

WARNING: Lead is a cumulative poison and has the potential to cause abortion and intellectual impairment to unborn children of pregnant workers.

See NIOSH, *RTECS* OF 7525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released or deposited on soil, it will be retained in the upper 2-5 cm of soil, especially soils with at least 5% organic matter or a pH 5 or above. Leaching is not important under normal conditions although there is some evidence to suggest that it is taken up by some plants. Generally, the uptake from soil into plants is not significant. It is expected to slowly undergo speciation to the more insoluble sulfate, sulfide, oxide, and phosphate salts. It enters water from atmospheric fallout, runoff or wastewater; little is transferred from natural ores. It is a stable metal and adherent films of protective insoluble salts form that protect the metal from further corrosion. That which dissolves tends to form ligands. It is effectively removed from the water column to the sediment by adsorption to organic matter and clay minerals, precipitation as insoluble salt (the carbonate or sulfate, sulfide), and reaction with hydrous iron and manganese oxide. Under most circumstances, adsorption predominates. It does not appear to bioconcentrate significantly in fish but does in some shellfish such as mussels. When released to the atmosphere, it will generally be in dust or adsorbed to particulate matter and subject to gravitational settling and be transformed to the oxide and carbonate.

Ecotoxicity: LC_{50} Japanese quail (Coturnix japonica), males or females, 14 days old, oral (5-day ad libitum in diet) >5,000 ppm; at 1000, 2236 & 5000 onset of toxic signs began at 7, 7 & 7 days and remissed at 11, 11 & 12 days, respectively, no mortality was observed; control references were dieldrin & dicrotophos; corn oil diluent was added to diet at ratio of 2:98 by wt; (extreme concentrations: 1,000-5,000 ppm)

BCF: freshwater fish 1.38 to 1.65

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options. Follow applicable federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: NONE
Hazard Class: None
ID No.: None
Packing Group: None
Label: No class label assigned

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed
CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 10 lb (4.535 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Issue Date: 2002-02

n-Hexane
HEX6400

Section 1 - Chemical Product and Company Identification 54

Material Name: n-Hexane **CAS Number:** 110-54-3

Chemical Formula: C_6H_{14}

Structural Chemical Formula: $H_3C(CH_2)_4CH_3$

Synonyms: DIPROPYL; ESANI; GETTYSOLVE-B; HEKSAN; HEXANE; N-HEXANE; N-HEXANE; HEXANEN; HEXYL HYDRIDE; NORMAL HEXANE; NORMAL-HEXANE; SKELLYSOLVE-B; SKELLYSOLVE B

General Use: An incidental component of many aliphatic solvent mixes used as lacquer, paint and enamel thinners, also in ink reducers and cleaning solvents.
Also used for solvent extraction of oil seeds and in pesticide residue analysis and gas chromatography.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
n-hexane	110-54-3	> 95

OSHA PEL
TWA: 500 ppm; 1800 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 50 ppm; 180 mg/m^3.

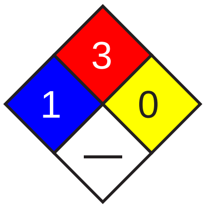
ACGIH TLV
TWA: 50 ppm, 176 mg/m^3; skin.

NIOSH REL
TWA: 50 ppm, 180 mg/m^3.

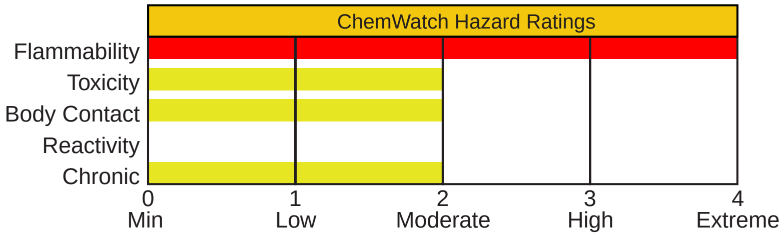
IDLH Level
1100 ppm; 10% LEL.

DFG (Germany) MAK
TWA: 50 ppm, 180 mg/m^3; PEAK: 400 ppm, 1440 mg/m^3; skin, ceiling, substances with systemic effects, onset of effect within 2 hours.

Section 3 - Hazards Identification



Fire Diamond



HMIS	
2	Health
3	Flammability
0	Reactivity

ANSI Signal Word
Danger!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, volatile liquid; sweet/gasoline odor. Irritating to eyes/skin/respiratory tract. Also causes: dizziness, fatigue, muscle weakness, hallucinations. Chronic: peripheral neuropathy (muscle weakness, motor loss, sensory disturbances). Flammable.

Potential Health Effects

Target Organs: eyes, skin, respiratory system, central nervous system (CNS), peripheral nervous system

Primary Entry Routes: inhalation, skin contact/absorption, eyes, ingestion

Acute Effects

Inhalation: The vapor is discomforting and harmful to the upper respiratory tract.
Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.
If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.
The vapor is irritating to the eyes and may cause smarting, painand redness.

The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is discomforting to the skin and is capable of causing skin reactions which may lead to dermatitis.

Toxic effects may result from skin absorption.

Ingestion: The liquid is highly discomforting and harmful if swallowed.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic inhalation or skin exposure to n-hexane may cause peripheral neuropathy, which is damage to nerve ends in extremities, e.g. fingers, with loss of sensation and characteristic thickening. Nerve damage has been documented with chronic exposures of greater than 500 ppm.

Improvement in condition does not immediately follow removal from exposure and symptoms may progress for two or three months. Recovery may take a year or more depending on severity of exposure, and may not always be complete.

Exposure to n-hexane with methyl ethyl ketone (MEK) will accelerate the appearance of damage, but MEK alone will not cause the nerve damage.

Other isomers of hexane do not cause nerve damage.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Following acute or short-term repeated exposures to n-hexane:

1.Large quantities of n-hexane are expired by the lungs after vapor exposure (50-60%). Humans exposed to 100 ppm demonstrate an n-hexane biological half life of 2 hours.

2. Initial attention should be directed towards evaluation and support of respiration. Cardiac dysrhythmias are a potential complication.

INGESTION:

1.Ipecac syrup should be considered for ingestion of pure hexane exceeding 2-3 mL/kg. Extreme caution must be taken to avoid aspiration since small amounts of n-hexane intratracheally, produce a severe chemical pneumonitis

BIOLOGICAL EXPOSURE INDEX - BEI

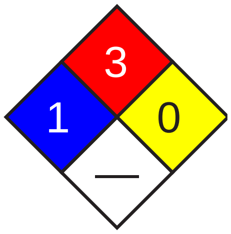
BEIs represent the levels of determinants which are most likely to be observed in specimens collected in a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
2,5-hexanedione in urine	5 mg/gm creatinine	End of shift	NS
n-Hexane in end-exhaled air			SQ

NS: Non-specific determinant; Metabolite observed following exposure to other materials.

SQ: Semi-quantitative determinant; Interpretation may be ambiguous - should be used as a screening test or confirmatory test.

Section 5 - Fire-Fighting Measures



Fire Diamond

Flash Point: -22 °C
Autoignition Temperature: 225 °C
LEL: 1.1% v/v
UEL: 7.5% v/v
Extinguishing Media: Dry chemical powder. Foam.
Carbon dioxide.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO). May emit clouds of acrid smoke.
Fire Incompatibility: Avoid reaction with oxidizing agents.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protective location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: Pollutant - clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so.
Water spray or fog may be used to disperse/absorb vapor.
Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable products into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.

Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Avoid concurrent exposure to materials containing Methyl Ethyl Ketone MEK

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in specific circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment

Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Polyethylene gloves. Wear chemical protective gloves, eg. PVC.
Wear safety footwear.
Do NOT use this product to clean the skin.

Respiratory Protection:
Exposure Range >500 to <1100 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range 1100 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Note: poor warning properties

Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

Glove Selection Index:

PE/EVAL/PE	Best selection
PVA	Best selection
SARANEX-23 2-PLY	Best selection
VITON	Best selection
VITON/CHLOROBUTYL	Best selection
TEFLON	Satisfactory; may degrade after 4 hours continuous immersion
NITRILE	Satisfactory; may degrade after 4 hours continuous immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion
NEOPRENE/NATURAL	Poor to dangerous choice for other than short-term immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion
BUTYL	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid with typical paraffinic odor; floats on water. Mixes with most other organic solvents, chloroform, ether, alcohol. A very volatile liquid, it readily forms explosive vapor /air mixes.

Physical State: Liquid
Vapor Pressure (kPa): 13.33
Vapor Density (Air=1): 2.97
Formula Weight: 86.17
Specific Gravity (H_2O=1, at 4 °C): 0.6603 at 20 °C
Water Solubility: 0.002% by weight
pH: Not applicable

pH (1% Solution): Not applicable
Boiling Point Range: 68.89 °C (156 °F)
Freezing/Melting Point Range: -100 °C (-148 °F) to -95 °C (-139 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Presence of heat source and ignition source. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

TOXICITY
Oral (rat) LD_{50}: 28710 mg/kg
Inhalation (human) TC_{Lo}: 190 ppm/8W
Inhalation (rat) LD_{50}: 48000 ppm/4h

IRRITATION
Eye (rabbit): 10 mg - mild

See NIOSH, *RTECS* MN9275000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Photolysis, hydrolysis or bioconcentration are not expected to be an important environmental fate processes. Biodegradation may occur in soil and water; however, volatilization and adsorption are expected to be far more important fate processes. A K_{oc} range of 1250 to 4100 indicates a low to slight mobility class in soil. In aquatic systems it may partition from the water column to organic matter contained in sediments and suspended materials. A Henry's Law constant of 1.81 atm-cu m/mole at 25 °C suggests rapid volatilization from environmental waters. The volatilization half-lives from a model river and a model pond, the latter considers the effect of adsorption, have been estimated to be 2.7 hr and 6.8 days, respectively. It is expected to exist entirely in the vapor-phase in ambient air. Reactions with photochemically produced hydroxyl radicals in the atmosphere have been shown to be important (average estimated half-life of 2.9 days). Data also suggests that nighttime reactions with nitrate radicals may contribute to atmospheric transformation, especially in urban environments.
Ecotoxicity: No data found.
Henry's Law Constant: calculated at 1.81
BCF: estimated at 2.24 to 2.89
Biochemical Oxygen Demand (BOD): theoretical 0%, 7 days
Octanol/Water Partition Coefficient: log $K_{ow} = 4.11$
Soil Sorption Partition Coefficient: K_{oc} = estimated at 1250 to 4100

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: HEXANES
Hazard Class: 3.1
ID No.: 1208
Packing Group: II
Label: Flammable Liquid[3]

Additional Shipping Information: METHYLPENTANES

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001 5000 lb (2268 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Issue Date: 2002-02

Nitric Acid
NIT1080

Section 1 - Chemical Product and Company Identification

Material Name: Nitric Acid **CAS Number:** 7697-37-2
Chemical Formula: HNO_3
Structural Chemical Formula: HNO_3
Synonyms: ACIDE NITRIQUE; ACIDO NITRICO; AQUA FORTIS; AZOTIC ACID; AZOTOWY KWAS; ENGRAVER'S ACID; ENGRAVERS ACID; HYDROGEN NITRATE; KYSELINA DUSICNE; NITAL; NITRIC ACID; NITRIC ACID OTHER THAN RED FUMING WITH >70% NITRIC ACID; NITRIC ACID OTHER THAN RED FUMING WITH NOT >70% NITRICACID; NITROUS FUMES; NITRYL HYDROXIDE; RED FUMING NITRIC ACID (RFNA); SALPETERSAURE; SALPETERZUUROPLOSSINGEN; WHITE FUMING NITRIC ACID (WFNA)
General Use: Manufacture of organic and inorganic nitrates and nitro compounds for fertilizers, dye intermediates and many organic chemicals.
Used for etching and cleaning metals.
Operators should be trained in procedures for safe use of this material.

Section 2 - Composition / Information on Ingredients

Name	**CAS**	**%**
nitric acid	7697-37-2	>95

OSHA PEL
TWA: 2 ppm; 5 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 2 ppm; 5 mg/m^3; STEL: 4 ppm; 10 mg/m^3.

ACGIH TLV
TWA: 2 ppm, 5.2 mg/m^3; STEL: 4 ppm, 10 mg/m^3.

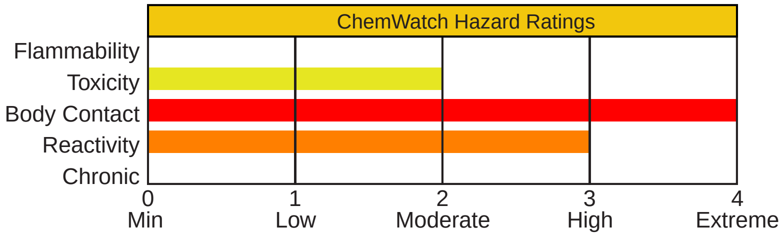
NIOSH REL
TWA: 2 ppm, 5 mg/m^3; STEL: 4 ppm, 10 mg/m^3.

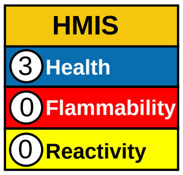
IDLH Level
25 ppm.

DFG (Germany) MAK
TWA: 2 ppm, 5.2 mg/m^3; PEAK: 2 ppm, 5.2 mg/m^3; local irritant effects determine peak value.

Section 3 - Hazards Identification

Fire Diamond





ANSI Signal Word

Danger!

Corrosive

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear to yellow fuming liquid; acrid, suffocating odor. Corrosive, causes severe burns to eyes/skin/respiratory tract. Also causes: heavy exposures: lung damage. Chronic: tooth erosion, bronchitis. Strong oxidizer capable of igniting combustibles.

Potential Health Effects

Target Organs: eyes, skin, respiratory system, teeth
Primary Entry Routes: inhalation, ingestion, skin contact, eye contact
Acute Effects
Inhalation: The vapor is extremely discomforting and corrosive to the upper respiratory tract and lungs and the material presents a hazard from a single acute exposure or from repeated exposures over long periods. Inhalation hazard is increased at higher temperatures.

Reactions may occur following a single acute exposure or may only appear after repeated exposures.

Reactions may not occur on exposure but response may be delayed with symptoms only appearing many hours later.

The material may produce respiratory tract irritation which produces an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system. Unlike most organs the lung can respond to a chemical insult or agent by first trying to remove or neutralize the irritant and then repairing the damage. The repair process, which initially developed to protect mammalian lungs from foreign matter and antigens, may however, cause further damage the lungs when activated by hazardous chemicals. The result is often the impairment of gas exchange, the primary function of the lungs.

Inhalation of nitric acid mist or fumes at 2 to 25 ppm over an 8 hour period may cause pulmonary irritation and symptoms of lung damage.

Only several minutes of exposure to concentrated atmosphere i.e. 200 ppm may cause severe pulmonary damage and even fatality. Death may be delayed for several days.

Exposure to nitric acid fumes (with concurrent inhalation of nitrogen dioxide and nitric oxide) may elicit prompt irritation of the upper respiratory tract leading to coughing, gagging, chest pain, dyspnea, cyanosis if concentrations are sufficiently high and duration of exposure sufficiently long, pulmonary edema.

Eye: The liquid is extremely corrosive to the eyes and contact may cause rapid tissue destruction and is capable of causing severe damage with loss of sight.

The vapor is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis.

Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.

The material may produce moderate eye irritation leading to inflammation.

Repeated or prolonged exposure to irritants may produce conjunctivitis.

Eye contact with concentrated acid may give no pain, whilst diluted solution causes intense pain and both can cause permanent eye damage or blindness. Burns may result in shrinkage of the eyeball, symblepharon (adhesions between tarsal and bulbar conjunctivae), permanent corneal opacification, and visual impairment leading to blindness.

Skin: The liquid is extremely corrosive to the skin and contact may cause tissue destruction with severe burns.

Bare unprotected skin should not be exposed to this material.

The vapor is highly discomforting to the skin.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Skin contact causes yellow discoloration of the skin, blisters and scars that may not heal. The skin may be stained bright-yellow or yellowish brown due to the formation of xanthoproteic acid. Dilute solutions may harden the epithelium without producing overt corrosion.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The material is extremely corrosive if swallowed and is capable of causing burns to mouth, throat, esophagus, with extreme discomfort, pain and may be fatal.

Even a small amount causes severe corrosion of the stomach, burning pain, vomiting and shock, possibly causing non-healing scarring of the gastrointestinal tract and stomach. Death may be delayed 12 hours to 14 days or to several months. Such late fatalities are attributed to a chemical lobular pneumonitis secondary to aspiration. Survivors show stricture of the gastric mucosa and subsequent pernicious anemia.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Prolonged or repeated overexposure to low concentrations of vapor may cause chronic bronchitis, corrosion of teeth, even chemical pneumonitis.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Immediately transport to hospital or doctor. DO NOT delay.

Skin Contact: Immediately flush body and clothes with large amounts of water, using safety shower if available.

Quickly remove all contaminated clothing, including footwear.

Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor. DO NOT delay.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

Immediately transport to hospital or doctor. DO NOT delay.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to strong acids:

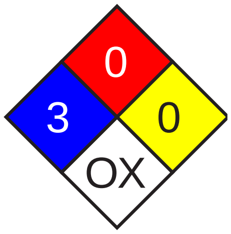
1.Airway problems may arise from laryngeal edema and inhalation exposure.
Treat with 100% oxygen initially.
2.Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.
3. Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
4.Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.

INGESTION:
1.Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.
2.Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
3.Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
4.Charcoal has no place in acid management.
5.Some authors suggest the use of lavage within 1 hour of ingestion.

SKIN:
1.Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
2.Deep second-degree burns may benefit from topical silver sulfadiazine.

EYE:
1.Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.
2.Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.
3.Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

Section 5 - Fire-Fighting Measures



Fire Diamond

Flash Point: Nonflammable
Autoignition Temperature: Not applicable
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).
Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Will not burn but increases intensity of fire.
Heating may cause expansion or decomposition leading to violent rupture of containers. Heat affected containers remain hazardous.
Contact with combustibles such as wood, paper, oil or finely divided metal may cause ignition, combustion or violent decomposition.
May emit irritating, poisonous or corrosive fumes.
Decomposes on heating and produces toxic fumes of nitrogen oxides (NO_x) and nitric acid.

Fire Incompatibility: Oxidizing agents as a class are not necessarily combustible themselves, but can increase the risk and intensity of fire in many other substances.
Reacts vigorously with water and alkali.
Avoid reaction with organic materials/compounds, powdered metals, reducing agents and hydrogen sulfide (H_2S) as ignition may result.
Reacts with metals producing flammable/explosive hydrogen gas.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
Extinguishers should be used only by trained personnel.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
If fire gets out of control withdraw personnel and warn against entry.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Dangerous levels of nitrogen oxides may form during spills of nitric acid.
Wear fully protective PVC clothing and breathing apparatus.
Clean up all spills immediately. No smoking, bare lights, ignition sources.
Avoid all contact with any organic matter including fuel, solvents, sawdust, paper or cloth and other incompatible materials, as ignition may result.
Avoid breathing dust or vapors and all contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb spill with dry sand, earth, inert material or vermiculite. DO NOT use sawdust as fire may result.
Scoop up solid residues and seal in labeled drums for disposal.
Neutralize/decontaminate area.
Use soda ash or slaked lime to neutralize.
Large Spills: DO NOT touch the spill material. Restrict access to area.
Clear area of personnel and move upwind. Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, flames or ignition sources. Increase ventilation.
Contain spill with sand, earth or other clean, inert materials.
NEVER use organic absorbents such as sawdust, paper, cloth; as fire may result. Avoid any contamination by organic matter.
Use spark-free and explosion-proof equipment.
Collect any recoverable product into labeled containers for possible recycling. DO NOT mix fresh with recovered material.
Collect residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains. Decontaminate equipment and launder all protective clothing before storage and reuse.
If contamination of drains or waterways occurs advise emergency services.
DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Do not allow clothing wet with material to stay in contact with skin.
Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.
Avoid smoking, bare lights or ignition sources.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately.
Launder contaminated clothing before reuse.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Recommended Storage Methods: Stainless steel drum. Check that containers are clearly labeled.
Packaging as recommended by manufacturer.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area.
Local exhaust ventilation may be required for safe working, i.e., to keep exposures below required standards; otherwise, PPE is required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.
Personal Protective Clothing/Equipment
Eyes: Chemical goggles. Full face shield.
DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Bare unprotected skin should not be exposed to this material. Impervious, gauntlet length gloves i.e., butyl rubber gloves or Neoprene rubber gloves or wear chemical protective gloves, e.g. PVC.

Wear safety footwear or safety gumboots, e.g. Rubber.

Respiratory Protection:

Exposure Range >2 to <25 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask

Exposure Range 25 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Other: Operators should be trained in procedures for safe use of this material.

Acid-resistant overalls or Rubber apron or PVC apron.

Ensure there is ready access to an emergency shower.

Ensure that there is ready access to eye wash unit.

Ensure that there is ready access to breathing apparatus.

Glove Selection Index:

BUTYL	Best selection
HYPALON	Best selection
NEOPRENE	Best selection
NEOPRENE/NATURAL	Best selection
PE/EVAL/PE	Best selection
SARANEX-23	Best selection
NATURAL RUBBER	Satisfactory; may degrade after 4 hours continuous immersion
NATURAL+NEOPRENE	Satisfactory; may degrade after 4 hours continuous immersion
PVC	Poor to dangerous choice for other than short-term immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless to slightly yellow liquid. Sharp strong odor.
CAUTION: exothermic dilution hazard.
HIGHLY CORROSIVE. Corrosive to most metals. Powerful oxidizing agent.
Darkens to brownish color on aging and exposure to light.

Physical State: Liquid
Vapor Pressure (kPa): 8.26
Vapor Density (Air=1): 1.5
Formula Weight: 63.02
Specific Gravity (H_2O=1, at 4 °C): 1.3-1.42
Water Solubility: Soluble in all proportions

pH: < 1
pH (1% Solution): 1
Boiling Point Range: 83 °C (181 °F) at 760 mm Hg
Freezing/Melting Point Range: -42 °C (-43.6 °F)
Volatile Component (% Vol): 100 (nominal)
Decomposition Temperature (°C): Not applicable

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Presence of heat source and direct sunlight. Storage in unsealed containers. Hazardous polymerization will not occur.

Storage Incompatibilities: Segregate from reducing agents, finely divided combustible materials, combustible materials, sawdust, metals and powdered metals.
Avoid contamination of water, foodstuffs, feed or seed.
Segregate from alkalies, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.

Section 11 - Toxicological Information

TOXICITY
Oral (human) LD_{Lo}: 430 mg/kg
Inhalation (rat) LC_{50}: 2500 ppm/1 hr
Unreported (man) LD_{Lo}: 110 mg/kg

IRRITATION
Nil reported

See NIOSH, *RTECS* QU 5775000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: LC_{50} Starfish 100-300 mg/l/48 hr /Aerated water conditions; LC_{50} Shore crab 180 mg/l/48 hr /Static, aerated water conditions; LC_{50} Cockle 330-1000 mg/l/48 hr /Aerated water conditions

BCF: no food chain concentration potential

Biochemical Oxygen Demand (BOD): none

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Special hazards may exist - specialist advice may be required.
Consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Treat and neutralize at an approved treatment plant.

Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed. Puncture containers to prevent reuse and bury at an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: NITRIC ACID
Hazard Class: 8
ID No.: 2031
Packing Group: I
Label: Corrosive[8],Oxid.Agent

Section 15 - Regulatory Information

EPA Regulations:

- **RCRA 40 CFR:** Not listed
- **CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4) 1000 lb (453.5 kg)
- **SARA 40 CFR 372.65:** Listed
- **SARA EHS 40 CFR 355:** Listed
  - **RQ:** 1000 lb
  - **TPQ:** 1000 lb
- **TSCA:** Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser’s purposes are necessarily the purchaser’s responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser’s intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
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Issue Date: 2006-06

Unleaded Petrol
AUT5000

Section 1 - Chemical Product and Company Identification 61

Material Name: Unleaded Petrol **CAS Number:** 8006-61-9
Chemical Formula: Mixture of hydrocarbons
EINECS Number: 232-349-1
ACX Number: X1003056-5
Synonyms: AUTOMOTIVE GASOLINE, LEAD-FREE; GASOLINE; MOTOR FUEL; MOTOR SPIRITS; NATURAL GASOLINE; PETROL; UNLEADED PETROL
General Use: Lead free motor fuel for internal combustion engines, 2-stroke and 4-stroke.

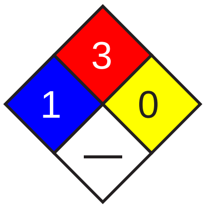
Section 2 - Composition / Information on Ingredients

Name	CAS	%
gasoline	8006-61-9	>90
benzene	71-43-2	5 max.

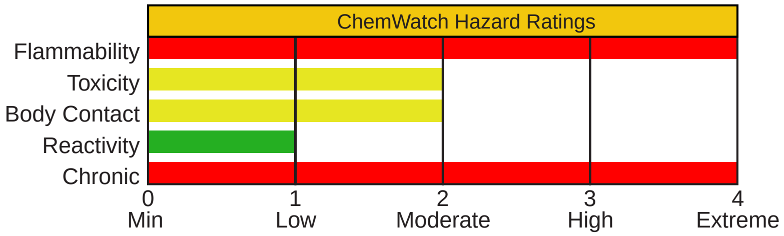
OSHA PEL **NIOSH REL**

ACGIH TLV
TWA: 300 ppm, 890 mg/m^3;
STEL: 500 ppm, 1480 mg/m^3.

Section 3 - Hazards Identification



Fire Diamond



HMIS
② Health
③ Flammability
① Reactivity

ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear liquid; distinctive odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, drunkenness, unconsciousness. Chronic Effects: dermatitis. Possible cancer hazard. Flammable.

Potential Health Effects

Target Organs: skin, eye, respiratory system, central nervous system (CNS)
Primary Entry Routes: inhalation, ingestion, skin contact

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract and may be harmful if exposure is prolonged. Inhalation hazard is increased at higher temperatures. Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death. WARNING: Intentional misuse by concentrating/inhaling contents may be lethal. High inhaled concentrations of mixed hydrocarbons may produce narcosis characterized by nausea, vomiting and lightheadedness. Inhalation of aerosols may produce severe pulmonary edema, pneumonitis and pulmonary hemorrhage. Inhalation of petroleum hydrocarbons consisting substantially of low molecular weight species may produce irritation of mucous membranes, incoordination, giddiness, nausea, vertigo, confusion, headache, appetite loss, drowziness, tremors and anesthetic stupor. Massive exposures may produce central nervous system depression with sudden collapse and deep coma; fatalities have been recorded. Irritation of the brain and/or apneic anoxia may produce convulsions. Although recovery following overexposure is generally complete, cerebral micro- hemorrhage of focal post-inflammatory scarring may produce eleptiform seizures some months after the exposure. Pulmonary episodes may include chemical pneumonitis with edema and hemorrhage. The lighter hydrocarbons may produce kidney and neurotoxic effects. Liquid paraffins may produce anesthesia and depressant actions leading to weakness, dizziness, slow and shallow respiration, unconsciousness, convulsions and death. C_{5-7} paraffins may also produce polyneuropathy. Aromatic hydrocarbons accumulate in lipid-rich tissues (typically the brain, spinal cord and peripheral nerves) and may produce functional impairment manifested by nonspecific symptoms such as nausea, weakness, fatigue, vertigo; severe exposures may produce inebriation or unconsciousness. Many of the petroleum hydrocarbons are cardiac sensitizers and may cause ventricular fibrillations.

Eye: The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration. The vapor is discomforting to the eyes. Petroleum hydrocarbons may produce pain after direct contact with the eyes. Slight, but transient, disturbances of the corneal epithelium may also result. The aromatic fraction may produce irritation and lachrymation. The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The material is moderately discomforting to the skin if exposure is prolonged. The material contains a component that may be absorbed through the skin and may cause drying of the skin, which may lead to dermatitis from repeated exposures over long periods. Toxic effects may result from skin absorption. Open cuts, abraded or irritated skin should not be exposed to this material. The material may accentuate any pre-existing dermatitis condition.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments. The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis. Ingestion of petroleum hydrocarbons may produce irritation of the pharynx, esophagus, stomach and small intestine with edema and mucosal ulceration. Resulting symptoms include a burning sensation in the mouth and throat. Large amounts may produce narcosis with nausea and vomiting, weakness or dizziness, slow and shallow respiration, swelling of the abdomen, unconsciousness and convulsions. Myocardial injury may produce arrhythmias, ventricular fibrillation and electrocardiographic changes. Central nervous system depression may also occur. Light aromatic hydrocarbons produce a warm, sharp, tingling sensation on contact with taste buds and may anesthetize the tongue. Aspiration into the lungs may produce coughing, gagging, and a chemical pneumonitis with pulmonary edema and hemorrhage.

Carcinogenicity: NTP - Not listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes. Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following. Chronic poisoning may occur from vapor inhalation or skin absorption. The most significant toxic effect is insidious and irreversible injury to the blood-forming tissue by benzene. Leukemia may develop. Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes. Gasoline "sniffing" has caused severe nerve damage. Repeated or prolonged exposure to mixed hydrocarbons may produce narcosis with dizziness, weakness, irritability, concentration and/or memory loss, tremor in the fingers and tongue, vertigo, olfactory disorders, constriction of visual field, paresthesias of the extremities, weight loss and anemia and degenerative changes in the liver and kidney. Chronic exposure by petroleum workers to the lighter hydrocarbons has been associated with visual disturbances, damage to the central nervous system, peripheral neuropathies (including numbness and paresthesias), psychological and neurophysiological deficits, bone marrow toxicities (including hypoplasia, possibly due to benzene) and hepatic and renal involvement. Chronic dermal exposure to petroleum hydrocarbons may result in defatting which produces localized dermatoses. Surface cracking and erosion may also increase susceptibility to infection by microorganisms.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove to fresh air. Lay patient down. Keep warm and rested.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital, or doctor.

Eye Contact: Immediately hold the eyes open and wash continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water). Wash affected areas thoroughly with water (and soap if available). Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. If swallowed, do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short term repeated exposures to petroleum distillates or related hydrocarbons:

1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
3. Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
4. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5. Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6. Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

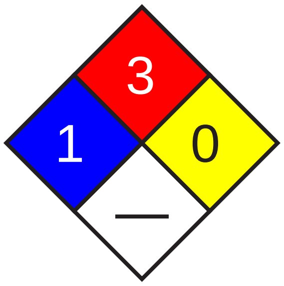
Section 5 - Fire-Fighting Measures

See DOT ERG

Flash Point: -43 °C
Autoignition Temperature: 280 °C
LEL: 1.4% v/v
UEL: 7.6% v/v

Extinguishing Media: Foam. Dry chemical powder.
Bromochlorodifluoromethane (BCF) (where regulations permit). Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable. Severe fire hazard when exposed to heat, flame and/or oxidizers. Vapor forms an explosive mixture with air. Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers. On combustion, may emit toxic fumes of carbon monoxide (CO).



Fire Diamond

Fire Incompatibility: Avoid contamination with oxidizing agents, i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc., as ignition may result.

Fire-Fighting Instructions: Alert fire department and tell them location and nature of hazard. May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or water ways. If safe, switch off electrical equipment until vapour fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area. Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot. Cool fire exposed containers with water spray from a protected location. If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

See DOT ERG

Small Spills: Remove all ignition sources. Clean up all spills immediately. Avoid breathing vapors and contact with skin and eyes. Control personal contact by using protective equipment. Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind. Alert fire department and tell them location and nature of hazard. May be violently or explosively reactive. Wear breathing apparatus plus protective gloves.
Prevent, by any means available, spillage from entering drains or water ways. No smoking, naked lights or ignition sources. Increase ventilation. Stop leak if safe to do so.
Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite. Use only

spark-free shovels and explosion proof equipment. Collect recoverable product into labeled containers for recycling. Absorb remaining product with sand, earth or vermiculite. Collect solid residues and seal in labelled drums for disposal. Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation. Wear protective clothing when risk of exposure occurs. Use in a well-ventilated area. Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked. Avoid smoking, bare lights, heat or ignition sources. When handling, DO NOT eat, drink or smoke. Vapor may ignite on pumping or pouring due to static electricity. DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling. Avoid contact with incompatible materials. Keep containers securely sealed. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately. Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can, metal drum. Packing as recommended by manufacturer. Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area. If inhalation risk of overexposure exists, wear a NIOSH approved organic-vapor respirator. Correct respirator fit is essential to obtain adequate protection. In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus. Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream with polyethylene gloves or PVC gloves. Safety footwear. Do NOT use this product to clean the skin.

Respiratory Protection:

Exposure Range >300 to 1000 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >1000 to 15,000 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range >15,000 to 300,000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range >300,000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black

Other: Overalls. Ensure that there is ready access to eye wash unit. Ensure there is ready access to an emergency shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Purple, highly flammable, volatile liquid with characteristic sharp odor. Floats on water. Consists of a complex mixture of hydrocarbons with small amounts of residual benzene from the refining operations.

Physical State: Liquid
Odor Threshold: 0.005 ppm
Vapor Pressure (kPa): 53.33 at 20 °C
Vapor Density (Air=1): > 2
Formula Weight: Not applicable.
Specific Gravity (H_2O=1, at 4 °C): 0.72-0.735 at 15 °C
Evaporation Rate: Fast

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 38.89 °C (102 °F)
Freezing/Melting Point: Not available
Volatile Component (% Vol): 100
Decomposition Temperature (°C): Not available.
Water Solubility: Insoluble

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Presence of incompatible materials. Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 18800 mg/kg

Irritation
Skin (rabbit): 500 mg/24h mild

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.
Biochemical Oxygen Demand (BOD): 8%, 5 days

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible. Follow all applicable federal, state, and local laws. Incinerate residue at an approved site. Recycle containers where possible, or dispose of in an authorized landfil.

BEWARE: Empty solvent, paint, lacquer and flammable liquid drums present a severe explosion hazard if cut by flame torch or welded. Even when thoroughly cleaned or reconditioned, the drum seams may retain sufficient solvent to generate an explosive atmosphere in the drum.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Gasoline
ID: UN1203
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: 139, B33, B101, T8
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** E **Other:**

Section 15 - Regulatory Information

EPA Regulations:
- **RCRA 40 CFR:** Not listed
- **CERCLA 40 CFR 302.4:** Not listed
- **SARA 40 CFR 372.65:** Not listed
- **SARA EHS 40 CFR 355:** Not listed
- **TSCA:** Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser’s purposes are necessarily the purchaser’s responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser’s intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
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Issue Date: 2006-06

Toluene
TOL2320

Section 1 - Chemical Product and Company Identification

Material Name: Toluene **CAS Number:** 108-88-3
Chemical Formula: C_7H_8
Structural Chemical Formula: $C_6H_5CH_3$
EINECS Number: 203-625-9
ACX Number: X1001512-0
Synonyms: ANTISAL 1A; BENZENE,METHYL-; CP 25; METHACIDE; METHANE,PHENYL-; METHYL BENZENE; METHYL BENZOL; METHYLBENZENE; METHYLBENZOL; PHENYL METHANE; PHENYLMETHANE; TOLUEEN; TOLUEN; TOLUENE; TOLUENO; TOLUOL; TOLUOLO; TOLU-SOL
General Use: Used as a solvent for paint, resins, lacquers inks & adhesives. Component of solvent blends and thinners; in gasoline and aviation fuel. Used in the manufacture of chemicals, dyes, explosives, benzoic acid.
Some grades of toluene may contain traces of xylene and benzene.
Odor threshold: 2 ppm approx. Odor is not a reliable warning property due to olfactory fatigue.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
toluene	108-88-3	> 99.5

OSHA PEL
TWA: 200 ppm; Ceiling: 300 ppm; 500 ppm, 10-minute maximum peak.

ACGIH TLV
TWA: 50 ppm; skin.

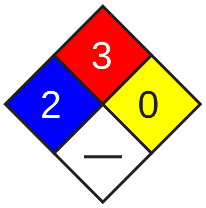
EU OEL
TWA: 192 mg/m^3 (50 ppm); STEL: 384 mg/m^3 (100 ppm).

NIOSH REL
TWA: 100 ppm (375 mg/m^3); STEL: 150 ppm (560 mg/m^3).

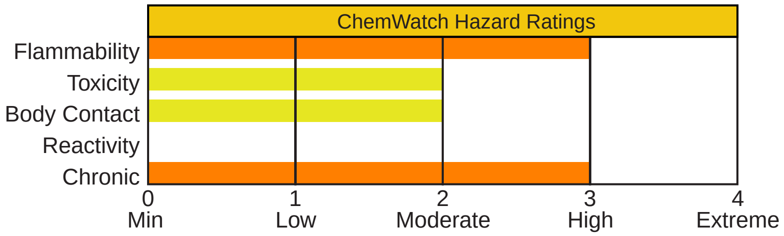
IDLH Level
500 ppm.

DFG (Germany) MAK
TWA: 50 ppm; PEAK: 200 ppm; skin.

Section 3 - Hazards Identification



Fire Diamond



HMIS
2 Health
3 Flammability
0 Reactivity

ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sickly, sweet odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: weakness, headache, dizziness, confusion, insomnia. Chronic Effects: liver/kidney damage, may cause birth defects. Flammable.

Potential Health Effects

Target Organs: Skin, liver, kidneys, central nervous system.
Primary Entry Routes: Inhalation, skin contact/absorbtion.
Acute Effects
Inhalation: The vapor is highly discomforting to the upper respiratory tract.
Inhalation hazard is increased at higher temperatures.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Central nervous system (CNS) depression may include nonspecific discomfort, symptoms of giddiness, headache, dizziness, nausea, anesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness. Serious poisonings may result in respiratory depression and may be fatal.

Eye: The liquid produces a high level of eye discomfort and is capable of causing pain and severe conjunctivitis.

Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.

The vapor is discomforting to the eyes if exposure is prolonged.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis and it is absorbed by skin.

Toxic effects may result from skin absorption.

Open cuts, abraded or irritated skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Chronic toluene habituation occurs following intentional abuse (glue-sniffing) or from occupational exposure. Ataxia, incoordination and tremors of the hands and feet (as a consequence of diffuse cerebral atrophy), headache, abnormal speech, transient memory loss, convulsions, coma, drowsiness, reduced color perception, frank blindness, nystagmus (rapid, involuntary eye-movements), decreased hearing leading to deafness and mild dementia have all been associated with chronic abuse.

Peripheral nerve damage, encephalopathy, giant axonopathy, electrolyte disturbances in the cerebrospinal fluid and abnormal computer tomographic (CT) scans are common amongst toluene addicts. Although toluene abuse has been linked with kidney disease, this does not commonly appear in cases of occupational toluene exposures. Cardiac and hematological toxicity are however associated with chronic toluene exposure. Cardiac arrhythmia, multifocal and premature ventricular contractions and supraventricular tachycardia are present in 20% of patients who abused toluene-containing paints.

Previous suggestions that chronic toluene inhalation produced human peripheral neuropathy have largely been discounted. However central nervous system (CNS) depression is well documented where blood toluene levels exceed 2.2 mg%. Toluene abusers can achieve transient circulating concentrations of 6.5 mg%. Amongst workers exposed for a median time of 29 years to toluene no subacute effects on neurasthenic complaints and pyschometric test results could be established.

The prenatal toxicity of very high toluene concentrations has been documented for several animal species and man. Malformations indicative of specific teratogenicity have not generally been found. The toxicity described in the literature takes the form of embryo death or delayed fetal growth and delayed skeletal system development. Permanent damage of children has been seen only when mothers had suffered from chronic intoxication as a result of "sniffing".

Section 4 - First Aid Measures

See
DOT
ERG

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Following acute or short-term repeated exposures to toluene:

1. Toluene is absorbed across to alveolar barrier, the blood/air mixture being 11.2/15.6 (at 37 °C) The order of toluene, in expired breath, is of the order of 18 ppm following sustained exposure to 100 ppm.
The tissue/blood proportion is 1/3 except in adipose where the proportion is 8/10.
2.Metabolism by microsomal mono-oxygenation, results in the production of hippuric acid. This may be detected in the urine in amounts between 0.5 and 2.5 g/24hr which represents, on average 0.8 gm/gm of creatinine.
The biological half life of hippuric acid is in the order of 1-2 hours.
3.Primary threat to life from ingestion and/or inhalation is respiratory failure.
4.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
5.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
6.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
7.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
8.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

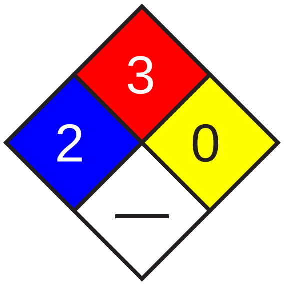
Determinant	Index	Sampling Time	Comments
Hippuric acid in urine	2.5 gm/gm creatinine	End of shift Last 4 hrs of shift	B,NS
Toluene in venous blood	1 mg/L	End of shift	SQ
Toluene in end-exhaled air		End of shift	SQ

NS: Non-specific determinant; also observed after exposure to other material
SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.
B: Background levels occur in specimens collected from subjects NOT exposed.

Section 5 - Fire-Fighting Measures

Flash Point: 4 °C Closed Cup
Autoignition Temperature: 480 °C
LEL: 1.2% v/v
UEL: 7.1% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO) and carbon dioxide (CO_2).

See DOT ERG



Fire Diamond

Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.

Nitric acid with toluene, produces nitrated compounds which are explosive.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Fight fire from a safe distance, with adequate cover.

If safe, switch off electrical equipment until vapor fire hazard removed.

Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protective location.

If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

See DOT ERG

Small Spills: Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.

Use only spark-free shovels and explosion proof equipment.

Collect recoverable product into labeled containers for recycling.

Absorb remaining product with sand, earth or vermiculite.

Collect solid residues and seal in labeled drums for disposal.

Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

Avoid smoking, bare lights, heat or ignition sources.

When handling, DO NOT eat, drink or smoke.

Vapor may ignite on pumping or pouring due to static electricity.

DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.

Avoid contact with incompatible materials.

Keep containers securely sealed. Avoid physical damage to containers.

Always wash hands with soap and water after handling.

Work clothes should be laundered separately.

Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; Metal drum; Metal safety cans. Packing as supplied by manufacturer.

Plastic containers may only be used if approved for flammable liquid.

Check that containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area; local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.

General exhaust is adequate under normal operating conditions.

Local exhaust ventilation may be required in special circumstances.

If risk of overexposure exists, wear NIOSH-approved respirator. Correct fit is essential to ensure adequate protection.

Provide adequate ventilation in warehouses and enclosed storage areas.

In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; chemical goggles. Full face shield.
DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Wear chemical protective gloves, eg. PVC. Wear safety footwear.

Respiratory Protection:
Exposure Range >200 to <500 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 500 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black

Other: Overalls. Barrier cream. Eyewash unit.

Glove Selection Index:

PE/EVAL/PE	Best selection
VITON/CHLOROBUTYL	Best selection
VITON	Best selection
PVA	Best selection
TEFLON	Satisfactory; may degrade after 4 hours continuous immersion
SARANEX-23 2-PLY	Poor to dangerous choice for other than short-term immersion
CPE	Poor to dangerous choice for other than short-term immersion
VITON/NEOPRENE	Poor to dangerous choice for other than short-term immersion
SARANEX-23	Poor to dangerous choice for other than short-term immersion
NEOPRENE/NATURAL	Poor to dangerous choice for other than short-term immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
NITRILE	Poor to dangerous choice for other than short-term immersion
BUTYL	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid
Odor Threshold: 2.14 ppm
Vapor Pressure (kPa): 2.93 at 20 °C
Vapor Density (Air=1): 3.2
Formula Weight: 92.14
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 20 °C
Evaporation Rate: 2.4 (BuAc=1)

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 111 °C (232 °F) at 760 mm Hg
Freezing/Melting Point: -95 °C (-139 °F)
Volatile Component (% Vol): 100
Water Solubility: < 1 mg/mL at 18 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Segregate from strong oxidizers.

Section 11 - Toxicological Information

Toxicity

Oral (human) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 636 mg/kg
Inhalation (human) TC_{Lo}: 100 ppm
Inhalation (man) TC_{Lo}: 200 ppm
Inhalation (rat) LC_{50}: > 26700 ppm/1h
Dermal (rabbit) LD_{50}: 12124 mg/kg
Reproductive effector in rats

Irritation

Skin (rabbit): 20 mg/24h-moderate
Skin (rabbit): 500 mg - moderate
Eye (rabbit): 0.87 mg - mild
Eye (rabbit): 2 mg/24h - SEVERE
Eye (rabbit): 100 mg/30sec - mild

See *RTECS* XS 5250000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be lost by evaporation from near-surface soil and by leaching to the groundwater. Biodegradation occurs both in soil and groundwater, but it is apt to be slow especially at high concentrations, which may be toxic to microorganisms. The presence of acclimated microbial populations may allow rapid biodegradation. It will not significantly hydrolyze in soil or water under normal environmental conditions. If released into water, its concentration will decrease due to evaporation and biodegradation. This removal can be rapid or take several weeks, depending on temperature, mixing conditions, and acclimation of microorganisms. It will not significantly adsorb to sediment or bioconcentrate in aquatic organisms. If released to the atmosphere, it will degrade by reaction with photochemically produced hydroxyl radicals (half-life 3 hr to slightly over 1 day) or be washed out in rain. It will not be subject to direct photolysis.

Ecotoxicity: LC$_{50}$ Aedes aegypti-4th instar (mosquito larvae) 22 mg/l /Conditions of bioassay not specified; LC$_{50}$ Cyprinodon variegatus (sheepshead minnow) 277-485 mg/l 96 hr /Conditions of bioassay not specified; LC$_{50}$ Calandra granaria (grain weevil) 210 mg/l /in air; LC$_{50}$ Cancer magister (crab larvae stage I) 28 ppm/96 hr /Conditions of bioassay not specified; LC$_{50}$ Crangon franciscorum (shrimp) 4.3 ppm 96 hr /Conditions of bioassay not specified; LC$_{50}$ Artemia salina (brine shrimp) 33 mg/l 24 hr /Conditions of bioassay not specified; LC$_{50}$ Morone saxatilis (striped bass) 7.3 mg/l 96 hr /Conditions of bioassay not specified; LC$_{50}$ Pimephales promelas (fathead minnows) 55-72 mg/l (embryos), 25-36 mg/l (1-day posthatch protolarvae), and 26-31 mg/l (30-day-old minnows)/ 96 hour /Conditions of bioassay not specified

Henry's Law Constant: 0.0067

BCF: eels 13.2

Biochemical Oxygen Demand (BOD): 0%, 5 days

Octanol/Water Partition Coefficient: log K$_{ow}$ = 2.69

Soil Sorption Partition Coefficient: K$_{oc}$ = silty loam 37

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Toluene
ID: UN1294
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: IB2, T4, TP1
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U220 Toxic Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
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Benzo(a)pyrene
BEN5560

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

Material Name: Benzo(a)pyrene **CAS Number:** 50-32-8
Chemical Formula: $C_{20}H_{12}$
EINECS Number: 200-028-5
ACX Number: X1002798-4
Synonyms: B(A)P; BAP; BENZO(D,E,F)CHRYSENE; 3,4-BENZOPIRENE; 1,2-BENZOPYRENE; 3,4-BENZOPYRENE; 6,7-BENZOPYRENE; BENZO(A)PYRENE; 3,4-BENZPYREN; 3,4-BENZ(A)PYRENE; 3,4-BENZPYRENE; BENZ(A)PYRENE; BENZ[A]PYRENE; 3,4-BENZYLPYRENE; 3,4-BENZYPYRENE; 3,4-BP; BP; COAL TAR PITCH VOLATILES: BENZO(A)PYRENE
Derivation: Synthesized from pyrene and succinic anhydride.
General Use: Benzo(a)pyrene is no longer used or produced commercially in the US. In its pure form, benzo(a)pyrene may be used as a research laboratory reagent. It also occurs in combustion products of coal, oil, petroleum, wood and other biological matter; in motor vehicle and other gasoline and diesel engine exhaust; in charcoal-broiled foods; in cigarette smoke and general soot and smoke of industrial, municipal, and domestic origin. It occurs naturally in crude oils, shale oils, coal tars, gases and fly ash from active volcanoes and forest fires.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Benzo(a)pyrene	50-32-8	ca 100% wt

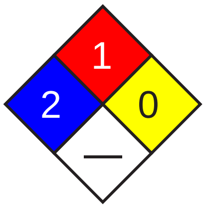
Except in laboratories, benzo(a)pyrene is usually mixed with other coal tar pitch chemicals. Consider exposure limits for coal tar pitch volatiles as a guideline. However, because benzo(a)pyrene is considered a probable carcinogen to humans, it is recommended that exposures to carcinogens be limited to the lowest feasible concentration.

OSHA PEL
TWA: 0.2 mg/m^3.

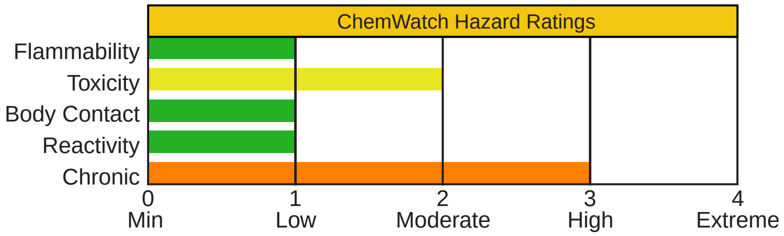
NIOSH REL

ACGIH TLV
Exposure by all routes should be carefully controlled to levels as low as possible.

Section 3 - Hazards Identification



Fire Diamond



HMIS	
2	Health
1	Flammability
0	Reactivity

ANSI Signal Word
Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Pale yellow, crystalline solid or powder. Irritating to skin, eyes, respiratory tract. Chronic Effects: carcinogen, mutagen. Handle with extreme caution!

Potential Health Effects

Target Organs: Respiratory system, bladder, kidneys, skin.
Primary Entry Routes: Inhalation, ingestion.

Acute Effects

Inhalation: Respiratory tract irritation. Pregnant women may be especially susceptible to exposure effects of benzo(a)pyrene; exposure may damage the fetus. In general, polyaromatic hydrocarbons such as benzo(a)pyrene tend to localize primarily in body fat and fatty tissues (for ex. breasts) and are excreted in breast milk. Benzo(a)pyrene may also affect the male reproductive system (testes and sperm).

Eye: Irritation and/or burns on contact.

Skin: Irritation with burning sensation, rash, and redness; dermatitis on prolonged exposure. Sunlight enhances effects (photosensitization).

Ingestion: None reported.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2A, Probably carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Medical Conditions Aggravated by Long-Term Exposure: Respiratory system, bladder, kidney, and skin disorders.

Chronic Effects: Inhalation: Cough and bronchitis. Eye: Photosensitivity and irritation. Skin: Skin changes such as thickening, darkening, pimples, loss of color, reddish areas, thinning of the skin, and warts. Sunlight enhances effects (photosensitization). Other: Gastrointestinal (GI) effects include leukoplakia (a pre-cancerous condition characterized by thickened white patches of epithelium on mucous membranes, especially of the mouth). Cancer of the lung, skin, kidneys, bladder, or GI tract is also possible. Smoking in combination with exposure to benzo(a)pyrene increases the chances of developing lung cancer. Persons with a high degree of inducibility of the enzyme aryl hydrocarbon hydroxylase may be a high risk population.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of tepid water for at least 15 min. Consult an ophthalmologist if irritation or pain persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water (less than 15 min). Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute. Inducing vomiting is not necessary since benzo(a)pyrene has a low acute toxicity and therefore, is generally an unnecessary procedure. Consider activated charcoal/cathartic.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Monitor CBC and arterial blood gases, conduct liver, renal, and pulmonary function tests (if respiratory tract irritation is present), and urinalysis. Biological monitoring techniques testing for metabolites in blood or urine, or DNA adducts in blood or tissues are useful for epidemiological studies that determine if exposure has occurred. Because neither normal nor toxic levels have been established, those techniques may not be useful for evaluating individual patients.

Special Precautions/Procedures: Emergency personnel should protect against exposure.

Section 5 - Fire-Fighting Measures

See DOT ERG

Flash Point: None reported. Benzo(a)pyrene may burn, but does *not* readily ignite.

Autoignition Temperature: None reported.

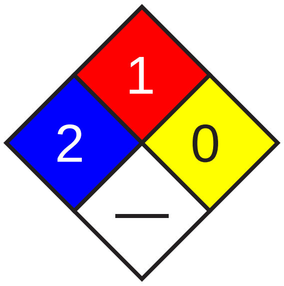
LEL: None reported.

UEL: None reported.

Extinguishing Media: For small fires, use dry chemical, sand, water spray, or foam. For large fires, use water spray, fog, or foam.

General Fire Hazards/Hazardous Combustion Products: Carbon monoxide and carbon dioxide.

Fire-Fighting Instructions: Isolate hazard and deny entry. If feasible and without undue risk, move containers from fire hazard area. Otherwise, cool fire-exposed containers with water spray until well after fire is extinguished. Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode and full protective clothing.



Fire Diamond

Section 6 - Accidental Release Measures

See DOT ERG

Spill/Leak Procedures: Notify safety personnel of large spills, remove heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and skin or eye contact. Clean up spills promptly.

Small Spills: Carefully scoop up spilled material and place into appropriate containers for disposal. For liquid spills, take up with a noncombustible, inert absorbent and place into appropriate containers for disposal.

Large Spills: For large spills, dike far ahead of liquid spill or contain dry spill for later disposal. Do not release into sewers or waterways. *Do not* dry sweep! Use a vacuum with a HEPA filter or a wet method to reduce dust. After cleanup is complete, thoroughly decontaminate all surfaces. *Do not* reuse contaminated cleaning materials.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Handle with extreme caution and take all necessary measures to avoid exposure to benzo(a)pyrene because it is a carcinogen and mutagen. Follow good personal hygiene procedures and thoroughly wash hands with soap and water after handling. Use safety pipettes for all pipetting.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed and properly labeled containers in a cool, well-ventilated area.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use a Class I, Type B, biological safety hood when working with benzo(a)pyrene in a laboratory. Decrease the rate of air extraction, so that benzo(a)pyrene can be handled without powder being blown around the hood. Keep glove boxes under negative pressure. Use vertical laminar-flow, 100% exhaust, biological safety cabinets for containment of in vitro procedures. The exhaust air flow should be sufficient to provide an inward air flow at the face opening of the cabinet. Ensure contaminated air sheaths that are under positive pressure are leak-tight. Never use horizontal laminar-flow hoods or safety cabinets where filtered air is blown across the working area towards the operator. Test cabinets before work begins to ensure they are functioning properly. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical examinations with emphasis on the oral cavity, bladder, kidneys, skin, and respiratory tract. Conduct urinalysis including specific gravity, albumin, glucose, and microscopic examination of centrifuged sediment for red blood cells. Also, include 14" x 17" chest roentgenogram, FVC + FEV1, and CBC to detect any leukemia or aplastic anemia. It is recommended that this exam be repeated on an annual basis and semiannual basis for employees 45 yr of age or older or with 10 or more years of exposure to coal tar pitch volatiles. Train workers about the hazards of benzo(a)pyrene and the necessary protective measures to prevent exposure. Periodically inspect lab atmospheres, surfaces such as walls, floors, and benches, and interior of fume hoods and air ducts for contamination. Post appropriate signs and labels on doors leading into areas where benzo(a)pyrene is used.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. In animal laboratories, wear protective suits (disposable, one-piece and close-fitting at ankles and wrists), gloves, hair covering, and overshoes. In chemical laboratories, wear gloves and gowns. Wear protective eyeglasses or chemical safety, gas-proof goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendations are for coal tar pitch volatiles. For any unknown concentration, wear any SCBA with a full facepiece and operated in a pressure- demand or other positive pressure mode, or any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive pressure mode. For escape, wear any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister having a high-efficiency particulate filter, or any appropriate escape-type SCBA. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Shower and change clothes after exposure or at the end of the workshift. Separate contaminated work clothes from street clothes. Launder before reuse. Remove benzo(a)pyrene from your shoes and clean personal protective equipment. Use procedures to ensure laundry personnel are not exposed. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Pale yellow monoclinic needles with a faint, aromatic odor.
Physical State: Solid
Vapor Pressure (kPa): >1 mm Hg at 68 °F (20 °C)
Formula Weight: 252.30
Specific Gravity (H_2O=1, at 4 °C): 1.351
Boiling Point: >680 °F (>360 °C); 590 °F (310 °C) at 10 mm Hg
Freezing/Melting Point: 354 °F (179 °C)
Water Solubility: Insoluble; 0.0038 mg (+/- 0.00031 mg) in 1 L at 77 °F (25 °C)
Other Solubilities: Ether, benzene, toluene, xylene, concentrated hydrosulfuric acid; sparingly soluble in alcohol, methanol.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Benzo(a)pyrene is stable at room temperature in closed containers under normal storage and handling conditions. It undergoes photo-oxidation when exposed to sunlight or light in organic solvents and is also oxidized by chromic acid and ozone. Hazardous polymerization cannot occur. Avoid heat and ignition sources and incompatibles.
Storage Incompatibilities: Strong oxidizers (chlorine, bromine, fluorine) and oxidizing chemicals (chlorates, perchlorates, permanganates, and nitrates).
Hazardous Decomposition Products: Thermal oxidative decomposition of benzo(a)pyrene can produce carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Acute Oral Effects:
Rat, oral: 15 mg/kg produced gastrointestinal and musculoskeletal tumors.
Irritation Effects:
Mouse: 14 µg caused mild irritation.
Other Effects:
Rat, oral: 40 mg/kg on the 14th day of pregnancy caused changes in the extra embryonic structures.
Rat, oral: 2 g/kg administered 28 days prior to mating and 1-22 days of pregnancy produced a stillbirth.
Tumorgenicity, mouse, oral: 75 mg/kg administered to the female during the 12- 14 day of pregnancy produced biochemical and metabolic effects on the newborn.
Mouse, inhalation: 200 ng/m^3/6 hr administered intermittently over 13 weeks produced tumors of the lungs.
Human, HeLa cell: 1500 nmol/L caused DNA inhibition.
Human, lung cell: 1 µmol/L caused DNA damage.
Human, liver cell: 100 nmol/L caused DNA damage.
Rabbit, skin: 17 mg/kg administered intermittently over 57 weeks produced tumors of the skin and appendages.

See *RTECS* DJ3675000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to water, benzo(a)pyrene adsorbs very strongly to particulate matter and sediments, bioconcentrates in aquatic organisms which cannot metabolize it, but does not hydrolyze. Direct photolysis at the water surface, evaporation, or biodegradation may be important, but adsorption may significantly retard these processes. Adsorption to particulates may also retard direct photolysis when benzo(a)pyrene is released to air. Benzo(a)pyrene may be removed from air by reaction with nitrogen dioxide (half-life, 7 days) or ozone (half-life, 37 min), or photochemically produced hydroxyl radicals (estimated half-life, 21.49 hr). It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils. It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils.
Ecotoxicity: Oysters, BCF (bioconcentration factor): 3000; rainbow trout, BCF: 920; *Daphnia pulex*, BCF: 13,000.
BCF: Some marine organisms such as phytoplankton, certain zooplankton, scallops (*Placopecten sp*), snails (*Litternia littorea*), and mussels (*Mytilus edulis*) lack a metabolic detoxification enzyme system to metabolize benzo(a)pyrene and therefore, tend to accumulate benzo(a)pyrene. Humic acid in solution may decrease bioconcentration.
Octanol/Water Partition Coefficient: log K_{ow} = 6.04

Section 13 - Disposal Considerations

Disposal: Small quantities: 10 mL of a solution containing 0.3 mol/L of potassium permanganate and 3 mol/L of sulfuric acid will degrade 5 mg of benzo(a)pyrene. Also, can treat with sodium dichromate in strong sulfuric acid (1-2 days). Benzo(a)pyrene is also a good candidate for fluidized bed incineration at a temperature range of 842 to 1796 °F (450 to 980 °C) or rotary kiln incineration at 820 to 1600°C. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Environmentally hazardous substances, solid, n.o.s.
ID: UN3077
Hazard Class: 9 - Miscellaneous hazardous material
Packing Group: III - Minor Danger
Symbols: G - Technical Name Required
Label Codes: 9 - Class 9
Special Provisions: 8, 146, B54, IB8, N20
Packaging: **Exceptions:** 155 **Non-bulk:** 213 **Bulk:** 240
Quantity Limitations: **Passenger aircraft/rail:** No limit **Cargo aircraft only:** No limit
Vessel Stowage: **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:
- **RCRA 40 CFR:** Listed U022 Toxic Waste
- **CERCLA 40 CFR 302.4:** Listed per RCRA Section 3001, per CWA Section 307(a) 1 lb (0.454 kg)
- **SARA 40 CFR 372.65:** Listed
- **SARA EHS 40 CFR 355:** Not listed
- **TSCA:** Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

ARCADIS

Attachment G

Air Monitoring Log

ARCADIS

Air Monitoring Log

Project:

Date:

Monitoring Instruments:

Air Monitor:

Activity:

Level of Protection:

Time	Location	Instrument Reading	Comments

ARCADIS

Attachment H

Generic Community Air Monitoring Plan

New York State Department of Health
Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical-specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a **continuous** basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored **continuously** at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring partculate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m³) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m³ above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m³ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m³ of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

June 20, 2000

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ARCADIS

Attachment I

Health and Safety Inspection Form

Infrastructure, environment, facilities

Health and Safety Inspection Form

Project Name:	**Date:**
Project Number:	**Location:**
Prepared By:	**Project Manager:**
Auditor:	**HSS On Site:**

General	Yes	No	N/A	Comments
Is the HASP on site?	☐	☐	☐	
Is the HASP finalized and approved?	☐	☐	☐	
Is the OSHA poster displayed?	☐	☐	☐	
Are emergency telephone numbers posted?	☐	☐	☐	
Is emergency eyewash immediately available?	☐	☐	☐	
Is an emergency shower immediately available?	☐	☐	☐	
Are emergency notification means available (radio, telephone)?	☐	☐	☐	
Is a first-aid kit immediately available?	☐	☐	☐	
Is the first-aid kit adequately stocked?	☐	☐	☐	
Is there a proper sanitation facility on site?	☐	☐	☐	

Documentation and Recordkeeping	Yes	No	N/A	Comments
Are only personnel listed and approved in the HASP on site?	☐	☐	☐	
Are all personnel properly trained? (Check company-issued wallet cards.)	☐	☐	☐	
Is the daily field log kept by the Site Manager?	☐	☐	☐	
Are levels of PPE recorded?	☐	☐	☐	
Are contaminant levels recorded?	☐	☐	☐	
Are site surveillance records kept by HSS?	☐	☐	☐	
Are copies of current fit test records on site?	☐	☐	☐	
Are calibration records maintained for air monitoring equipment?	☐	☐	☐	
Are accident / incident forms on site?	☐	☐	☐	
Are field team review sheets signed?	☐	☐	☐	
Are additional hospital route directions available?	☐	☐	☐	
Is the visitors’ logbook being accurately maintained?	☐	☐	☐	
Are MSDSs available for all chemicals on site?	☐	☐	☐	
Are HASP revisions recorded?	☐	☐	☐	
Is the first-aid kit inspected weekly?	☐	☐	☐	
Are daily safety meetings held?	☐	☐	☐	
Are emergency procedures discussed during safety meetings?	☐	☐	☐	

ARCADIS
Infrastructure, environment, facilities

Health and Safety Inspection Form

Emergency Responses	Yes	No	N/A	Comments
Is a vehicle available on site for transportation to the hospital?	☐	☐	☐	
Are fire extinguishers on site and immediately available at designated work areas?	☐	☐	☐	
Is at least one person trained in CPR and first aid on site at all times during work activities?	☐	☐	☐	
Do all personnel know who is trained in CPR / first aid?	☐	☐	☐	
Personal Protective Equipment (PPE)	**Yes**	**No**	**N/A**	**Comments**
Is proper PPE being worn as specified in HASP?	☐	☐	☐	
Level of PPE being worn.				
Is PPE adequate for work conditions?	☐	☐	☐	
If not, give reason.				
Upgrade / downgrade to PPE level.	☐	☐	☐	
Does any employee have facial hair that would interfere with respirator fit?	☐	☐	☐	
If yes, willing to shave, as necessary?	☐	☐	☐	
Fit-tested within the last year? (Documentation present)	☐	☐	☐	
If Level B, is a back-up / emergency person suited up (except for air)?	☐	☐	☐	
Does the HSS periodically inspect PPE and equipment?	☐	☐	☐	
Is the PPE not in use properly stored?	☐	☐	☐	
Is all equipment required in the HASP on site?	☐	☐	☐	
Properly calibrated?	☐	☐	☐	
In good condition?	☐	☐	☐	
Used properly?	☐	☐	☐	
Other equipment needed?	☐	☐	☐	
List.				
Is monitoring equipment covered with plastic to minimize contamination?	☐	☐	☐	
Personnel and Equipment Decontamination	**Yes**	**No**	**N/A**	**Comments**
Is the decontamination area properly designated?	☐	☐	☐	
Is appropriate cleaning fluid used for known or suspected contaminants?	☐	☐	☐	
Are appropriate decontamination procedures used?	☐	☐	☐	
Are decontamination personnel wearing proper PPE?	☐	☐	☐	
Is the equipment decontaminated?	☐	☐	☐	
Are sample containers decontaminated?	☐	☐	☐	
Are disposable items replaced as required?	☐	☐	☐	

ARCADIS
Infrastructure, environment, facilities

Health and Safety Inspection Form

Work Practices	Yes	No	N/A	Comments
Was proper collection and disposal of potentially contaminated PPE performed?	☐	☐	☐	
Was proper collection and disposal of decontamination fluid performed?	☐	☐	☐	
Is water available for decontamination?	☐	☐	☐	
Is the buddy system used?	☐	☐	☐	
Is equipment kept off drums and the ground?	☐	☐	☐	
Is kneeling or sitting on drums or the ground prohibited?	☐	☐	☐	
Do personnel avoid standing or walking through puddles or stained soil?	☐	☐	☐	
Are work zones established?	☐	☐	☐	
If night work is conducted, is there adequate illumination?	☐	☐	☐	
Is smoking, eating, or drinking in the exclusion zone or CRZ prohibited?	☐	☐	☐	
To the extent feasible, are contaminated materials handled remotely?	☐	☐	☐	
Is contact lenses use prohibited on site?	☐	☐	☐	
Is entry into excavations not allowed unless properly shored or sloped?	☐	☐	☐	
Is a competent person on site during excavation?	☐	☐	☐	
Are all unusual situations on site listed in HASP?	☐	☐	☐	
If not, when?				
Action taken?				
HASP revised?				
Confined Space Entry	**Yes**	**No**	**N/A**	**Comments**
Are employees trained according to 1910.146 – Confined Space Entry?	☐	☐	☐	
Are all confined spaces identified? If not, list:	☐	☐	☐	
Is all appropriate equipment available and in good working order?	☐	☐	☐	
Is equipment properly calibrated?	☐	☐	☐	
Are confined space permits used?	☐	☐	☐	
Are confined space permits completely and correctly filled out?	☐	☐	☐	

Appendix D

Community Air Monitoring Plan

National Grid

Community Air Monitoring Plan

Little Falls (Mill Street) Non-Owned Former MGP Site

Little Falls, New York

April 2010

ARCADIS

Community Air Monitoring Plan

Little Falls – (Mill Street) Non-Owned Former Manufacturing Gas Plant (MGP) Site

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Our Ref.:
0036673.0000 #10

Date:
April 2010

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Exhibits

I Generic Community Air Monitoring Plan

II NYSDEC TAGM 4031 – Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites

1. Introduction

This Community Air Monitoring Plan (CAMP) has been prepared by ARCADIS to support implementation of ongoing groundwater and Dense Non-Aqueous Phase Liquid (DNAPL) monitoring/recovery activities at the National Grid Little Falls (Mill Street) non-owned former manufactured gas plant (MGP) site located on Mill Street in Little Falls, New York (the Site). This CAMP fulfills the requirements set forth by the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (GCAMP), dated June 2000 (Exhibit I), and the New York State Department of Environmental Conservation's (NYSDEC's) Technical and Administrative Guidance Memorandum (TAGM) 4031, "Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites" (Exhibit II). This CAMP presents monitoring activities that will be conducted to detect potential airborne releases of constituents of concern during implementation of the ongoing groundwater and DNAPL monitoring/recovery activities. The CAMP also specifies the air emissions action levels, air monitoring procedures, monitoring schedule and data collection and reporting to be performed during implementation of the ongoing groundwater and DNAPL monitoring/recovery activities.

1.1 Site Description

The Site is located on the western portion of an approximately 6.5-acre property currently owned by Feldmeier Equipment, Inc. (Feldmeier). The site is located on the south side of East Mill Street in Little Falls, New York. The site is bordered by East Mill Street to the north, George Lumber and Building Materials Company to the west, the Mohawk River to the south, and a tank manufacturing building that is currently owned and operated by Feldmeier (the "tank manufacturing building") to the east. Adjacent properties located to the north (across East Mill Street), east, and west of the former MGP site are used for industrial and/or commercial purposes.

1.2 Ongoing Monitoring/Recovery Activities

The ongoing groundwater and DNAPL monitoring/recovery activities primarily include: 1) monitoring groundwater quality and flow conditions; 2) monitoring DNAPL in recovery wells; 3) attempting to recover any detected NAPL; and 4) potential monitoring well/recovery well repairs, replacement, and decommissioning.

1.3 Potential Air Emissions Related to Ongoing Monitoring/Recovery Activities

As defined in the NYSDOH GCAMP, intrusive ongoing monitoring/recovery activities to be performed at the Site have the potential to generate localized impacts to air quality. These ongoing monitoring/recovery activities include, but may not be limited to, the following:

- Monitoring/recovery of DNAPL in recovery wells; and
- Potential monitoring well/recovery well repairs, replacement, and decommissioning.

1.4 Air/Dust Emissions and Control Measures

Air emissions control and fugitive dust suppression measures will be implemented concurrently with the activities identified above (as needed) to limit the potential for organic vapor and dust emissions from the Site. Air emissions associated with groundwater monitoring, monitoring/recovery of DNAPL, and potential monitoring well/recovery well repairs, replacement, and decommissioning, and certain nonintrusive activities, such as mobilization, transportation, and restoration activities, will be controlled as necessary. The following vapor and dust control measures may be used during these activities, depending on specific circumstances, visual observations, and air monitoring results:

- Water spray.
- Polyethylene sheeting (for covering material stockpiles, etc.).
- Minimizing drilling/excavation surface area to be exposed at any given time.
- Vapor suppression foams.

Prior to implementing intrusive work activities, a supply of materials for the above-referenced control measures will be obtained, as necessary. An adequate supply of such materials will be maintained for the duration of intrusive activities.

2. Air Monitoring Procedures

Real-time air monitoring will be implemented at representative locations in the vicinity of the ongoing monitoring/recovery activities for organic vapors and particulate matter less than 10 microns in diameter (PM_{10}). Real-time air monitoring for organic vapors will be conducted during the groundwater and DNAPL monitoring/recovery activities. Real-time monitoring for organic vapors and PM_{10} will be conducted during all ground intrusive activities (including potential monitoring well/recovery well repairs, replacement, and decommissioning). Details of the air monitoring, including information regarding the monitoring locations, are presented below.

2.1 Monitoring Station Location Selection and Deployment

Prior to the initiation of and during all intrusive activities, organic vapors and PM_{10} monitoring station locations will be determined daily based on data from an onsite meteorological monitoring station and the nature of the anticipated intrusive work activities. An upwind location for both organic vapors and PM_{10} monitoring will be selected at the start of each workday. One downwind (based on predominant wind direction) location for both volatile organic compounds (VOCs) and PM_{10} monitoring will also be selected. The organic vapor and PM_{10} monitoring stations will be deployed each day before the start of intrusive work activities. If wind direction shifts radically during the workday and for an extended period of time, such that the upwind location and the downwind location no longer fall within acceptable guidelines (+/- 60° compass change from the original wind direction), the monitoring stations will be relocated so that the upwind and downwind locations are maintained. Air monitoring location changes will be documented by the field logbook.

2.2 PAHs and VOCs Monitoring

Because real-time monitors for polycyclic aromatic hydrocarbons (PAHs) do not exist, the real-time VOC and particulate monitors will also serve as surrogate indicators of PAH emissions at the Site. The real-time particulate monitoring is described in Section 2.3. As required by the NYSDOH GCAMP, VOCs will be monitored continuously during implementation of the groundwater and DNAPL monitoring/recovery activities and all intrusive activities (i.e., monitoring well/recovery well repairs, replacement, and decommissioning) using instrumentation equipped with electronic data-logging capabilities. A real-time VOC monitor (MiniRAE 2000 [or equivalent]), equipped with either a photo-ionization detector (PID) calibrated to 10 parts per million (ppm) Isobutylene, or a flame-ionization detector (FID), will be used to conduct the monitoring for VOCs (and PAHs). All running average (15-minute intervals) concentrations and any instantaneous readings that support decisions regarding the remedial activities will be recorded by the Contractor using an electronic data logger and/or in the field logbook.

2.3 PM_{10} Monitoring

Fugitive dust migration will be visually assessed during work activities, and reasonable dust suppression techniques will be used during Site activities that may generate fugitive dust. These activities and their design controls are discussed in Section 1.4.

As required by the NYSDOH GCAMP, real-time airborne particulate monitoring will be conducted continuously during intrusive activities, including monitoring well/recovery well repairs, replacement, and decommissioning. Particulate monitoring will be conducted using instrumentation equipped with electronic data-logging capabilities. As previously discussed in Subsection 2.2, particulate monitoring will also serve as a surrogate indicator of PAH emissions at the Site. A MIE DataRAM (or equivalent) will be used to conduct the real-time PM_{10} monitoring. Concentration readings will be recorded as specified in Subsection 2.2 above.

2.4 Action Levels

The action levels provided below will be used to initiate response actions, if necessary, based on real-time monitoring. Each piece of monitoring equipment will have alarm capabilities to indicate exceedances of the action levels indicated below.

2.4.1 Action Levels for VOCs

As outlined in the NYSDOH GCAMP, if the ambient air concentration of total VOCs at any one (or more) of the downwind perimeter locations exceeds 5 ppm above the background (upwind location) concentrations for a 15-minute average, intrusive activities will be temporarily halted while monitoring continues. If the total VOC concentration readily decreases (through observation of instantaneous readings) below 5 ppm above background, then intrusive activities can resume with continuous monitoring.

If the ambient air concentrations of total VOCs at any one (or more) of the downwind perimeter locations persist (despite cessation of work activities) at levels in excess of 5 ppm above background but less than 25 ppm above background, intrusive activities will be halted, the potential source(s) of the elevated VOC concentrations will be identified, corrective actions to reduce or abate the emissions will be undertaken, and air monitoring will be continued. Once these actions have been performed, intrusive activities can resume provided that the TOV level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

If the ambient air concentrations of total VOCs at one (or more) of the downwind perimeter locations are above 25 ppm above background, the intrusive activities must cease, and emissions control measures must be implemented.

2.4.2 Action Levels for PM_{10}

As required by the NYSDOH GCAMP, if the ambient 15-minute average PM_{10} air concentration at any one (or more) of the downwind perimeter locations is noted at levels in excess of 100 micrograms per cubic meter (µg/m3) above the background concentration, or if airborne dust is visually observed leaving the work area, then dust suppression activities will be implemented, and air monitoring will continue. Work may continue following the implementation of dust-suppression techniques provided the PM_{10} levels do not exceed 150 $\mu g/m^3$ above background, and no visible dust is observed migrating from the work areas.

If, after implementation of dust-suppression techniques, the downwind PM_{10} levels are greater than 150 $\mu g/m^3$ above background, work must be stopped and Site activities must be re-evaluated. Once additional actions have been implemented, work may resume only if dust-suppression measures and other controls are successful in reducing the 15-minute average PM_{10} levels to less than 150 µg/m3 above background at the downwind perimeter of the Site and if no visible dust is observed migrating from the work area.

2.5 Meteorological Monitoring

Meteorological monitoring will be conducted continuously at the Site using available local meteorological monitoring stations and a wind sock to indicate wind direction.

2.6 Instrument Calibration

Calibration of the VOC and PM_{10} monitoring instrumentation will be conducted in accordance with the equipment manufacturer's calibration and quality assurance requirements. The VOC and PM_{10} monitors will be calibrated at least daily, and calibrations will be recorded by the Contractor in the field logbook.

3. Monitoring Schedule and Data Collection/Reporting

The following identifies the monitoring schedule and data collection/reporting requirements.

3.1 Monitoring Schedule

As previously indicated, real-time air monitoring for organic vapors will be conducted during the groundwater and DNAPL monitoring/recovery activities. Real-time monitoring for organic vapors and PM_{10} will be conducted during all ground intrusive activities and/or potential dust-generating activities (including potential monitoring well/recovery well repairs, replacement, and decommissioning). Air monitoring will be conducted prior to initiating intrusive work activities to establish adequate baseline data and until such time that significant soil handling activities are complete (i.e., removal of impacted soils staged onsite). With respect to soils that are to be staged onsite, air monitoring will be performed during periods when the staging area is "active" (i.e., when soils are being added or removed from the stockpile). When the staging areas are "inactive," the affected soils will be covered with suitable tarpaulins or plastic sheeting, which will be anchored to resist potential wind- and rainfall-related upsets. The frequency of air monitoring will be relative to the level of site work activities being conducted and may be adjusted as the work proceeds and in consideration of the monitoring results.

3.2 Data Collection and Reporting

Air monitoring data will be collected continuously from VOC and PM_{10} monitors during ongoing monitoring/recovery activities (as detailed above) by the electronic data-logging system. The data management software will be set up so that instantaneous observed readings will be recorded by the electronic data acquisition system and averaged over 15-minute periods. All readings will be recorded and archived to facilitate subsequent review by NYSDOH and NYSDEC personnel.

Exhibits

Exhibit I

Generic Community Air monitoring Plan

APPENDIX 1A

New York State Department of Health
Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

ARCADIS

Exhibit II

NYSDEC TAGM 4031-Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites

New York State Department of Environmental Conservation

TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM #4031

FUGITIVE DUST SUPPRESSION AND PARTICULATE MONITORING PROGRAM AT INACTIVE HAZARDOUS WASTE SITES

TO:	Regional Hazardous Waste Remediation Engrs., Bur. Directors & Section Chiefs
FROM:	Michael J. O'Toole, Jr., Director, Division of Hazardous Waste Remediation
SUBJECT:	DIVISION TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM -- FUGITIVE DUST SUPRESSION AND PARTICULATE MONITORING PROGRAM AT INACTIVE HAZARDOUS WASTE SITES
DATE:	Oct 27, 1989

Michael J. O'Toole, Jr. (signed)

1. Introduction

Fugitive dust suppression, particulate monitoring, and subsequent action levels for such must be used and applied consistently during remedial activities at hazardous waste sites. This guidance provides a basis for developing and implementing a fugitive dust suppression and particulate monitoring program as an element of a hazardous waste site's health and safety program.

2. Background

Fugitive dust is particulate matter--a generic term for a broad class of chemically and physically diverse substances that exist as discrete particles, liquid droplets or solids, over a wide range of sizes--which becomes airborne and contributes to air quality as a nuisance and threat to human health and the environment.

On July 1, 1987, the United States Environmental Protection Agency (USEPA) revised the ambient air quality standard for particulates so as to reflect direct impact on human health by setting the standard for particulate matter less than ten microns in diameter (PM_{10}); this involves fugitive dust whether contaminated or not. Based upon an examination of air quality composition, respiratory tract deposition, and health effects, PM_{10} is considered conservative for the primary standard--that requisite to protect public health with an adequate margin of safety. The primary standards are 150 ug/m^3 over a 24-hour averaging time and 50 ug/m^3 over an annual averaging time. Both of these standards are to be averaged arithmetically.

There exists real-time monitoring equipment available to measure PM_{10} and capable of integrating over a period of six seconds to ten hours. Combined with an adequate fugitive dust suppression program, such equipment will aid in preventing the off-site migration of contaminated soil. It will also protect both on-site personnel from exposure to high levels of dust and the public around the site from any exposure to any dust. While specifically intended for the protection of on-site personnel as well as the public, this program is not meant to replace long-term monitoring which may be required given the contaminants inherent to the site and its air quality.

3. Guidance

A program for suppressing fugitive dust and monitoring particulate matter at hazardous waste sites can be developed without placing an undue burden on remedial activities while still being protective of health and environment. Since the responsibility for implementing this program ultimately will fall on the party performing the work, these procedures must be incorporated into appropriate work plans. The following fugitive dust suppression and particulate monitoring program will be employed at hazardous waste sites during construction and other activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Such activities shall also include the excavation, grading, or placement of clean fill, and control measures therefore should be considered.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM_{10}) with the following minimum performance standards:

   Object to be measured: Dust, Mists, Aerosols
   Size range: <0.1 to 10 microns
   Sensitivity: 0.001 mg/m^3
   Range: 0.001 to 10 mg/m^3
   Overall Accuracy: ±10% as compared to gravimetric analysis of stearic acid or reference dust

   Operating Conditions:
      Temperature: 0 to 40°C
      Humidity: 10 to 99% Relative Humidity

   Power: Battery operated with a minimum capacity of eight hours continuous operation

   Automatic alarms are suggested.

   Particulate levels will be monitored immediately downwind <u>at</u> the working site and integrated over a period not to exceed 15 minutes. Consequently, instrumentation shall require necessary averaging hardware to accomplish this task; the P-5 Digital Dust Indicator as manufactured by MDA Scientific, Inc. or similar is appropriate.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the entity operating the equipment to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m^3 over the integrated period not to exceed 15 minutes. While conservative, this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m^3, the upwind background level must be measured immediately using the same portable monitor. If the working site particulate measurement is greater than 100 ug/m^3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see Paragraph 7). Should the action level of 150 ug/m^3 be exceeded, the Division of Air Resources must be notified in writing within five working days; the notification shall include a description of the control measures implemented to prevent further exceedences.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM_{10} at or above the action level. Since this situation has the potential to migrate contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

    1. Applying water on haul roads.
    2. Wetting equipment and excavation faces.
    3. Spraying water on buckets during excavation and dumping.
    4. Hauling materials in properly tarped or watertight containers.
    5. Restricting vehicle speeds to 10 mph.
    6. Covering excavated areas and material after excavation activity ceases.
    7. Reducing the excavation size and/or number of excavations.

    Experience has shown that utilizing the above-mentioned dust suppression techniques, within reason as not to create excess water which would result in unacceptable wet conditions, the chance of exceeding the 150 ug/m^3 action level at hazardous waste site remediations is remote. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. If the dust suppression techniques being utilized at the site do not lower particulates to an acceptable level (that is, below 150 ug/m^3 and no visible dust), work must be suspended until appropriate corrective measures are approved to remedy the situation. Also, the evaluation of weather conditions will be necessary for proper fugitive dust control--when extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended.

There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require appropriate toxics monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

Appendix E

Site-Wide Inspection Form

Little Falls (Mill Street) Non-Owned Former MGP Site
Little Falls, Herkimer County, New York

Site Wide Inspection Form

Date:

Personnel:

Time of Arrival:

Time of Departure:

Weather Conditions:

Temperature:

Wind Speed:

Wind Direction (from):

Inspection Checklist	Yes	No	Comments
Exterior Cover System			
- Soil intrusion activities being performed?			
- Signs of soil intrusive activities?			
- Evidence of saw cutting?			
- Evidence of excavation or trenching?			
- Burrowing animals?			
Interior Slab (West Side of Feldmeier Building)			
- Sub-slab activities being performed?			
- Signs of sub-slab soil intrusive activities?			
- Evidence of excavation or tunneling?			
Monitoring Well Condition			
- Monitoring event occurring?			
- Covers secure?			
- Casing in need of repair?			
- Concrete surface seal intact?			
- Obstructed?			
- Settling?			

General Comments/Suggested Action Items:

Appendix F

Monitoring Well Boring and Construction Logs

Date Start/Finish: 10/22/04
Drilling Company: Lyon Drilling
Driller's Name: Harry Lyon
Drilling Method: Hollow Stem Auger
Bit Size: 6.25" OD
Auger Size: 4.25" ID
Rig Type: CME 45B
Sampling Method: 2" OD x 2'

Northing: 1,533,095.81
Easting: 396,525.23
Casing Elevation: NA

Borehole Depth: 16.8' below grade
Surface Elevation: 362.09

Geologist: Jennifer Sandorf

Well/Boring ID: SB-101

Client: Niagara Mohawk
A National Grid Company

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	365										
0		1	1-2	1.2	11 11 12 15	23	0.5			Gray to brown GRAVEL, medium to coarse Gravel, trace to little subangular Cobbles, little fine to coarse Sand, moderately loose to moderately dense, dry. [FILL]	
	360	2	2-4	0.4	3 3 3 2	6	1.3			Red BRICK fragments, little fine to medium Sand, trace coarse subrounded Gravel and Cobbles, moderately loose, dry.	Borehole was backfilled to grade with cement-bentonite grout.
5		3	4-6	0.4	1 1 1 2	2	1.5				
	355	4	6-8	0.4	3 2 2 2	4	0.4			Trace Coal fragments, below 6.0' bgs.	
		5	8-10	1.4	3 9 11 8	20	0.8	X		Black COAL fragments, dry. Yellowish-brown fine to medium SAND, little medium to coarse Gravel, trace red Brick fragments and Wood, dry.	
10		6	10-12	0.1	2 1 WOR 1	NA	0.7				
	350	7	12-14	0.4	2 3 4 3	7	0.0			Trace Cinders and fine to coarse Gravel, moist, from 12.0' - 14.0' bgs.	
15		8	14-16	0.5	1 1 1 1	2	0.5			Red BRICK fragments, some Coal and Cinders, loose, wet.	

Remarks: bgs = below ground surface; NA = Not Applicable/Available; WOR = Weight of Rod.
Sample taken from 8'-10' bgs.

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Project: 36673.002
Data File:SB-101.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFalls.ldf
Date: 11/19/04

Client:
Niagara Mohawk

Site Location:
Little Falls (Mill St)
Former MGP Site
Little Falls, NY

Well/Boring ID: SB-101

Borehole Depth: 16.8' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
		9	16-16.8	0.2	2 50/0.3	NA	0.2			Red BRICK fragments, some Coal and Cinders, loose, wet.	Borehole was backfilled to grade with cement-bentonite grout.
	345									Auger Refusal at 16.8' bgs.	
20											
	340										
25											
	335										
30											
	330										
35											

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Remarks: bgs = below ground surface; NA = Not Applicable/Available; WOR = Weight of Rod.
Sample taken from 8'-10' bgs.

Date Start/Finish: 10/22/04
Drilling Company: Lyon Drilling
Driller's Name: Harry Lyon
Drilling Method: Hollow Stem Auger
Bit Size: 6.25" OD
Auger Size: 4.25" ID
Rig Type: CME 45B
Sampling Method: 2" OD x 2'

Northing: 1,533,067.05
Easting: 396,525.54
Casing Elevation: NA

Borehole Depth: 19.2' below grade
Surface Elevation: 362.06

Geologist: Jennifer Sandorf

Well/Boring ID: SB-102

Client: Niagara Mohawk
A National Grid Company

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Stratigraphic Description	Well/Boring Construction
0		1	1-2	0.8	35 20 13 13	33	1.5		Gray to brown GRAVEL, fine to coarse angular Gravel, little to some fine to coarse Sand, trace subrounded Cobbles, medium dense, dry. [FILL]	
	360	2	2-4	0.9	7 11 8 10	19	1.4			Borehole was backfilled to grade with cement-bentonite grout.
5		3	4-6	0.7	6 7 5 5	12	1.3			
	355	4	6-8	0.3	2 3 2 4	5	1.8		Trace red Brick fragments, moist, below 8.0' bgs.	
		5	8-10	0.1	5 1 1 1	2	1.7		COAL fragments and subangular to subrounded coarse Gravel, moist.	
10		6	10-12	0.4	3 3 3 4	6	5.6		BRICK, WOOD, CINDERS, COAL, coarse GRAVEL, loose, moist. [FILL]	
	350	7	12-14	0.0	4 4 4 3	8	NA		No Recovery. COAL fragments.	
15		8	14-16	0.9	1 3 2 2	5	1.6	X	Light brownish-gray SILT, little fine to medium Sand, trace red Brick fragments and Shale fragments, moist.	

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Remarks: bgs = below ground surface; NA = Not Applicable/Available;
Sample collected at 16'-18' bgs, 14'-16' bgs and DUP-1 collected at 16'-18' bgs.

Client:
Niagara Mohawk

Site Location:
Little Falls (Mill St)
Former MGP Site
Little Falls, NY

Well/Boring ID: SB-102

Borehole Depth: 19.2' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	345	9	16-18	1.3	2 3 3 3	6	1.7	☒		Brown fine to medium SAND, little Silt, trace Cinders, moist to wet.	Borehole was backfilled to grade with cement-bentonite grout.
		10	18-19.2	0.5	2 10 50/0.2	NA	1.8			Trace subangular Cobbles, wet below 18.0' bgs.	
										Auger Refusal at 19.2' bgs.	
20											
	340										
25											
	335										
30											
	330										
35											

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Remarks: bgs = below ground surface; NA = Not Applicable/Available;
Sample collected at 16'-18' bgs, 14'-16' bgs and DUP-1 collected at 16'-18' bgs.

Project: 36673.002
Data File:SB-102.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFalls.ldf
Date: 11/19/04

Date Start/Finish: 10/21/04 **Drilling Company:** Lyon Drilling **Driller's Name:** Harry Lyon **Drilling Method:** Hollow Stem Auger **Bit Size:** 6.25" OD **Auger Size:** 4.25" ID **Rig Type:** CME 45B **Sampling Method:** 2" OD x 2'	**Northing:** 1,533,054.36 **Easting:** 396,534.75 **Casing Elevation:** NA **Borehole Depth:** 24.3' below grade **Surface Elevation:** 356.87 **Geologist:** Jennifer Sandorf	**Well/Boring ID:** SB-103 **Client:** Niagara Mohawk A National Grid Company **Location:** Little Falls (Mill St) Former MGP Site Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
0										Grayish pink GRAVEL. [FILL]	
	355	1	1-2	1.0	6 7 3 4	10	0.6			Brown SILT, little fine to medium Sand, slightly plastic, medium stiff, dry.	
		2	2-4	0.9	2 12 10 8	22	0.8			Trace Organics (Roots), Wood fibers, gray coarse Gravel, pink Rock fragments, and 1/2" piece thin Styrofoam, 2.0' - 4.0' bgs.	Borehole was backfilled to grade with cement-bentonite grout.
5		3	4-6	0.5	10 7 6 6	13	1.3			Mixed GRAVEL (subrounded to angular medium to coarse Gravel and Cobbles), little to some fine to medium Sand, trace black Plastic(film), moderately loose, moist. [FILL]	
	350	4	6-8	0.4	4 6 4 4	10	1.6			No Plastic or Cobbles, moist to wet (possibly due to rain), 6.0' - 10.0' bgs.	
		5	8-10	0.4	8 4 5 4	9	1.5				
10	345	6	10-12	0.7	3 3 2 3	5	1.6			Trace broken Cobbles, red Brick fragments, and Wood, in tip of spoon.	
		7	12-14	0.4	2 2 2 2	4	0.9			Red BRICK fragments, trace clear Glass.	
15		8	14-16	0.6	2 2 1 2	3	14.6	X		Black CINDERS and clear GLASS, in dark brownish-black Silty matrix, trace fine red Brick pieces.	

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Remarks: bgs = below ground surface; NA = Not Applicable/Available; WOR = Weight of Rod.
WOH = Weight of Hammer.
Sample taken at 14'-16' bgs and 16'-18' bgs.

Project: 36673.002
Data File:SB-103.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFalls.ldf
Date: 11/18/04

Client:
Niagara Mohawk

Site Location:
Little Falls (Mill St)
Former MGP Site
Little Falls, NY

Well/Boring ID: SB-103

Borehole Depth: 24.3' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	340	9	16-18	0.8	1 WOH 1 2	NA	2.8	X		Black CINDERS, loose, from 16.0' - 16.6' bgs. Thin lenses of white flaky material at 16.6' bgs. Dark brown SILT, some fine to medium Sand, slightly plastic, moderately soft, moist.	
		10	18-20	0.0	2 2 1 2	3	NA			No Recovery.	Borehole was backfilled to grade with cement-bentonite grout.
20		11	20-22	0.0	WOH 1 2 2	3	NA				
	335	12	22-24	0.2	WOR/ 12" 7 1	NA	2.6			Black stained fine to medium SAND, little to some Silt, trace to little coarse subrounded Gravel to small Cobbles, trace Wood pieces, no apparent odor or sheen, wet.	
		13	24-24.3	0.2	WOR/ 0.3 50/ 0.0	NA	2.0			Black stained ROCK fragments, trace hydrocarbon odor.	
25										Auger Refusal at 24.3' bgs.	
	330										
30											
	325										
35											

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Remarks: bgs = below ground surface; NA = Not Applicable/Available; WOR = Weight of Rod.
WOH = Weight of Hammer.
Sample taken at 14'-16' bgs and 16'-18' bgs.

Project: 36673.002
Data File:SB-103.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFalls.ldf
Date: 11/18/04

Date Start/Finish: 10/28/04
Drilling Company: Lyon Drilling
Driller's Name: Harry Lyon
Drilling Method: Hollow Stem Auger
Bit Size: 6.25" OD
Auger Size: 4.25" ID
Rig Type: CME 45B
Sampling Method: 2" OD x 2'

Northing: 1,533,198.29
Easting: 396,733.28
Casing Elevation: NA

Borehole Depth: 11.6' below grade
Surface Elevation: 355.55

Geologist: Jennifer Sandorf

Well/Boring ID: SB-104

Client: Niagara Mohawk
A National Grid Company

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
0	355	1	0.5-2	0.3	- 2 5 3	7	4.7			CONCRETE floor. Gray- brown medium to coarse angular GRAVEL, some fine to medium Sand, little Silt, moderately loose, wet from cutting the concrete.	Borehole was backfilled to grade with cement-bentonite grout.
		2	2-4	0.8	4 3 1 1	4	6.8			Brown fine to medium SAND, moderately loose, wet from coring.	
5	350	3	4-6	0.7	50 14 10 18	24	6.4	X		Brown subangular to subrounded fine to coarse GRAVEL, some fine to medium Sand, trace Concrete chunks and red Brick at bottom of spoon.	
		4	6-8	0.7	12 12 8 12	20	5.7			CLINKERS and crumbly yellow BRICK fragments. Trace fine to coarse Sand, black staining, odor, wet.	
		5	8-10	0.5	8 22 13 7	35	5.3			CONCRETE fragments, black staining at bottom of spoon, wet.	
10	345	6	10-11.6	1.5	8 16 5 50/0.1	21	10.1	X		Same as above, little fine to coarse Sand and fine to coarse Gravel. Dark brown CLAYEY SILT, trace natural Organics, earthy odor (Peat), wet.	
										Auger Refusal at 11.6' bgs.	
15	340										

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Remarks: bgs = below ground surface; NA = Not Applicable/Available
Sample taken at 4'-6' bgs and 10'-12' bgs.

Date Start/Finish: 10/29/04
Drilling Company: Lyon Drilling
Driller's Name: Harry Lyon
Drilling Method: Hollow Stem Auger
Bit Size: 6.25" OD
Auger Size: 4.25" ID
Rig Type: CME 45B
Sampling Method: 2" OD x 2'

Northing: 1,533,161.24
Easting: 396,740.21
Casing Elevation: NA

Borehole Depth: 4.0' below grade
Surface Elevation: 355.58

Geologist: Jennifer Sandorf

Well/Boring ID: SB-105

Client: Niagara Mohawk
A National Grid Company

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
0	355									CONCRETE floor.	Borehole was backfilled to grade with cement-bentonite grout.
		1	0.5-2	0.8	- 27 22 18	49	6.1			Gray crushed GRAVEL, wet from coring concrete, then dark brown fine to coarse Sand, little to some fine to coarse Gravel, trace Silt, moderate dense, moist. [FILL]	
		2	2-4	0.9	3 4 7 7	11	6.4	X		Dark gray medium to coarse GRAVEL, loose, wet. Red BRICK fragments, moderately dense, dry to moist. Trace Recovery, small pieces of CONCRETE, possibly part of former building foundation.	
		3	4-6	trace	50/0.0	NA	NA			Spoon Refusal at 4.0' bgs.	
5	350										
10	345										
15	340										

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Remarks: bgs = below ground surface; NA = Not Applicable/Available
Samples taken at 2'-4' bgs.

Project: 36673.002
Data File:SB-105.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFalls.ldf
Date: 11/29/04

Date Start/Finish: 10/28/04
Drilling Company: Lyon Drilling
Driller's Name: Harry Lyon
Drilling Method: Hollow Stem Auger
Bit Size: 6.25" OD
Auger Size: 4.25" ID
Rig Type: CME 45B
Sampling Method: 2" OD x 2'

Northing: 1,533,083.91
Easting: 396,743.20
Casing Elevation: NA

Borehole Depth: 15.4' below grade
Surface Elevation: 355.54

Geologist: Jennifer Sandorf

Well/Boring ID: SB-106

Client: Niagara Mohawk
A National Grid Company

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
0	355	1	0.6-2	0.9	- 7 17 22	NA	1.3			CONCRETE floor. Gray medium to coarse GRAVEL, little fine to coarse Sand, trace Cobbles, moderately loose to moderately dense, wet from concrete coring then dry.	
		2	2-4	0.9	14 22 27 20	49	1.5			Brown to gray medium to coarse GRAVEL, little Concrete chunks, little fine to coarse Sand, slight trace fine red Brick fragments, moderately loose to moderately dense, dry.	Borehole was backfilled to grade with cement-bentonite grout.
5	350	3	4-6	1.2	- 35 17 18	52	5.4	X		COBBLE. Brown fine to medium SAND, little to some coarse Gravel and Cobble sized misc. Rock fragments, moderately loose to moderately dense, dry.	
		4	6-8	0.7	35 23 13 12	36	3.4	X		Same as above, trace Rock fragments, moderately loose.	
		5	8-10	0.4	4 2 2 1	4	2.4			Dark brown fine to coarse SAND, little medium to coarse Gravel, trace Coal and red Brick fragments, moderately loose, moist.	
10	345	6	10-12	0.0	2 2 6 6	8	NA			No Recovery.	
		7	12-14	trace	4 5 5 9	10	2.9			Water depth at 13.0' bgs. Trace recovery, small pieces of red Brick fragments and coarse Gravel, wet.	
15		8	14-15.4	0.3	12 9 50/0.4	NA	4.6			Dark brown coarse GRAVEL, little fine to coarse Sand, Bricks, Wire fragments, moderately loose, wet.	
	340									Auger Refusal at 15.4' bgs.	

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Remarks: bgs = below ground surface; NA = Not Applicable/Available
Samples taken at 6'-8' bgs and 4.5'-6' bgs.

Project: 36673.002
Data File:SB-106.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFalls.ldf
Date: 11/29/04

Date Start/Finish: 10/15/04 - 10/18/04
Drilling Company: Lyon Drilling
Driller's Name: Harry Lyon
Drilling Method: Hollow Stem Auger
Bit Size: 6.25" OD
Auger Size: 3.25" ID
Rig Type: CME 45B
Sampling Method: 2" OD x 2'

Northing: 1,533,042.07
Easting: 396,758.92
Casing Elevation: 351.25

Borehole Depth: 33.3' below grade
Surface Elevation: 351.56

Geologist: Jennifer Sandorf

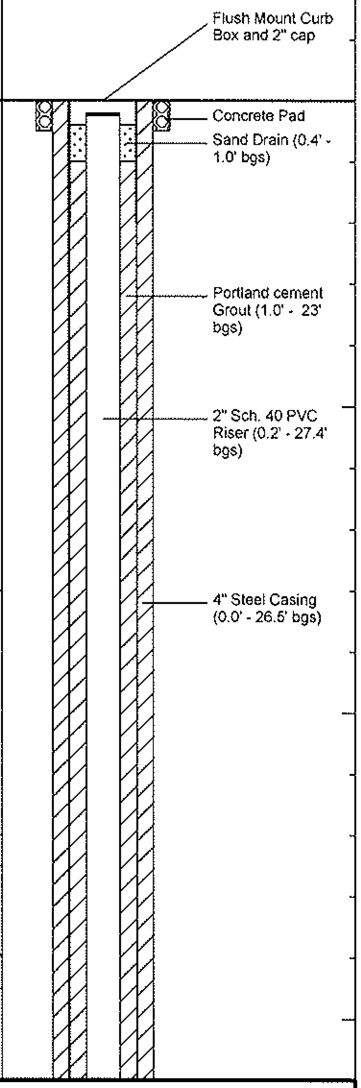
Well/Boring ID: MW-101R

Client: Niagara Mohawk
A National Grid Company

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows per 6 Inches	N - Value/ RQD (%)	PID Headspace (ppm)	Geologic Column	Stratigraphic Description
0	350	1	0.5-2	1.0	2 5 7 5	12	0.0		Brown fine to coarse SAND, some fine to coarse Gravel, little Cobbles, moderately loose to moderately dense, dry. [FILL]
		2	2-4	0.9	5 9 5 7	14	0.8		No Cobbles below 2.0' bgs.
5		3	4-6	0.5	4 4 3 3	7	3.4		
	345	4	6-8	0.4	4 3 2 4	5	4.5		Little Silt, trace red Brick fragments and Glass, 1" Ceramic Insulator fragment, from 6.0' - 8.0' bgs. [FILL]
		5	8-10	1.0	7 12 10 6	22	1.8		Black stained fine to coarse SAND, some fine to coarse Gravel, trace Cobbles, moderately loose to moderately dense, dry. [FILL]
10	340	6	10-12	0.9	8 8 11 17	19	6.0		Trace Cinders, 10.0' - 12.0' bgs.
		7	12-14	Trace	NA 3 3 6	6	0.3		COBBLE. Drill through rubble with Boulder Buster. ROCK fragments, trace recovery.
15		8	14-16	0.7	4 10 2 2	12	7.4		Black stained fine to coarse SAND, some fine to coarse Gravel, trace Cobbles, moderately loose to moderately dense, dry. Black stained fine to medium SAND, some Silt, trace Clay and Wood fibers, slight to moderate MGP-type odor, trace black sticky NAPL, wet. [FILL]

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available.
WOH = Weight of Hammer.
Minutes per foot not available due to stopping and starting of drilling.

Client:
Niagara Mohawk
A National Grid Company

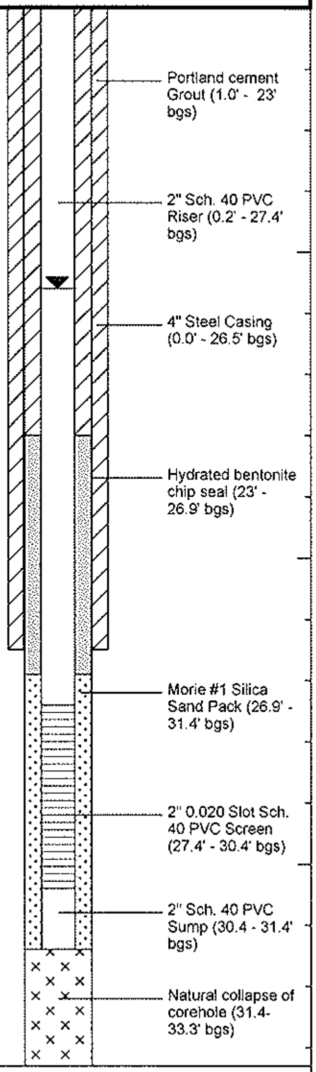
Site Location:
Little Falls (Mill St)
Former MGP Site
Little Falls, NY

Well/Boring ID: MW-101R

Borehole Depth: 33.3' below grade

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows per 6 Inches	N - Value/ RQD (%)	PID Headspace (ppm)	Stratigraphic Description
335	9	16-18	2.0	1 2 2 2	4	20.6	Dark gray to black fine to medium SAND, little to some Silt, slight MGP-type odor, trace oily NAPL, moderately dense, wet.
	10	18-20	1.7	1 WOH 1 1	NA	5.0	Black, trace Silt and Wood fibers, faint MGP-type odor, no apparent NAPL, moderately loose, wet, below 18.0' bgs. [FILL]
20 330	11	20-22	2.0	1 2 1 2	3	40.1	Light brown fine to medium SAND, little Silt, trace natural Organics (Roots), slight MGP-type odor, slightly plastic, moderately loose, wet. Some light gray-brown Silt and Clay, medium stiff, below 22.0' bgs.
	12	22-24	1.0	1 2 16 22	18	144	Little brown oily NAPL Sheen, wet.
25	13	24-26	0.6	4 5 3 25	8	341	
	14	26-26.4	0.1	50/0.4	NA	165	Some medium to coarse Gravel and Cobble fragments below 26.0' bgs.
325	15	26.5-28.3	1.8	NA	66%		Pink-gray GRANITE GNEISS, very hard, cannot be scratched with knife. Black stain at 27.65' bgs. Fractures at 27.1', 27.4', 27.6', 27.7', and 28.3', all subangular. Brown NAPL and sheen observed on fracture surfaces. Driller indicates sand seam at 27.2' bgs, Sand and NAPL blebs were observed in return water.
30 320	16	28.3-33.3	5.0	NA	94%		Pink-gray GRANITE GNEISS, fracture at 33.05' is at ~30° and has NAPL/sheen on surface. No NAPL or sheen apparent on other fracture surfaces. Also observed fracture oriented at ~70° in 32.6-33.0' section, although it is not open. Subhorizontal fractures occurred at 28.8', 29.7', 30.6', 31.65', 32.3', 32.65', 33.05', 33.15', and 33.45' bgs. Small rubble zone at 33.1'.
35							Base of Corehole at 33.3' bgs.

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available.
WOH = Weight of Hammer.
Minutes per foot not available due to stopping and starting of drilling.

Project: 36673.002
Data File:MW-101R.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFallsBR.ldf
Date: 11/22/04

Date Start/Finish: 1/13/05-1/25/05
Drilling Company: Parrott-Wolff, Inc.
Driller's Name: Glen Lansing
Drilling Method: Hollow Stem Auger
Bit Size: 5 7/8" OD
Auger Size: 4 1/4" ID
Rig Type: CME 75
Sampling Method: 2" OD x 2'

Northing: 1533042.5
Easting: 396746.7
Casing Elevation: 351.58

Borehole Depth: 50' below grade
Surface Elevation: 351.89

Geologist: Micheal Arlaukas

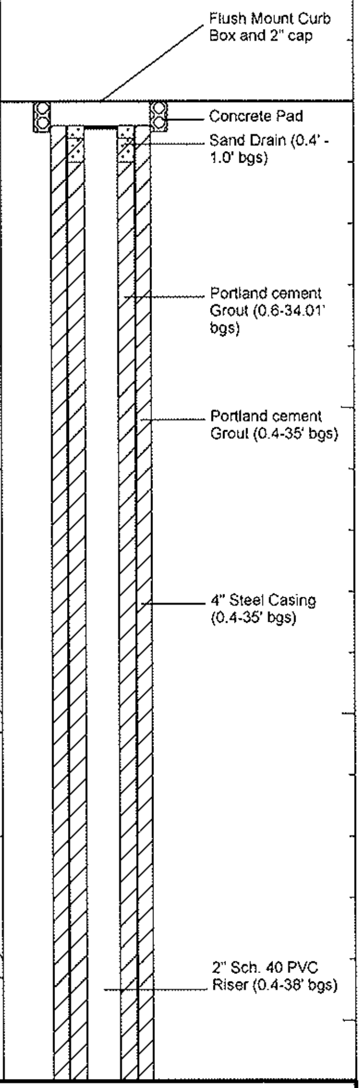
Well/Boring ID: MW-101RD

Client: Niagara Mohawk
A National Grid Company

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows per 6 Inches	N - Value/ RQD (%)	PID Headspace (ppm)	Geologic Column	Stratigraphic Description
0	350	1	0.5-2	0.9	9 12 10 8	22	0.2		Brown very fine SAND and SILT, trace Organics, frozen. Dark brown to gray fine to medium SAND, little coarse Sand, trace fine angular Gravel, moist.
		2	2-4	NA	8 8 7 8	13	NA		No Recovery. Tan brick fragment in spoon.
5		3	4-6	NA	6 6 6 5	12	NA		No Recovery. Rock fragment in spoon.
	345	4	6-8	0.2	9 8 8 7	16	NA		No Recovery. Black SILT in spoon.
		5	8-10	0.5	29 17 17 10	36	NA		Gray to pink granitic GNEISS rock fragments.
10	340	6	10-12	0.9	29 21 12 17	33	1.1		Black CINDERS, ASH, SLAG, COAL, GLASS, dry.
		7	12-14	0.8	18 11 5 4	16	2.1		Brown Silty SAND, little Brick, Wood Fibers, Rock fragments, moist. Dark gray Silty SAND, trace Organics (rootlets, wood fibers).
15		8	14-16	1.7	13 6 5 4	11	3.8		Tan Silty SAND, trace Organics and Brick fragments, moist to wet.

Well/Boring Construction



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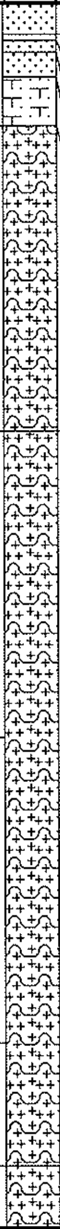
Remarks: bgs = below ground surface; NA = Not Applicable/Available.

Client: Niagara Mohawk A National Grid Company	**Site Location:** Little Falls (Mill St) Former MGP Site Little Falls, NY	**Well/Boring ID:** MW-101RD **Borehole Depth:** 50' below grade	

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows per 6 Inches	N - Value/ RQD (%)	PID Headspace (ppm)
	335	9	16-18	1.8	30 27 6 8	33	3.5
20	330	10	18-23	5.02	5 5 5 5 5	83.475	NA
25	325	11	23-28	5.0	5 7 6 6 6	92.5%	NA
30	320	12	28-33	5.11	5 6 6 6 7	100%	NA
		13	33-35	1.88	8 7	100%	NA
35		14	35-38	3.15	11	74.17%	NA

Geologic Column



Stratigraphic Description

Tan to brown Silty SAND.

Brown SILT.

Tan to gray fine SAND, trace Silt and Organics.

Gray fine to medium SAND.

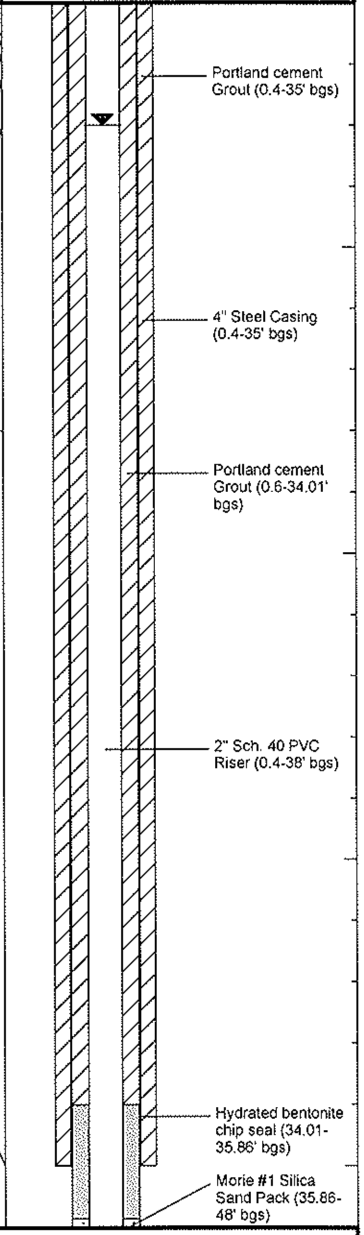
Black Silty SAND, trace Organics, slight organic odor, wet.

Light gray to pink medium grained GRANITE GNEISS, horizontal fracture at 18.77', 18.83', 18.98', 19.75', 20.04', 22.43', and 22.85' bgs, low angle fracture at 18.63-18.67' (30 degrees), 21.30-21.34' (30 degrees), and 21.71-21.75' (30 degrees), 80 degree fracture at 18.78-18.81' bgs. Possible relic phenocrysts or porphyroblasts - augen.

Light gray to pink medium grained GRANITE GNEISS, horizontal fracture at 23.35', 24.09', 24.49', 24.88', and 25.06' bgs, non-opened vertical fracture at 23.35-23.65' (70 degrees), and 33.88-35.0' bgs (80 degrees), non-opened low angle fracture at 27.35' bgs (30 degrees), 30.36-30.41' (20 degrees), 31.03-31.06' (15 degrees), 31.41-31.45' (20 degrees), 32.63-32.66' (25 degrees), and 33.70-33.74' bgs (20 degrees). Mechanical break at 23.02', 26.38', 27.28', 28.0', and 33.11' bgs. Possible augen.

Light gray medium grained GRANITE GNEISS, some pink grains, horizontal fracture at 36.05', 36.35', 36.65', and 36.91' bgs, vertical fracture at 35.0-36.05' (80 degrees) and 36.05-36.65' bgs (80 degrees). Mechanical break at 35.0' bgs.

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available.

Project: 36673.002
Data File:MW-101RD.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFallsBR.ldf
Date: 2/28/05

Client:
Niagara Mohawk
A National Grid Company

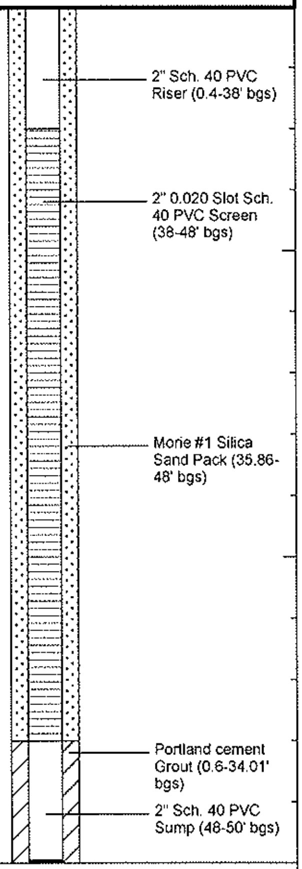
Site Location:
Little Falls (Mill St)
Former MGP Site
Little Falls, NY

Well/Boring ID: MW-101RD

Borehole Depth: 50' below grade

DEPTH ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows per 6 Inches	N - Value/ RQD (%)	PID Headspace (ppm)	Geologic Column	Stratigraphic Description
315	14	35-38	3.15	15 20	74.17%	NA		Light gray medium grained GRANITE GNEISS, some pink grains, horizontal fracture at 36.05', 36.35', 36.65', and 36.91' bgs, vertical fracture at 35.0-36.05' (80 degrees) and 36.05-36.65' bgs (80 degrees). Mechanical break at 35.0' bgs.
40 310	15	38-43	4.96	17 21 16 19 18	100%	NA		Light gray to pink medium grained GRANITE GNEISS, horizontal fracture at 38.45', 39.85', and 40.21' bgs. Mechanical break at 38.15', and 42.75' bgs.
45 305	16	43-48	4.77	NA NA NA NA NA	100%	NA		Light gray to pink (some orange) GRANITE GNEISS. Black fine grained Granite at 45.71' bgs, horizontal fracture at 45.48' and 46.07' bgs, low angle fracture at 44.09-44.13' (20 degrees), 46.38-46.44' (30 degrees), 46.84-46.88' (30 degrees), and 47.19-47.27' bgs (40 degrees). Mechanical break at 44.84', 44.96', and 47.81' bgs.
	17	48-50	2.15	7 8	76.92%	NA		Black/white medium grained GRANITE, horizontal fracture at 49.75' and 50.02' bgs. Mechanical break at 50.15' bgs. Broken zone at 48.02-48.1' bgs.
50 300 55								Base of Corehole at 50' bgs.

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available.

Project: 36673.002
Data File:MW-101RD.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFallsBR.ldf
Date: 2/28/05

Date Start/Finish: 10/19/04 - 10/26/04
Drilling Company: Lyon Drilling
Driller's Name: Harry Lyon
Drilling Method: Hollow Stem Auger
Bit Size: 6.25" OD
Auger Size: 4.25" ID
Rig Type: CME 45B
Sampling Method: 2" OD x 2'

Northing: 1,533,035.80
Easting: 396,532.60
Casing Elevation: 356.10

Borehole Depth: 39.0' below grade
Surface Elevation: 356.63

Geologist: Jennifer Sandorf

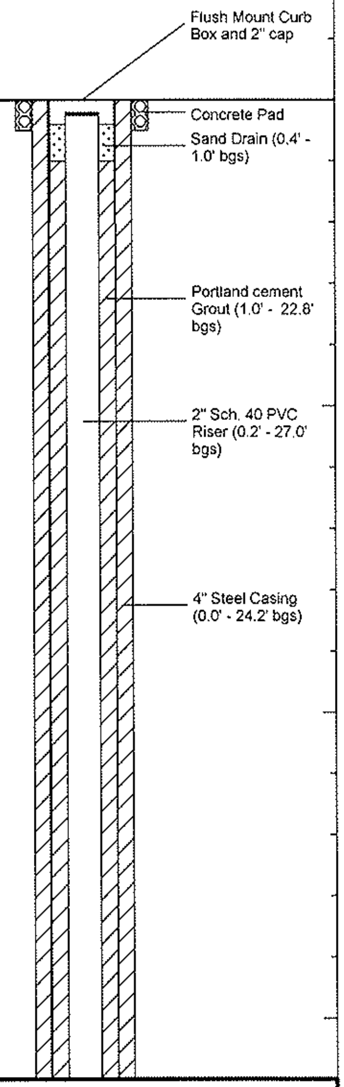
Well/Boring ID: MW-102R

Client: Niagara Mohawk,
A National Grid Company

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows per 6 Inches	N - Value/ RQD (%)	PID Headspace (ppm)	Stratigraphic Description
0		1	1-2	0.6	5 5 5 6	10	7.4	Gray-brown coarse GRAVEL fill, some fine to coarse Sand, moderately loose, dry.
	355	2	2-4	0.6	10 13 6 12	19	9.0	
5		3	4-6	0.8	5 7 6 7	13	2.8	Little rounded Cobbles, 4.0' - 6.0' bgs.
	350	4	6-8	0.6	12 7 6 7	13	19.1	Trace red Brick fragments, below 6.0' bgs.
		5	8-10	0.5	3 7 6 4	13	55.1	Moist below 8.0' bgs.
10	345	6	10-12	1.0	7 9 15 18	24	174	Little broken cobble-sized Rock fragments, 10.0' - 12.0' bgs.
		7	12-14	0.0	3 4 7 7	11	NA	No Recovery.
15		8	14-16	0.1	10 10 7 7	17	1.5	Gray ROCK fragments.

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available; WOR = Weight of Rod. Minutes per foot not available due to frequent stopping and starting of drilling.

Project: 36673.002
Data File:MW-102R.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFallsBR.ldf
Date: 11/18/04

Client:
Niagara Mohawk,
A National Grid Company

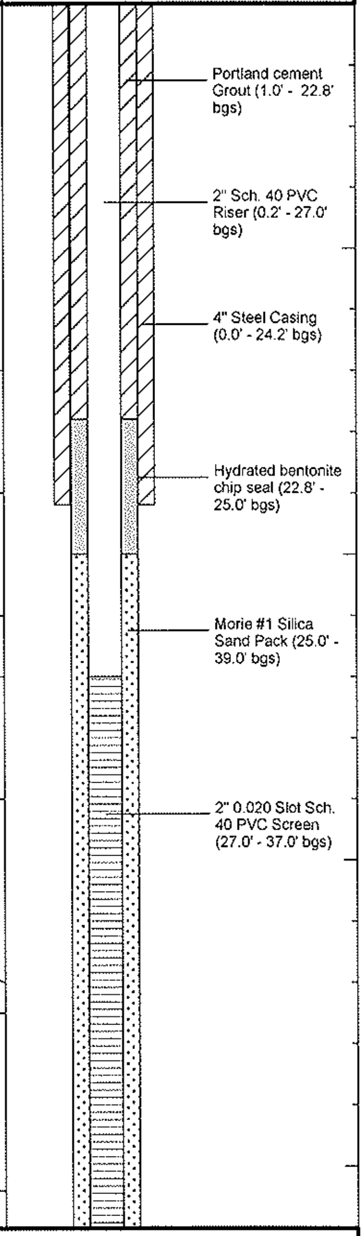
Site Location:
Little Falls (Mill St)
Former MGP Site
Little Falls, NY

Well/Boring ID: MW-102R

Borehole Depth: 39.0' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows per 6 Inches	N - Value/ RQD (%)	PID Headspace (ppm)	Geologic Column	Stratigraphic Description
	340	9	16-18	Trace	5 6 5 4	11	1.0		Brown fine to coarse SAND, little fine to coarse Gravel, loose, moist to wet.
		10	18-20	0.4	WOR/ 24"	NA	1.7		Trace red Brick fragments and white flaky-substance, wet, 18.0' - 20.0' bgs.
20	335	11	20-22	0.9	1 1 2 1	3	1.0		Trace Silt, clear Glass, Clinker, wet, soft, 20.0' - 22.0' bgs.
		12	22-24	0.0	1 7 2 5	9	NA		No Recovery. Possible Boulder at ~23' bgs.
25		13	24-26	Trace	50/ 0.0	NA	2.3		Pinkish-gray GRANITIC GNEISS, no apparent staining on broken surfaces, very hard, subangular fractures. Broken zone 24.0' - 24.6' bgs. Loss of core water during drilling, did not get any return.
	330	14	26-27	1.4	NA	86	NA		Gray and pinkish-gray GRANITIC GNEISS. Fractures at approximately 40° at 26.4', 26.8', and 26.9' bgs.
		15	27-29	2.5	NA	92	NA		Gray GRANITIC GNEISS. Sub-horizontal fractures at 27.5', 28.0', 28.1', 28.7', and 28.9' bgs.
30	325	16	29-32	2.6	NA	69	NA		Gray GRANITIC GNEISS, horizontal banding, very hard. Fractures at 29.2', 30.1', 31.0', and 31.25' bgs.
		17	32-32.5	0.2	NA	0	NA		Gray GRANITIC GNEISS. Rubble.
35		18	32.5-35.4	3.2	NA	100	NA		Gray GRANITIC GNEISS, horizontal banding, very hard. Mostly pink band 33.6' - 34.0' bgs. Sub-horizontal fractures at 33.1', 34.3', 35.1', 35.65' bgs.
		19	35.4-37	1.7	NA	85	NA		Gray GRANITIC GNEISS.

Well/Boring Construction



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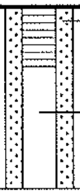
Remarks: bgs = below ground surface; NA = Not Applicable/Available; WOR = Weight of Rod. Minutes per foot not available due to frequent stopping and starting of drilling.

Client:
Niagara Mohawk,
A National Grid Company

Site Location:
Little Falls (Mill St)
Former MGP Site
Little Falls, NY

Well/Boring ID: MW-102R

Borehole Depth: 39.0' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows per 6 Inches	N - Value/ RQD (%)	PID Headspace (ppm)	Geologic Column	Stratigraphic Description	Well/Boring Construction
	320	19	35.4-37	1.7	NA	85	NA		Gray GRANITIC GNEISS. 2-3" Cobbles at top of return appear to have some solution weathering, however, it is unclear if the Cobbles are from this interval or brought down from above. Sub-horizontal fractures at 35.65', 36.55', and 37.1' bgs.	 Morie #1 Silica Sand Pack (25.0' - 39.0' bgs)
		20	37-39	2.2	NA	100	NA		Gray to pinkish-gray GRANITIC GNEISS. Sub-horizontal fractures at 37.55', 38.2', 38.6', and 39.2' bgs.	2" Sch. 40 PVC Sump (37.0' - 39.0' bgs)
									Base of Corehole at 39' bgs.	
40										
	315									
45										
	310									
50										
	305									
55										

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Remarks: bgs = below ground surface; NA = Not Applicable/Available; WOR = Weight of Rod. Minutes per foot not available due to frequent stopping and starting of drilling.

Project: 36673.002
Data File:MW-102R.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFallsBR.ldf
Date: 11/18/04

Date Start/Finish: 1/11/05-1/20/05
Drilling Company: Parrott-Wolff, Inc.
Driller's Name: Glen Lansing
Drilling Method: Hollow Stem Auger
Bit Size: 5 7/8" OD
Auger Size: 4 1/4" ID
Rig Type: CME 75
Sampling Method: 2" OD x 2'

Northing: 1,533,046.5
Easting: 396,684.8
Casing Elevation: NA

Borehole Depth: 39' below grade
Surface Elevation: 354.16

Geologist: Micheal Arlaukas

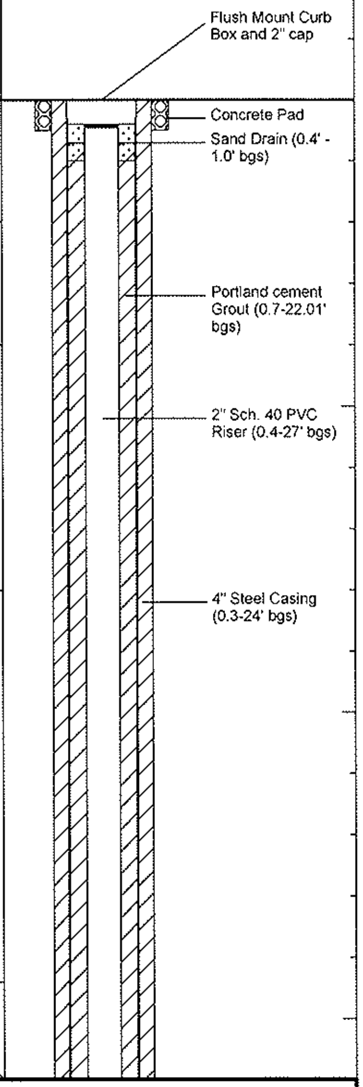
Well/Boring ID: MW-103R

Client: Niagara Mohawk
A National Grid Company

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows per 6 Inches	N - Value/ RQD (%)	PID Headspace (ppm)	Geologic Column	Stratigraphic Description
	355								
0		1	0.5-2	0.7	9 12 10 8	22	0.0		Dark Brown medium to coarse SAND, little Silt, trace Organics and fine angular Gravel, moist.
		2	2-4	0.5	8 8 7 8	13	0.2		Brown fine to medium SAND, little to some Silt, trace fine to medium angular Gravel, moist.
5	350	3	4-6	NA	6 6 6 5	12	NA		No Recovery.
		4	6-8	NA	9 8 8 7	16	NA		
	345	5	8-10	1.2	29 17 17 10	36	0.0		Brown fine to medium SAND, little Silt, trace fine to medium angular Rock fragments, moist.
10		6	10-12	0.5	29 21 12 17	33	0.3		
		7	12-14	1.3	18 11 5 4	16	1.6		
15	340	8	14-16	1.2	13 6 5 4	11	4.1		Dark gray fine to medium SAND, little Silt, trace Brick, Cinders, Coal fragments, moist Augers grinding something hard, possibly metallic.

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available.

Project: 36673.002
Data File:MW-10R.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFallsBR.ldf
Date: 2/28/05

Client:

Niagara Mohawk
A National Grid Company

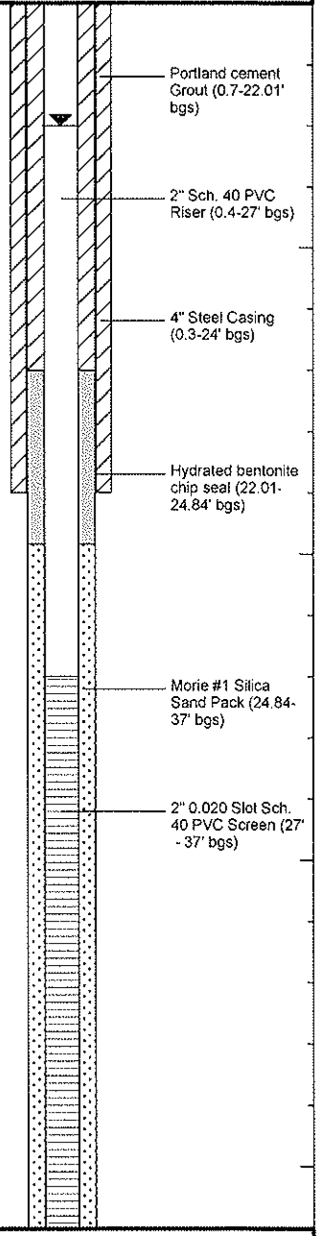
Site Location:

Little Falls (Mill St)
Former MGP Site
Little Falls, NY

Well/Boring ID: MW-103R

Borehole Depth: 39' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows per 6 Inches	N - Value/ RQD (%)	PID Headspace (ppm)	Geologic Column	Stratigraphic Description	Well/Boring Construction
		9	16-18	1.2	30 27 6 8	33	3.5		Dark gray fine to medium SAND, little Silt, trace Brick, Cinders, Coal fragments, moist Orange-brown fine to medium SAND, moist to wet.	
20	335	10	18-20	1.9	5 2 2 2	4	3.1		Orange fine SAND. Gray fine SAND, little Silt, trace Organics (layered rootlets, leaves, and sticks with organic odor), wet.	
		11	20-22	1.6	1 2 1 2	3	3.0		Gray fine to medium SAND, little Silt, trace Organics (as above).	
	330	12	22-24	2.0	4 4	93.75%	NA		Light gray to pink medium grained GRANITE GNEISS, horizontal fracture at 23.85' bgs, non-opened 80 degree vertical fracture at 22-22.9' bgs.	
25	325	13	24-29.5	5.40	9 10 7 6 7 8	74.13%	NA		Light gray to pink medium grained GRANITE GNEISS, horizontal fracture at 25.51', 26.35', 27.15' 28.24', and 28.51' bgs, non-opened 80 degree vertical fracture at 25.22-25.81' bgs, low angle fractures at 24.26' (10 degrees) and 25.94' bgs (15 degrees), 60 degree fracture at 28.73-29.24' bgs.	
30		14	29.5-31.5	2.08	7 9	90%	NA		Light gray to pink medium grained GRANITE GNEISS, horizontal fracture at 30.08' and 30.68' bgs, low angle fracture at 31.35' (10 degrees) bgs.	
	320	15	31.5-34.5	3.03	6 7 6	91.03%	NA		Light gray to pink medium grained GRANITE GNEISS, horizontal fracture at 34.27' bgs.	
35		16	34.5-39	4.45	9	90.14%	NA		Light gray to pink medium grained GRANITE GNEISS, horizontal fracture at 30.08' and 30.68' bgs, low angle fracture at 31.35' (10 degrees) bgs.	



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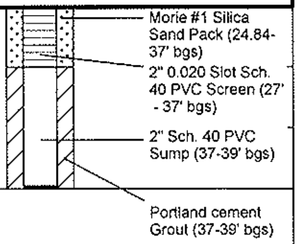
Remarks: bgs = below ground surface; NA = Not Applicable/Available.

Client:	**Site Location:**	
Niagara Mohawk A National Grid Company	Little Falls (Mill St) Former MGP Site Little Falls, NY	**Well/Boring ID:** MW-103R **Borehole Depth:** 39' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows per 6 Inches	N - Value/ RQD (%)	PID Headspace (ppm)	Geologic Column	Stratigraphic Description	Well/Boring Construction
		16	34.5-39	4.45	9 9 9 4	90.14%	NA		Light gray to pink medium grained GRANITE GNEISS, horizontal fracture at 30.08' and 30.68' bgs, low angle fracture at 31.35' (10 degrees) bgs.	 Morie #1 Silica Sand Pack (24.84-37' bgs) 2" 0.020 Slot Sch. 40 PVC Screen (27' - 37' bgs) 2" Sch. 40 PVC Sump (37-39' bgs) Portland cement Grout (37-39' bgs)
	315								Base of Corehole at 39' bgs.	
40										
	310									
45										
	305									
50										
	300									
55										

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Remarks: bgs = below ground surface; NA = Not Applicable/Available.

Project: 36673.002
Data File:MW-10R.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFallsBR.ldf
Date: 2/28/05

Date Start/Finish: 10/13/04
Drilling Company: Lyon Drilling
Driller's Name: Jeff Grant
Drilling Method: Hollow Stem Auger
Bit Size: 6.25" OD
Auger Size: 3.25" ID
Rig Type: CME 45B
Sampling Method: 2" OD x 2'

Northing: 1,533,163.52
Easting: 396,611.01
Casing Elevation: 357.61

Borehole Depth: 26.5' below grade
Surface Elevation: 358.03

Geologist: Jennifer Sandorf

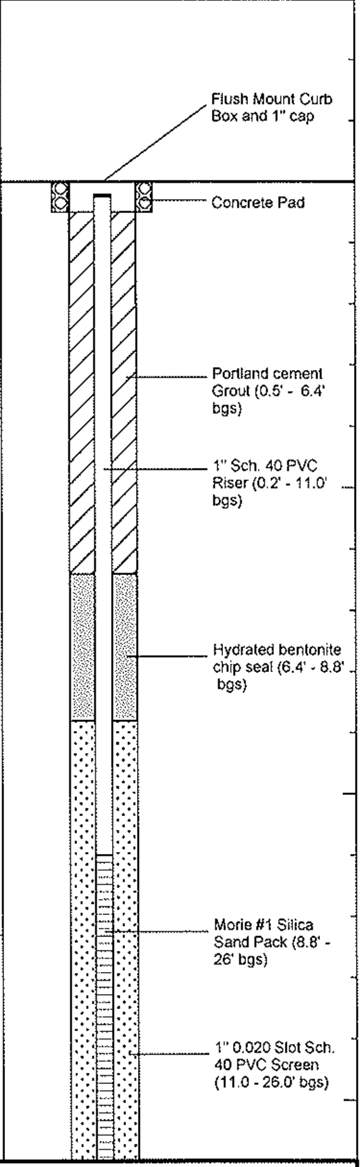
Well/Boring ID: PZ-101

Client: Niagara Mohawk

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
	360									
0		1	0.5-2	0.4	NA 4 5 2	9	0.6			ASPHALT Brown fine to coarse SAND, some coarse Gravel and Cobbles, moderately loose, dry.
	355	2	2-4	0.5	7 5 3 4	8	0.9			
5		3	4-6	0.1	2 3 2 2	5	1.5			Trace red Brick fragments from 4.0' - 6.0' bgs.
		4	6-8	0.4	4 4 3 4	7	2.4			No Brick fragments from 6.0' - 8.0' bgs, moist.
	350	5	8-10	Trace	WOR 2 3 1	5	NA			Moist to wet from 8.0' - 10.0' bgs.
10		6	10-12	0.2	WOR 1 2 1	3	1.4			Wet from 10.0' - 12.0' bgs.
	345	7	12-14	0.6	1 4 5 5	9	2.4			Red BRICK fragments, Wood fibers, wet.
15		8	14-16	0.1	1 2 4 6	6	0.8			

Well/Boring Construction



Remarks: bgs = below ground surface; NA = Not Applicable/Available.
WOR = Weight of Rod.

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Project: 36673.002
Data File:PZ-101.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFalls.ldf
Date: 10/22/04

Client:
Niagara Mohawk

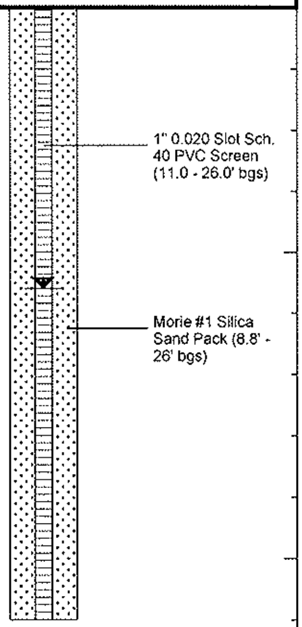
Site Location:
Little Falls (Mill St)
Former MGP Site
Little Falls, NY

Well/Boring ID: PZ-101

Borehole Depth: 26.5' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
		9	16-18	0.8	4 6 3 3	9	7.3			Red BRICK fragments, Wood fibers, wet. Red BRICK fragments
	340	10	18-20	0.1	WOR 1 2 2	3	0.8			Red BRICK fragments, Wood fibers, wet.
20		11	20-22	0.3	7 6 2 2	8	1.4			
	335	12	22-24	0.1	WOR 1	NA	0.5			WOOD fibers. Black stained from 22.0' - 24.0' bgs.
25		13	24-26	Trace	23 8 4 3	12	0.5			Trace Brick from 24.0' - 26.0' bgs.
		14	26-26.5	Trace	11	NA	1.0			WOOD fibers, little Rock fragments (pink Granite or Granitic Gneiss)
										Auger Rufusal at 26.5' bgs.
	330									
30										
	325									
35										

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available.
WOR = Weight of Rod.

Date Start/Finish: 10/11/04
Drilling Company: Lyon Drilling
Driller's Name: Jeff Grant
Drilling Method: Hollow Stem Auger
Bit Size: 6.25" OD
Auger Size: 3.25" ID
Rig Type: CME 45B
Sampling Method: 2" OD x 2'

Northing: 1,533,088.93
Easting: 396,595.59
Casing Elevation: 356.10

Borehole Depth: 12.5' below grade
Surface Elevation: 356.32

Geologist: Jennifer Sandorf

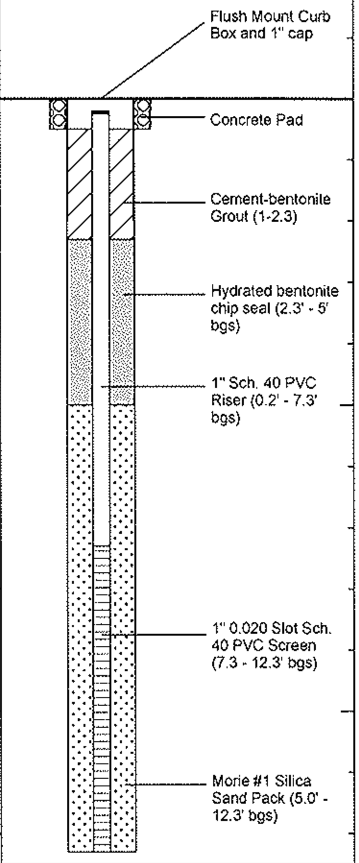
Well/Boring ID: PZ-102

Client: Niagara Mohawk

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	355	1	0.5-2	1.1	NA 13 16 19	29	0.7			ASPHALT Brown fine to medium SAND, little Silt, trace to little coarse Gravel and Pebbles, moderately loose to moderately dense, dry. Color change to dark brown from 2' - 2.5' bgs.
		2	2-4	0.9	4 2 2 2	4	0.7			Red Brick fragments.
5		3	4-6	0.9	4 3 2 3	5	0.8			
	350	4	6-8	1.1	3 3 1 1	4	5.2			Trace wood fibers from 6' - 7.1' bgs.
		5	8-10	1.4	1 20 17 27	37	1.0			Red BRICK fragments, moist. Trace black staining from 8.5' - 8.6' bgs. Pebble with purple-blue coloring at 9.3' bgs.
10	345	6	10-12	0.0	50/.2 NA NA NA	NA	NA			Red Brick fragments.
		7	12-12.5	0.6	50/.3	NA	0.7			Red BRICK fragments, moist.
15										Auger Refusal at 12.5' bgs.

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available.
PID readings taken on 10/12/04

Project: 36673.002
Data File:PZ-102.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFalls.ldf
Date: 10/19/04

Date Start/Finish: 10/14/04
Drilling Company: Lyon Drilling
Driller's Name: Jeff Grant
Drilling Method: Hollow Stem Auger
Bit Size: 6.25" OD
Auger Size: 3.25" ID
Rig Type: CME 45B
Sampling Method: 2" OD x 2'

Northing: 1,533,157.51
Easting: 396,580.58
Casing Elevation: 357.85

Borehole Depth: 17.2' below grade
Surface Elevation: 358.25

Geologist: Jennifer Sandorf

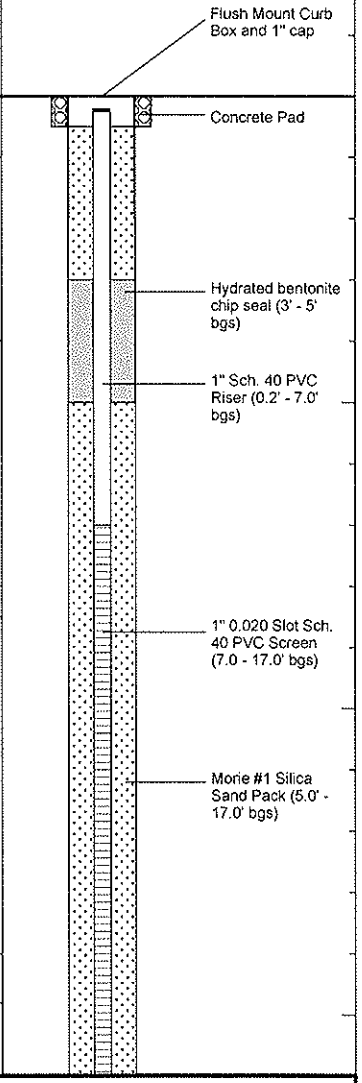
Well/Boring ID: PZ-103

Client: Niagara Mohawk

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
	360									
0		1	1-2	0.6	NA NA 22 22	NA	1.9			ASPHALT Dark brown fine to coarse SAND, some pink and gray Cobbles, moderately dense, dry. Trace red Brick from 2.0' to 4.0' bgs.
	355	2	2-4	0.6	10 15 10 10	25	1.4			
5		3	4-6	0.7	4 3 13 30	16	2.7			Brown fine to coarse SAND, little fine to coarse Gravel, moderately loose to moderately dense, trace Wood fibers, dry to moist. Trace Brick 4.6' to 4.7' bgs.
		4	6-8	0.5	14 5 11 10	16	1.1			Little to some gray Cobbles, little Ash-like material.
	350	5	8-10	0.4	NA WOR 4 6	NA	0.9			COBBLE. Red BRICK fragments, Wood fibers, moist.
10		6	10-12	0.5	10 5 6 6	11	6.8			Brick, wood, cinders.
	345	7	12-14	0.9	28 6 4 4	10	0.9			Moist to wet.
15		8	14-16	1.0	3 6 3 1	9	1.0			CINDERS and CLINKERS. Reddish-brown SILT, some fine Sand, trace to little Clay, moderately soft, slightly plastic, moist to wet.

Well/Boring Construction



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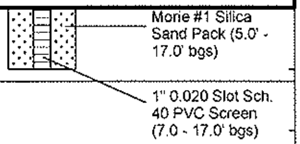
Remarks: bgs = below ground surface; NA = Not Applicable/Available.
WOR = Weight of Rod.
Sample taken from 8.5'-10.0' bgs.

Client:
Niagara Mohawk

Site Location:
Little Falls (Mill St)
Former MGP Site
Little Falls, NY

Well/Boring ID: PZ-103

Borehole Depth: 17.2' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
		9	16-17.2	0.6	1 1 50/.3	NA	1.8			Gray-brown SILT, some fine Sand, trace Clay, trace to little natural organics (wood pieces), moderately soft, slightly plastic, wet.	
										Auger Refusal at 17.2' bgs.	
	340										
20											
	335										
25											
	330										
30											
	325										
35											

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Remarks: bgs = below ground surface; NA = Not Applicable/Available.
WOR = Weight of Rod.
Sample taken from 8.5'-10.0' bgs.

Date Start/Finish: 10/14/04 - 10/19/04
Drilling Company: Lyon Drilling
Driller's Name: Harry Lyon
Drilling Method: Hollow Stem Auger/ Flushjoint
Bit Size: 6.25" OD
Auger Size: 3.25" ID
Rig Type: CME 45B
Sampling Method: 2" OD x 2'

Northing: 1,533,171.80
Easting: 396,637.43
Casing Elevation: 358.18

Borehole Depth: 13.8' below grade
Surface Elevation: 358.51

Geologist: Jennifer Sandorf

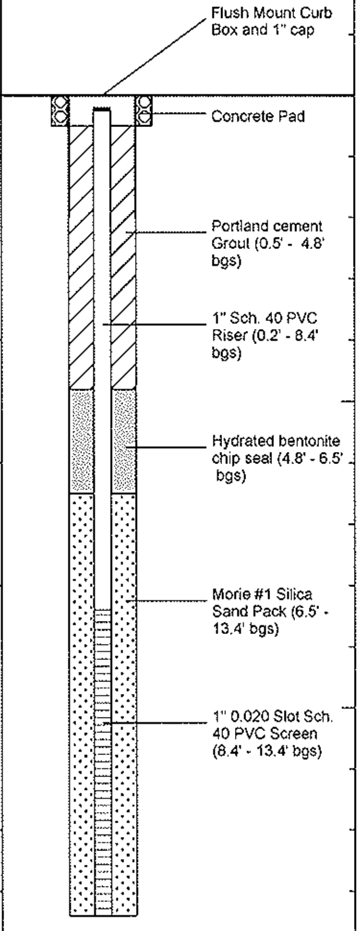
Well/Boring ID: PZ-104

Client: Niagara Mohawk
A National Grid Company

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
	360									
0										ASPHALT. Auger to 1.0' bgs.
		1	1-2	0.6	6 6	NA	1.5			Dark brown fine to coarse SAND, little to some fine to coarse Gravel, trace Cobbles, moderately loose, dry. Trace red Brick fragments, 2.0' - 4.0' bgs.
	355	2	2-4	0.7	2 2 3 4	5	2.2			
5		3	4-6	0.1	4 3 2 2	5	1.6			Trace Recovery. Red BRICK and COBBLE fragments.
		4	6-8	0.5	5 4 3 10	7	1.4			Dark brown fine to coarse SAND, little Cobbles, red Brick fragments, and Wood fibers, dry to moist.
	350	5	8-10	0.4	WOR 30 16 9	46	NA			Red BRICK fragments, some Cinders and Ash-like material, moist.
10		6	10-12	0.3	2 2 1 12	3	3.1			Some Wood fiber, 10.0' - 12.0' bgs.
										Drive Boulder Buster to 13.0' bgs.
	345	7	13-13.8	Trace	50/0.3	NA	NA			Trace Recovery. Red BRICK, RUBBLE, and ROCK.
15										Auger Refusal at 13.8' bgs.

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available; WOR = Weight of Rod.

Project: 36673.002
Data File:PZ-104.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFalls.ldf
Date: 11/18/04

Date Start/Finish: 10/11/04-10/12/04
Drilling Company: Lyon Drilling
Driller's Name: Jeff Grant
Drilling Method: Hollow Stem Auger
Bit Size: 6.25" OD
Auger Size: 3.25" ID
Rig Type: CME 45B
Sampling Method: 2" OD x 2'

Northing: 1,533,088.31
Easting: 396,568.06
Casing Elevation: 355.90

Borehole Depth: 28.3' below grade
Surface Elevation: 356.27

Geologist: Jennifer Sandorf

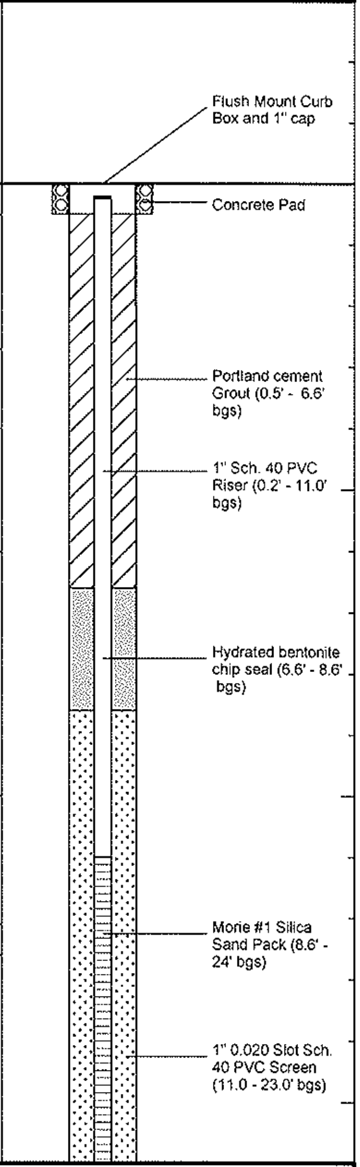
Well/Boring ID: PZ-105

Client: Niagara Mohawk

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0	355	1	0.5-2	0.5	NA 21 35 14	56	0.9			ASPHALT Gray-brown fine to medium SAND, little Silt, trace coarse Gravel, moderately dense, dry.
		2	2-4	1.2	8 3 2 2	5	1.2			Color change to dark brown at 2.0' bgs. Red Brick fragments, fine to medium Sand-sized, dry to moist.
5		3	4-6	1.0	15 7 5 4	12	1.6			Dark brown fine to medium SAND, little to some medium to coarse Gravel, trace red Brick fragments, moist.
	350	4	6-8	0.6	4 30 2 1	32	0.7			Red BRICK fragments, trace Wood fibers, moist.
		5	8-10	0.5	6 5 10 5	15	1.6			Red BRICK fragments, trace Wood fibers, trace black stains, moist, moderately loose.
10	345	6	10-12	0.8	2 4 4 2	8	2.9			Brown SILT, some fine Sand, trace red Brick fragments and Wood fibers, moderately soft to medium stiff, moist.
		7	12-14	0.9	4 4 3 2	7	1.0			Red BRICK fragments, moist. Black CINDERS, ASH.
15		8	14-16	1.2	1 2 2 1	4	1.2			Slight trace red Brick.

Well/Boring Construction



BBL
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Remarks: bgs = below ground surface; NA = Not Applicable/Available.
WOH = Weight of Hammer.
WOR = Weight of Rod.

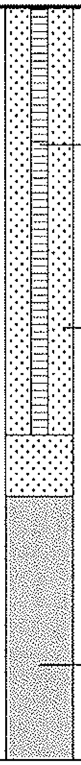
Client:
Niagara Mohawk

Site Location:
Little Falls (Mill St)
Former MGP Site
Little Falls, NY

Well/Boring ID: PZ-105

Borehole Depth: 28.3' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	340	9	16-18	0.0	1 2 2 1	4	NA			Slight trace of black Cinders, no measureable recovery.	
		10	18-19.7	1.3	WOH	NA	5.5			CINDERS, trace red Brick, wet. Dark brownish-gray SILT, some fine Sand, soft, plastic, no apparent odor, wet.	1" 0.020 Slot Sch. 40 PVC Screen (11.0 - 23.0' bgs)
20		11	19.7-20.9	1.3	1	NA	5.5				
	335	12	20.9-22	0.6	1 WOR	NA	3.3				Morie #1 Silica Sand Pack (8.6' - 24' bgs)
		13	22-24	0.0	WOH/2'	NA	NA			No recovery	
25		14	24-26	1.4	1 11 7 4	18	4.2			Dark brown-gray fine SAND and SILT, trace Clay, soft loose, wet.	
	330	15	26-28	2.0	3 5 6 10	11	4.4			Dark gray SILT and fine SAND, little natural Organics (wood), medium stiff, slightly plastic, wet.	Hydrated bentonite chip seal (24.0' - 28.3' bgs)
		16	28-28.3	0.9	50/.3	NA	4.3			Trace shells, piece of limestone at bottom of spoon, at 28.3' bgs.	
										Spoon Refusal at 28.3' bgs.	
30											
	325										
35											



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Remarks: bgs = below ground surface; NA = Not Applicable/Available.
WOH = Weight of Hammer.
WOR = Weight of Rod.

Date Start/Finish: 10/13/04
Drilling Company: Lyon Drilling
Driller's Name: Jeff Grant
Drilling Method: Hollow Stem Auger
Bit Size: 6.25" OD
Auger Size: 3.25" ID
Rig Type: CME 45B
Sampling Method: 2" OD x 2'

Northing: 1,533,098.37
Easting: 396,616.52
Casing Elevation: 355.85

Borehole Depth: 17' below grade
Surface Elevation: 356.19

Geologist: Jennifer Sandorf

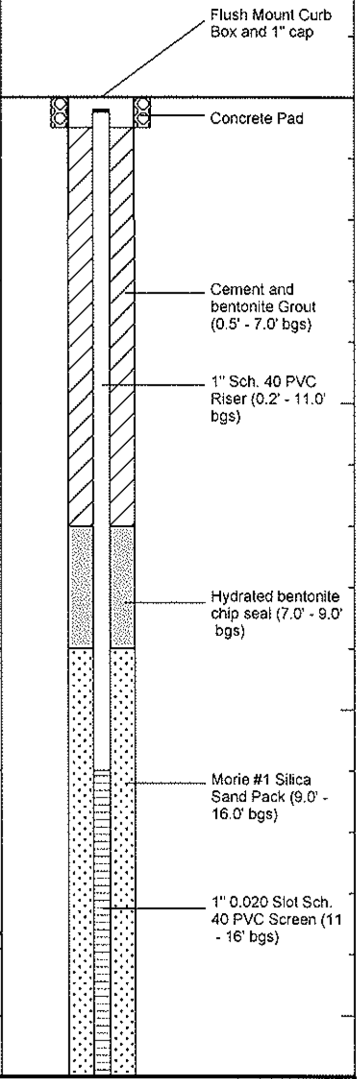
Well/Boring ID: PZ-106

Client: Niagara Mohawk

Location: Little Falls (Mill St)
Former MGP Site
Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description
0					NA NA					ASPHALT
	355	1	1-3	0.8	12 12 27 50/.3	39	0.9			Dark brown to brown fine SAND, little Silt, little coarse Gravel to Cobbles, loose, dry. Refusal on cobble, driller notes large cobbles at 2.5' bgs.
		2	3-5	0.4	3 7 5 5	12	1.3			Dark brown fine to coarse SAND, little coarse Gravel and Cobbles, trace red Brick at bottom of spoon, moderately loose, dry to moist.
5	350	3	5-7	0.5	3 3 1 2	4	10.4			Red BRICK fragments, little Wood fibers with blue-green staining, moderately loose to moderately dense, moist.
		4	7-9	0.1	WOR 1 2 2	3	1.7			Red BRICK fragments, little dark brown fine to medium Sand, moderately loose, moist.
10		5	9-11	0.4	1 7 5 7	12	4.0			Red BRICK fragments, Glass, Cinders, Slag, moderately loose, moist.
	345	6	11-13	0.9	2 1 1 1	2	3.7			CINDERS, Slag, Ash, trace red Brick fragments, moderately loose, wet.
		7	13-15	1.0	3 4 3 6	7	2.0			Brown SILTY CLAY, Stiff, slightly plastic, wet. Brown fine to medium SAND, trace Silt, trace Cobble, moderately loose, wet.
15		8	15-17	0.5	1 12	25	1.2			Brown fine SAND and SILT, trace Cobble, moderately loose, slightly plastic, wet.

Well/Boring Construction



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Remarks: bgs = below ground surface; NA = Not Applicable/Available.
WOR = Weight of Rod.
PID readings taken on 10/12/04

Client:
Niagara Mohawk

Site Location:
Little Falls (Mill St)
Former MGP Site
Little Falls, NY

Well/Boring ID: PZ-106

Borehole Depth: 17' below grade

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
	340	8	15-17	0.5	13 15	25	1.2		▦	Brown fine SAND and SILT, trace Cobble, moderately loose, slightly plastic, wet.	
										Bottom of Boring at 17' bgs.	
20											
	335										
25											
	330										
30											
	325										
35											

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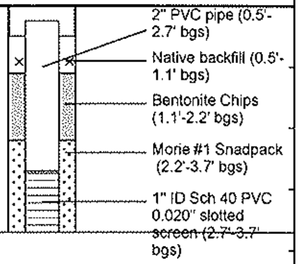
Remarks: bgs = below ground surface; NA = Not Applicable/Available.
WOR = Weight of Rod.
PID readings taken on 10/12/04

Date Start/Finish: 10/29/04 **Drilling Company:** Lyon Drilling **Driller's Name:** Harry Lyon **Drilling Method:** Hollow Stem Auger **Bit Size:** 6.25" OD **Auger Size:** 4.25" ID **Rig Type:** CME 45B **Sampling Method:** 2" OD x 2'	**Northing:** 1,533,161.24 **Easting:** 396,740.21 **Casing Elevation:** NA **Borehole Depth:** 3.7' below grade **Surface Elevation:** 355.58 **Geologist:** Jennifer Sandorf	**Well/Boring ID:** VP-101 **Client:** Niagara Mohawk A National Grid Company **Location:** Little Falls (Mill St) Former MGP Site Little Falls, NY

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
0										CONCRETE floor.	
	355									Gray crushed GRAVEL, wet from coring concrete, then dark brown fine to coarse Sand, little to some fine to coarse Gravel, trace Silt, moderate dense, moist. [FILL]	
										Dark gray medium to coarse GRAVEl, loose, wet.	
										Red BRICK fragments, moderately dense, dry to moist.	
5	350										
10	345										
15	340										

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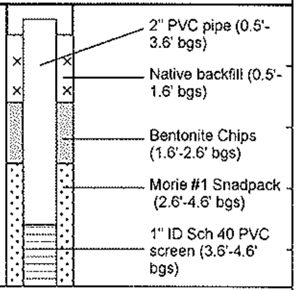
Remarks: bgs = below ground surface; NA = Not Applicable/Available
VP-101 installed adjacent to SB-105. Stratigraphic description taken from soil boring SB-105.

Project: 36673.002
Data File:VP-101.dat

Template:J:\Rockware\LogPlot 2001\LogFiles\36673\LittleFalls.ldf
Date: 11/30/04

Date Start/Finish: 10/28/04	**Northing:** 1,533,085.60	**Well/Boring ID:** VP-102
Drilling Company: Lyon Drilling	**Easting:** 396,743.20	
Driller's Name: Harry Lyon	**Casing Elevation:** NA	**Client:** Niagara Mohawk A National Grid Company
Drilling Method: Hollow Stem Auger		
Bit Size: 6.25" OD	**Borehole Depth:** 4.6' below grade	**Location:** Little Falls (Mill St) Former MGP Site Little Falls, NY
Auger Size: 4.25" ID	**Surface Elevation:** 355.53	
Rig Type: CME 45B		
Sampling Method: 2" OD x 2'	**Geologist:** Jennifer Sandorf	

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	Blows / 6 Inches	N - Value	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Well/Boring Construction
0										CONCRETE floor.	
	355									Gray medium to coarse GRAVEL, little fine to coarse Sand, trace Cobbles, moderately loose to moderately dense, wet from concrete coring then dry.	
										Brown to gray medium to coarse GRAVEL, little Concrete chunks, little fine to coarse Sand, slight trace fine red Brick fragments, moderately loose to moderately dense, dry.	
										COBBLE.	
5	350										
10	345										
15	340										

BBL
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Remarks: bgs = below ground surface; NA = Not Applicable/Available
VP-102 installed adjacent to SB-106. Stratigraphic description taken from soil boring SB-106.

Date Start/Finish:	8/17/09	**Northing:**	NA
Drilling Company:	Parratt Wolff	**Easting:**	NA
Driller's Name:	Lee Penrod/Rodney Fisk		
Drilling Method:	HSA/NX-Core B.I/5"7/8 Rot.Bit NX-Core Barrel/5" 7/8 Rot. Bit	**Casing Elevation:**	NA
		Surface Elevation:	NA
Sampler Size:	2' x 2"	**Borehole Depth:**	24.5' bgs
Auger Size:	4" 1/4		
Rig Type:	CME-78	**Geologist:**	Levia Terrel

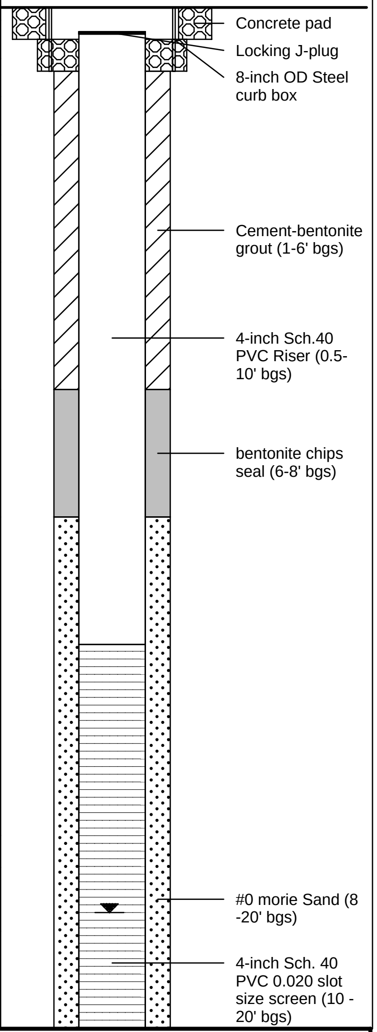
Well ID: **RW-01**

Client: National Grid

Location: Little Falls (Mill Street) Non-Owned Former MGP Site

Depth (ft. bgs)	Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Blows per 6 Inches	N - Value / RQD (%)	Recovery (feet)	PID Headspace (ppm)	Geologic Column	Bedrock Fractures	Stratigraphic Description
0	0	1	0-2	6 9 23 13	32	1.6	0.0			Brown fine to medium SAND and fine subangular GRAVEL, loose, moist. Light gray CONCRETE. Blue SILT and fine angular GRAVEL, odor, moist. Dark gray SILT and fine angular GRAVEL. odor, moist.
		2	2-4	5 12 20 30	32	1.0	0.0			Brown fine to medium SAND, little subrounded Gravel, red Brick, odor, moist.
5	-5	3	4-6	9 7 4 3	11	NR	NA			No Recovery.
		4	6-8	2 1 1 2	2	0.3	0.0			Brown fine to medium SAND and little fine Gravel, trace Asphalt, moist.
		5	8-10	1 4 3 5	7	0.5	1.8			Brown to black fine to medium SAND and fine subrounded to subangular Gravel, trace cinders, tar like odor, moist.
10	10	6	10-12	2 3 3 2	6	0.5	0.0			
		7	12-14	5 8 17 18	25	1.5	45.6			Dark brown to black fine to medium SAND, black sticky tar like material, saturated, tar like odor, moist. Gravel in tip of spoon. No Recovery -Coarse pink Gravel in tip of spoon.
		8	14-14.5	50	>50	NR	NA			
15	15						33.4		15 15.05 15.4 15.5 15.7 15.9	Pink gray GRANITIC GNEISS, horizontal and vertical fractures, lost water, blacky sticky tar like material and sheen on fracture surfaces, tar like material on fracture at 18.55' bgs. Tar like odor, weathered fractures.

Well Construction



ARCADIS
Infrastructure, environment, buildings

Remarks: Remarks: bgs = below ground surface; NA = Not Applicable/Available; NR = No recovery.

Client: National Grid

Well ID: **RW-01**

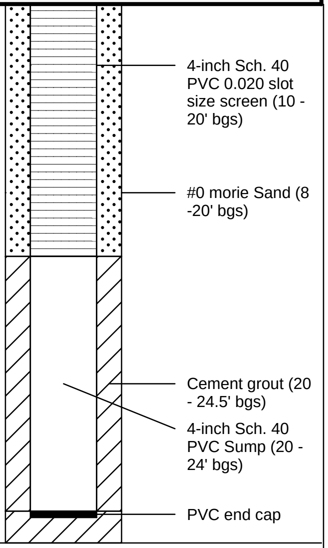
Borehole Depth: 24.5' bgs

Site Location:
Little Falls (Mill Street) Non-Owned Former MGP Site

DRAFT

Depth (ft. bgs)	Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Blows per 6 Inches	N - Value / RQD (%)	Recovery (feet)	PID Headspace (ppm)	Geologic Column	Bedrock Fractures	Stratigraphic Description
		9	14.5-19.5	NA	66%	5	11.4 24.6		16.05 16.2 16.3 16.5 V 17.05 V 17.3 17.6 17.75 18.55 19.1	Pink gray GRANITIC GNEISS, horizontal and vertical fractures, lost water, blacky sticky tar like material and sheen on fracture surfaces, tar like material on fracture at 18.55' bgs. Tar like odor, weathered fractures.
20	20	10	19.5-24.5	NA	94%	5	0.1 0.4 0.1		20.7 21.45 22.2 23.8 23.95	Pink gray GRANITIC GNEISS weathered horizontal fractures, lost water, rainbow sheen outside of core, mild tar like odor.
25	25									En of boring at 24.5' bgs.
30	30									
35	35									

Well Construction



ARCADIS
Infrastructure, environment, buildings

Remarks: Remarks: bgs = below ground surface; NA = Not Applicable/Available; NR = No recovery.

Project: B0036673.0000 Template: G:\DIV11\Rockware\Logplot 2001\Logs\Templates Well double-cased bedrock.ldfx
Data File:RW-01.dat Date: 9/30/2009 Created/Edited by: RJ/RJ

Date Start/Finish: 8/20/09
Drilling Company: Parratt Wolff
Driller's Name: Lee Penrod/Rodney Fisk
Drilling Method: HSA/NX-Core B.I/5"7/8 Rot.Bit NX-Core Barrel/5" 7/8 Rot. Bit
Sampler Size: 2' x 2"
Auger Size: 4" 1/4
Rig Type: CME-78

Northing: NA
Easting: NA

Casing Elevation: NA
Surface Elevation: NA
Borehole Depth: 20.5' bgs

Geologist: Levia Terrel

Well ID: **RW-02**

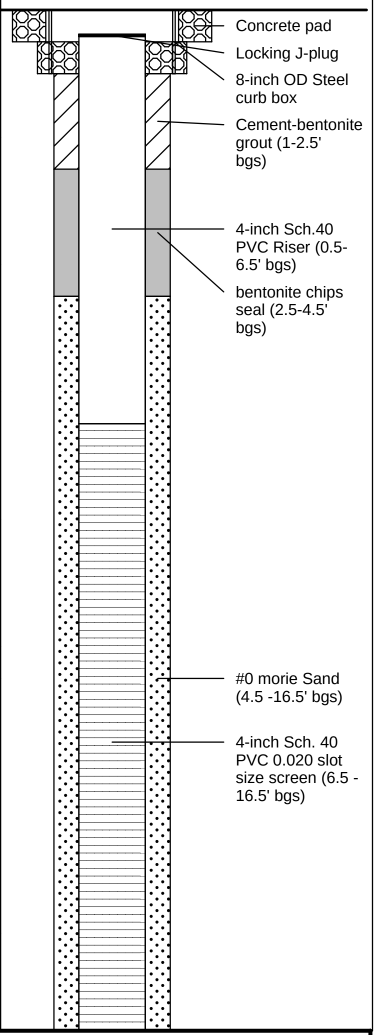
Client: National Grid

Location: Little Falls (Mill Street) Non-Owned Former MGP Site

DRAFT

Depth (ft. bgs)	Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Blows per 6 Inches	N - Value / RQD (%)	Recovery (feet)	PID Headspace (ppm)	Geologic Column	Bedrock Fractures	Stratigraphic Description
0	0	1	0-2	21 10 9 8	19	0.2	0.0			Asphalt
		2	2-4	7 7 5 5	12	0.8	0.0			Brown SAND and SILT, little fine subangular Gravel, trace red Brick, moist.
5	-5	3	4-6	4 1 1 2	2	0.2	0.0			Black ASPHALT, some brown fine to medium Sand, trace coarse Sand, moist.
		4	6-8	2 2 2 3	4	0.5	0.0			Brown fine SAND, some Silt, trace Slag, medium Sand and red Brick, moist.
		5	8-10	5 9 23 25	32	0.4	0.0			Brown fine to medium SAND, little fine to medium subangular Gravel, trace Wood, Red Brick and Slag, moist.
10	10	6	10-10.5	50/5	>50	NR	0.0			No Recovery
		7	10.5-14.5	NA	21%	2.25	0.0 0.0		10.75 11.15 11.7 11.85 12.05 12.2 12.45 12.6	Gray GRANITIC GNEISS, horizontal fractures weathered, broken zone 11.85 - 12.05, Tar like odor (note: several voids encountered as coring).
15	15						0.0		14.7 14.95 15.1 15.35 15.7 15.85	Gray GRANITIC GNEISS, weathered horizontal fractures 60 degree fracture at 16.1 - 16.4. Brown oily NAPL bleb of approximately 2 mm in diameter on fractured surface at 16.1, broken zone 14.5 - 14.7, 15.35 - 15.7.

Well Construction



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Remarks: Remarks: bgs = below ground surface; NA = Not Applicable/Available; NR = No recovery.

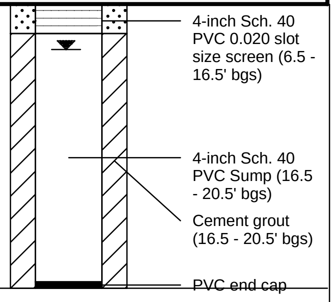
Client: National Grid

Well ID: **RW-02**

Site Location:
Little Falls (Mill Street) Non-Owned Former MGP Site

Borehole Depth: 20.5' bgs

DRAFT

Depth (ft. bgs)	Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Blows per 6 Inches	N - Value / RQD (%)	Recovery (feet)	PID Headspace (ppm)	Geologic Column	Bedrock Fractures	Stratigraphic Description	Well Construction
		8	14.5-20.5	NA	37%	4	0.0		1616.160 17.1 18.5	Gray GRANITIC GNEISS, weathered horizontal fractures 60 degree fracture at 16.1 - 16.4. Brown oily NAPL bleb of approximately 2 mm in diameter on fractured surface at 16.1, broken zone 14.5 - 14.7, 15.35 - 15.7.	
20	*20*										
										En of boring at 20.5' bgs.	
25	*25*										
30	*30*										
35	*35*										

ARCADIS
Infrastructure, environment, buildings

Remarks: Remarks: bgs = below ground surface; NA = Not Applicable/Available; NR = No recovery.

Date Start/Finish: 8/24/09 - 8/25/09
Drilling Company: Parratt Wolff
Driller's Name: Lee Penrod/Rodney Fisk
Drilling Method: HSA/NX-Core B.I/5"7/8 Rot.Bit
NX-Core Barrel/5" 7/8 Rot. Bit
Sampler Size: 2' x 2"
Auger Size: 4" 1/4
Rig Type: CME-78

Northing: NA
Easting: NA

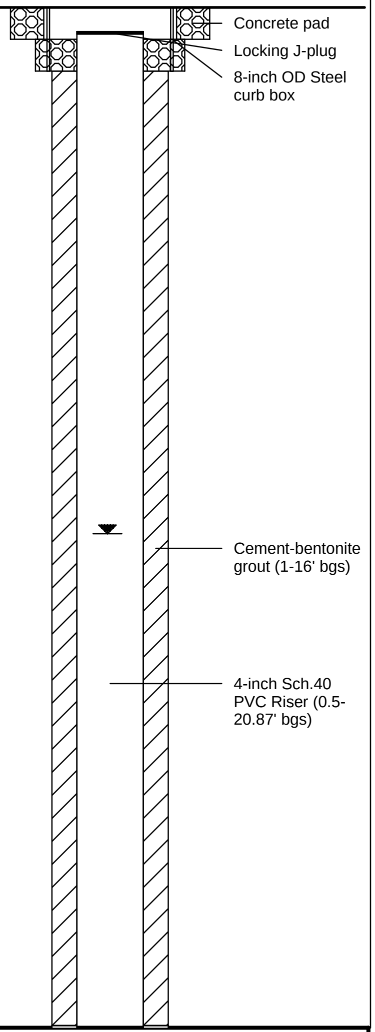
Casing Elevation: NA
Surface Elevation: NA
Borehole Depth: 34.5' bgs

Geologist: Ricardo Jaimes

Well ID: **RW-03A**

Client: National Grid

Location: Little Falls (Mill Street) Non-Owned
Former MGP Site

Depth (ft. bgs)	Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Blows per 6 Inches	N - Value / RQD (%)	Recovery (feet)	PID Headspace (ppm)	Geologic Column	Bedrock Fractures	Stratigraphic Description	Well Construction
0	0	1	0-2	14 40 28 40	68	2.0	4.0			Gray fine to coarse SAND, some Silt and medium angular Gravel, loose, dry. Gray to dark gray fine to medium SAND, trace Brick fragments, plastic fiber, medium dense, moist to dry, concrete odor. Gray fine SAND and some Silt, trace Brick and fine to medium angular Gravel, medium dense, odor, moist.	
		2	2-4	50/4	>50	0.58	2.8			No Recovery.	
5	-5	3	4-6	11 30 50/3	>50	1.17	2.5			Dark gray medium to coarse SAND, little Gravel, loose, odor, moist. Gray to brown fine to medium SAND, some angular Gravel, medium dense, odor, moist. Brick and fresh cement, soil and fill, odor, dry to moist.	
		4	6-8	7 7 17 50/4	24	1.54	4.7			No recovery (very hard material). Gray coarse SAND and fine subangular GRAVEL, loose, concrete odor, moist. Gray to brown fine to coarse SAND, some angular fine Gravel, little Brick fragments,medium dense, cement odor, moist.	
		5	8-10	14 18 34 12	52	2.0	11.3			Gray fine SAND, little Slag, little Brick fragments, medium dense, cement odor, moist.	
10	10	6	10-12	4 17 25 9	42	1.48	14.0			Gray to brown fine to coarse SAND, some angular medium to coarse Gravel, little Brick fragments, medium dense, odor, moist to wet. Gray fine to medium SAND, little to trace Coal, Slag and Brick fragments, medium dense, odor, moist.	
		7	12-14	31 37 30 30	67	2.0	15.2			Same as above, moist to wet.	
15	15	8	14-16	10 40 14 12	54	0.95	21.3			BRICK and CONCRETE fragments, dense, slight odor, dry.	

Remarks: Remarks: bgs = below ground surface; NA = Not Applicable/Available; NR = No recovery.

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Client: National Grid

Well ID: **RW-03A**

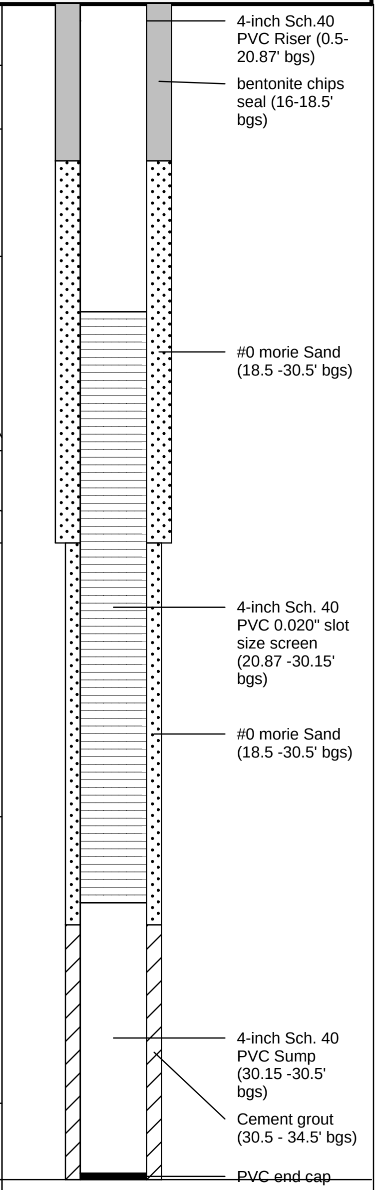
Borehole Depth: 34.5' bgs

Site Location:
Little Falls (Mill Street) Non-Owned Former MGP Site

DRAFT

Depth (ft. bgs)	Elevation (ft. AMSL)	Sample Run Number	Sample/Int/Type	Blows per 6 Inches	N - Value / RQD (%)	Recovery (feet)	PID Headspace (ppm)	Geologic Column	Bedrock Fractures	Stratigraphic Description
		9	16-18	12 7 6 5	13	1.4	69.1			BRICK and CONCRETE fragments, dense, slight odor, dry. Dark gray to black Wood, stained and saturated of plastic asphalt like material, odor, moist to wet.
		10	18-20	14 11 18 14	29	1.05	115			Brown fine to medium SAND, some angular fine to medium Gravel, little Brick and Concrete fragments, loose to dense, petroleum like odor and black staining at the tip, moist.
20	20	11	20-22	12 26 14 15	40	2.0	120			Dark gray fine SAND, Trace Roots, medium dense, odor, moist.
		12	22-24	42 48 20 3	68	1.46	7.5			Black SLAG. Brown fine to medium SAND, medium dense, odor, wet.
		13	24-24.5	NA	>50	NR	NA			No Recovery.
25	25	14	24.5-28.8	NA	93%	4.3	0.0 0.6		25.28 27.07 28.03	Light gray to pink GRANITIC GNEISS, good rock quality, subhorizontal fractures, no odor, no NAPL, wet.
30	30	15	28.8-33.3	NA	88%	4.5	0.0 0.0		30.56 31.17 32.55 32.72 32.89	Light gray to pink GRANITIC GNEISS, good rock quality, subhorizontal fractures, no odor, no NAPL, wet.
										No recovery. Drilled with roller bit.
35	35									En of boring at 34.5' bgs.

Well Construction



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Remarks: Remarks: bgs = below ground surface; NA = Not Applicable/Available; NR = No recovery.

Appendix G

Field Sampling Plan

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Imagine the result

National Grid

Field Sampling Plan

Little Falls (Mill Street)
Non-Owned Former MGP Site,
Little Falls, New York

April 2010

ARCADIS

Field Sampling Plan

Little Falls (Mill Street)
Non-Owned Former MGP Site,
Little Falls, New York

Signature 1 Name
Title

Signature 2 Name
Title

Signature 3 Name
Title

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Our Ref.:
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Date:
April 2010

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1. Introduction

1.1 General

This Field Sampling Plan (FSP) supports the Site Management Plan (SMP) (ARCADIS, April 2010) for the Little Falls (Mill Street) non-owned former manufactured gas plant (MGP) site (the "Site") located on the south side of East Mill Street in Little Falls, New York. This FSP presents field investigation and sampling procedures to be conducted during implementation of ongoing monitoring/recovery activities at the Site. Related documents include the Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP), which are included in the SMP.

1.2 Monitoring/Recovery Objectives

The monitoring and sampling of groundwater will be conducted to achieve the following objectives:

- Evaluate the groundwater quality of the overburden (fill, sand, silty sand, and silt and sand).

- Evaluate the groundwater quality of the bedrock at wells that are completed in bedrock.

- Evaluate the onsite post remedial groundwater flow pattern.

- Evaluate the post-remedial groundwater concentrations of Constituents of Concern (COCs).

- Confirm that groundwater quality is improving and/or does not represent a significant threat to human health or the environment based on the contemplated site use.

1.3 Overview of Ongoing Sampling Activities

Field sampling efforts which will be conducted to obtain information necessary to meet the monitoring/recovery objectives will include annual groundwater sampling activities

The rationale for the field sampling investigation is provided in detail in the SMP. A site location map is included on Figure 1 in the SMP. The location of physical features at the site and the groundwater sampling locations are shown on Figures 2 and 13 in the SMP. Further detail regarding the field sampling investigation is provided in Section 2 of this FSP.

2. Field Sampling

2.1 General

This section presents detailed information for conducting groundwater sampling activities as part of the ongoing Site management activities at the Site. The following information is provided for the groundwater sampling investigation:

- Procedures for collecting samples, measuring groundwater field parameters (i.e., pH, conductivity, depth to groundwater, dissolved oxygen, organic vapors, temperature, turbidity)

- A summary of the data to be generated from the sampling efforts.

Detailed information regarding the frequency of quality assurance/quality control (QA/QC) samples to be collected and the corresponding parameters to be analyzed during the ongoing Site management activities are presented in Table 1. Information regarding the sample containers, preservation, and holding times for samples is presented in Table 2. Detailed sample collection procedures are provided Attachments A through C of this FSP.

2.2 Task 1 - Groundwater Monitoring/Sampling

The groundwater sampling activities will consist of the following subtasks:

- Measuring groundwater levels at each monitoring well in the vicinity of the former MGP site

- Collecting groundwater samples from each monitoring well in the vicinity of the former MGP site for laboratory analysis.

A detailed description of the field activities to be conducted as part of the groundwater sampling activities is presented in the SMP and summarized below.

2.2.1 Subtask 1.1 – Groundwater Level Measurements

Groundwater level measurements will be obtained from eight monitoring well locations including FWMW-1, FWMW-2, FWMW-3, FWMW-5, B-MW-3, MW-101RD, MW-102R, and MW-103R and three passive DNAPL recovery well locations including RW-1, RW-

2, and RW-3, prior to collecting groundwater samples. Groundwater levels at each well will be measured to the nearest one-hundredth of a foot from the reference point at the top of the inner well casing using the procedures described in Attachment C. The measurements will be converted to elevations (referenced to a site-specific datum).

2.2.2 Subtask 1.2 – Groundwater Sampling

One round of groundwater samples will be collected from eight monitoring well locations including FWMW-1, FWMW-2, FWMW-3, FWMW-5, B-MW-3, MW-101RD, MW-102R, and MW-103R using the low-flow purging and sampling techniques in accordance the sampling protocol discussed in Attachment C. Samples will be submitted to TestAmercia-Edison for laboratory analysis for laboratory analysis for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), and Target Analyte List (TAL) inorganic constituents (including cyanide) using the NYSDEC ASP analytical methods. QA/QC samples (including trip blank, field duplicate, matrix spike, and matrix spike duplicate samples) will be collected and submitted for laboratory analysis, as referenced in the QAPP.

Groundwater samples will be placed into appropriate sample containers as described in Section 4 and sample containers will be labeled as described in Section 3. The samples will be handled, packaged, and shipped following the procedures in Section 4 and Attachment A.

3. Sample Designation System

A sample designation code and the sample date will provide each sample with a unique “name”. This alphanumeric system will apply to all soil, soil-gas, groundwater, and sediment samples which are collected and submitted for laboratory analysis. The sample designation code system includes a letter prefix describing the sample matrix and a number indicating the sample location. Letter prefixes that will be used for the sample designation code system are as follows:

- Groundwater – “MW”

The sample location number will be assigned by the field sampling personnel prior to each sampling event. Rinse blank, trip blank, and blind duplicate samples will be designated as follows:

- Rinse Blank – “RB”
- Trip Blank – “TB”
- Blind Duplicate – “DUP”

Multiple rinse blank, trip blank, and blind duplicate samples will be distinguished by adding a numeric suffix which is preceded by the letter code and a hyphen (i.e., RB-1, RB-2, etc.). Additional sample volumes collected for matrix spike (“MS”) and matrix spike duplicate (“MSD”) analysis will be noted on the chain-of-custody forms, and the associated additional sample containers will be labeled, as described above, with the appropriate suffix (“MS” or “MSD”).

4. Sample Handling and Documentation

4.1 Sample Containers and Preservations

Appropriate sample containers, preservation methods, and laboratory holding times for groundwater samples are presented in Table 2.

TestAmerica-Edison will supply appropriate sample containers in sealed cartons, as well as sample labels and preservatives. The field personnel will be responsible for properly labeling containers and preserving samples (as appropriate). Sample labeling procedures are described in Attachment A.

4.2 Packing, Handling, and Shipping Requirements

Sample custody seals and packing materials for filled sample containers will also be provided by TestAmerica-Edison. The filled, labeled, and sealed containers will be placed in a cooler on ice and carefully packed to minimize the possibility of container breakage.

All samples will be packaged by the field personnel and transported as low-concentration environmental samples. The packaged samples will be either shipped via express overnight carrier (Federal Express or courier) or hand delivered by sampling personnel to the laboratory within 24 to 48 hours of sample collection. General procedures for packing, handling, and shipping environmental samples are included in Attachment A.

4.3 Documentation

Field personnel will provide comprehensive documentation covering all aspects of field sampling, field analysis, and sample chain-of-custody. This documentation constitutes a record which allows reconstruction of all field events to aid in the data review and interpretation process. All documents, records, and information relating to the performance of the field work will be retained in the project file.

The various forms of documentation to be maintained throughout the RI include:

- Daily Production Documentation - A field notebook consisting of a waterproof, bound notebook which will contain a record of all activities performed at the site.

- Sampling Information - Detailed notes will be made as to the exact site of sampling, physical observations, and weather conditions. Groundwater sampling field logs (included in Attachment C) will be filled out during each sampling event and will contain sample location, data on water levels, well depths, physical observations of the water, and field parameter measurements (pH, conductivity, dissolved oxygen, temperature, and turbidity). Water level readings will be measured to surveyed reference points, and will be documented in the field notebook or on the groundwater sampling field log in Attachment C.

- Sample Chain-of-Custody - Chain-of-custody forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. Chain-of-custody forms will be filled out at each sampling site, at a group of sampling sites, or at the end of each day of sampling by one of the field personnel designated to be responsible for sample custody. In the event that the samples are relinquished by the designated sampling person to other sampling or field personnel, the chain-of-custody form will be signed and dated by the appropriate personnel to document the sample transfer. The original chain-of-custody form will accompany the samples to the laboratory and copies will be forwarded to the project files. Persons will have custody of samples when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.

- Field Equipment, Calibration, and Maintenance Logs - To document the calibration and maintenance of field instrumentation, calibration and maintenance logs will be maintained for each piece of field equipment (which is not factory calibrated). Calibration procedures and calibration and maintenance logs are provided in Attachment D.

4.4 Management of Investigation-Derived Materials and Wastes

The handling of investigation-derived materials and wastes is discussed below.

4.4.1 Excess Ground Water

Development water purged water from the monitoring wells will be placed into Department of Transportation- (DOT-) approved steel 55-gallon drums. The liquid waste will be disposed by National Grid in accordance with applicable regulations following completion of the groundwater sampling activities.

4.4.2 Disposable Equipment and Debris

Disposable equipment and debris, such as health and safety equipment, plastic sheeting, sampling equipment, and other equipment not reused in the investigation will be collected in plastic bags during the sampling events and placed into DOT-approved steel drums, which will be stored in a suitable onsite location. The waste materials will be disposed by National Grid in accordance with applicable regulations.

4.4.3 Decontamination Rinsate

Field sampling equipment will be decontaminated by following the procedures outlined in Attachment B. Decontamination rinsate will be containerized at each sampling location or group of locations. Upon completion of the field activities, the rinsate will be containerized in a steel drum or polyethylene tank for storage in a suitable onsite location prior to offsite disposal by National Grid in accordance with applicable regulations.

5. Quality Assurance/Quality Control

This section summarizes the QA/QC requirements for field investigation activities associated with the groundwater sampling activities.

5.1 Field Instrument Calibration and Preventative Maintenance

Field personnel will be responsible for assuring that a master calibration/maintenance log is maintained (following procedures specified in Attachment D) for each measuring device. Each log will include at a minimum (where applicable):

- Name of device and/or instrument calibrated (i.e., HNU, Photovac, or Multi-RAE)
- Device/instrument serial/I.D. number
- Frequency of calibration
- Date(s) of calibration(s)
- Results of calibration(s)
- Name of person(s) performing calibration(s)
- Identification of calibration gas (i.e., isobutylene)
- Buffer solutions (pH meter only)

Equipment to be used each day shall be calibrated prior to the commencement of the day’s activities or as suggested by the manufacturer.

Health and safety monitoring equipment (i.e., meter to measure total organic vapors, oxygen, carbon monoxide, hydrogen sulfide, and combustible gas) and water quality testing equipment (pH, conductivity, dissolved oxygen, and temperature meters) will be calibrated and maintained in accordance with the manufacturer’s specifications.

5.2 QA/QC Sample Collection

The frequency of QA/QC field samples to be collected is provided in Table 1. This estimate is based on the QA/QC sample collection frequency as discussed in the QAPP. Guidance on the collection of the QA/QC samples is presented below.

Trip Blanks

On events/days of aqueous volatile sampling, a trip blank will be collected. A trip blank is an aliquot of analyte-free water which is sealed in 40-millimeter (ml) glass vials with Teflon™-lined septum caps prior to initiation of field work. This blank is applied in sample validation to determine if any cross-contamination has occurred between samples during shipment. These sealed bottles will be prepared and included with each shipment of sample bottles for aqueous media to and from the lab site.

Rinse Blanks

Rinse blanks will be prepared by pouring analyte-free water over decontaminated sampling equipment as a check that the decontamination procedure has been adequately performed and that cross contamination of samples will not occur due to the equipment. One rinse blank will be collected for each type of decontaminated equipment used each day. Rinse blanks will be performed on sampling equipment and other equipment such as bowls or pans used to homogenize samples. The same aliquot of rinse water may be used on all equipment coming in contact with a particular matrix for analysis for SVOCs and inorganic constituents. A separate rinse blank must be collected for each piece of equipment used for a particular sample matrix to be analyzed for VOCs. Rinse blanks will be collected at the beginning of the day before the sampling event and must accompany the samples collected that day.

Rinse blanks will be prepared in the field. Laboratory-supplied analyte-free water will be poured into or over the sampling equipment and then directly into the laboratory-supplied sample bottles. The intent is for the water making up the blank to follow the same path, and therefore, come in contact with the same equipment as the samples.

Duplicate Samples

Duplicate samples will be sent for laboratory analysis to evaluate the reproducibility of the sampling technique used. Five percent (i.e., one for every 20 samples) of each matrix will be duplicated.

Duplicate samples will be collected using methods to maximize the compatibility of the samples. For example, groundwater contained in a bailer retrieved from a monitoring well will be divided between the sample and duplicate sample laboratory containers.

Matrix Spike/Matrix Spike Duplicate

Triple sample volumes from designated sample locations will be collected for each matrix in order to perform matrix spike/matrix spike duplicate analysis. Table 1 sets forth the frequency of collection for matrix spike/matrix spike duplicates.

Tables

TABLE 1

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

FIELD SAMPLING PLAN

ESTIMATED QUANTITY OF ENVIRONMENTAL AND QUALITY CONTROL SAMPLES

Parameters	Estimated Environmental Sample Quantity	Field QC Analysis						Laboratory QC Analysis								Estimated Total (Per Year)
		Trip Blank		Field Duplicate		Rinse Blank		MS		MSD		MSB		Lab Duplicate		
		Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	
Groundwater Sampling																
TCL VOCs	8	1/day	3	1/20	1	1/20	1	1/20	1	1/20	1	1/20	1	--	--	16
TCL SVOCs	8	--	--	1/20	1	1/20	1	1/20	1	1/20	1	1/20	1	--	--	13
TAL Inorganics (including cyanide)	8	--	--	1/20	1	1/20	1	1/20	1	1/20	1	1/20	1	1/20	1	14
Waste Characterization Sampling																
PCBs	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
TCLP VOCs	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
TCLP SVOCs	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
TCLP Inorganics	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Reactivity	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Corrosivity	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Ignitability	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1

TABLE 1

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

FIELD SAMPLING PLAN

ESTIMATED QUANTITY OF ENVIRONMENTAL AND QUALITY CONTROL SAMPLES

Notes:

1. Abbreviations used in this table and the corresponding terms are listed below:
    - A. MSD - Matrix spike duplicate
    - B. MSB - Matrix spike blank
    - C. QC - Quality Control
    - D. PCBs - Polychlorinated biphenyls
    - E. TCL - Target Compound List
    - F. VOCs - Volatile Organic Compounds
    - G. SVOCs - Semi-Volatile Organic Compounds
    - H. TAL - Target Analyte List
    - I. USEPA - United States Environmental Protection Agency
    - J. TCLP - Toxicity Characteristic Leaching Procedure
    - K. TOC - Total Organic Carbon

2. 1/day - One trip blank per day of volatile organic sampling media. One rinse blank per day of sampling with sampling device which requires field-cleaning. Dedicated sampling equipment will be used to collect subsurface soil and groundwater samples.

3. Table assumes that samples will be processed in groups of 20 samples for QC analyses. If smaller groups are processed, then one MS/MSD (or MS/lab duplicate) per sample delivery group (up to 20 samples) will be prepared for each sample delivery group.

4. NYSDEC 2005 ASP (or latest version) guidelines will be used for the laboratory analyses of the following constituents:
    - A. TCL VOCs: USEPA SW-846 Method 8260
    - B. TCL SVOCs: USEPA SW-846 Method 8270
    - C. TAL inorganic Constituents: USEPA SW-846 Method 6010 with the following exceptions: Mercury will be analyzed using Method 7470/7471 and Cyanide will be analyzed using Method 9010
    - D. TOCs: Lloyd Kahn Method

5. Laboratory analyses will be performed by the following laboratory:
    - A. Severn Trent Laboratories, Inc. of Edison, New Jersey

TABLE 2

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

FIELD SAMPLING PLAN

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter	Method	Bottle Type	Preservation	Holding Time
Water Samples				
TCL VOCs	8260	(2) 40 mL glass vials with Teflon-lined lid	HCl to pH<2, Cool to 4°C	14 days to analysis
TCL SVOCs	8270	(2) 1 liter amber glass bottles with Teflon-lined lid	Cool to 4°C	7 days to extraction 40 days to analysis
Metals (except mercury)	6010	(1) 500 mL plastic container, cap lined with Teflon	HNO_3 to pH<2	180 days to analysis
Mercury	7471		Cool to 4°C	28 days to analysis
Cyanide	9010		NaOH to pH>12, Cool to 4ºC	14 days to analysis
Waste Characterization Samples				
TCLP VOCs	1311 / 8260	(1) 125 mL widemouth glass container, cap lined	Cool to 4°C	14 days to analysis
TCLP SVOCs	1311 / 8270	(1) 250 mL widemouth glass container, cap lined with Teflon	Cool to 4°C	14 days to analysis
TCLP Metals	1311 / 6010 / 7470		Cool to 4°C	14 days to analysis
Reactivity	SW-846 Chapter 7		Cool to 4°C	No holding time
Corrosivity	SW-846 Chapter 7		Cool to 4°C	No holding time
Ignitability	SW-846 Chapter 7		Cool to 4°C	No holding time
PCBs	8082		Cool to 4°C	14 days to extraction 40 days to analysis

Notes:

1. USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste. SW-846 3rd ed. Washington, D.C. 1996.*
2. All holding times are measured from date of collection.
3. NS - Not Specified
4. NA - Not Applicable

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Attachment A

Sample Packing, Handling and Shipping Procedures

Attachment A – Sample Packing, Handling, and Shipping Procedures

1.1 Introduction

This attachment presents procedures for sample handling, packaging, and shipping.

1.2 Equipment and Materials

- Indelible ink pens and black permanent markers
- Field book
- Chain of custody forms
- Sample labels and sample custody seals
- Clear packaging tape
- Duct tape
- Shipping labels
- Appropriate sample containers
- Sample cooler
- Ice
- Polyethylene bags (e.g., Ziploc-type bags)
- Bubble pack or vermiculite

1.3 Sample Handling Procedures

1. Fill in sample label (Exhibit B-1) with:
    a. Sample matrix (soil, groundwater, etc.);
    b. Project number and site name;
    c. Sample identification code and other sample identification information, if applicable;
    d. Analysis required;
    e. Date sampled;
    f. Time sampled;
    g. Name, affiliation, and contact phone number;
    h. Sample type (composite or grab); and
    i. Preservative added, if applicable.

2. Cover the label with clear packing tape to secure the label onto the container.

3. Check the caps on the sample containers to ensure that they are tightly sealed.

4. Mark the level of the sample in the container using an indelible ink marker or grease pencil.

5. Wrap the sample container cap with clear packing tape to prevent it from becoming loose.

6. Place a signed custody seal label (Exhibit B-2) over the cap such that the cap cannot be removed without breaking the custody seal.

7. Initiate chain-of-custody form (Exhibit B-3) by designated sampling personnel responsible for sample custody (after sampling or prior to sample packing). Note: If the designated sampling person relinquishes the samples to other sampling or field personnel for packing or other purposes, the samplers will complete the chain-of-custody form prior to transfer. The appropriate personnel will sign and date the chain-of-custody form to document the sample custody transfer.

1.4 Sample Packing Procedures

1. Using duct tape, secure the outside and inside of the drain plug at the bottom of the cooler (if present) that is used for sample transport.

2. Place each sample container or package in individual polyethylene bags (Ziploc-type) and seal.

3. Place 1 to 2 inches of cushioning material at the bottom of the cooler (i.e., bubble pack or vermiculite).

4. Package the sealed sample containers upright in the cooler.

5. Repackage ice (if required) in small Ziploc-type plastic bags and place loosely in the cooler. Do not pack ice so tightly that it may prevent addition of sufficient cushioning material.

6. Fill the remaining space in the cooler with cushioning material.

7. Place the completed chain-of-custody forms (Exhibit B-3) in a large Ziploc-type bag and tape the forms to the inside of the cooler lid.

8. Close the lid of the cooler and fasten with duct tape.

9. Wrap strapping tape around both ends of the cooler at least twice.

10. Mark the cooler on the outside with the following information: shipping address, return address, “Fragile” labels (Exhibit 4) on the top and on one side, and arrows indicating “This Side Up” (Exhibit B-4) on two adjacent sides.

11. Place custody seal evidence tape (Exhibit B-2) over front right and back left of the cooler lid and cover with clear plastic tape.

1.5 Sample Shipping Procedures

1. All samples will be hand delivered or delivered by an express carrier within 48 hours or less from the date of sample collection.

2. The following chain-of-custody procedures will apply to sample shipping:

    a. Relinquish the sample containers to the laboratory via express carrier. The signed and dated forms should be included in the cooler. The express carrier will not be required to sign the chain-of-custody forms. The sampler should retain the express carrier receipt or bill of lading.

    b. When the samples are received by the laboratory, the laboratory personnel shall complete the chain-of-custody forms by recording receipt of samples, measure and record the internal temperature of the shipping container, and then check the sample identification numbers on the containers to the chain-of-custody forms.

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Attachment B

Equipment Decontamination and Cleaning Procedures

Attachment B – Equipment Decontamination and Cleaning Procedures

1.1 Introduction

This attachment presents procedures which will be used to decontaminate equipment used to collect groundwater samples. In addition, this attachment presents the procedures to be followed in cleaning equipment used to install monitoring wells. The adequacy of cleaning procedures will be monitored through the collection of QA/QC rinse blank samples which will be submitted for laboratory analysis.

1.2 Sampling Equipment Decontamination

Generally, dedicated sampling equipment will be used during the investigations (i.e., stainless-steel trowels, groundwater sample bailers). However, equipment that is not dedicated (i.e., split-spoon sampler) will be decontaminated prior to each use to mitigate the potential for cross-contamination of the samples collected for laboratory analysis. The decontamination procedures to be utilized during the investigation are presented below:

<u>For VOC, SVOC, and Inorganic Sampling</u>

1. Non-phosphate detergent solution wash.
2. Tap water rinse.
3. Citrus-based degreaser wash (if necessary).
4. Tap water rinse.
5. Non-phosphate detergent solution wash.
6. Tap water rinse.
7. 10 percent nitric acid rinse.
8. Distilled water rinse.
9. Methanol rinse.
10. Distilled water rinse.
11. Allow to air-dry.

1.3 Drilling and Excavation Equipment Cleaning

In addition to the above-discussed decontamination procedures, the drilling rig and all downhole equipment associated with the drilling of soil borings and the installation of monitoring wells will be steam cleaned prior to arrival on site and between each drilling location.

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Attachment C

Fluid Level Measurement and Sampling Procedures for Monitoring Wells

Attachment C – Fluid Level Measurement and Sampling Procedures for Monitoring Wells

1.1 Introduction

This attachment describes the procedures to be used to measure water levels in monitoring wells and collect groundwater samples. During precipitation events, groundwater sampling will be discontinued until precipitation ceases. When a round of water levels is taken for the purpose of generating water elevation data, the water levels will be taken consecutively at one time prior to sampling or other activities.

1.2 Materials

The following materials, as required, shall be available during groundwater sampling:

- Sample pump
- Sample tubing
- Power source (i.e. generator)
- Photoionization detector (PID)
- Appropriate PPE (as required by the Health and Safety Plan)
- Plastic sheeting
- Dedicated or disposable bailers
- Polypropylene rope
- Buckets to measure purge water
- Water level probe
- 6' rule with gradation in hundredths of a foot
- Conductivity/temperature meter
- pH meter
- Turbidity meter
- DO meter
- Hacksaw
- Appropriate water sample containers
- Appropriate blanks (trip blank supplied by the laboratory)
- Appropriate transport containers (coolers) with ice and appropriate labeling, packing, and shipping materials
- Groundwater sampling logs (Exhibit G-1)
- Chain-of-Custody forms
- Indelible ink pens
- Site map with well locations and groundwater contours maps
- Peristaltic pump and dedicated tubing
- Keys to wells

1.3 Procedures

The procedures to measure water levels and sample monitoring wells will be as follows:

1. Review materials check list (Part II) to ensure the appropriate equipment has been acquired.
2. Identify the site name and well ID on sampling log sheets, along with date, arrival time, and weather conditions. Identify the personnel and equipment utilized and other pertinent data requested on the groundwater sampling field log (Exhibit G-1).
3. Label the sample containers as described in Section 3.0 and Attachment C. Cover the sample label with clear packaging tape to secure the label to the container.
4. Don safety equipment, as required in the Health and Safety Plan.
5. Place plastic sheeting adjacent to well to use as a clean work area.
6. Establish the background reading with the PID and record the reading on the groundwater sampling field log (Exhibit 1). If the well headspace reading is less than 5 ppm, proceed; if the well headspace reading is greater than 5 ppm, screen the air within the breathing zone. If the PID reading in the breathing zone is below 5 ppm, proceed. If the PID reading is above 5 ppm, move upwind from the well for 5 minutes to allow the volatiles to dissipate. Repeat the breathing zone test. If the reading is still above 5 ppm, don appropriate respiratory protection in accordance with the requirements of the HASP.
7. Remove lock from well and if rusted or broken replace with a new brass lock (with similar key).
8. Unlock and open the well cover while standing upwind of the well. Remove well cap and place on the plastic sheeting. Insert PID probe in the breathing zone above the well casing following instructions in the Health and Safety Plan.
9. Set out on plastic sheeting the dedicated or disposable sampling device and meters.
10. Prior to sampling, measure the depth to groundwater in each monitoring well and the depth to the bottom of each monitoring well. The depth to groundwater (and depth to the bottom of the well) will be determined using an electric water level probe. If a reference point on the well casing is not found, initiate a reference point by notching the inner casing (or outer if necessary) with a hacksaw. All downhole measurements will be taken from one reference point established at each well. Measurements will be recorded to the nearest hundredth of a foot, along with the height of the inner and outer casings from the reference point to ground level. The measurements and reference point will be recorded on a sampling log sheet. Clean the well probe before and after each use with a soapy (Alconox) water wash and a tap water rinse. [Note: water levels will be measured at all wells prior to initiating any sampling activities].
11. When checking the depth to groundwater in each well, check the water level probe for evidence of LNAPL. If LNAPL is determined not to be present at the well, the well will be purged. If LNAPL is found in the well, a groundwater sample will not be collected.
12. Pump, safety cable, tubing, and electrical lines will be lowered slowly into the well to a depth corresponding to the center of the saturated screen section of the well, or at a location determined to either be a preferential flow path, or zone where contamination is present. The pump intake must be kept at least two feet above the bottom of the well to prevent mobilization of any sediment present in the bottom of the well.

13. Measure the water level again with the pump in well before starting the pump. Start pumping the well at 200 to 500 milliliters per minute. Ideally, the pump rate should cause little or no water level drawdown in the well (less than 0.3 feet and the water level should stabilize). The water level should be monitored every three to five minutes (or as appropriate) during pumping. Care should be taken not to cause pump suction to be broken or entrainment of air in the sample. Record pumping rate adjustments and depths to water. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to avoid pumping the well dry and/or to ensure stabilization of indicator parameters. If the recharge rate of the well is very low, purging should be interrupted so as not to cause the drawdown within the well to advance below the pump. However, a steady flow rate should be maintained to the extent practicable. Sampling should commence as soon as the volume in the well has recovered sufficiently to permit collection of samples.

14. During purging of the well, monitor the field indicator parameters (pH, conductivity, dissolved oxygen, temperature, turbidity, etc.) every three to five minutes (or as appropriate). Groundwater samples will be collected for laboratory analysis following the stabilization of field parameters and the reduction of turbidity levels in the groundwater to less than 50 nephelometric turbidity units (NTUs). For the purpose of the RI, the field parameters will be considered to have stabilized after three consecutive readings are within the following values:

    - pH: ± 0.1;
    - Conductivity: ± 3%;
    - Oxidation/Reduction Potential (ORP): ± 10 mV;
    - Dissolved Oxygen: ± 10%; and
    - Turbidity: less than 50 NTU.

    If the field parameters have not stabilized after a reasonable effort has been made during the well purging, a sample will be collected based on the judgment of the field personnel. If the field parameters have stabilized, but the turbidity of the groundwater is not less than the 50 NTU goal, the pump flow rate will be decreased to no more than 100 mL/min, and additional purging will be conducted. The purging will continue until the 50 NTU turbidity goal is achieved or, if not possible, until reasonable effort has been made to reduce the turbidity to less than 50 NTUs.

15. After the appropriate purge volume of groundwater in the well has been removed, obtain the groundwater sample for analysis from the sampling device. Groundwater samples will be placed directly into the appropriate containers. When sampling for volatiles, collect water samples directly from a bottom-loading bailer into 40-mL vials with Teflon-lined septa. The bailer will be slowly lowered into the screened portion of the well to retrieve a filled bailer from the well causing minimal disturbance to the water and any sediments in the well. Groundwater sample containers will be collected in the following order:

    a. VOCs
    b. TOC (if sampled)
    c. SVOCs
    d. metals and cyanide
    e. others

16. Secure the caps on the sample containers. Place the sample containers on ice in an insulated transport container provided by the laboratory.

17. After all sampling containers have been filled, remove an additional volume of groundwater. Check the calibration of the meters and then measure and record on the field log physical appearance, pH, conductivity, dissolved oxygen, temperature, and turbidity.

18. If using a dedicated bailer, replace dedicated bailer in the well and replace the well cap and lock well.

19. Record the time sampling procedures were completed on the field logs.

20. Place all disposable sampling materials (plastic sheeting, disposable bailers, and health and safety equipment) in appropriately labeled containers.

21. Complete the procedures for packaging, shipping, and handling.

If new locks were installed, forward copies of the keys to the Project Manager (PM) at the end of the sampling activities.

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Attachment D

Calibration Procedures

Attachment D – Calibration, Operation, and Maintenance Procedures for Field Investigation Activities

D-1 Photoionization Detector Calibration, Operation, and Maintenance Procedures

D-2 pH Meter Calibration, Operation, and Maintenance Procedures

D-3 Temperature/Conductivity Meter Calibration, Operation, and Maintenance Procedures

D-4 Dissolved Oxygen Meter Calibration, Operation, and Maintenance Procedures

D-5 Water Level Probe Calibration Procedures

D-6 Turbidity Meter Calibration, Operation, and

1. Attachment D-1 - Photoionization Detector Calibration, Operation and Maintenance Procedures

1.1 Introduction

Field screening with a photoionization detector (PID) (HNU meter) is a procedure to measure relative concentrations of volatile organic compounds (VOCs) and other compounds. The characteristics of the PID are presented in Exhibit K-1.1. Compounds which the PID can detect are presented in Exhibit K-1.2. The PID will be used for field screening the following:

- The work area air to assess exposure to on-site workers of air contaminants via the air pathway;
- The headspace at each well as a precautionary measure each time the well cover is opened; and
- The headspace of soil samples to assess the relative concentration of volatile organic compounds in the samples.

1.2 Materials

The following materials, as required, shall be available while performing PID field screening:

- Appropriate PPE (as required by the Health and Safety Plan)
- PID and operating manual
- Isobutylene calibration gas tank with pressure regulator
- Plastic tubing to connect the PID probe to the calibration gas tank
- Sample jars
- Aluminum foil
- Field notebook
- PID calibration log

1.3 PID Calibration

PID field instruments will be calibrated and operated to yield “total organic vapor” in ppm (v/v) as benzene. Operation, maintenance, and calibration shall be performed in accordance with the manufacturers instructions and entered on the PID calibration and maintenance log (Exhibit K-1.3).

1. Don appropriate PPE (as required by the Health and Safety Plan);

2. Turn the FUNCTION switch to the BATTERY CHECK position. Check that the indicator is within or beyond the green battery arc. If indicator is below the arc or the red LED is lit, the battery must be charged.

3. Turn the FUNCTION switch to the STANDBY position and rotate the ZERO POTENTIOMETER until the meter reads zero. Wait 15 to 20 seconds to confirm the adjustment. If unstable, readjust.

4. Check to see that the SPAN POTENTIOMETER is adjusted for the probe being used (e.g., 9.8 for 10.2 eV).

5. Set the FUNCTION switch to the desired ppm range (0-20, 0-200, or 0-2,000). A violet glow from the UV source should be visible at the sample inlet of the probe/sensor unit.

6. Listen for the fan operation to verify fan function.

7. Connect one end of the sampling hose to the calibration canister regulator outlet and the other end to the sampling probe of the PID. Crack the regulator valve and take a reading after 5 to 10 seconds. Adjust the span potentiometer to produce the concentration listed on the span gas cylinder. Record appropriate information on the field calibration log (Exhibit K-1.3 or equivalent).

8. If so equipped, set the alarm at desired level.

1.4 Work Area Air Monitoring Procedure

1. Measure and record the background PID reading.

2. Measure and record breathing space reading.

1.5 Well Headspace Screening Procedure

1. Measure and record the background PID reading.

2. Unlock and open the well cover while standing upwind of the well.

3. Remove the well cap.

4. Place the PID probe approximately 6 inches above the top of the casing.

5. Record all PID readings and proceed in accordance with the site Health and Safety Plan.

1.6 Maintenance Procedures

1. At the end of each day of after 8 hours of monitoring with the PID, recharge the batteries for 12 hours.

2. Store the instrument in protective case when not in use.

3. Keep records of operation, maintenance, calibration, problems, and repairs.

4. After use, the instrument will be inspected and the inspection recorded in the field notebook.

5. A replacement instrument will be available on-site or ready for overnight shipment, if necessary.

6. The PID will be sent back to the manufacturer for service, if needed.

7. Record calibration information on PID Calibration and Maintenance Log (Exhibit K-1.3).

1.7 Equipment Cleaning

After each use, the readout unit should be wiped down with a clean cloth or paper towel. The UV light source window and ionization chamber should be cleaned in the following manner once a month:

1. With the PID off, disconnect the sensor/probe from the unit.

2. Remove the exhaust screw, grasp the end cap in one hand and the probe shell in the other, and pull apart.
3. Loosen the screws on the top of the end cap, and separate the end cap and ion chamber from the lamp and lamp housing.
4. Tilt the lamp housing with one hand over the opening so that the lamp slides out into your hand.
5. Clean the lamp with lens paper and HNU cleaning compound (except 11.7 eV). For the 11.7 eV lamp, use a chlorinated organic solvent.
6. Clean the ion chamber using methanol on a cotton swab and then dry gently at 50ºC to 60ºC for 30 minutes.
7. Following cleaning, reassemble by first sliding the lamp back into the lamp housing. Place ion chamber on top of the housing, making sure the contacts are properly aligned.
8. Place the end cap on top of the ion chamber and replace the two screws, tighten the screws only enough to seal the o-ring.

9. Line up the pins on the base of the lamp housing with pins inside the probe shell and slide the housing assembly into the shell.

Exhibit K -1.1
CHARACTERISTICS OF THE PHOTOIONIZATION DETECTOR (PID)

1.1 Introduction

Photoionization detectors (PIDs) are used in the field to detect a variety of compounds in air. PIDs can be used to detect leaks of volatile substances in drums and tanks, to determine the presence of volatile compounds in soil and water, and to make ambient air surveys. If personnel are thoroughly trained to operate the instrument and to interpret the data, these PID instruments can be a valuable tool. Its use can help in deciding the level of protection to be worn, assist in determining the implementation of other safety procedures, and in determining subsequent monitoring or sampling locations.

Portable PIDs detect the concentration of organic gases as well as a few inorganic gases. The basis for detection is the ionization of gaseous species. The incoming gas molecules are subjected to ultraviolet (UV) radiation, which ionizes molecules that have an ionization potential (IP) less than or equal to that rated for the UV source. Every molecule has a characteristic IP, which is the energy required to remove an electron from the molecule, thus yielding a positively charged ion and the free electron. These ions are attracted to an oppositely charged electrode, causing a current and an electric signal to the LED display. Compounds are measured on a parts per million (ppm) volume basis.

1.2 HNU PI-101

The HNU portable photoionizer detects the concentration of organic gases as well as a few inorganic gases. The basis for detection is the ionization of gaseous species. The incoming gas molecules are subjected to UV radiation, which is energetic enough to ionize many gaseous compounds. Each molecule is transformed into charged ion pairs, creating a current between two electrodes. Every molecule has a characteristic IP, which is the energy required to remove an electron from the molecule, yielding a positively charged ion and the free electron.

Three probes, each containing a different UV light source, are available for use with the HNU. Energies are 9.5, 10.2, and 11.7 electron volts (eV), respectively. All three probes detect many aromatic and large-molecule hydrocarbons.

The 10.2 eV and 11.7 eV probes, in addition, detect some smaller organic molecules and some halogenated hydrocarbons. The 10.2 eV probe is the most useful for environmental response work, as it is more durable that the 11.7 eV probe and detects more compounds than the 9.5 eV probe. The 10.2 eV probe will be used for all PID screenings related to field activities at this site. A listing of molecules and compounds that the HNU can detect is presented in Exhibit K-1.2.

The primary HNU calibration gas is either benzene or isobutylene. The span potentiometer knob is turned to 9.8 for benzene calibration. A knob setting of zero increases the sensitivity to benzene approximately tenfold. Its lower detection limit is in the low ppm range. Additionally, response time is rapid; the dot matrix liquid crystal displays 90 percent of the indicated concentration in three seconds.

1.3 Limitations

The PID instrument can monitor several vapors and gases in air. Many non-volatile liquids, toxic solids, particulates, and other toxic gases and vapors, however, cannot be detected with PIDs. Since the PIDs cannot detect all the chemicals that may be present at a sample location, a zero reading on either instrument does not necessarily signify the absence of air contaminants.

The PID instrument is generally not specific, and their response to different compounds is relative to the calibration gases. Instrument readings may be higher or lower than the true concentration. This effect can be observed when monitoring total contaminant concentrations if several different compounds are being detected at once. In addition, the response of these instruments is not linear over the entire detection range. Therefore, care must be taken when interpreting the data. Concentrations should be reported in terms of the calibration gas and span potentiometer or gas-select-knob setting.

PIDs are small, portable instruments and may not yield results as accurate as laboratory instruments. PIDs were originally designed for specific industrial applications. They are relatively easy to use and interpret when detecting total concentrations of known contaminants in air, but interpretation becomes more difficult when trying to identify the individual components of a mixture. Neither instrument can be used as an indicator for combustible gases or oxygen deficiency.

This FSP intends for the PIDs to be used only as a guide for work area air monitoring to establish action levels (as defined in the Health and Safety Plan).

Exhibit D-1.2
MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Some Atoms and Simple Molecules

Molecule	IP(eV)	Molecule	IP(eV)
H	13.595	I2	9.28
C	11.264	HF	15.77
N	14.54	HCl	12.74
O	13.614	HBr	11.62
Si	8.149	HI	10.38
S	10.357	SO2	12.34
F	17.42	CO2	13.79
Cl	13.01	COS	11.18
Br	11.84	CS2	10.08
I	10.48	N2O	12.9
H_2	15.426	NO2	9.78
N_2	15.58	O3	12.8
O_2	12.075	H2O	12.59
CO	14.01	H2S	10.46
CN	15.13	H2Se	9.88
NO	9.25	H2Te	9.14
CH	11.1	HCN	3.91
OH	13.18	C2N2	13.8
F_2	15.7	NH3	10.15
Cl_2	11.48	CH3	9.84
Br_2	10.55	CH_4	12.98

Paraffins and Cycloparaffins

Molecule	IP(eV)
methane	12.98
ethane	11.65
propane	11.07
n-butane	10.63
I-butane	10.57
n-pentane	10.35
I-pentane	10.32
2,2-dimethylpropane	10.35
n-hexane	10.18
2-methlypentane	10.12
3-methlypentane	10.08
2,2-dimethlybutane	10.06
2,3-dimethlybutane	10.02
n-heptane	10.08
2,2,4-trimethylpentane	9.86
cyclopropane	10.06
cyclopentane	10.53
cyclohexane	9.88
methlycyclohexane	9.85

Exhibit D-1.2 (cont'd)
MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Alkyl Halides

Molecule	IP(eV)
HCl	12.74
Cl_2	11.48
CH_4	12.98
methyl chloride	11.28
dichloroemethane	11.35
trichloromethane	11.42
tetrachloromethane	11.47
ethyl chloride	10.98
1,2-dichloroethane	11.12
1-chloropropane	10.82
2-chloropropane	10.78
1,2-dichloropropane	10.87
1,3-dichloropropane	10.85
1-chlorobutane	10.67
2-chlorobutane	10.65
1-chloro-2-methylpropane	10.66
2-chloro-2-methylpropane	10.61
HBr	11.62
Br_2	10.55
methyl bromide	10.53
dibromomethane	10.49
tribromomethane	10.51
CH_2BrCl	10.77
$CHBr_2Cl$	10.59
ethyl bromide	10.29
1,1-dibromoethane	10.19
1-bromo-2-chloroethane	10.63
1-bromopropane	10.18
2-bromopropane	10.075
1,3-dibromopropane	10.07
1-bromobutane	10.13
2-bromobutane	9.98
1-bromo-2-methylpropane	10.09

Alkyl Halides

Molecule	IP(eV)
methyl iodide	9.54
diiodomethane	9.34
ethyl iodide	9.33
1-iodopropane	9.26
2-iodopropane	9.17
1-iodobutane	9.21
2-iodobutane	9.09
1-iodo-2-methylpropane	9.18
2-iodo-2-methylpropane	9.02
1-iodopentane	9.19
F_2	15.7
HF	15.77
$CFCl_3$ (Freon 11)	11.77
CF_2Cl_2 (Freon 12)	12.31
CF_3Cl (Freon 13)	12.91
$CHClF_2$ (Freon 22)	12.45
$CFBR_3$	10.67
CF_2Br_2	11.07
CH_3CF_2Cl (Genetron 101)	11.98
$CFCl_2CF_2Cl$	11.99
CF_3CCl_3 (Freon 113)	11.78
$CFHBrCH_2Cr$	10.75
CF_2BrCH_2Br	10.83
CF_3CH_2I	10
n-C_3F_7I	10.36
n-$C_3F_7CH_2Cl$	11.84
n-$C_3F_7CH_2I$	9.96
2-bromo-2-methylpropane	9.89
1-bromopentane	10.1
HI	10.38
I_2	9.28

Exhibit D-1.2 (cont'd)
MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Aliphatic Alcohol, Ether, Thiol, and Sulfides

Molecule	IP(eV)
H_2O	12.59
methyl alcohol	10.85
ethyl alcohol	10.48
n-propyl alcohol	10.20
I-propyl alcohol	10.16
n-butyl alcohol	10.04
dimethyl ether	10.00
diethyl ether	9.53
n-propyl ether	9.27
I-propyl ether	9.20
H_2S	10.46
methanethiol	9.440
ethanethiol	9.285
1-propanethiol	9.195
1-butanethiol	9.14
dimethyl sulfide	8.685
ethyl methyl sulfide	8.55
diethyl sulfide	8.430
di-n-propyl sulfide	8.30

Exhibit D-1.2 (cont'd)
MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Aliphatic Aldehydes and Ketones

Molecule	IP(eV)
CO_2	13.79
formaldehyde	10.87
acetaldehyde	10.21
propionaldehyde	9.98
n-butyraldehyde	9.86
isobutyraldehyde	9.74
n-valeraldehyde	9.82
isovaleraldehyde	9.71
acrolein	10.10
crotonaldehyde	9.73
benzaldehyde	9.53
acetone	9.69
methyl ethyl ketone	9.53
methyl n-propyl ketone	9.39
methyl I-propyl ketone	9.32
diethyl ketone	9.32
methyl n-butyl ketone	9.34
methyl I-butyl ketone	9.30
3,3-dimethyl butanone	9.17
2-heptanone	9.33
cyclopentanone	9.26
cyclohexanone	9.14
2,3-butanedione	9.23
2,4-pentanedione	8.87

Aliphatic Acids and Esters

Molecule	IP(eV)
CO_2	13.79
formic acid	11.05
acetic acid	10.37
propionic acid	10.24
n-butyric acid	10.16
isobutyric acid	10.02
n-valeric acid	10.12
methyl formate	10.815
ethyl formate	10.61
n-propyl formate	10.54
n-butyl formate	10.50
isobutyl formate	10.46
methyl acetate	10.27
ethyl acetate	10.11
n-propyl acetate	10.04
isopropyl acetate	9.99
n-butyl acetate	10.01
isobutyl acetate	9.97
sec-butyl acetate	9.91
methyl propionate	10.15
ethyl propionate	10.00
methyl n-butyrate	10.07
methyl isobutyrate	9.98

Exhibit D-1.2 (cont'd)
MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Aliphatic Amines and Amides

Molecule	IP(eV)
NH_3	10.15
methyl amine	8.97
ethyl amine	8.86
n-propyl amine	8.78
I-propyl amine	8.72
n-butyl amine	8.71
I-butyl amine	8.70
s-butyl amine	8.70
t-butyl amine	8.64
dimethyl amine	8.24
diethyl amine	8.01
di-n-propyl amine	7.84
di-I-propyl amine	7.73
di-n-butyl amine	7.69
trimethyl amine	7.82
triethyl amine	7.50
tri-n-propyl amine	7.23
formamide	10.25
acetamide	9.77
N-methyl acetamide	8.90
N,N-dimethyl formamide	9.12
N,N-dimethyl acetamide	8.81
N,N-diethyl formamide	8.89
N,N-diethyl acetamide	8.60

Other Aliphatic Molecules with N Atom

Molecule	IP(eV)
nitromethane	11.08
nitroethane	10.88
1-nitropropane	10.81
2-nitropropane	10.71
HCN	13.91
acetonitrile	12.22
propionitrile	11.84
n-butyronitrile	11.67
acrylonitrile	10.91
3-butene-nitrile	10.39
ethyl nitrate	11.22
n-propyl nitrate	
methyl thiocyanate	10.065
ethyl thiocyanate	9.89
methyl isothiocyanate	9.25
ethyl isothiocyanate	9.14

Exhibit D-1.2 (cont'd)

MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Olefins, Cyclo-ofefins, Acetylenes

Molecule	IP(eV)
ethylene	10.515
propylene	9.73
1-butene	9.58
2-methylpropene	9.23
trans-2-butene	9.13
cis-2-butene	9.13
1-pentene	9.50
2-methyl-1-butene	9.12
3-methyl-1-butene	9.51
3-methyl-2-butene	8.67
1-hexene	9.46
1,3-butadiene	9.07
isoprene	8.845
cyclopentene	9.01
cyclohexene	8.945
4-methylcyclohexene	8.91
4-cinylcylohexene	8.93
cyclo-octatetraene	7.99
acetylene	11.41
propyne	10.36
1-butyne	10.18

Some Derivatives of Olefins

Molecule	IP(eV)
vinyl chloride	9.995
cis-dichloroethylene	9.65
trans-dichloroethylene	9.66
trichloroethylene	9.45
tetrachloroethylene	9.32
vinyl bromide	9.80
1,2-dibromoethylene	9.45
tribromoethylene	9.27
3-chloropropene	10.04
2,3-dichloropropene	9.82
1-bromopropene	9.30
3-bromopropene	9.7
$CF_3CCl=CClCF_3$	10.36
n-$C_5F_{11}CF=CF_2$	10.48
acrolein	10.10
crotonaldehyde	9.73
mesityl oxide	9.08
vinyl methyl ether	8.93
allyl alcohol	9.67
vinyl acetate	9.19

Exhibit D-1.2 (cont'd)

MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Aromatic Compounds

Molecule	IP(eV)
benzene	9.245
toluene	8.82
ethyl benzene	8.76
n-propyl benzene	8.72
I-propyl benzene	8.69
n-butyl benzene	8.69
s-butyl benzene	8.68
t-butyl benzene	8.68
o-xylene	8.56
m-xylene	8.56
p-xylene	8.445
mesitylene	8.40
durene	8.025
styrene	8.47
alpha-methyl styrene	8.35
ethynylbenzene	8.815
napthalene	8.12
1-methylnapthalene	7.69
2-methylnapthalene	7.955
biphenyl	8.27
phenol	8.50
anisole	8.22
phenetole	8.13
benzaldehyde	9.53
acetophenone	9.27
benzenethiol	8.33
phenyl isocyanate	8.77

Aromatic Compounds

Molecule	IP(eV)
phenyl isothiocyanate	8.520
benzonitrile	9.705
nitrobenzene	9.92
aniline	7.70
fluoro-benzene	9.195
chloro-benzene	9.07
bromo-benzene	8.98
iodo-benzene	8.73
o-dichlorobenzene	9.07
m-dichlorobenzene	9.12
p-dichlorobenzene	8.94
1-chloro-2-fluorobenzene	9.155
1-chloro-3-fluorobenzene	9.21
1-chloro-4-fluorobenzene	8.99
o-fluorotoluene	8.915
m-fluorotoluene	8.915
p-fluorotoluene	8.785
o-chlorotoluene	8.83
m-chlorotoluene	8.83
p-chlorotoluene	8.70
o-bromotoluene	8.79
m-bromotoluene	8.81
p-bromotoluene	8.67
o-iodotoluene	8.62
m-iodotoluene	8.61
p-iodotoluene	8.50
benzotrifluoride	9.68
o-fluorophenol	8.66

Exhibit D-1.2 (cont'd)

MOLECULES AND COMPOUNDS DETECTED BY A PHOTOIONIZATION DETECTOR (PID)

Heterocyclic Molecules

Molecule	IP(eV)
furan	8.89
2-methyl furan	8.39
2-furaldehyde	9.21
tetrahydrofuran	9.54
dihydropyran	8.34
tetrahydropyran	9.26
thiophene	8.860
2-chlorothiophene	8.68
2-bromothiophene	8.63
pyrrole	8.20
pyridine	9.32
2-picoline	9.02
3-picoline	9.04
4-picoline	9.04
2,3-lutidine	8.85
2,4-lutidine	8.85
2,6-lutidine	8.85

Miscellaneous Molecules

Molecule	IP(eV)
ethylene oxide	10.565
propylene oxide	10.22
p-dioxane	9.13
dimethoxymethane	10.00
diethoxymethane	9.70
1,1-dimethoxyethane	9.65
propiolactone	9.70
methyl disulfide	8.46
ethyl disulfide	8.27
diethyl sulfite	9.68
thiolacetic acid	10.00
acetyl chloride	11.02
acetyl bromide	10.55
cyclo-$C_6H_{11}CF_3$	10.46
$(n\text{-}C_3F_7)(CH_3)C{=}O$	10.58
trichlorovinylsilane	10.79
$(C_2F_5)_3N$	11.7
isoprene	9.08
phosgene	11.77

Notes:

Reference: HNU Systems, Inc., 1985

IP = Ionization Potential

Exhibit D-1.3

PID Calibration and Maintenance Log

Instrument Manufacturer:
Instrument Model Number:
Instrument Serial Number:
Lamp (Circle One) 9.5 eV 10.2 eV 11.7 eV

Date/Time	Initials	Battery Check	Standard Used/Expiration			Span Potentiometer Setting	Comments
			Source	Type	Concentration		

2. Attachment D-2 – pH Meter Calibration, Operations, and Maintenance Procedures

2.1 Introduction

The pH meter will be calibrated daily prior to use.

2.2 Materials

- 10.0, 7.0, 4.0 pH buffer solutions
- Thermometer
- Distilled water
- Disposable plastic beakers
- Calibration and maintenance log

2.3 Calibration Procedures

The pH meter will be calibrated as follows:

1. Switch on instrument.

2. Connect electrode to meter and remove protective cap.

3. Rinse electrode in distilled water.

4. Measure and record temperature of buffer solutions.

5. Immerse pH electrode in pH buffer 7.00, set the temperature control to that of the buffer 7.00 and allow sufficient time for the electrode to stabilize. Adjust the Standardize Control for the correct readout.

6. Rinse electrode with distilled water.

7. Immerse pH electrode in buffer 4.0, set the temperature control to that of the buffer 4.0 and allow sufficient time for the electrode to stabilize. Adjust the Slope Control for the correct readout.

8. a. Rinse the electrode with distilled water. The meter is calibrated and ready for use.
   b. (Optional step) If the pH is expected or could be between 7.0 to 10.0, then immerse the pH electrode in buffer 10.0, set temperature control, and allow sufficient time for the electrode to stabilize. Adjust the slope control for the correct read out.

9. Record calibration information on the Temperature/pH/DO/Conductivity Meter Calibration and Maintenance Log (Exhibit K-2).

2.4 Operation Procedures

1. Calibrate pH meter.

2. Rinse probe in distilled water.
3. Fill a disposable beaker with the water sample.
4. Insert probe into one sample beaker and obtain a reading. The meter will read between 0 and 14, in 0.01 increments.
5. Repeat Step 4.
6. Log results in field notebook and the average will be the actual result.
7. Rinse probe off in distilled water.

2.5 Maintenance Procedures

1. Replace batteries on a regular basis.
2. Store electrode in protective casing when not in use.
3. Keep records of operation, maintenance, calibration, problems, and repairs.
4. After use, the meter will be inspected and the inspection recorded in the field notebook.
5. A replacement meter will be available on-site or ready for overnight shipment, if necessary.
6. pH meter will be sent back to manufacturer for service, if needed.
7. Record maintenance information on the Temperature/pH/DO/Conductivity Meter Calibration and Maintenance Log (Exhibit K-2).

Exhibit D-2

Temperature/pH/DO/Conductivity Meter Calibration and Maintenance Log

Instrument Manufacturer:

Instrument Model Number:

Instrument Serial Number:

Date/Time	Initials	Temp.	Standard Used/Expiration		DO	Battery Check	Comments
			pH	Conduct			

3. Attachment D-3 – Temperature/Conductivity Meter Calibration, Operation, and Maintenance Procedures

3.1 Introduction

The temperature/conductivity meter (HACH Model 44600 or equivalent) will be calibrated daily prior to use.

3.2 Materials

- Beaker capable of submerging the entire probe in a calibration liquid standard
- Calibration liquid standard (NaCl, 1,000 mg/L or equivalent)
- Fine end screw driver
- Disposable plastic beakers

3.3 Calibration Procedures

The conductivity meter will be calibrated as follows:

1. Be sure the probe is clean.

2. Soak the probe in distilled water for at least 30 minutes.

3. Remove the probe from the water and shake off distilled water.

4. Immerse the probe to or beyond the vent holes in a disposable beaker containing Sodium Chloride Standard Solution, 1,000 mg/L. Agitate vertically to remove trapped air.

5. Repeat Steps 3 and 4 at least once more.

6. Press the Power key and CND key. Verify that the LO BAT indicator does not appear.

7. Press the 2 milliSiemens per centimeter (mS/cm) range key.

8. Check the reading on the display. It should be 1.990 mS/cm. If adjustment is needed, use a small screwdriver to adjust the CAL control next to the display. Counterclockwise adjustment increases the reading.

9. Record calibration information on Temperature/pH/DO/ORP/Conductivity Meter Calibration and Maintenance Log (Exhibit K-2).

3.4 Operation Procedures - Temperature/Conductivity

1. Calibrate the conductivity meter.

2. Rinse probe in distilled water.

3. Fill a disposable beaker with water.

4. Turn meter to read temperature and record the temperature of the water twice.

5. Turn meter on to the 2 mS/cm scale.

6. Insert probe into sample beaker and obtain a reading. The meter will read between 0 and 20 mS/cm, in 0.001 increments.

7. Repeat Step 6.

8. Record results in the field notebook and the average will be the actual result.

9. Rinse probe off in distilled water.

3.5 Maintenance Procedures

1. Replace batteries on a regular basis.

2. Store electrode in protective casing when not in use.

3. Keep records of operation, maintenance, calibration, and of any problems and repair.

4. After use, the meter will be inspected and the inspection recorded in the log book.

5. A replacement meter will be available on-site or ready for overnight shipment, if necessary.

6. Conductivity meter will be sent back to manufacturer for service when needed.

4. Attachment D-4 – Dissolved Oxygen Meter Calibration, Operation, and Maintenance Procedures

4.1 Introduction

Dissolved oxygen (DO) will be measured using a YSI Model 50 Series or equivalent meter which will be calibrated prior to each field event.

4.2 Calibration Procedure

The dissolved oxygen meter will be calibrated as follows:

1. Prepare the probe with a thin Teflon® membrane stretched over the sensor.
2. Perform a battery check.
3. Set mode switch to operate and the operation switch to zero, and zero the instrument.
4. Take a temperature measurement and determine the calibration value from the provided table for the appropriate atmospheric pressure.
5. Select the desired range and adjust the instrument to an appropriate calibration value (determined in Step 4).
6. Place the probe in a water sample with a known dissolved oxygen level and read mg/L-dissolved oxygen.
7. Record temperature and dissolved oxygen calibration information on the Dissolved Oxygen Meter Calibration and Maintenance Log (Exhibit K-2).

4.3 Operation Procedure

1. Calibrate the dissolved oxygen meter.
2. Perform the battery check.
3. Fill a disposable beaker with water.
4. Set mode switch to operate and the operation switch to the desired range.
5. Place probe into water sample.
6. Take a temperature measurement and adjust temperature dial.
7. Switch to dissolved oxygen content measurement and allow reading to stabilize.
8. Record results in the field notebook.
9. Repeat procedure and record second reading. Average results and record.

10. Rinse the probe with distilled water.

4.4 Maintenance Procedures

1. Replace batteries on a regular basis.
2. Store electrode in protective casing when not in use.
3. Keep records of operation, maintenance, calibration, and any problems and repair.
4. A replacement dissolved oxygen meter will be ready for overnight shipment, if necessary.
5. Dissolved oxygen meter will be sent back to manufacturer for service when needed.
6. Record maintenance information on the Dissolved Oxygen Meter Calibration and Maintenance Log (Exhibit K-2).

5. Attachment D-5 – Water Level Probe Calibration Procedures

5.1 Introduction

The water level probe cable will be checked once to a standard to assess if the meter has been correctly calibrated by the manufacturer.

5.2 Materials

- Water level probe and cable
- Six-foot engineer's rule

5.3 Procedures

1. Each water level probe will be calibrated prior to using.

2. To calibrate, the lengths between each increment markers on the cable will be measured with a six-foot engineer's rule. The cable will be checked for the first 150 feet.

3. If markers are incorrect, the probe will be sent back to the manufacturer.

4. Record verification on form (Exhibit K-5).

Exhibit D-5

WATER LEVEL PROBE MAINTENANCE LOG

Instrument Model Number:

Instrument Serial Number:

Date/Time	Initials	Battery Check	Sound Indicator Check	Light Indicator Check	Case	6-Foot Ruler	Comments

6. Attachment D-6 – Turbidity Meter Calibration, Operation and Maintenance Procedures

6.1 Introduction

The turbidity meter, a Cole-Parmer Model 8391-35 or equivalent, will be calibrated daily prior to use.

6.2 Materials

- Portable turbidity meter
- 0.5, 5.0, 40 Formazin standard solutions

6.3 Calibration Procedures

The turbidity meter will be calibrated as follows:

Zero Adjust

1. With the instrument turned off, check the meter needle position. If the needle does not read zero, adjust the mechanical zero screw.

2. Turn on the instrument and allow to warm up for 5 minutes.

3. Insert the black body into the sample well.

4. Turn the set standard control fully clockwise.

5. Place the NTU range switch to the x 0.01 position.

6. Adjust the circuit board mounted potentiometer to read zero on the meter (an access hole is marked on the right hand side of the instrument).

Note: An insulated, non-magnetized calibration screwdriver is required for both adjustments.

Calibrations of Secondary Standards

1. Make the Formazin standard or obtain a commercially available standard.

2. Set the NTU range switch to x 1 (0-100 NTU full scale).

3. Pour the 40 NTU Formazin or commercial standard into the chosen sample cuvette. Make certain that the sample cuvette is wiped clean of all dirt and finger prints. Insert the cuvette into the sample well and align properly. Cover with the light shield.

4. Use the SET STANDARD knob to adjust the meter needle to read exactly 40 NTU.

5. Remove the sample cuvette and insert the 40 NTU standard. Align the cuvette properly and cover with the light shield. Note the exact reading and record this value on the calibration and maintenance log (Exhibit K-6). This is the value that should now be used for the 40 NTU sealed standard.

6. Rinse the sample cuvette thoroughly and dry completely inside and out.

7. Fill the sample cuvette with the 5 NTU Formazin or commercial standard. Insert the sample cuvette into the test well. Align the cuvette properly and cover with the light shield.

8. Turn NTU RANGE knob to x 0.1 (0-10 NTU full scale). Use the SET STANDARD knob to adjust the meter needle to read exactly 50 (actually 5 NTU).

9. Remove the sample cuvette and insert the 5 NTU sealed standard. Align the cuvette properly and cover with the light shield. Note the exact reading and record this value on the calibration and maintenance log (Exhibit K-6). This is the value that should now be used for the 5 NTU sealed standard.

10. Rinse the sample cuvette thoroughly and dry completely inside and out.

11. Fill the sample cuvette with the 0.5 NTU Formazin or commercial standard. Insert the sample cuvette into the test well, align properly and cover with the light shield.

12. Turn NTU RANGE knob to x 0.01 (0-1 NTU full scale). Use the SET STANDARD knob to adjust the meter needle to read exactly 50 (actually 0.5 NTU).

13. Remove the sample cuvette and insert the 0.5 NTU sealed standard. Align the cuvette properly and cover with the light shield. Note the exact reading and record this value on the calibration and maintenance log (Exhibit K-6). This is the value that should be used for the NTU sealed standard.

14. Record calibration information on the Turbidity Calibration and Maintenance Log (Exhibit K-6).

6.4 Operation Procedures

1. Calibrate turbidity meter.

2. All samples should be measured using the same sample cuvette. Samples are read by inserting the sample cuvette, properly aligned with the key, into the test well. Cover with the light shield and take the reading off of the correct scale on the meter. Make certain to take the range factor (x 1, x 0.1, or x 0.01) into account when calculating the actual NTU value of the sample.

6.5 Maintenance Procedures

1. Replace batteries on a regular basis.

2. Store instrument in protective carrying case when not in use.

3. Keep records of operation, maintenance, calibration, problems and repairs.

4. After use, the meter will be inspected and the inspection recorded in the field book.

5. A replacement meter will be available on-site or ready for overnight shipment, if necessary.

6. The turbidity meter will be sent back to the manufacturer for service when needed.

7. Record maintenance information on the Turbidity Calibration and Maintenance Log (Exhibit K-6).

Exhibit D-6

TURBIDITY CALIBRATION AND MAINTENANCE LOG

Instrument Manufacturer:
Instrument Model:
Identification Number:

Date/Time	Initials	Calibration/Standard		Standard Reading (NTU)		
		Type	Concentration	40	5	0.5
4						

Appendix H

Quality Assurance Project Plan

ARCADIS
Infrastructure, environment, buildings

Imagine the result

National Grid

Little Falls –Little Falls, New York
Site Management Plan
Quality Assurance Project Plan

April 2010

Quality Assurance Project Plan

Little Falls (Mill Street) Non-Owned Former MGP Site, Little Falls, New York

Project Manager
New York State Department of Environmental Conservation

Project Manager
ARCADIS

Quality Assurance Coordinator
ARCADIS

Project Manager
Analytical Laboratory

Quality Assurance Manager
Analytical Laboratory

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Date:
April 2010

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1. Introduction

1.1 Project Organization

Ongoing monitoring/recovery activities performed as part of the Site Management Plan (SMP) for the Little Falls Non-Owned former manufactured gas plant (MGP) Site (the “Site”) will require integration of personnel from the organizations identified below, collectively referred to as the “project team.” A detailed description of the responsibilities of each member of the project team is presented below.

1.1.1 Overall Project Management

On behalf of National Grid, ARCADIS of New York, Inc. (ARCADIS) will have overall responsibility for the ongoing monitoring/recovery activities performed as part of the SMP at the Site. As part of the ongoing monitoring/recovery activities, ARCADIS personnel will perform annual groundwater sampling and bi-monthly dense non-aqueous phase liquid (DNAPL) monitoring/recovery activities. In addition, ARCADIS will be responsible for performing an annual site-wide inspection to monitor the condition of engineering controls and overall Site conditions. The rationale for the ongoing monitoring/recovery activities is provided in detail in the SMP. A site location map is included on Figure 1 in the SMP. The location of physical features at the site and the groundwater sampling locations/DNAPL recovery well locations are shown on Figures 2 and 13 in the SMP. Project direction and oversight will be provided by National Grid. A listing of the key project personnel is provided below.

Company/Organization	Title	Name	Phone Number
NYSDEC	Project Manager	Bernard Franklin	(518) 402-9662
National Grid	Project Manager	James F. Morgan	(315) 428-3101
ARCADIS	Project Officer	James M. Nuss, P.E.	(315) 671-9230
	Project Manager	Michael C. Jones	(518) 671-9211
	Quality Assurance Manager	Dennis K. Capria	(315)-971-9299
TestAmerica (Edison, New Jersey)	Account Manager	TBD	--
	Project Manager	TBD	--
	Quality Assurance Manager	TBD	--

1.1.2 Task Managers

The staff performing the sampling and site activities will be directed by representatives of the project team. The personnel responsible for each of the site activities are listed below.

Company/Organization	Title	Name	Phone Number
ARCADIS	Field Task Manager	Allen Evans, P.E.	(530) 949-7144
	Analytical Task Manager	Allen Evans, P.E.	(530) 949-7144
	Health and Safety Manager	Charles Webster, CSP	(315) 671-9297
	Database Administrator	John Garrett	(315) 671-9642
	Data Validator	Dennis Capria	(315) 446-9120

1.2 Team Member Responsibilities

1.2.1 National Grid

Project Manager

Responsibilities and duties include:

- Overall direction of the ongoing monitoring/recovery activities
- Direction of ARCADIS
- Review of ARCADIS work products, including data, memoranda, letters, reports, and all other documents transmitted to the NYSDEC

1.2.2 ARCADIS

Project Officer

Responsibilities and duties include:

- Oversight during ARCADIS preparation of work products
- Provide ARCADIS approval for major project deliverables

Project Manager

Responsibilities and duties include:

- Management and coordination of all aspects of the project as defined in the SMP, with an emphasis on adhering to the objectives and schedule of the SMP
- Maintain communication with National Grid
- Review documents prepared by ARCADIS
- Assure corrective actions are taken for deficiencies cited during audits of site activities

Task Managers

The ongoing monitoring/recovery activities will be managed by Task Managers as set forth in Section 1.1.2. Responsibilities and duties of each Task Manager include:

- Manage relevant day-to-day activities
- Develop, establish, and maintain files on relevant site activities
- Review data reductions from the relevant site activities
- Perform final data review of field data reductions and reports on relevant site activities
- Assure corrective actions are taken for deficiencies cited during audits of relevant site activities
- Perform overall Quality Assurance/Quality Control (QA/QC) of the relevant portions of the work activities
- Review relevant field records and logs
- Instruct personnel working on relevant site activities
- Coordinate field and laboratory schedules pertaining to relevant site activities
- Request sample bottles from laboratory
- Review the field instrumentation, maintenance, and calibration to meet quality objectives
- Prepare reports pertaining to relevant site activities
- Maintain field and laboratory files of notebooks and logs, data reductions, and calculations, and transmit originals to the Project Manager

Field Personnel

Responsibilities and duties include:

- Perform field procedures associated with the sampling as set forth in the SMP
- Perform field analyses and collect QA samples
- Calibrate, operate, and maintain field equipment
- Reduce field data
- Maintain sample custody
- Prepare field records and logs

Quality Assurance Manager (QAM)

- Responsibilities and duties include
- Overall direction of the work activities
- Review laboratory data packages
- Oversee and interface with the analytical laboratory
- Coordinate field QA/QC activities with Task Managers, including audits of removal action activities, concentrating on field analytical measurements and practices to meet data quality objectives
- Review field reports
- Review audit reports
- Prepare interim QA/QC compliance reports
- Prepare a QA/QC report in accordance with United States Environmental Protection Agency (USEPA) guidelines, which includes an evaluation of field and laboratory data and data usability reports

1.2.3 Analytical Laboratories

- General responsibilities and duties of the analytical laboratories include
- Perform sample analyses and associated laboratory QA/QC procedures
- Supply sampling containers and shipping cartons
- Maintain laboratory custody of sample
- Strictly adhere to all protocols in the QAPP

Project Manager

Responsibilities and duties include:

- Serve as primary communication link between ARCADIS and laboratory technical staff
- Monitor workloads and ensure availability of resources
- Oversee preparation of analytical reports
- Supervise in-house chain-of-custody

Quality Assurance Manager

Responsibilities and duties include:

- Supervise the group that reviews and inspects all project-related laboratory activities
- Conduct audits of all laboratory activities

1.2.4 New York State Department of Conservation (NYSDEC)

Project Manager

Responsibilities and duties include:

- Provide NYSDEC review and approval of the SMP, supporting documents, and future deliverables
- Monitor progress of site activities
- Review and approval of the QAPP
- Review of the QA/QC portion of any submitted report
- Monitor progress of the work activities
- Ensure that all activities are performed in compliance with applicable federal and regional requirements
- Perform field and laboratory audits, if necessary

2. Project Background

2.1 Site Location and Description

The Site is located on the western portion of an approximately 6.5 acre property (currently owned by Feldmeier) located south of East Mill Street in Little Falls, Herkimer County, New York. As shown on Figure 2 in the SMP, the Site is located north of the Mohawk River, east of George Lumber and Building Materials Company (George Lumber), south of East Mill Street, and west of the line of demarcation (the NYSDEC has agreed to recognize the eastern property line of parcel Lot 21 as the line of demarcation between the area subject to remedial activities conducted by National Grid and the portion of the property to be addressed by SPX Corporation and Feldmeier under a separate VCA with the NYSDEC).

The Site is occupied by a paved parking lot and the western portion of a tank manufacturing building owned by Feldmeier. Some grass and vegetated areas are present along the margins of the parking lot and in the area south of the tank manufacturing building along the bank of the Mohawk River. Based on the extent of pavement and structures present at the Site, infiltration of precipitation in the immediate vicinity of the site is limited. Surface runoff from the site flows from north to south (toward the Mohawk River), with a portion of the paved area draining to a shallow storm sewer drain line located along the western edge of the tank manufacturing building which discharges to the Mohawk River.

2.2 Site History

Historical MGP operations at the site were primarily conducted within a small (approximately 0.56-acre) area in the central portion of the Site. Historical MGP operations were conducted from approximately 1853 to approximately 1907. Based on available Sanborn Fire Insurance Maps, buildings and structures associated with the former MGP operation included a coal storage shed, horizontal retorts, gas purifiers, maintenance shops, a warehouse, and several smaller unnamed buildings/structures. The buildings and structures were primarily located within the western portion of the footprint of the Feldmeier manufacturing building. The Sanborn Maps show that one 50,000-cubic-foot gas holder (the former onsite gas holder) was formerly located adjacent to the Mohawk River, south of the gas works. The Sanborn Maps indicate that approximately 60% of the former onsite gas holder is located beneath the southwest corner of the tank manufacturing building. The Sanborn Maps also indicate that a second gas holder (the former offsite gas holder) was constructed between 1884 and 1891 in the southeast corner of the current George Lumber Property. The layout of historical MGP structures at the site is shown on Figure 2.

Feldmeier purchased the property from SPX Corporation in 2004. In support of the property transfer, several investigations were completed at the property beginning in 1997. A Phase II ESA identified suspected MGP-related impacts in the vicinity of historical MGP operations at the Site. As a result of the suspected MGP-related impacts identified at the property, National Grid implemented a Site Characterization Investigation and a Remedial Investigation (RI) at the Site under a multi-site VCO with the NYSDEC (VCO Index No. D0-001-011). As previously mentioned, the NYSDEC has agreed to recognize the eastern property line of parcel Lot 21 (shown on Figure 2) as the line of demarcation between the area subject to remedial activities conducted by National Grid and the portion of the property to be addressed by SPX Corporation and Feldmeier under the separate VCA with the NYSDEC. Previous investigations that have been conducted at the Feldmeier property, including within the limits of the historical MGP operation at the Site, include the following:

- Phase I ESA conducted by Delta Environmental Consultants, Inc. (Delta Environmental) in 1997
- Phase I ESA conducted by Buck Engineering, LLC (Buck Engineering) in 1998
- Phase II ESA conducted by Delta Environmental in 1998
- VCP investigation and supplemental VCP investigations conducted by Buck in 2000, 2001, and 2002
- Site Characterization Investigation conducted by Foster Wheeler Environmental Corporation in 2002
- Remedial Investigation conducted by ARCADIS between 2004 and 2006

Current Site Status

National Grid completed remedial actions based on the results of previous site investigations and the current and anticipated future use(s) of the Site. After completion of the remedial actions, MGP-related residuals (including impacted subsurface soil, groundwater, and the potential presence of DNAPL) remain in subsurface media at the site. The SMP, including this QAPP, was prepared to manage remaining MGP-related residuals at the Site until a deed restriction is no longer required in accordance with ECL Article 71, Title 36. All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State.

3. Project Description

3.1 Ongoing Monitoring/Recovery Objectives

The monitoring and sampling of groundwater will be conducted to achieve the following objectives:

- Evaluate the groundwater quality of the overburden (fill, sand, silty sand, and silt and sand)
- Evaluate the groundwater quality of the bedrock at wells that are completed in bedrock
- Evaluate the onsite post remedial groundwater flow pattern
- Evaluate the post-remedial groundwater concentrations of Constituents of Concern (COCs)
- Confirm that groundwater quality is improving and/or does not represent a significant threat to human health or the environment based on the contemplated site use

3.2 Approach

The ongoing monitoring/recovery activities will consist of the following tasks to address the above-referenced objectives:

- Annual Groundwater Sampling
- Bi-Monthly DNAPL Monitoring/Recovery
- Annual Site-Wide Inspection

A description of the activities to be completed under each work task referenced above is presented in the SMP.

4. Quality Objectives and Criteria for Measurement Data

The data quality objectives (DQO) process, as described in the USEPA QA/G-4 QAPP instructions document, is intended to provide a “logical framework” for planning field sampling activities. The following sections addressed, in turn, each of the seven sequential steps in the USEPA QA/G-4 DQO process.

Step 1: Problem Statement

National Grid completed remedial actions based on the results of previous site investigations and the current and anticipated future use(s) of the Site. After completion of the remedial actions, MGP-related residuals (including impacted subsurface soil, groundwater, and the potential presence of DNAPL) remain in subsurface media at the site. The ongoing monitoring/recovery program is intended to manage and monitor engineering controls and institutional controls that have been implemented as part of the SMP at the Site.

Step 2: Decision Identification

The initial use of the data is to monitor the distribution and concentration of Site constituents, and there is no decision point for this descriptive application. The decision in this case is to determine whether or not unacceptable risk is present at the Site and whether the current SMP needs to be revised based on the distribution and concentrations of Site constituents present.

Step 3: Identifying Decision Inputs

Decision inputs incorporate both concentration and distribution. A fundamental basis for decision making is that a sufficient number of data points of acceptable quality are available from the monitoring to support the decision. Thus, the necessary inputs for the decision are: 1) the proportion of non-rejected (usable) data points; and 2) the quantity of data needed to evaluate risk.

Step 4: Defining the Study Boundaries

The Little Falls non-owned former MGP Site is located on the western portion of an approximately 6.5-acre property currently owned by Feldmeier on the south side of East Mill Street in Little Falls, New York. The boundaries of the Site are shown in Figure 2 of the SMP. The NYSDEC has agreed to recognize the eastern property line of historical parcel Lot 21 as the line of demarcation between the area subject to ongoing monitoring/recovery activities to be conducted by National Grid and the portion of the property to be addressed by SPX and Feldmeier under a separate VCA with the NYSDEC. Specifically, environmental impacts associated with historical MGP-related operations located west of the demarcation line will be addressed under the VCO between National Grid and the NYSDEC. Environmental concerns associated with the portion of the property located east of the demarcation line (and other non-MGP-related impacts) will be addressed by SPX and Feldmeier and are not covered by this QAPP or the SMP.

Step 5: Developing a Decision Rule

The decision on whether data can be used to support the project objectives will be based on the validation results. Following validation, the data will be flagged, as appropriate, and any use restrictions noted. A reasonable decision rule would be that 90% of the data points not be rejected and deemed unusable.

Step 6: Limits on Decision Errors

Specifications for this step call for: 1) giving forethought to corrective actions to improve data usability; and 2) understanding the representative nature of the sampling design. This QAPP has been designed to meet both specifications for this step. The sampling and analysis program has been developed based on a review of previous site data and knowledge of present Site conditions. Corrective actions are described elsewhere in the document and in the appended contractor documents. The representative nature of the sampling design has been assured by discussions among professionals familiar with the Site and the appropriate government agencies.

Step 7: Design Optimization

The overall quality assurance objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results which will provide the means to manage and monitor engineering controls and institutional controls that have been implemented as part of the SMP at the Site, and be consistent with National Contingency Plan (NCP) requirements. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, data reporting, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

The sampling plan involves a phased approach to both sampling and analysis. This provides the opportunity to evaluate and focus each data collection step to optimize the overall data collection process.

A DQO summary for the sampling efforts is presented in the subsequent section. The summary consists of stated DQOs relative to data uses, data types, data quantity, sampling and analytical methods, and data measurement performance criteria.

4.1 Data Categories

A wide range of data quality is achieved through the use of various analytical methods. There are three analytical categories that address various data uses and the QA/QC effort and methods required to achieve the desired level of quality. These categories include:

- Screening Data: Screening data afford a quick assessment of site characteristics or conditions. This objective for data quality is available for data collection activities that involve rapid, non-rigorous methods of analysis and quality assurance. This objective is generally applied to physical and/or chemical properties of samples, degree of contamination relative to concentration differences, and preliminary health and safety assessment.

- Screening Data with Definitive Confirmation: Screening data provide rapid identification and quantitation; however, because screening generally involves the use of less precise methods of analysis with less rigorous sample preparation, the quantitation may be relatively imprecise. Generally, at least 10% of the data are confirmed using analytical methods and QA/QC procedures and criteria associated with definitive data. This objective can also be used to verify less rigorous laboratory-based methods. This objective of data quality is available for data collection activities that require qualitative and/or quantitative verification of a select portion of sample findings.

- Definitive Data: Definitive data are generated using rigorous analytical methods, such as approved USEPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files. Data may be generated at the site or at an off-site location, as long as the QA/QC requirements are satisfied. For data to be definitive, either analytical or total measurement error must be determined.

> Definitive data are used for site characterization, environmental monitoring, confirmation of field data, and to support engineering studies or risk assessments. Definitive data are used to confirm lower level data, risk assessment, and to obtain highly documented data.

It is anticipated that both the screening and definitive data categories will be used during the sampling. Field parameters (e.g., turbidity, conductivity, temperature, dissolved oxygen, and pH) that will be obtained during groundwater sampling will be determined using screening techniques. All remaining parameters will be determined using definitive techniques.

The following levels of data reporting have been defined as potentially applicable to the ongoing monitoring/recovery activities:

Level 1 - Minimal Reporting: Minimal or “results only” reporting is used for analyses that, either due to their nature (e.g., field monitoring) or the intended data use (e.g., preliminary screening), do not generate or require extensive supporting documentation.

Level 2 - Limited Reporting: Limited reporting is used when some additional QC information is required. The documentation includes sample analytical results as well as summarized QC sample results.

Level 3 - Expanded Reporting: Modified reporting is used for analyses that are performed following standard USEPA-approved methods and QA/QC protocols and that, based on the intended data use, require some supporting documentation but not, however, full “Contract Laboratory Program (CLP)-type” reporting.

Level 4 - Full Reporting: Full “CLP-type” reporting is used for those analyses that, based on the intended data use, require full documentation.

The reporting levels for the individual sampling efforts described herein are presented in the following sections.

4.2 Annual Groundwater Sampling

Data Uses

The annual groundwater sampling activities are designed to generate hydrogeologic and water quality data to support the following evaluations:

- Evaluate the groundwater quality of the overburden (fill, sand, silty sand, and silt and sand)

- Evaluate the groundwater quality of the bedrock at wells that are completed in bedrock

- Evaluate the onsite post remedial groundwater flow pattern

- Evaluate the post-remedial groundwater concentrations of COCs

- Confirm that groundwater quality is improving and/or does not represent a significant threat to human health or the environment based on the contemplated site use

Data Types

As set forth in the SMP, physical and chemical data for groundwater are required to meet the DQOs of the annual groundwater sampling activities, as follows:

- Physical data for groundwater will consist of water level information from the existing monitoring wells at the Site. Groundwater flow direction and velocity will be determined using the water level data and geometric mean hydraulic conductivity for the soil at site. In addition, field parameters consisting of pH, conductivity, dissolved oxygen, temperature, and turbidity will be measured

- Chemical data for groundwater samples will consist of TCL VOCs, TCL SVOCs, and TAL metals (including cyanide)

The SMP provides the rationale for the physical and chemical parameters selected for analysis for the annual groundwater sampling activities.

Data Quality

Laboratory analysis of the groundwater samples collected as part of the annual groundwater sampling activities will be conducted using the following USEPA SW-846 Methods as referenced in the NYSDEC 2005 ASP:

- Method 8260 for laboratory analysis for TCL VOCs

- Method 8270 for laboratory analysis for TCL SVOCs
- Method 6010 for laboratory analysis for inorganic constituents, with the following exceptions: mercury will be analyzed using Method 7470/7471 and cyanide will be analyzed using Method 9010

The analytical results will be reported using NYSDEC ASP Category B deliverables (i.e., Reporting Level 4). Field measurement of pH, conductivity, dissolved oxygen, temperature, and turbidity will be performed in accordance with the equipment manufacturer's procedures, as outlined in the appendices to this QAPP (Analytical Level 1).

The specific VOCs and SVOCs to be analyzed for groundwater samples collected as part of the annual groundwater sampling activities include the VOCs/SVOCs on the compound lists established for the above-referenced methods by the USEPA (and selected VOCs on the supplemental compound list established for Method 8260 by the USEPA). The specific VOCs and SVOCs to be analyzed for groundwater samples collected as part of the annual groundwater sampling activities are presented in Table 1. The specific inorganic constituents to be analyzed for groundwater samples collected as part of the annual groundwater sampling activities include all of the constituents on the Target Analyte List (TAL), which are also presented in Table 1.

Data Quantity

The annual groundwater sampling activities will consist of collecting groundwater samples from eight monitoring well locations including FWMW-1, FWMW-2, FWMW-3, FWMW-5, B-MW-3, MW-101RD, MW-102R, and MW-103R. Measurements of pH, conductivity, dissolved oxygen, temperature, and turbidity will be obtained for each groundwater sample collected for the annual groundwater sampling activities. The type and quantity of QA/QC samples to be submitted for laboratory analysis during the annual groundwater sampling activities are presented in Table 2.

Sampling and Analytical Methods

The groundwater level measurement procedures, water quality measurement procedures, and groundwater sampling procedures are provided in the FSP. The laboratory analytical methods for groundwater samples are presented in Table 3.

Measurement Performance Criteria

Precision and accuracy QC limits for chemical constituents, which are used during data validation to assess analytical performance, are presented in Table 4. When possible, these limits reflect the laboratory's control limits, although as noted on the table, published guidance limits are identified in some situations. Published method accuracy limits are used to provide the required analytical control.

Data representativeness is addressed by the sample quantities and locations identified in the SMP. Data comparability is intended to be achieved through the use of standard USEPA-approved and NYSDEC ASP-approved methods.

5. Special Training Requirements/Certification

In compliance with the Occupational Safety and Health Administration's (OSHA) final rule, "Hazardous Waste Operations and Emergency Response," 29 CFR Part 1910.120(e), all personnel performing ongoing monitoring/recovery activities at the Site will have completed the requirements for OSHA 40-hour Hazardous Waste Operations and Emergency Response training. Persons in field supervisory positions will have also completed the additional OSHA 8-hour Supervisory Training.

6. Documentation and Records

6.1 General

Groundwater samples will be collected as described in the SMP. Detailed descriptions of the sample designation system, documentation and reporting requirements are presented below.

6.2 Sample Designation System

6.2.1 Sample Codes

A sample designation code and the sample date will provide each sample with a unique “name”. This alphanumeric system will apply to all groundwater samples which are collected and submitted for laboratory analysis. The sample designation code system includes a letter prefix describing the sample matrix and a number indicating the sample location. Letter prefixes that will be used for the sample designation code system are as follows:

- Groundwater – “MW”

The sample location number will be assigned by the field sampling personnel prior to each sampling event. Rinse blank, trip blank, and blind duplicate samples will be designated as follows:

- Rinse Blank – “RB”
- Trip Blank – “TB”
- Blind Duplicate – “DUP”

Where necessary, the code system will be supplemented to accommodate additional sample identification information.

Multiple rinse blank, trip blank, and blind duplicate samples will be distinguished by adding a numeric suffix which is preceded by the letter code and a hyphen (i.e., RB-1, RB-2, etc.). Additional sample volumes collected for matrix spike (“MS”) and matrix spike duplicate (“MSD”) analysis will be noted on the chain-of-custody forms, and the associated additional sample containers will be labeled, as described above, with the appropriate suffix (“MS” or “MSD”).

Sediment probing transects will be distinguished using the letter prefix “T”, a numerical value to identify the individual probing transect, and an additional number (preceded by a hyphen) to identify the probing location along the transect.

6.3 Field Documentation

Field personnel will provide comprehensive documentation covering various aspects of field sampling, field analysis, and sample chain-of-custody. This documentation consists of a record that allows reconstruction of field events to aid in the data review and interpretation process. Documents, records, and information relating to the performance of the field work will be retained in the project file.

The various forms of documentation to be maintained throughout the action include:

- Daily Production Documentation - A field notebook consisting of a waterproof, bound notebook that will contain a record of all activities performed at the site.

- Sampling Information - Detailed notes will be made as to the exact sampling location, physical observations, and weather conditions (as appropriate).

- Sample Chain-of-Custody - Chain-of-custody (COC) forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. COC forms will be filled out at each sampling site, at a group of sampling sites, or at the end of each day of sampling by ARCADIS’ field personnel responsible for sample custody. In the event that the samples are relinquished by the designated sampling person to other sampling or field personnel, the COC form will be signed and dated by the appropriate personnel to document the sample transfer. The original COC form will accompany the samples to the laboratory, and copies will be forwarded to the project files.

Persons will have custody of samples when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.

- Field Equipment, Calibration, and Maintenance Logs - To document the calibration and maintenance of field instrumentation, calibration and maintenance logs will be maintained for each piece of field equipment that is not factory-calibrated.

6.4 Laboratory Documentation Files

6.4.1 Laboratory Project Files

The laboratory will establish a file for pertinent data. The file will include COC forms, raw data, chromatograms, correspondence, and faxed information. The laboratory will retain project files and data packages for not less than a period of 5 years.

6.4.2 Laboratory Logbooks

Workbooks, bench sheets, instrument logbooks, and instrument printouts will be used to trace the history of samples through the analytical process and document important aspects of the work, including the associated quality controls. As such, logbooks, bench sheets, instrument logs, and instrument printouts will be part of the permanent record of the laboratory.

Each page or entry will be dated and initialed by the analyst at the time of entry. Errors in entry will be crossed out in indelible ink with a single stroke, corrected without the use of white-out or by obliterating or writing directly over the erroneous entry, and initialed and dated by the individual making the correction. Pages of logbooks that are not used will be completed by lining out unused portions.

Information regarding the sample, analytical procedures performed, and the results of the testing will be recorded on laboratory forms or personal notebook pages by the analyst. These notes will be dated and will also identify the analyst, the instrument used, and the instrument conditions.

Laboratory notebooks will be periodically reviewed by the laboratory group leaders for accuracy, completeness, and compliance to this QAPP. All entries and calculations will be verified by the laboratory group leader. If all entries on the pages are correct, then the laboratory group leader will initial and date the pages. Corrective action will be taken for incorrect entries before the laboratory group leader signs.

6.4.3 Computer Tape and Hard Copy Storage

All electronic files and deliverables will be retained for not less than five years; hard copy data packages (or electronic copies) will also be retained for not less than five years.

6.5 Data Reporting Requirements

6.5.1 Field Data Reporting

Information collected in the field through visual observation, manual measurement, and/or field instrumentation will be recorded in field notebooks or data sheets and/or on forms. Such data will be reviewed by the appropriate Task Manager for adherence to the SMP and for consistency. Concerns identified as a result of this review will be discussed with the field personnel, corrected if possible, and, as necessary, incorporated into the data evaluation process.

If applicable, field data forms and calculations will be processed and included in appendices to the appropriate reports (when generated). The original field logs, documents, and data reductions will be kept in the project file at the ARCADIS office in Syracuse, New York.

6.5.2 Laboratory Data Reporting

The laboratory is responsible for reporting the data in tabular format. Data will be tabulated by method and sample with reference to the sample by both field and laboratory identifications. The data tables will provide a cross-reference between each sample and the appropriate QC data package.

The laboratory will prepare full NYSDEC ASP Category B data packages and case narratives for each sample delivery group for the laboratory analyses for VOCs, SVOCs, and inorganic constituents. Reports will include all raw data required to recalculate any result, including sample and standard printouts, chromatograms, and quantitation reports. In addition, sample preparation records including extraction sheets, digestion sheets, percent solids, and logbook pages will also be provided in the data package.

6.6 Project File

Project documentation will be placed in project files according to ARCADIS requirements identified in the corporate quality procedure (QP 1.02) for document management. Project files typically consist of the following components:

1. Agreements/Proposals (filed chronologically)
2. Change Orders/Purchase Orders (filed chronologically)
3. Invoices (filed chronologically)

4. Project Management (filed by topic)
5. Correspondence (filed chronologically)
6. Notes and Data (filed by topic)
7. Public Relations Information (filed by topic)
8. Regulatory Documents (filed chronologically)
9. Marketing Documents (filed chronologically)
10. Final Reports/Presentations (filed chronologically)
11. Draft Reports/Presentations (filed chronologically)
12. Documents Prepared by Others (filed chronologically)

Final reports (including QAPPs and QA reports) are filed in folder #10 – Final Reports/Presentations. Analytical laboratory documentation (when received) and field data are filed in folder #6 – Notes and Data. Filed materials may be removed and signed out by authorized personnel on a temporary basis only.

7. Sample Process Design

The sampling process for the annual groundwater sampling activities has been designed to satisfy the requirements of the VCO for the site. The goal of the sampling process is to collect sufficient data to monitor the distribution and concentration of Site constituents in subsurface media at the Site and to confirm that groundwater quality is improving and/or does not represent a significant threat to human health or the environment based on the contemplated site use.

8. Sample Method Requirements

As part of the field sampling activities, several standard field procedures will be utilized. This section of the QAPP presents the sampling methodologies that will be used for the field sampling. Sample handling, packing, and shipping are discussed in Section 9. Equipment maintenance requirements and instrument calibration and frequency are discussed in Sections 12 and 13, respectively. Sample quantities and analytical constituents and parameters for the following sections are summarized in Table 1, 2, and 3. The required sample containers, volumes, preservation, and holding times are summarized in Table 5.

8.1 Sampling Equipment and Procedures

8.1.1 Groundwater Level Measurement

Groundwater-level measurements will be measured using an electric water level meter and an electronic oil/water interface probe using the procedures described in the FSP.

8.1.2 Groundwater Sampling

Groundwater samples will be collected using low-flow sampling methods. The groundwater sampling procedures are presented in the FSP.

9. Sample Handling and Custody Requirements

9.1 Sample Containers and Preservation

Appropriate sample containers, preservation methods, and laboratory holding times for the annual groundwater sampling samples are shown in Table 5.

The analytical laboratory will supply appropriate sample containers and preservatives, as necessary. The bottles will be purchased pre-cleaned according to USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9240.05A requirements. The field personnel will be responsible for properly labeling containers and preserving samples (as appropriate). Sample labeling procedures are discussed in Section 9.2.2.

9.2 Field Custody Procedures

The objective of field sample custody is to assure that samples are not tampered with from the time of sample collection through time of transport to the analytical laboratory. Persons will have “custody of samples” when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.

Field custody documentation consists of both field logbooks and field COC forms.

9.2.1 Field Logbooks

Field logbooks will provide the means of recording data collecting activities performed. As such, entries will be described in as much detail as possible so that persons going to the site could re-construct a particular situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in a secure location when not in use. Each logbook will be identified by the project specific document number. The title page of each logbook will contain the following:

- Person to whom the logbook is assigned
- Logbook number
- Project name
- Project start date

- End date

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the site, field sampling team personnel, and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. Entries will be made in ink, and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark. Whenever a sample is collected or a measurement is made, a detailed description of the location of the station shall be recorded. The number of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in Section 8. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume, and number of containers. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description.

9.2.2 Sample Labeling

The following information is required on each sample label:

- Project
- Date collected
- Time collected
- Location
- Sampler
- Analysis to be performed
- Preservative
- Sample number

9.2.3 Field Chain-of-Custody Forms

Completed COC forms will be required for all samples to be analyzed. COC forms will be initiated by the sampling crew in the field. The COC forms will contain the unique sample identification number, sample date and time, sample description, sample type, preservation (if any), and analyses required. The original COC form will accompany the samples to the laboratory. Copies of the COC will be made prior to shipment (or multiple copy forms used) for field documentation. The COC forms will remain with the samples at all times. The samples and signed COC forms will remain in the possession of the sampling crew until the samples are delivered to the express carrier (e.g., Federal Express) or hand delivered to a mobile or permanent laboratory, or placed in secure storage.

Sample labels will be completed for each sample using waterproof ink. The labels will include sample information such as: sample number and location, type of sample, date and time of sampling, sampler’s name or initials, preservation, and analyses to be performed. The completed sample labels will be affixed to each sample bottle and covered with clear tape.

Whenever samples are split with a government agency or other party, a separate COC will be prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the representative’s signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the “Received By” space.

9.3 Management of Investigation-Derived Materials and Wastes

Management of sample-derived materials and wastes will be performed consistent with the USEPA guidance Guide to Management of Investigation – Derived Wastes, 9345.3-03FS, dated January 1992. Disposable equipment (including personal protective equipment) and debris will be containerized and appropriately labeled during the sampling events, and will be disposed of accordingly. All purged groundwater and water generated during equipment decontamination will be containerized and staged onsite in a 55-gallon drum or polyethylene storage tank, and will be disposed of appropriately based on analytical results.

9.4 Packing, Handling and Shipping Requirements

Sample packaging and shipment procedures are designed to insure that the samples will arrive at the laboratory, with the COC, intact.

Samples will be packaged for shipment as outlined below:

- Ensure that sample containers have sample labels securely affixed to the container with clear packing tape
- Check the caps on the sample containers to ensure that they are properly sealed
- Wrap the sample container cap with clear packing tape to prevent it from becoming loose
- Complete the COC form with the required sampling information and ensure that the recorded information matches the sample labels. NOTE: If the designated sampler relinquishes the samples to other sampling or field personnel for packing or other purposes, the sampler will complete the COC prior to this transfer. The appropriate personnel will sign and date the COC form to document the sample custody transfer
- Using duct tape, secure the outside drain plug at the bottom of the cooler
- Wrap sample containers in bubble wrap or other cushioning material
- Place 1 to 2 inches of cushioning material at the bottom of the cooler
- Place the sealed sample containers into the cooler
- Place ice in plastic bags and seal. Place loosely in the cooler
- Fill the remaining space in the cooler with cushioning material
- Place COC forms in a plastic bag and seal. Tape the forms to the inside of the cooler lid
- Close the lid of the cooler, lock, and secure with duct tape
- Wrap strapping tape around both ends of the cooler at least twice

- Mark the cooler on the outside with the following information: shipping address, return address, "Fragile" labels, and arrows indicating “this side up.” Cover the labels with clear plastic tape. Place a signed custody seal over the cooler lid.

Samples will be packaged by the field personnel and transported as low-concentration environmental samples. The samples will be hand-delivered or delivered by an express carrier within 48 hours of the time of collection. Shipments will be accompanied by the COC form identifying the contents. The original form will accompany the shipment; copies will be retained by the sampler for the sampling office records. If the samples are sent by common carrier, a bill of lading will be used. Receipts or bills of lading will be retained as part of the permanent project documentation. Commercial carriers are not required to sign off on the COC form as long as the forms are sealed inside the sample cooler and the custody seals remain intact.

Sample custody seals and packing materials for filled sample containers will be provided by the analytical laboratory. The filled, labeled, and sealed containers will be placed in a cooler on ice and carefully packed to eliminate the possibility of container breakage.

9.5 Laboratory Custody Procedures

9.5.1 General

Upon sample receipt, laboratory personnel will be responsible for sample custody. The original field COC form will accompany all samples requiring laboratory analysis. The laboratory will use COC guidelines described in the USEPA guidance documents. Samples will be kept secured in the laboratory until all stages of analysis are complete. All laboratory personnel having samples in their custody will be responsible for documenting and maintaining sample integrity.

9.5.2 Sample Receipt and Storage

Immediately upon sample receipt, the laboratory sample custodian will verify the cooler seal, open the cooler, and compare the contents against the field COC. If a sample container is missing, a sample container is received broken, the sample is in an inappropriate container, or has not been preserved by appropriate means, ARCADIS will be notified. The laboratory sample custodian will be responsible for logging the samples in, assigning a unique laboratory identification number to each sample, labeling the sample bottle with the laboratory identification number, and moving the sample to an appropriate storage location to await analysis. The project name, field sample code, date sampled, date received, analysis required, storage location and date, and action for final disposition will be recorded in the laboratory tracking system. Relevant custody documentation will be placed in the project file.

9.5.3 Sample Analysis

Analysis of an acceptable sample will be initiated by worksheets that contain all pertinent information for analysis. The analyst will sign and date the laboratory COC form when removing the samples from storage.

Samples will be organized into sample delivery groups (SDGs) by the laboratory. A SDG may contain up to 20 field samples (field duplicates, trip blanks, and rinse blanks are considered field samples for the purposes of SDG assignment). All field samples assigned to a single SDG shall be received by the laboratory over a maximum of 7 calendar days, and must be processed through the laboratory (preparation, analysis, and reporting) as a group. Every SDG must include a minimum of one site-specific matrix spike/matrix spike duplicate (MS/MSD) pair, which shall be received by the laboratory at the start of the SDG assignment.

Each SDG will therefore be self-contained for all of the required quality control samples. All parameters within an SDG will be extracted and analyzed together in the laboratory. At no time will the laboratory be allowed to run any sample (including QC samples) at an earlier or later time than the rest of the SDG. An entire SDG for any single parameter will be analyzed on a single instrument within the laboratory. These rules for analysis will ensure that the quality control samples for an SDG are applicable to the field samples of the same SDG, and that the best possible comparisons may be made.

Information regarding the sample, analytical procedures performed, and the results of the testing will be recorded on laboratory forms or personal notebook pages by the analyst. These notes will be dated, and also identify the analyst, the instrument used, and the instrument conditions.

9.5.4 Sample Storage Following Analysis

Samples will be maintained by the laboratory for one month after the final report is delivered to ARCADIS. After this period, the laboratory is responsible for the disposal of the samples. Unused portions of the samples, sample extracts and associated wastes will be disposed of by the laboratory in accordance with applicable rules and regulations as specified in their SOP for waste disposal.

10. Analytical Method Requirements

10.1 Field Parameters and Methods

The methods listed below include the range of analyses expected to be performed.

10.1.1 Groundwater

Groundwater-level measurements will be made with the use of an electronic water-level or interface probe. Field measurement of the water-quality parameters pH, temperature, specific conductance, dissolved oxygen, and turbidity will be conducted using a multi-parameter field meter (e.g. Horiba U-22®, or similar). Field instruments will be calibrated daily following the manufacturers recommended procedures.

10.2 Laboratory Parameters and Methods

The methods listed below include the range of analyses expected to be performed.

10.2.1 Groundwater Sampling

Groundwater samples will be analyzed for:

TCL VOCs	NYSDEC ASP (USEPA SW-846 Method 8260)
TCL SVOCS	NYSDEC ASP (USEPA SW-846 Method 8270)
TAL Inorganic Constituents	NYSDEC ASP (USEPA SW-846 Method 6010/7000)
Cyanide	NYSDEC ASP (USEPA SW-846 Method 9010)

10.2.2 Waste Characterization Sampling

Waste characterization samples will be analyzed for:

TCLP VOCs	NYSDEC ASP (USEPA SW-846 Method 1311/8260)
TCLP SVOCS	NYSDEC ASP (USEPA SW-846 Method 1311/8270)
TCLP Metals	NYSDEC ASP (USEPA SW-846 Method 1311/6010/7000)
Corrosivity	NYSDEC ASP (SW-846 Chapter 7)
Ignitability	NYSDEC ASP (SW-846 Chapter 7)
Reactivity	NYSDEC ASP (SW-846 Chapter 7)

11. Quality Control Procedures

11.1 Quality Assurance Indicators

The overall quality assurance objective for this QAPP is to develop and implement procedures for sampling, COC, laboratory analysis, instrument calibration, data reduction and reporting, internal quality control, audits, preventive maintenance, and corrective action, such that valid data will be generated. These procedures are presented or referenced in the following sections of the QAPP. Specific QC checks are discussed in Section 11.2.

Quality assurance indicators are generally defined in terms of five parameters:

1. Representativeness
2. Comparability
3. Completeness
4. Precision
5. Accuracy

Each parameter is defined below. Specific objectives for the site actions are set forth in other sections of this QAPP as referenced below.

11.1.1 Representativeness

Representativeness is the degree to which sampling data accurately and precisely represent site conditions, and is dependent on sampling and analytical variability and the variability of environmental media at the site. The actions have been designed to assess the presence of the chemical constituents at the time of sampling. The SMP presents the rationale for sample quantities and location. This QAPP presents field sampling methodologies and laboratory analytical methodologies. The use of the prescribed field and laboratory analytical methods with associated holding times and preservation requirements are intended to provide representative data.

11.1.2 Comparability

Comparability is the degree of confidence with which one data set can be compared to another. Comparability between phases of the actions (if additional phases are required) will be maintained through consistent use of the sampling and analytical methodologies set forth in this QAPP and through the use of established QA/QC procedures, and the utilization of appropriately trained personnel.

11.1.3 Completeness

Completeness is defined as a measure of the amount of valid data obtained from an event and/or investigation compared to the total amount that was obtained. This will be determined upon final assessment of the analytical results, as discussed in Section 11.6.

11.1.4 Precision

Precision is a measure of the reproductability of sample results. The goal is to maintain a level of analytical precision consistent with the objectives of the action. To maximize precision, sampling and analytical procedures will be followed. All work for the site actions will adhere to established protocols presented in the QAPP. Checks for analytical precision will include the analysis of matrix spike, matrix spike duplicates, laboratory duplicates and field duplicates. Checks for field measurement precision will include obtaining duplicate field measurements. Further discussion of precision QC checks is provided in Section 11.4.

11.1.5 Accuracy

Accuracy is a measure of how close a measured result is to the true value. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, reference standards, matrix spikes, blank spikes, and surrogate standards will be used to assess the accuracy of the analytical data.

11.2 Field Quality Control Checks

11.2.1 1Field Measurements

To verify the quality of data using field instrumentation, duplicate measurements will be obtained and reported for all field measurements. A duplicate measurement will involve obtaining measurements a second time at the same sampling location.

11.2.2 Sample Containers

Certified-clean sample containers (I-Chem 300 Series or equivalent) will be supplied by the laboratory. Certificates of analysis will be filed in the project file.

11.2.3 Field Duplicates

Field duplicates will be collected from the different site materials to verify the reproducibility of the sampling methods. Field duplicates will be prepared by placing well homogenized aliquots from the same sample location into individual sample containers, which are submitted blind to the laboratory. In general, field duplicates will be analyzed at a 5 percent frequency (every 20 samples) for the chemical constituents. Table 2 provides an estimated number of field duplicates to be prepared for each applicable parameter and matrix.

11.2.4 Rinse Blanks

Rinse blanks are used to monitor the cleanliness of the sampling equipment and the effectiveness of the cleaning procedures. Rinse blanks will be prepared and submitted for analysis at a ratio of one per 20 field samples, or once per week of sampling, whichever is most frequent. Rinse blanks will be prepared by filling sample containers with analyte-free water (supplied by the laboratory) which has been routed through a cleaned sampling device. When dedicated sampling devices are used or sample containers are used to collect the samples, rinse blanks will not be necessary. Table 2 provides an estimated number of rinse blanks for environmental media samples to be collected during the annual groundwater sampling activities.

11.2.5 Trip Blanks

Trip blanks will be used to assess whether site samples have been exposed to non-site-related volatile organic constituents during sample storage and transport. Trip blanks will be analyzed at a frequency of once per day, for each cooler containing groundwater samples to be analyzed for volatile organic constituents. A trip blank will consist of a container filled with analyte-free water (supplied by the laboratory) which remains unopened with field samples throughout the sampling event. Trip blanks will only be analyzed for volatile organic constituents. The estimated number of trip blanks to be collected for each matrix and parameter during the annual groundwater sampling activities is presented in Table 2.

11.2.6 Zero Span Gasses

A photoionization detector (PID) will be used during the annual groundwater sampling activities to monitor air in the worker breathing zone as described in the HASP. The PID will be calibrated daily prior to use. Background ambient air will be the “zero gas” used to calibrate the PID to a reading of 0.0 parts per million (ppm). Isobutylene will be used to calibrate the span of the PID at 100 ppm. Detailed procedures for calibrating the PID are presented in the FSP.

11.3 Analytical Laboratory Quality Control Checks

Internal laboratory quality control checks will be used to monitor data integrity. These checks will include method blanks, matrix spikes (and matrix spike duplicates), spike blanks, internal standards, surrogate samples, calibration standards, and reference standards. Project QC limits for duplicates and matrix spikes are identified in Table 4. Laboratory control charts will be used to determine long-term instrument trends.

11.3.1 Method Blanks

Sources of contamination in the analytical process, whether specific analyses or interferences, need to be identified, isolated, and corrected. The method blank is useful in identifying possible sources of contamination within the analytical process. For this reason, it is necessary that the method blank is initiated at the beginning of the analytical process and encompasses all aspects of the analytical work. As such, the method blank would assist in accounting for any potential contamination attributable to glassware, reagents, instrumentation, or other sources which could affect sample analysis. One method blank will be analyzed with each analytical series associated with no more than 20 samples.

11.3.2 Matrix Spikes/Matrix Spike Duplicates

Matrix spikes and matrix spike duplicates will be used to measure the accuracy of analyte recovery from the sample matrices. Matrix spikes and matrix spike duplicates will be site-specific. Matrix spike duplicate pairs will be analyzed at a 5 percent frequency (every 20 samples or once every week, whichever comes first).

When matrix spike recoveries are outside QC limits, associated control sample and surrogate spike recoveries will be evaluated, as applicable, to attempt to verify the reason for the deviation and determine the effect on the reported sample results.

Table 2 presents an estimated number of matrix spike and matrix spike duplicate analyses for each applicable parameter.

11.3.3 Surrogate Spikes

Surrogates are compounds which are unlikely to occur under natural conditions that have properties similar to the analytes of interest. This type of control is primarily used for organic samples analyzed by gas chromatography/mass spectrometry (GC/MS) and gas chromatography (GC) methods and is added to the samples prior to purging or extraction. The surrogate spike is utilized to provide broader insight into the proficiency and efficiency of an analytical method on a sample-specific basis. This control reflects analytical conditions that may not be attributable to sample matrix.

If surrogate spike recoveries exceed specified QC limits, then the analytical results need to be evaluated thoroughly in conjunction with other control measures. In the absence of other control measures, the integrity of the data may not be verifiable and reanalysis of the samples with additional control may be necessary.

Surrogate spike compounds will be selected utilizing the guidance provided in the analytical methods.

11.3.4 Laboratory Duplicates

For inorganics, laboratory duplicates will be analyzed to assess laboratory precision. Laboratory duplicates are defined as a separate aliquot of an individual sample that is analyzed as a separate sample. Table 2 presents an estimated number of laboratory duplicates for each applicable parameter.

11.3.5 Calibration Standards

Calibration check standards analyzed within a particular analytical series provide insight regarding instrument stability. A calibration check standard will be analyzed at the beginning and end of an analytical series, or periodically throughout a series containing a large number of samples.

In general, calibration check standards will be analyzed after every 12 hours, or more frequently as specified in the applicable analytical method. If results of the calibration check standard exceed specified tolerances, then samples analyzed since the last acceptable calibration check standard will be reanalyzed.

Laboratory instrument calibration standards will be selected utilizing the guidance provided in the analytical methods as summarized in Section 13.

11.3.6 Reference Standards/Control Samples

Reference standards are standards of known concentration, and independent in origin from the calibration standards. The intent of reference standard analysis is to provide insight into the analytical proficiency within an analytical series. This includes the preparation of calibration standards, the validity of calibration, sample preparation, instrument set-up, and the premises inherent in quantitation. Reference standards will be analyzed at the frequencies specified within the analytical methods.

11.4 Data Precision Assessment Procedures

Field precision is difficult to measure because of temporal variations in field parameters. However, precision will be controlled through the use of experienced field personnel, properly calibrated meters, and duplicate field measurements. Field duplicates will be used to assess precision for the entire measurement system including sampling, handling, shipping, storage, preparation, and analysis.

Laboratory data precision will be monitored through the use of matrix spike/matrix spike duplicate and laboratory duplicate sample analyses.

The precision of data will be measured by calculation of the relative percent difference (RPD) by the following equation:

$$\text{RPD} = \text{ABS}\ \frac{(A-B)}{(A+B)/2} \times 100$$

Where:

A = Analytical result from one of two duplicate measurements
B = Analytical result from the second measurement

Precision objectives for duplicate analyses are identified in Table 4.

11.5 Data Accuracy Assessment Procedures

The accuracy of field measurements will be controlled by experienced field personnel, properly calibrated field meters, and adherence to established protocols. The accuracy of field meters will be assessed by review of calibration and maintenance logs.

Laboratory accuracy will be assessed via the use of matrix spikes, surrogate spikes and reference standards. Where available and appropriate, QA performance standards will be analyzed periodically to assess laboratory accuracy. Accuracy will be calculated in terms of percent recovery as follows:

$$\% \text{ Recovery} = \frac{A-X}{B} \times 100$$

Where:

A = Value measured in spiked sample or standard
X = Value measured in parent sample
B = True value of amount added to sample or true value of standard

This formula is derived under the assumption of constant accuracy between the original and spiked measurements. Accuracy objectives for matrix spike recoveries are identified in Table 4.

11.6 Data Completeness Assessment Procedures

Completeness of a field or laboratory data set will be calculated by comparing the number of valid sample results generated to the total number of results generated.

$$\text{Completeness} = \frac{\text{Number valid results}}{\text{Total number of results generated}} \times 100$$

As a general guideline, overall project completeness is expected to be at least 90 percent. The assessment of completeness will require professional judgment to determine data usability for intended purposes.

12. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

12.1 General

Testing and maintenance schedules have been developed for both field and laboratory instruments. A summary of the testing and maintenance activities to be performed is presented below.

12.2 Field Instruments and Equipment

Prior to any field sampling, each piece of field equipment will be inspected to assure it is operational. It is anticipated that all field instruments used in the annual groundwater sampling activities will be rented from an equipment vendor. It is the responsibility of the appropriate Task Manager or field personnel to determine that the rental equipment has been properly maintained and is in good working order. If the equipment is not operational, it will be returned to the equipment for service or replacement prior to its use. If instrument servicing is required, it is the responsibility of the appropriate Field Task Manager or field personnel to follow the maintenance schedule and arrange for prompt service. A summary of preventive maintenance requirements for field instruments is provided in Table 6. Details regarding field equipment maintenance, operation, and calibration are provided in the FSP. All meters which require charging or batteries will be fully charged and have fresh batteries.

12.3 Laboratory Instruments and Equipment

12.3.1 General

Laboratory instrument and equipment documentation procedures include details of any observed problems, corrective measure(s), routine maintenance, and instrument repair (which will include information regarding the repair and the individual who performed the repair).

Preventive maintenance of laboratory equipment generally will follow the guidelines recommended by the manufacturer. A malfunctioning instrument will be repaired immediately by in-house staff or through a service call from the manufacturer.

12.3.2 Instrument Maintenance

Maintenance schedules for laboratory equipment adhere to the manufacturer's recommendations. Records reflect the complete history of each instrument and specify the time frame for future maintenance. Major repairs or maintenance procedures are performed through service contracts with manufacturer or qualified contractors. Paperwork associated with service calls and preventative maintenance calls will be kept on file by the laboratory.

Laboratory Systems Managers are responsible for the routine maintenance of instruments used in the particular laboratory. Any routine preventative maintenance carried out is logged into the appropriate logbooks. The frequency of routine maintenance is dictated by the nature of samples being analyzed, the requirements of the method used, and/or the judgment of the Laboratory Systems Manager.

All major instruments are backed up by comparable (if not equivalent) instrument systems in the event of unscheduled downtime. An inventory of spare parts is also available to minimize equipment/instrument downtime.

13. Instrument Calibration and Frequency

13.1 Field Instruments and Equipment

Field personnel are responsible for ensuring that a record of equipment calibration and maintenance log is maintained in the field book. Calibration record sheets provided by equipment vendors shall be retained for project file. Where applicable, the following information will be recorded:

- Name of device and/or instrument calibrated
- Device/instrument serial/identification numbers
- Calibration method
- Tolerance
- Calibration standard used
- Frequency of calibration
- Date(s) of calibration(s)
- Name of person(s) performing calibration(s)

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated at the intervals specified by the manufacturer or more frequently, and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. A summary of minimum frequencies for calibration of select field instruments and equipment is presented in Table 7. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service. Equipment found to be out of tolerance during the period of use shall be removed from the field and measuring and testing activities performed using the equipment shall be addressed via the corrective action system described in Section 17.4 of this QAPP.

13.2 Laboratory Instruments and Equipment

When analyses are conducted according to the USEPA SW-846 methods, the calibration procedures and frequencies specified in the applicable method will be followed. Records of calibrations will be filed and maintained by the laboratory. These records will be subject to QA audit. For all instruments, the laboratory will maintain trained repair staff with in-house spare parts or will maintain service contracts with vendors.

All standards used in the calibration of equipment are traceable, directly or indirectly, to National Institute of Standards and Technology (NIST). All standards received shall be logged into standard receipt logs maintained by the individual analytical groups. Each group shall maintain a standards log which tracks the preparation of standards used for calibration and QC purposes.

14. Inspection/Acceptance Requirements for Supplies and Consumables

All laboratory reagents will be tested prior to use with site samples. All standards will be verified against a second source standard. The laboratory will follow a “first in, first out” procedure for the storage and use of all consumables to minimize the risk of contamination and degradation.

15. Data Acquisition Requirements for Non-Direct Measurements

Prior to their use, historical data sets will be reviewed according to the procedures identified in subsequent sections of this QAPP to determine the appropriate uses of such data. The extent to which these data can be validated will be determined by the analytical level and QC data available. The evaluation of historic data requires the following:

- Identification of analytical levels
- Evaluation of QC data, when available
- Development of conclusions regarding the acceptability of the data for intended uses

Acceptability of historic data for intended uses will be determined by application of these procedures and professional judgment. If the historic data quality cannot be determined, its use will be limited to general guidance in the decision-making process. Historic data that have been generated consistent with NCP requirements will be used in decision-making for the site.

16. Data Management

The purpose of the data management is to ensure that all of the necessary data are accurate and readily accessible to meet the analytical and reporting objectives of the project. The field sampling activities will encompass a large number of samples and analytes from a large geographic area. Due to the large amount of resulting data, the need arises for a structured, comprehensive, and efficient program for management of data.

The data management program established for the project includes field documentation and sample QA/QC procedures, methods for tracking and managing the data, and a system for filing all site-related information. More specifically, data management procedures will be employed to efficiently process the information collected such that the data are readily accessible and accurate. These procedures are described in detail in the following section.

The data management plan has five elements: 1) sample designation system, 2) field activities, 3) sample tracking and management, and 4) data management system.

16.1 Sample Designation System

A concise and easily understandable sample designation system is an important part of the project sampling activities. It provides a unique sample number that will facilitate both sample tracking and easy re-sampling of select locations to evaluate data gaps, if necessary. The sample designation system to be employed during the sampling activities will be consistent, yet flexible enough to accommodate unforeseen sampling events or conditions. A combination of letters and numbers will be used to yield a unique sample number for each field sampled collected, as outlined in Section 6.2.1.

16.2 Field Activities

Field activities designed to gather the information necessary to make decisions during the sampling process require consistent documentation and accurate record keeping. During site activities, standardized procedures will be used for documentation of field activities, data security, and QA. These procedures are described in further detail in the following subsections.

16.2.1 Field Documentation

Complete and accurate record keeping is a critical component of the field sampling activities. When interpreting analytical results and identifying data trends, investigators realize that field notes are an important part of the review and validation process. To ensure that the field sampling is thoroughly documented, several different information records, each with its own specific reporting requirements, will be maintained, including:

- Field logs
- Chain-of-custody forms

A description of each of these types of field documentation is provided below.

Field Logs

The personnel performing the field activities will keep field logs that detail all observations and measurements made during the annual groundwater sampling activities. Data will be recorded directly into site-dedicated, bound notebooks, with each entry dated and signed. To ensure at any future date that notebook pages are not missing, each page will be sequentially numbered. Erroneous entries will be corrected by crossing out the original entry, initialing it, and then documenting the proper information. In addition, certain media sampling locations will be surveyed to accurately record their locations. The survey crew will use their own field logs and will supply the sampling location coordinates to the Database Administrator.

Information recorded will include but not be limited to: geologic descriptions of materials sampled (if applicable), locations sampled, the sampling methodologies used, blind duplicate and MS/MSD sample identification numbers, equipment decontamination procedures, personnel involved in the activity, and any other noteworthy events that occurred.

Chain-of-Custody Forms

COC forms are used as a means of documenting and tracking sample possession from time of collection to the time of disposal. A COC form will accompany each field sample collected, and one copy of the form will be filed in the field office. All field personnel will be briefed on the proper use of the COC procedure.

16.2.2 Data Security

Measures will be taken during the field sampling to ensure that samples and records are not lost, damaged, or altered. When not in use, all field notebooks will be stored at the field office or locked in the field vehicle. Access to these files will be limited to the field personnel who utilize them.

16.3 Sample Management and Tracking

A record of all field documentation will be maintained to ensure the validity of data used in the site analysis. To effectively execute such documentation, specific sample tracking and data management procedures will be used throughout the sampling program.

Sample tracking will begin with the completion of COC forms as summarized in Section 9.2.3. The completed COC forms associated with samples collected will be faxed to the QAM. Copies of all completed COC forms will be maintained in the field office. The laboratory shall verify receipt of the samples electronically (via email) on the following day.

When analytical data are received from the laboratory, the QAM will review the incoming analytical data packages against the information on the COCs to confirm that the correct analyses were performed for each sample and that results for all samples submitted for analysis were received. Any discrepancies noted will be promptly followed-up by the QAM.

16.4 Data Management System

In addition to the sample tracking system, a data management system will be implemented. The central focus of the data management system will be the development of a personal computer-based project database. The project database, to be maintained by the Database Administrator, will combine pertinent geographical, field, and analytical data. Information that will be used to populate the database will be derived from three primary sources: surveying of sampling locations, field observations, and analytical results. Each of these sources is discussed in the following sections.

16.4.1 Computer Hardware

The database will be constructed on Pentium®-based personal computer work stations connected through a Novell network server. The Novell network will provide access to various hardware peripherals, such as laser printers, backup storage devices, image scanners, modems, etc. Computer hardware will be upgraded to industrial and corporate standards, as necessary, in the future.

16.4.2 Computer Software

The database will be written in Microsoft Access, running in a Windows operating system. Custom applets, such as diskette importing programs, will be written in either Microsoft VBA or Microsoft Visual Basic. Geographic Information System (GIS) applications will be developed in ESRI ArcGIS, with additional customization performed with Visual Basic. Tables and other database reports will be generated through Access in conjunction with Microsoft Excel, Microsoft Word, and/or Seagate Crystal Reports. These software products will be upgraded to current industrial standards, as necessary.

16.4.3 Field Observations

An important part of the information that will ultimately reside in the data management system for use during the project will originate in the observations that are recorded in the field. Refer to Section 16.2.1 for details on how field observations are to be recorded.

16.4.4 Analytical Results

Analytical results will be provided by the laboratory in both a digital and a hard copy format. The data packages will be examined to ensure that the correct analyses were performed for each sample submitted and that all of the analyses requested on the COC form were performed. If discrepancies are noted, the QAM will be notified and will promptly follow up with the laboratory to resolve any issues.

Each data package will be validated in accordance with the procedures presented in Section 20.1. Any data that does not meet the specified standards will be flagged pending resolution of the issue. The flag will not be removed from the data until the issue associated with the sample results is resolved. Although flags may remain for certain data, the use of that data may not necessarily be restricted.

Following completion of the data validation, the digital files will be used to populate the appropriate database tables. An example of the format of electronic data deliverable (EDD) format is included in Table 9. This format specifies one data record for each constituent for each sample analyzed. Specific fields include:

- Sample identification number
- Date sampled
- Date analyzed
- Parameter name
- Analytical result
- Units
- Detection limit
- Qualifier(s)

The individual EDDs, supplied by the laboratory in either an ASCII comma separated value (CSV) format or in a Microsoft Excel worksheet, will be loaded into the appropriate database table via a custom-designed user interface Visual Basic program. Any analytical data that cannot be provided by the laboratory in electronic format will be entered manually. After entry into the database, the EDD data will be compared to the field information previously entered into the database to confirm that all requested analytical data have been received.

16.4.5 Data Analysis and Reporting

The database management system will have several functions to facilitate the review and analysis of the annual groundwater sampling data. Routines have been developed to permit the user to scan analytical data from a given site for a given media. Several output functions are also available which can be modified, as necessary, for use in the data management system.

A valuable function of the data management system will be the generation of tables of analytical results from the project databases. The capability of the data management system to directly produce tables reduces the redundant manual entry of analytical results during report preparation and precludes transcription errors that may occur otherwise. This data management system function creates a digital file of analytical results and qualifiers for a given media. The file can then processed into a table of rows and columns which can be transferred to word processing software (e.g., Microsoft Word) for final formatting and addition of titles and notes.

Another function of the data management system will be to create digital files of analytical results and qualifiers suitable for transfer to mapping/presentation software. A function has been created by ARCADIS that creates a digital file consisting of sample location number, state plane coordinates, sampling date, and detected constituents and associated concentrations and analytical qualifiers. The file is then transferred to an AutoCAD work station, where another program has been developed to plot a location's analytical data in a "box" format at the sample location (represented by the state plane coordinates). This routine greatly reduces the redundant keypunching of analytical results and facilitates the efficient production of interpretative and presentation graphics.

The data management system also has the capability of producing a digital file of select parameters that exists in one or more of the databases. This type of custom function is accomplished on an interactive basis and is best used for transferring select information into a number of analysis tools, such as statistical or graphing programs.

16.4.6 Document Control and Inventory

ARCADIS maintains project files in its Syracuse, New York office. Each client project is assigned a file/job number. Each file is then broken down into the following subfiles:

1. Agreements/Proposals (filed chronologically)
2. Change Orders/Purchase Orders (filed chronologically)
3. Invoices (filed chronologically)
4. Project Management (filed by topic)
5. Correspondence (filed chronologically)
6. Notes and Data (filed by topic)
7. Public Relations Information (filed by topic)
8. Regulatory Documents (filed chronologically)
9. Marketing Documents (filed chronologically)
10. Final Reports/Presentations (filed chronologically)
11. Draft Reports/Presentations (filed chronologically)
12. Documents Prepared by Others (filed chronologically)

Originals, when possible, are placed in the files. These are the central files and will serve as the site-specific files for the annual groundwater sampling activities.

17. Assessment and Response Actions

17.1 General

Performance and systems audits will be completed in the field and laboratory during the annual groundwater sampling activities as described below.

17.2 Field Audits

The appropriate Task Manager will monitor field performance. Field performance audit summaries will contain an evaluation of field activities to verify that activities are performed according to established protocols. The ARCADIS QAM will review field reports and communicate concerns to the ARCADIS Project Manager and/or Task Managers, as appropriate. In addition, the ARCADIS QAM will review the rinse and trip blank data to identify potential deficiencies in field sampling and cleaning procedures. In addition, systems audits comparing scheduled QA/QC activities from this document with actual QA/QC activities completed will be performed. The appropriate Task Manager and QAM will periodically confirm that work is being performed consistent with this QAPP, the SMP, and the FSP.

17.3 Laboratory Audits

Internal laboratory audits are conducted by the laboratory QAM. As part of the audit, the overall performance of the laboratory staff is evaluated and compared to the performance criteria outlined in the laboratory quality assurance manual and SOPs. The results of the audits are summarized and issued to each department supervisor, the laboratory manager and the laboratory director. A systems audit of each laboratory is also performed by the QAM to determine if the procedures implemented by each laboratory are in compliance with the quality assurance manual and SOPs.

In addition to the laboratory’s internal audits, as participants in state and federal certification programs, the laboratory is audited by representatives of the regulatory agency issuing certification. Audits are usually conducted on an annual basis and focus on laboratory conformance to the specific program protocols for which the laboratory is seeking certification. The auditor reviews sample handling and tracking documentation, analytical methodologies, analytical supportive documentation, and final reports. The audit findings are formally documented and submitted to the laboratory for corrective action, if necessary.

ARCADIS reserves the right to conduct an on-site audit of the laboratory prior to the start of analyses for the project. Additional audits may be performed during the course of the project, as deemed necessary.

17.4 Corrective Action

Corrective actions are required when field or analytical data are not within the objectives specified in this QAPP or the SMP. Corrective actions include procedures to promptly investigate, document, evaluate, and correct data collection and/or analytical procedures. Field and laboratory corrective action procedures for the actions are described below.

17.4.1 Field Procedures

When conducting the action field work, if a condition is noted that would have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause, and corrective action implemented will be documented on a Corrective Action Form (Attachment 1) and reported to the appropriate ARCADIS Task Manager, QAM, and Project Manager.

Examples of situations that would require corrective actions are provided below:

- Protocols as defined by the QAPP, SMP, and FSP have not been followed
- Equipment is not in proper working order or is not properly calibrated
- QC requirements have not been met
- Issues resulting from performance or systems audits have not been resolved

Project personnel will continuously monitor ongoing work performance in the normal course of daily responsibilities.

17.4.2 Field Procedures

In the laboratory, when a condition is noted to have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause, and corrective action to be taken will be documented and reported to the appropriate project manager and QAM.

Corrective action may be initiated, at a minimum, under the following conditions:

- Protocols as defined by this QAPP have not been followed
- Predetermined data acceptance standards are not obtained
- Equipment is not in proper working order or calibrated
- Sample and test results are not completely traceable
- QC requirements have not been met
- Issues resulting from performance or systems audits have not been resolved

Laboratory personnel will continuously monitor ongoing work performance in the normal course of daily responsibilities. Corrective action is initiated at a point were the problem has been identified. At whatever level this occurs (analyst, supervisor, data review, or quality control), it is brought to the attention of the laboratory QAM and, ultimately, the Laboratory Director. Final approval of any action deemed necessary is subject to the approval of the Laboratory Director.

Any corrective action deemed necessary based on system or performance audits, the analytical results of split samples, or the results of data review will be implemented. The corrective action may include sample re-extraction, re-preparation, re-analysis, cleanup, dilutions, matrix modifications, or other activities.

18. Reports to Management

The QAM will audit the implementation of the QAPP. Each project component will result in some type of QA report or, by its absence, acknowledge that no significant QA or QC deviations occurred. Items that may result in a QA report include:

- Changes or updates to the QAPP
- Deviations from QAPP or SMP specification
- The results of system and performance audits
- Significant QA/QC problems, recommended solutions, and the results of corrective actions
- Limitations on the use of measurement data

18.1 Field Reports

Reporting of the quality of field sample collection and field measurements will be the responsibility of the Field Supervisor or designee. Information from the field logbooks will be compiled and a summary report on field activity QA will be prepared for the project file.

18.2 Laboratory Reports

The laboratory will maintain QA records related to analyses, quality control, and corrective action. This information will be made available to the Project Manager upon request. Routine reporting will include documenting of all internal quality control checks performed for this project.

19. Data Reduction and Review

19.1 General

After field and laboratory data are obtained, the data will be subject to the following:

- Reduction, or manipulation mathematically, or otherwise into meaningful and useful forms
- Review
- Organization, interpretation, and reporting
- Data validation

19.2 Field Data Reduction and Review

19.2.1 Field Data Reduction

Information collected in the field through visual observation, manual measurement, and/or field instrumentation will be recorded in field notebooks or data sheets, and/or on forms. Such data will be reviewed by the appropriate Task Manager for adherence to the SMP, FSP, and this QAPP and for consistency. Concerns identified as a result of this review will be discussed with the field personnel, corrected if possible, and, as necessary, incorporated into the data evaluation process.

19.2.2 Field Data Review

Field data calculations, transfers, and interpretations will be conducted by the field personnel and reviewed for accuracy by the appropriate Task Manager and the QAM. Logs and documents will be checked for:

- General completeness
- Readability
- Usage of appropriate procedures
- Appropriate instrument calibration and maintenance

- Reasonableness in comparison to present and past data collected
- Correct sample locations
- Correct calculations and interpretations

19.3 Laboratory Data Reduction and Review

19.3.1 Laboratory Data Reduction

The calculations used for data reduction will be specified in each of the analytical methods referenced previously. Whenever possible, analytical data will be transferred directly from the instrument to a computerized data system. Raw data will be entered into permanently bound laboratory notebooks. The data entered are sufficient to document all factors used to arrive at the reported value.

Concentration calculations for chromatographic analyses will be based on response factors. Quantitation will be performed using either internal or external standards.

Inorganic analyses will be based on regression analysis. Regression analysis is used to fit a curve through the calibration standard data. The sample concentrations will be calculated using the resulting regression equations.

Non-aqueous values will be reported on a dry-weight basis. Unless otherwise specified, all values will be reported uncorrected for blank contamination.

19.3.2 Laboratory Data Review

Data will be subject to multi-level review by the laboratory. The group leader will review all data reports prior to release for final data report generation. The QAM will review the final data reports, and the laboratory director will review a cross section of the final data reports prior to shipment to ARCADIS.

If discrepancies or deficiencies exist in the analytical results, then corrective action will be taken, as discussed in Section 17. Deficiencies discovered as a result of internal data review, as well as the corrective actions to be used to rectify the situation, will be documented on a Corrective Action Form. This form will be submitted to the ARCADIS Project Manager.

19.4 Data Validation and Verification

All data generated for health and safety and engineering design/control purposes will be subjected to the data validation and verification procedures outlined in Section 20. Data generated for disposal purposes will not be reviewed.

20. Data Validation and Verification

Analytical data for the soil and groundwater samples will be evaluated using either the Data Usability Summary Report (DUSR) format or full analytical data validation. The DUSR will be utilized for routine characterization samples and that data validation will be completed for specific groups of samples that are used to support conclusions or recommendations. The decision whether to utilize the DUSR or data validation for each sample delivery group will be made by Niagara Mohawk's project manager based on the anticipated use of the analytical results.

Data validation entails a review of the QC data and the raw data to verify that the laboratory was operating within required limits, the analytical results were correctly transcribed from the instrument read outs, and which, if any, environmental samples were related to any out-of-control QC samples. The objective of data validation is to identify any questionable or invalid laboratory measurements.

The data validator will verify that reduction of laboratory measurements and laboratory reporting of analytical parameters is in accordance with the procedures specified for each analytical method and/or as specified in this QAPP. Any deviations from the analytical method or any special reporting requirements apart from that specified in this QAPP will be detailed on COC forms.

Upon receipt of laboratory data, the following procedures will be executed by the data validator:

- Evaluate completeness of data package

- Verify that field COC forms were completed and that samples were handled properly

- Verify that holding times were met for each parameter. Holding time exceedences, should they occur, will be documented. Data for all samples exceeding holding time requirements will be flagged as either estimated or rejected. The decision as to which qualifier is more appropriate will be made on a case-by-case basis

- Verify that parameters were analyzed according to the methods specified

- Review QA/QC data (i.e., make sure duplicates, blanks, and spikes were analyzed on the required number of samples, as specified in the method; verify that duplicate and matrix spike recoveries are acceptable)

- Investigate anomalies identified during review. When anomalies are identified, they will be discussed with the project manager and/or laboratory manager, as appropriate

- If data appears suspect, investigate the specific data of concern. Calculations will be traced back to raw data; if calculations do not agree, the cause will be determined and corrected

Deficiencies discovered as a result of the data review, as well as the corrective actions implemented in response, will be documented and submitted in the form of a written report.

It should be noted that qualified results do not necessarily invalidate data. The goal to produce the best possible data does not necessarily mean producing data without QC qualifiers. Qualified data can provide useful information.

Resolution of any issues regarding laboratory performance or deliverables will be handled between the laboratory and the data validator. Suggestions for reanalysis may be made by the ARCADIS QAM at this point.

Upon completion of the validation of each sample delivery group/parameter, a data validation report addressing the following topics (as applicable to each method) will be prepared:

- Assessment of the data package;
- Description of any protocol deviations;
- Failures to reconcile reported and/or raw data;
- Assessment of any compromised data;
- Overall appraisal of the analytical data; and
- Table of site name, sample quantities, matrix, and fractions analyzed.

Following completion of data validation reports for all sample delivery groups/parameters, ARCADIS will prepare a data usability report that will present a detailed analysis of whether the data generated by implementation of the annual groundwater sampling activities achieves the DQOs. The data validation/usability reports will be included as an appendix to the Annual Review Report, if appropriate. The data validation/usability reports will be kept in the project file at the ARCADIS office in Syracuse, New York.

21. Reconciliation with User Requirements

The data results will be examined to determine the performance that was achieved for each data usability criteria. The performance will then be compared with the project objectives and DQOs. Deviations from objectives will be noted. Additional action may be warranted when performance does not meet performance objectives for critical data. Options for corrective action may include any or all of the following:

- Retrieval of missing information
- Request for additional explanation or clarification
- Reanalysis of sample from extract (when appropriate)
- Recalculation or reinterpretation of results by the laboratory

These actions may improve the data quality, reduce uncertainty, and may eliminate the need to qualify or reject data.

If these actions do not improve the data quality to an acceptable level, the following additional actions may be taken:

- Extrapolation of missing data from existing data points
- Use of historical data
- Evaluation of the critical/non-critical nature of the sample

If the data gap can not be resolved by these actions, an evaluation of the data bias and potential for false negatives and positives can be performed. If the resultant uncertainty level is unacceptable, then the following action must be taken:

- Additional sample collection and analysis.

Tables

TABLE 1

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

METHOD REPORTING LIMITS AND ACTION LIMITS

Analyte	Water (ug/L) Laboratory MDL	Water (ug/L) Laboratory RL
Volatile Organic Compounds 8260 [1]		
1,1,1-Trichloroethane	0.37	10
1,1,2,2-Tetrachloroethane	0.11	10
1,1,2-Trichloroethane	0.17	10
1,1-Dichloroethene	0.24	10
1,2 Dichloroethane	0.11	10
1,2,4-Trichlorobenzene	0.3	10
1,2-Dibromo-3-chloropropane (DBCP)	0.31	10
1,2-Dibromoethane (EDB)	0.16	10
1,2-Dichlorobenzene	0.14	10
1,2-Dichloropropane	0.17	10
1,3-Dichlorobenzene	0.17	10
1,4-Dichlorobenzene	0.2	10
2-Butanone (MEK)	1.98	10
2-Hexanone	1.09	10
4-Methyl-2-pentanone (MIBK)	1.13	10
Acetone	1.89	10
Benzene	0.2	10
Bromoform	0.24	10
Bromomethane	0.32	10
Carbon Disulfide	0.26	10
Carbon Tetrachloride	0.39	10
Chlorobenzene	0.08	10
Chloroethane	0.46	10
Chloroform	0.17	10
cis-1,2-Dichloroethene	0.22	10
cis-1,3-Dichloropropene	0.23	10
Cyclohexane	0.39	10
Dibromochloromethane	0.17	10
Dichlorobromomethane	0.08	10
Dichlorodifluoromethane	0.4	10
Ethylbenzene	0.18	10
Isopropylbenzene	0.26	10
Methyl Acetate	0.47	10
Methyl Chloride	0.54	10
Methyl t-butyl ether (MTBE)	0.29	10
Methylcyclohexane	0.38	10
Methylene Chloride	0.13	10
Styrene	0.16	10
Tetrachloroethene	0.39	10
Toluene	0.17	10
Total Xylenes	0.62	10
trans-1,2-Dichloroethene	0.21	10
trans-1,3-Dichloropropene	0.09	10
Trichloroethene	0.25	10
Trichlorofluoromethane	0.35	10
Vinyl Chloride	0.38	10

TABLE 1

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

METHOD REPORTING LIMITS AND ACTION LIMITS

Analyte	Water (ug/L) Laboratory MDL	Water (ug/L) Laboratory RL
Semivolatile Organic Compounds 8270 [1]		
1,2,4-Trichlorobenzene	0.3	10
1,2-Dichlorobenzene	0.14	10
1,3-Dichlorobenzene	0.17	10
1,4-Dichlorobenzene	0.2	10
2,4,5-Trichlorophenol	1.32	25
2,4,6 Trichlorophenol	0.93	10
2,4-Dichlorophenol	1.43	10
2,4-Dimethylphenol	0.84	10
2,4-Dinitrophenol	0.94	25
2,4-Dinitrotoluene	0.4	10
2,6 Dinitrotoluene	0.62	10
2-Chloronaphthalene	0.52	10
2-Chlorophenol	0.87	10
2-Methylnaphthalene	0.49	10
2-Methylphenol	0.84	10
2-Nitroaniline	0.54	25
2-Nitrophenol	1.02	10
3,3'-Dichlorobenzidine	2.18	10
3-Nitroaniline	0.61	25
4-Bromophenyl-phenylether	0.2	10
4-Chloro-3-Methylphenol	0.69	10
4-Chloroaniline	0.71	10
4-Chlorophenyl-phenylether	0.42	10
4-Methylphenol	0.53	10
4-Nitroaniline	0.4	25
4-Nitrophenol	0.6	25
Acenaphthene	0.11	10
Acenaphthylene	0.07	10
Anthracene	0.08	10
Benzo (g,h,i,) Perylene	0.06	10
Benzo(a)anthracene	0.04	10
Benzo(a)pyrene	0.08	10
Benzo(b)fluoranthene	0.11	10
Benzo(k)fluoranthene	0.16	10
bis(2-Chloroethoxy)methane	0.33	10
bis(2-Ethylhexyl) phthalate	0.56	10
Butylbenzylphthalate	0.4	10
Carbazole	0.08	10
Chrysene	0.07	10
Di-n-butyl phthalate	0.41	10
Di-n-octyl phthalate	0.25	10
Dibenzo(a,h)anthracene	0.04	10
Dibenzofuran	0.34	10
Diethyl phthalate	0.25	10
Dimethylphthalate	0.38	10
Fluoranthene	0.05	10

TABLE 1

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

METHOD REPORTING LIMITS AND ACTION LIMITS

Analyte	Water (ug/L) Laboratory MDL	Water (ug/L) Laboratory RL
Semivolatile Organic Compounds 8270 (continued)		
Fluorene	0.11	10
Hexachlorobenzene	0.8	10
Hexachlorobutadiene	0.45	10
Hexachlorocyclopentadiene	0.93	10
Hexachloroethane	0.58	10
Indeno(1,2,3-cd)pyrene	0.08	10
Isophorone	0.35	10
N-Nitroso-di-n-propylamine	0.45	10
N-Nitrosodiphenylamine	0.19	10
Naphthalene	0.04	10
Nitrobenzene	0.55	10
Pentachlorophenol	3.1	25
Phenanthrene	0.1	10
Phenol	0.52	10
Pyrene	0.07	10
Inorganics 6010 [1]		
Aluminum	17.4	200
Antimony	5.8	60
Arsenic	4.44	15
Barium	1.78	200
Beryllium	0.3	1
Cadmium	0.4	1
Calcium	74.6	5000
Chromium	2.8	10
Cobalt	3.4	50
Copper	3.7	25
Iron	39.7	100
Lead	2.96	5
Magnesium	76	5000
Manganese	2.9	15
Nickel	3.9	40
Potassium	315.4	5000
Selenium	4.5	35
Silver	1.7	10
Sodium	395.5	5000
Thallium	4.91	25
Vanadium	2.48	50
Zinc	5.8	60
Inorganics 7470/7471 [1]		
Mercury	0.10	0.2
Inorganics 9010B/9012A 1		
Cyanide	10	10

Notes:

1. USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste SW-846 3rd ed. Washington, D.C. 1996.*
2. The target reporting limits are based on wet weight. The actual reporting limits will vary based on sample weight and moisture cont
3. The reporting limits listed are the Maximum Concentration of Contaminants for the Toxicity Characteristic (Fed. Reg.)

TABLE 2

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

ESTIMATED QUANTITY OF ENVIRONMENTAL AND QUALITY CONTROL SAMPLES

Parameters	Estimated Environmental Sample Quantity	Field QC Analysis						Laboratory QC Analysis								Estimated Total (Per Year)
		Trip Blank		Field Duplicate		Rinse Blank		MS		MSD		MSB		Lab Duplicate		
		Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	Freq.	No.	
Groundwater Sampling																
TCL VOCs	8 per year	1/day	3	1/20	1	1/20	1	1/20	1	1/20	1	1/20	1	--	--	16
TCL SVOCs	8 per year	--	--	1/20	1	1/20	1	1/20	1	1/20	1	1/20	1	--	--	13
TAL Inorganics (including cyanide)	8 per year	--	--	1/20	1	1/20	1	1/20	1	1/20	1	1/20	1	1/20	1	14
Waste Characterization Sampling																
PCBs	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
TCLP VOCs	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
TCLP SVOCs	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
TCLP Inorganics	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Reactivity	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Corrosivity	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Ignitability	1 per year (estimated)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1

TABLE 3

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

ESTIMATED ENVIRONMENTAL SAMPLE QUANTITIES

Parameters	SW-846 Analytical Method	Estimated Sample Quantity (Per Year)
Groundwater Sampling		
TCL VOCs	NYSDEC ASP SW-846 8260B	8
TCL SVOCs	NYSDEC ASP SW-846 8270C	8
TAL Inorganics (including cyanide)	NYSDEC ASP SW-846 6010/7470	8
Waste Characterization Sampling		
PCBs	NYSDEC ASP SW-846 8082	1
TCLP VOCs	NYSDEC ASP SW-846 1311/8260B	1
TCLP SVOCs	NYSDEC ASP SW-846 1311/8270C	1
TCLP Metals	NYSDEC ASP SW-846 1311/6010/7470	1
Reactivity	NYSDEC ASP SW-846 Chapter 7.3	1
Corrosivity	NYSDEC ASP SW-846 Method 9045	1
Ignitability	NYSDEC ASP SW-846 Method 1030	1

Notes:

1. PCBs - Polychlorinated biphenyls
2. TCL - Target Compound List
3. VOCs - Volatile Organic Compounds
4. SVOCs - Semi-Volatile Organic Compounds
5. TAL - Target Analyte List
6. TCLP - Toxicity Characteristic Leaching Procedure

TABLE 4

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

ANALYTICAL QUALITY CONTROL (QC) LIMITS

Parameter	Accuracy - % Recovery			Precision - RPD			Method Blanks
	Surrogate	MS/MSD	LCS	MS/MSD	Lab Duplicate	Field Duplicate	
Groundwater							
Volatile Organics	75-115	60-145	70-140	20	--	30	Below Detection Limit (where applicable)
Semivolatile Organics	20-140	20-130	40-120	40	--	30	
Metals	--	80-120	80-120	--	30	30	

Notes:

1 The listed QC limits are based on SW-846 guidance and are advisory. The actual limits are determined based on laboratory performance. Frequent failure to meet the QC limits; however, warrant investigation of the laboratory.

TABLE 5

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Parameter	Method	Bottle Type	Preservation	Holding Time
Water Samples				
TCL VOCs	8260	(2) 40 mL glass vials with Teflon-lined lid	HCl to pH<2, Cool to 4°C	14 days to analysis
TCL SVOCs	8270	(2) 1 liter amber glass bottles with Teflon-lined lid	Cool to 4°C	7 days to extraction 40 days to analysis
Metals (except mercury)	6010	(1) 500 mL plastic container, cap lined with Teflon	HNO_3 to pH<2	180 days to analysis
Mercury	7471		Cool to 4°C	28 days to analysis
Cyanide	9010		NaOH to pH>12, Cool to 4ºC	14 days to analysis
Waste Characterization Samples				
TCLP VOCs	1311 / 8260	(1) 125 mL widemouth glass container, cap lined	Cool to 4°C	14 days to analysis
TCLP SVOCs	1311 / 8270	(1) 250 mL widemouth glass container, cap lined with Teflon	Cool to 4°C	14 days to analysis
TCLP Metals	1311 / 6010 / 7470		Cool to 4°C	14 days to analysis
Reactivity	SW-846 Chapter 7		Cool to 4°C	No holding time
Corrosivity	SW-846 Chapter 7		Cool to 4°C	No holding time
Ignitability	SW-846 Chapter 7		Cool to 4°C	No holding time
PCBs	8082		Cool to 4°C	14 days to extraction 40 days to analysis

Notes:

1. USEPA. Office of Solid Waste and Emergency Response. *Test Methods for Evaluating Solid Waste. SW-846 3rd ed. Washington, D.C. 1996.*
2. All holding times are measured from date of collection.
3. NS - Not Specified
4. NA - Not Applicable

TABLE 6

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

FIELD INSTRUMENT PREVENTATIVE MAINTENANCE SUMMARY

Maintenance	Frequency
Turbidity Meter	
Store in protective casing	D
Inspect equipment after use	D
Clean sample cells	D
Clean lens	M or X
Check and recharge batteries	D
Keep log book on instrument	D
Have replacement meter available	D
Return to manufacturer for service	X
Calibration	D
Conductivity, pH, Dissolved Oxygen Meters	D
Store in protective casing	D
Inspect equipment after use	D
Clean probe	D
Keep log book in instrument	D
Have replacement meter available	X
Replace probes	X
Return to manufacturer for service	D
Calibration	
Thermometer	
Store in protective casing	D
Inspect equipment after use	D
Have a replacement thermometer available	D
Water Level Meter	
Store in protective covering	D
Inspect equipment after use	D
Check indicators/batteries	D
Keep log book on instrument	D
Have a replacement meter available	X
Photoionization Detector	
Store in protective casing	D
Inspect equipment after use	D
Check and recharge batteries	D
Clean UV lamp and ion chamber	M or X
Keep log book on instrument	D
Have replacement meter available	D
Return to manufacturer for service	X
Calibration	D

Notes:
D - Daily
M - Monthly
X - Operator's discretion

TABLE 7

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

FIELD INSTRUMENT CALIBRATION FREQUENCY SUMMARY

Equipment	Calibration Check	Calibration Standard	Calibration Standard Holding Time
pH Meter	Prior to use - daily[1]	pH 4.0 pH 7.0 pH 10.0	One Month
Conductivity Meter	Prior to use - daily	1,000 mg/l Sodium Chloride	One Month
Water Level Meter	Prior to implementing field work	100-foot engineer's tape	N/A
Dissolved Oxygen Meter	Per sampling event	Air	N/A
Turbidity	Prior to use - daily	Formazin 0.5 NTU, 5.0 NTU, 40.0 NTU	N/A
PID	Prior to use - daily	Isobutylene	N/A

Notes:

1. [1] - The pH meter will also be calibrated at each well prior to ground water sampling.
2. N/A - not applicable.
3. NTU - nephelometric turbidity units.
4. mg/l - milligrams per liter.

TABLE 8

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

FIELD MEASUREMENT QUALITY CONTROL SUMMARY

Field Parameter	Precision [1]	Accuracy
Water Temperature	. 1ºC	. 1ºC instrument capability
pH	. 0.1 S.U.	. 0.1 S.U. (instrument capability)
Conductivity	. 0.01 mS/cm	. 5% standard
Dissolved Oxygen	. 0.02 mg/l	. 5%
Turbidity	. 1.0 NTU	. 2% standard
Water Level	. 0.01 foot	. 0.01 foot

Notes:

1. [1] - Precision units presented in applicable significant figures.
2. S.U. - standard units.
3. mS/cm - millisiemens per centimeter.
4. mg/l - milligrams per liter.

TABLE 9

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

QUALITY ASSURANCE PROJECT PLAN

ELECTRONIC DATA DELIVERABLE FORMAT

Field Name	Maximum Length	Data Type	Comments
FIELD SAMPLE ID	50	TEXT	From the chain of custody. Add "RE" or "DL" to differentiate reanalyses and dilutions.
SDG	50	TEXT	
LAB SAMPLE ID	50	TEXT	
MATRIX	10	TEXT	SOIL, WATER, SEDIMENT, etc.
SAMPLE TYPE	10	TEXT	FB, RB, TB, FD, FS for Field Blank, Rinse Blank, Trip Blank, Field Duplicate and Field Sample, respectively. DEFAULT TO FS
DATE COLLECTED	--	DATE/TIME	MM/DD/YY
TIME COLLECTED*	--	DATE/TIME	Military time
DEPTH START	--	NUMBER	
DEPTH END	--	NUMBER	
DEPTH UNITS	25	TEXT	FEET, INCHES, METERS, etc.
ANALYTICAL METHOD	50	TEXT	
CAS NUMBER	25	TEXT	
ANALYTE	100	TEXT	
RESULT VALUE	--	NUMBER	For non-detected results, enter Reporting Limit ("U" must be present in Lab Qualifier field).
LAB QUALIFIER	10	TEXT	"U" for non-detected, others as defined by laboratory.
REPORTING LIMIT	--	NUMBER	
RESULT UNIT	25	TEXT	
DILUTION FACTOR	--	NUMBER	
REPORTABLE RESULT	--	YES/NO	DEFAULT TO YES
FILTERED?	--	YES/NO	
DATE ANALYZED	--	DATE/TIME	MM/DD/YY
TIME ANALYZED*	--	DATE/TIME	Military time
DATE EXTRACTED	--	DATE/TIME	MM/DD/YY
LABORATORY NAME*	50	TEXT	

Notes:

This definition is for an "Excel-type" spreadsheet. Fields flagged with an "*" are optional and may be left blank if not available electronically from the laboratory.
Depth-related fields may be left blank for samples and matrices for which they are not applicable.

Attachment 1

Corrective Action Form

ATTACHMENT 1

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

CORRECTIVE ACTION FORM

Corrective Action No.: ________________________________ Date: ______________

To: ____ cc: Task Manager

You are hereby requested to take corrective actions indicated below and as otherwise determined by you (A) to resolve the noted condition, and (B) to prevent it from recurring. Your written response is to be returned to the Quality Assurance Manager (QAM).

Condition

Reference Documents

Recommended Corrective Actions

Originator	Date	QAM Approval Date	P.M. Approval Date

Response

Corrective Action

A. Resolution
B. Pretention
C. Affected Documents

Signature: ___________________________________ Date: ______________

Follow-up:

Corrective Action Verified:

By: ____ Date: ______________

Appendix I

Stormwater Pollution Prevention Plan

ARCADIS
Infrastructure, environment, facilities

Imagine the result

National Grid

Stormwater Pollution Prevention Plan for Remedial Activities

Little Falls (Mill Street) Non-Owned Former MGP Site

May 2008

Confidentiality Statement (optional)

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1. Introduction

1.1 General

This Stormwater Pollution Prevention Plan (SWPPP) has been prepared to describe stormwater management practices that will be implemented to control potential impacts (e.g., erosion, sediment loading, etc.) of stormwater runoff associated with the implementation of remedial action activities at the National Grid Little Falls (Mill Street) non-owned former manufactured gas plant (MGP) site (the “site”). The site is located at 575 East Mill Street in Little Falls, New York. The geographic location of the site is shown on the site location map included on Figure 1. The general layout of the site is illustrated on Figure 2.

This SWPPP has been prepared consistent with the requirements and standards outlined in the following documents:

- *Instruction Manual for Stormwater Construction Permit* (New York State Department of Environmental Conservation [NYSDEC], 2004);
- *New York Standards and Specifications for Erosion and Sediment Control* (NYSDEC , 2005) (“NYSDEC Standards and Specifications”); and
- *New York State Stormwater Management Design Manual* (NYSDEC, 2003).

1.2 Background Information

A summary of background information associated with the site is presented below.

1.2.1 Site Description

The Little Falls former MGP site is located on the western portion of an approximately 6.5-acre property currently owned by Feldmeier Equipment, Inc. (Feldmeier). The site is bordered by East Mill Street to the north, George Lumber and Building Materials Company (George Lumber) to the west, the Mohawk River to the south, and a tank manufacturing building that is owned and operated by Feldmeier (the “tank manufacturing building”) to the east. Adjacent properties located to the north (across East Mill Street), east, and west of the former MGP site are used for industrial and/or commercial purposes.

1.2.2 Site History

Historical MGP operations at the site were primarily located within a small (approximately 0.56-acre) area on the western portion of the Feldmeier property. Historical MGP operations were conducted at the site from approximately 1853 to approximately 1907. Based on available Sanborn Fire Insurance Maps, buildings and structures associated with the former MGP operation included a coal storage shed, horizontal retorts, gas purifiers, maintenance shops, a warehouse, and several smaller unnamed buildings/structures. The buildings and structures were primarily located within the western portion of the footprint of the current tank manufacturing building. The Sanborn Maps also show that one 50,000-cubic-foot gas holder (the former onsite gas holder) was formerly located adjacent to the Mohawk River, south of the gas works. The Sanborn Maps indicate that approximately 60% of the former onsite gas holder is located beneath the southwest corner of the current tank manufacturing building. The Sanborn Maps also indicate that a second gas holder (the former offsite gas holder) was constructed between 1884 and 1891 in the southeast corner of the current George Lumber Property. The layout of historical MGP structures is shown on Figure 2.

1.2.3 Summary of Environmental Conditions

Historical operations at the site have resulted in environmental impacts to soil and groundwater at the property.

Several phases of site investigation activities have been conducted since the mid 1990s to characterize environmental conditions at the site. Site investigations indicate that visible MGP impacts were encountered in the vicinity of the former onsite gas holder and at specific locations within the former underground “MGP pipe gallery” located west of the tank manufacturing building. The primary MGP-related chemical constituents detected in subsurface soil and groundwater at the site include: benzene, toluene, ethylbenzene, and xylenes (BTEX) and polynuclear aromatic hydrocarbons (PAHs).

1.3 Existing Hydrologic Conditions

The site is located on the north bank of the Mohawk River. The majority of the site is paved and slopes toward storm sewer catch basins and the Mohawk River. Based on the extent of pavement and structures present at the site, infiltration of precipitation in the immediate vicinity of the site is limited. Surface runoff from the site flows from north to south (toward the Mohawk River), with a portion of the paved area draining to a shallow storm sewer drain line (located along the western edge of the tank manufacturing building), which discharges to the Mohawk River.

Surface topography in the vicinity of the Little Falls former MGP site slopes gently toward the south and east. The ground surface elevations at the site range from approximately 354 feet above mean sea level (amsl) at the southern boundary (along the top of the bank for the Mohawk River) to 363 feet amsl in the northwest corner of the property. Stormwater flow from the area north of the site is conveyed offsite by an approximately 78–inch-diameter (equivalent) elliptical concrete pipe that flows from north to south across the central portion of the parking lot at the site (approximately 100 feet west of the tank manufacturing building), which is shown on Figure 2.

1.4 Project Description

In accordance with an existing multi-site Voluntary Consent Order (Index # D0-0001-0011) between National Grid and the NYSDEC, National Grid is required to implement cleanup measures to address environmental impacts identified at the site. A detailed description of the remedial activities to be implemented at the site is presented in the NYSDEC-approved *Remedial Action Work Plan* (RAWP) prepared by ARCADIS (ARCADIS, 2007). As part of this program, National Grid will implement remedial activities which are described below.

1.4.1 Pipe Gallery Removal

Excavation will be performed to remove former MGP piping and visually-impacted soil located west of the tank manufacturing building. The removal effort will focus on the two 4-inch diameter pipes that are at a depth of approximately 6 feet below grade. The approximate limits of the pipe removal activities are shown on Figure 3. The actual extent of pipe removal will be determined during removal activities. Excavation activities will not be conducted beneath the existing building or at depths below the groundwater table. If the pipes cannot be fully removed, then the pipe(s) may be cut, drained of NAPL, and filled with grout. A portion of the onsite shallow stormwater drainage piping located adjacent to the manufacturing building will be removed to facilitate completion of the excavation activities. The approximate location of the onsite shallow stormwater drainage piping is shown on Figure 3. Following completion of the excavation activities, the excavated areas will be backfilled with imported fill material and the removed portion of the drainage piping will be replaced. Final surface restoration will be performed by paving with asphalt in the disturbed areas to match pre-excavation conditions at the site.

1.4.2 In-Situ Soil Stabilization

In-situ soil mixing will be the primary method of ISS treatment implemented at the site. Impacted subsurface soils within the ISS treatment area identified on Figure 4 will be treated by in-situ mixing with Portland cement. Additional additives and/or reagent materials may be used during the in-situ mixing activities (to be determined by implementing a bench scale test prior to the ISS treatment). Jet grouting, or other appropriate methods, will also be used to treat soil located immediately adjacent to subsurface structures and underground utilities. The approximate ISS treatment area shown on Figure 4 encompasses approximately 600 cubic yards of soil at depths ranging from approximately 13 to 26.5 feet, including accessible areas inside the former gas holder structure. In order to avoid potential damage to the integrity of the existing building, ISS soil treatment will not be performed within a distance of approximately 5 feet from the existing edge of the building or within approximately 2 feet of existing building foundation footers. The actual extent of the ISS treatment may be modified in the field based on site conditions.

1.5 Post-Remedial Construction Hydrological Conditions

Following completion of the remedial activities, the pipe gallery removal and ISS treatment areas will be backfilled using imported fill. The entire pipe gallery and ISS areas will be smoothed and graded to remove potholes and surface irregularities. The pipe gallery area and a small portion of the ISS treatment area will be restored using a 12-inch layer of crushed stone base course and a 4.5-inch layer of asphaltic concrete pavement to match existing site conditions. The majority of the ISS treatment area between the existing tank manufacturing building and the Mohawk River (approximately 0.01-acre [approximately 440 square feet]) will be restored using general fill and a 12-inch layer of crushed stone. Stormwater runoff from the pipe gallery and ISS treatment areas will continue to be directed to existing catch basins at the site and conveyed to the Mohawk River, as described in Section 1.3.

1.6 Maps

Figure 1 attached to this SWPPP includes a site location map. Figures 2 through 4 include site plans depicting the existing and proposed conditions.

2. Stormwater Management

2.1 General

This section presents a summary of stormwater management objectives for the remedial activities and a description of the plan for implementing stormwater pollution prevention control measures, including an erosion and sediment control plan.

2.2 Stormwater Management Objectives

The following stormwater management objectives have been established for the remedial activities:

- Minimize the transport of suspended soil/sediment within surface water during and following the remedial activities; and
- Reduce the potential for sediment-laden surface water runoff to offsite areas.

2.3 Erosion and Sediment Control

The selected contractor will be responsible for installing and maintaining all temporary erosion and sediment control measures (e.g. silt fence, inlet protection, and dust control) that may be required during construction, in accordance with the NYSDEC Standards and Specifications and/or as indicated on the Erosion and Sediment Control Plan shown on Figure 5. Sections and details for erosion and sediment control measures are shown on Figure 6. Temporary erosion and sediment control measures will be installed prior to any significant soil disturbance activities at the site. Figures 5 and 6 illustrate the minimum anticipated erosion and sediment controls that will be implemented throughout the performance of construction activities. The selected contractor will be responsible for providing additional erosion and sediment control measures, as needed, to achieve the stormwater management objectives for the remedial activities. These temporary erosion and sediment control measures will be left in place and maintained until completion of the remedial activities and site restoration. Transport of sediment from the active work areas will be controlled to the extent possible in order to reduce the potential for impacts to the stormwater system and downgradient water bodies. Sediment control practices that will be used at the site include the following:

- Reinforced Silt Fence – Reinforced silt fence will be installed along the perimeter of the proposed area of disturbance within the pipe gallery and ISS treatment areas as shown on Figure 5. Silt fencing will be installed prior to any earth moving activities to provide control of sediment once bare earth is exposed. The silt fencing will be inspected weekly and/or after significant storm events (rainfall in excess of 0.5 inches in a 24-hour period). Damaged fabric and/or collapsed posts will be repaired/replaced promptly by the Contractor. Sediment deposits will be removed when they reach a depth of one-half the height of the silt fence.

- Inlet Protection – Temporary concrete block/gravel filter inlet protection will be installed at storm sewer inlets (shown on Figure 5) prior to commencing remedial activities, and will remain intact throughout the duration of the remedial activities. The catch basin inlet protection will be inspected weekly, and will be replaced when damaged; sediment depths reach one-half the height of the storm sewer inlet protection; or at the request of the Engineer.

- Dust Control – Water will be applied to exposed soils on an as-needed basis during the construction activities to reduce the potential for dust generation without causing soil erosion. Additional dust control measures, as needed, will be implemented to minimize dust generation from excavation, loading, and unloading activities. It is anticipated that excavated soils may be stockpiled onsite prior to being transported for offsite disposal. Material being transported to onsite locations or for offsite disposal will be covered, as necessary, prior to transport to further reduce the potential for dust generation.

- Equipment Decontamination – Decontamination areas will be constructed within and adjacent to the limits of work to reduce the potential for tracking soil materials throughout the site and/or to offsite areas during construction. Decontamination activities will consist of thoroughly brushing the tires/tracks and undercarriages of any vehicles and equipment with visible deposits of soil prior to exiting the pipe gallery and ISS treatment areas and/or by wet washing any vehicles/equipment whose wheels, tracks, and/or undercarriages have contacted potentially impacted soil material. Washwater from the decontamination areas will be collected and containerized for offsite disposal in accordance with applicable regulations.

- Good Housekeeping - Good housekeeping practices will be implemented to minimize the potential for impacted materials to be mobilized via stormwater discharges from the site. During construction, the contractor will be responsible for maintaining the site in a neat and orderly condition. This will include, but may not be necessarily limited to: routine waste management activities, including the collection and disposal of trash, rubbish, construction waste and sanitary wastes; prompt cleanup of decontamination residues, prompt cleanup of spills of liquid or dry materials (if any); and prompt cleanup of any soil/sediments tracked by construction vehicles and/or transported by wind or stormwater from active work areas to other areas of the site or nearby offsite areas.

Throughout the duration of the project, erosion and sediment control measures will be inspected and maintained and/or modified by the Contractor, as necessary, to retain their intended functionality. At a minimum, the erosion and sediment control measures will be inspected once per week and/or immediately following significant rain events (greater than or equal to 0.5 inches of rainfall in a 24-hour period). The erosion and sediment control measures will be maintained for the duration of the project until such time that all permanent stabilization measures have been fully established.

Upon completion of the remedial activities, silt fencing, inlet protection, and any other temporary erosion and sediment control measures will be removed and disposed of offsite, in accordance with applicable regulations.

2.4 Water Quality Control

Water Quality Volumes are summarized below for pre-construction and post-construction conditions associated with the pipe gallery removal and ISS treatment areas using the Unified Stormwater Sizing Criteria described in the New York State Stormwater Management Design Manual (NYSDEC, 2003).

<u>Pre-Construction Water Quality Volume</u>

Based on existing site conditions, the percentage of impervious cover (i.e., gravel and asphalt) is estimated to be approximately 99%. The resulting pre-construction Water Quality Volume (WQv) has been calculated as follows:

$WQv = [(P)(Rv)(A)]/12$

Where:

Rv = Volumetric Runoff Coefficient = 0.05 + 0.009(I) = 0.05 + 0.009 (99%) = 0.94
I = Impervious Cover = 99% (1)
P = 90% Rainfall Event Number =0.95 (based on Figure 4.1 presented in the *New York State Stormwater Management Design Manual* [NYSDEC, 2003])
A = Area = 6.49 acres

Therefore, WQv = [(0.95) (0.94) (6.49)]/12 = 0.48 acre-feet (ac-ft).

Notes: [1] Impervious Cover estimated to be approximately 99% based on existing conditions described in Section 1.2.

Post-Construction Water Quality Volume

Restored surface conditions with in the pipe gallery removal and ISS treatment areas for pre- and post-construction scenarios and the quantity of impervious cover that discharges to the onsite storm sewer system decreases will remain the same. Therefore, the post-construction Water Quality Volume (WQv) equals 0.48 ac-ft and no extended detention of the Water Quality Volume calculation has been provided. However, as described above, temporary erosion control measures will be employed throughout the remedial activities to limit the potential for erosion and offsite migration of sediments.

2.5 Water Quantity Control

Based on guidance provided by NYSDEC's Instruction Manual for Stormwater Construction Permit (NYSDEC, 2004a), stormwater quantity calculations for channel protection (CPv), Overbank Flood (Qp), and Extreme Flood (Qf) are not necessary because site stormwater discharges to a storm sewer system that discharges directly to a fourth order or larger stream (i.e., the Mohawk River). Additionally, since the runoff characteristics of existing and proposed conditions (as described in Sections 1.4 and 1.5 respectively) are not modified by the remedial activities, impacts to the down-gradient storm sewer system (and the Mohawk River) are considered to be negligible.

2.6 Construction Sequence Schedule

The selected Contractor will be required to prepare a detailed schedule of proposed construction activities at the start of the project. National Grid anticipates that the remedial activities will commence during October 2008. Currently, it is anticipated that construction activities will proceed approximately as follows:

1. Site Preparation and Pre-Construction Actions

    - Survey control and limits of work will be established and site access controls will be installed.
    - Site features will be identified and marked within the project limits that are to be maintained and protected throughout construction.
    - Exclusion, contamination reduction, and support zones will be established.
    - Air monitoring stations will be established.

2. Runoff and Drainage Control / Erosion and Sediment Control

- Temporary erosion and sediment controls will be installed (e.g., silt fencing, inlet protection, etc.) as needed to reduce potential for erosion during construction.
- Decontamination and temporary material staging areas will be installed, as required.

3. Pipe Gallery Removal

- Surface and shallow subsurface soils will be excavated to a depth of approximately 6 feet below existing grade and former MGP piping removed.
- Excavated soil will be temporarily staged, stockpiled on, and covered with polyethylene sheeting for subsequent transport and disposal at an offsite facility in accordance with applicable regulations.
- Surface runoff that enters the excavations, decontamination area(s), and/or waste material staging area(s), if any, will be collected, containerized, and transported to an offsite facility for treatment/disposal.
- Excavated areas will be backfilled and compacted to match existing site conditions required.

4. In-Situ Soil Stabilization

- Pre-excavation performed (as required).

- ISS treatment performed.

- Excavated soil and spoils from ISS treatment will be temporarily staged, stockpiled on, and covered with polyethylene sheeting for subsequent transport and disposal at an offsite facility in accordance with applicable regulations.

5. Site Restoration

- The pipe gallery removal areas will be backfilled with a 12-inch layer of crushed stone base course material and 4.5-inch asphaltic binder course material.

- ISS areas will be backfilled with imported fill and finished with a 12-inch layer of crushed stone.

6. Maintenance, Inspection, and Updates:

- Installed measures will be inspected and maintained throughout duration of construction activities.

- Inspection and maintenance records will be maintained and updated with descriptions of any additional erosion and sediment control practices implemented that were not originally shown on the erosion and sediment control plan.

- Inspection and maintenance of temporary erosion and sediment control measures will be continued through the completion of site activities.

3. References

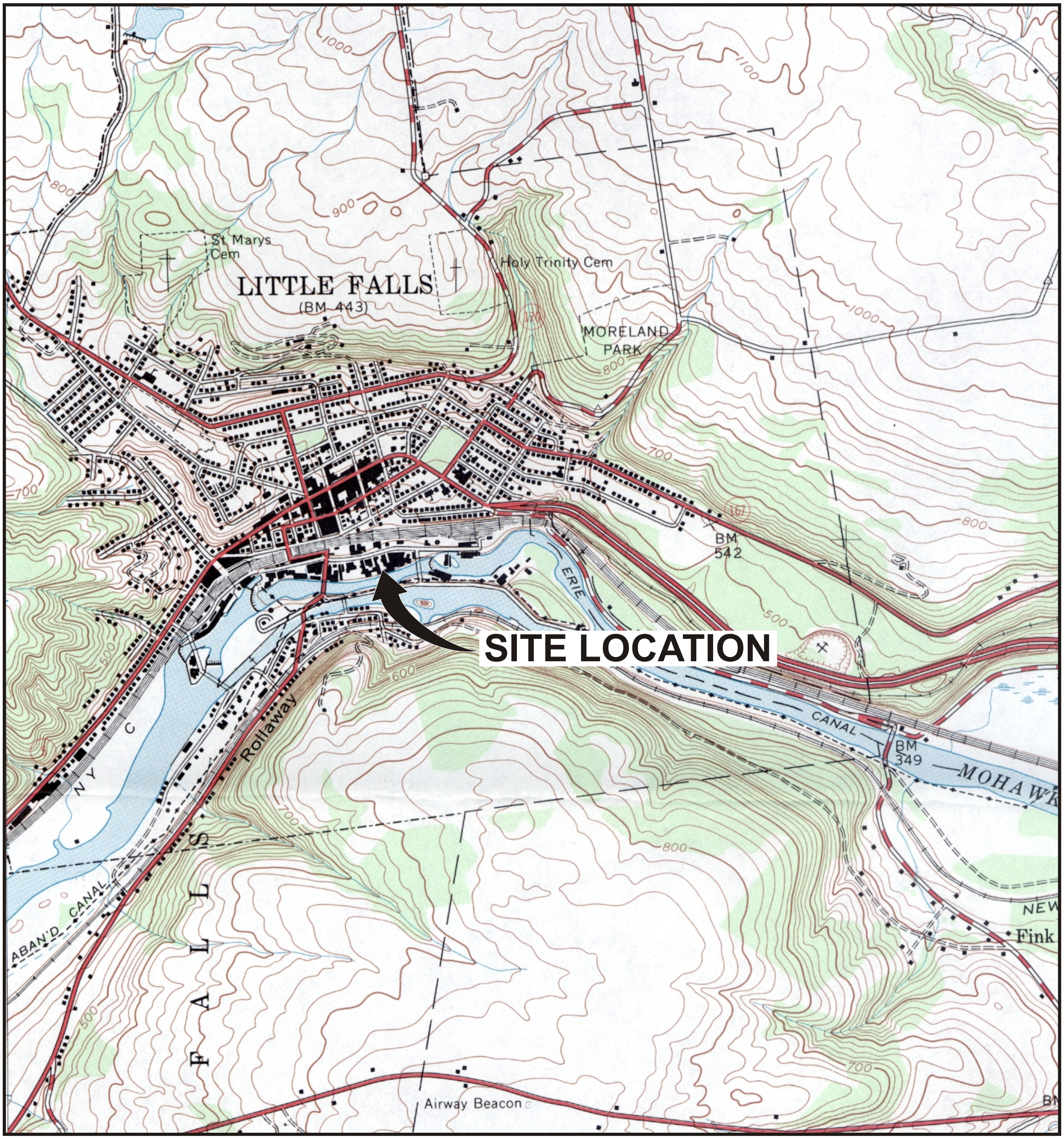
ARCADIS BBL. 2007. *Remedial Action Work Plan*. Prepared for National Grid, Little Falls (Mill Street) Non-Owned Former MGP Site. December 2007

New York State Department of Environmental Conservation (NYSDEC). 2003. *New York State Stormwater Management Design Manual.* Prepared by the Center for Watershed Protection. August 2003.

NYSDEC. 2004. *Instruction Manual for Stormwater Construction Permit.* July 2004.

NYSDEC. 2005. *New York Standards and Specifications for Erosion and Sediment Control.* August 2005

Figures



REFERENCE: BASE MAP USGS 7.5 MIN. QUAD., LITTLE FALLS, NY, 1943.

Approximate Scale: 1" = 2000'

NATIONAL GRID
LITTLE FALLS (MILL STREET) NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK

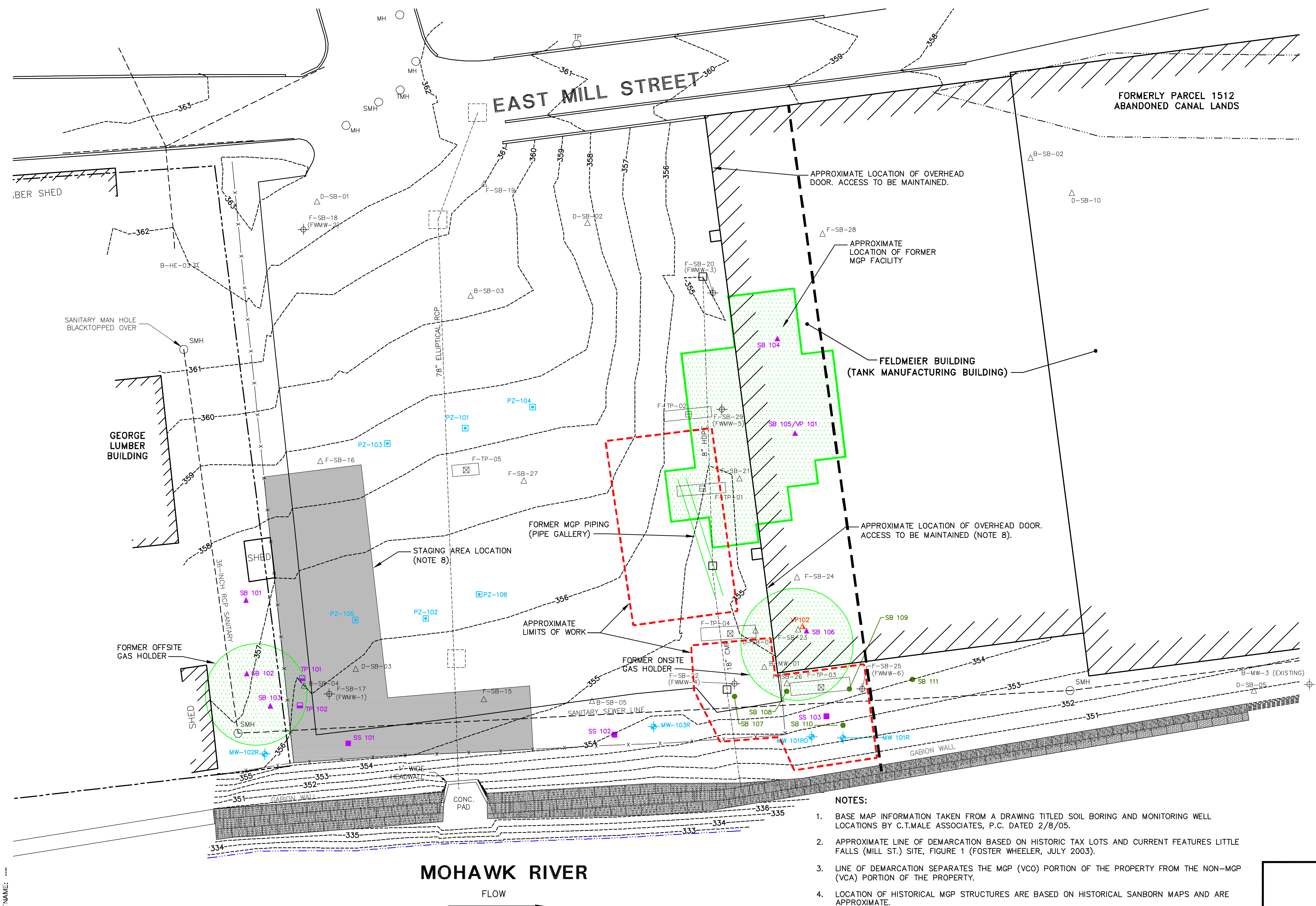
REMEDIAL ACTIVITIES

SITE LOCATION MAP

ARCADIS

FIGURE
1

05/02/08 SYR-141ENV-DJH
B0036673/0000/00090/CDR/36673N03.CDR



LEGEND:

— - - —	PROPERTY LINE
▨	BUILDING
—··—··—	EDGE OF WATER
— — — —	SANITARY SEWER
SMH ○	SANITARY MANHOLE
- - - - - -	STORM SEWER
□	CATCH BASIN
🟩	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
▬ ▬ ▬	LINE OF DEMARCATION
-----352-----	CONTOUR ELEVATION
▩	GABION WALL
▩	STAGING AREA LOCATION
🟥 🟥 🟥	APPROXIMATE LIMITS OF WORK
SB 107 ●	TREATABILITY STUDY SOIL BORING LOCATION
SB 102 ▲	RI SOIL BORING LOCATION
MW 102R ⌖	RI MONITORING WELL LOCATION
TP 101 ⊟	RI TEST PIT SAMPLE LOCATION
VP102 △	RI SOIL/GAS MONITORING LOCATION
SS 103 ■	RI SURFACE SOIL SAMPLE LOCATION
PZ-104 ▣	RI PIEZOMETER LOCATION
D-SB-01 △	PREVIOUS SOIL BORING LOCATION
TP ⊟	PREVIOUS TEST PIT SAMPLE LOCATION
F-TP-03 ☒	PREVIOUS TEST PIT LOCATION – NO SAMPLE COLLECTED
SB-18 ⌖	PREVIOUS MONITORING WELL LOCATION
HE ¤	PREVIOUS BACKGROUND SOIL SAMPLE LOCATION
D	DELTA ENVIRONMENTAL CONSULTANTS SAMPLE LOCATION
B	BUCK ENGINEERING, LLC SAMPLE LOCATION
F	FOSTER WHEELER SAMPLE LOCATION

0 20' 40'
GRAPHIC SCALE

NOTES:

1. BASE MAP INFORMATION TAKEN FROM A DRAWING TITLED SOIL BORING AND MONITORING WELL LOCATIONS BY C.T.MALE ASSOCIATES, P.C. DATED 2/8/05.
2. APPROXIMATE LINE OF DEMARCATION BASED ON HISTORIC TAX LOTS AND CURRENT FEATURES LITTLE FALLS (MILL ST.) SITE, FIGURE 1 (FOSTER WHEELER, JULY 2003).
3. LINE OF DEMARCATION SEPARATES THE MGP (VCO) PORTION OF THE PROPERTY FROM THE NON-MGP (VCA) PORTION OF THE PROPERTY.
4. LOCATION OF HISTORICAL MGP STRUCTURES ARE BASED ON HISTORICAL SANBORN MAPS AND ARE APPROXIMATE.
5. APPROXIMATE LOCATION OF THE PIPE GALLERY IS BASED ON PREVIOUS INVESTIGATIONS AND TEST PITTING ACTIVITIES CONDUCTED BY FOSTER WHEELER ENVIRONMENTAL CORPORATION.
6. RI SAMPLE LOCATIONS BASED ON SURVEY PERFORMED BY C.T. MALE ASSOCIATES, P.C. (DATED 2/8/05) AND SURVEY PERFORMED BY BLASLAND, BOUCK & LEE, INC. IN 11/2004 AND 4/2005.
7. CATCH BASIN LOCATION INFORMATION IS BASED ON FIELD MEASUREMENTS BY ARCADIS, APRIL 2008.
8. STAGING AREA LOCATION AND LIMITS OF WORK TO BE COORDINATED WITH FELDMEIER. PARKING ACCESS, FELDMEIER EQUIPMENT STORAGE AREAS, DRIVEWAYS, AND ACCESS TO OVERHEAD DOORS TO REMAIN CLEAR TO ALLOW FACILITY OPERATIONS. DISRUPTION OF ACCESS TO SOUTHERN OVERHEAD DOOR TO BE SCHEDULED AND COORDINATED WITH FELDMEIER. TEMPORARY ACCESS TO BE PROVIDED AS REQUIRED.

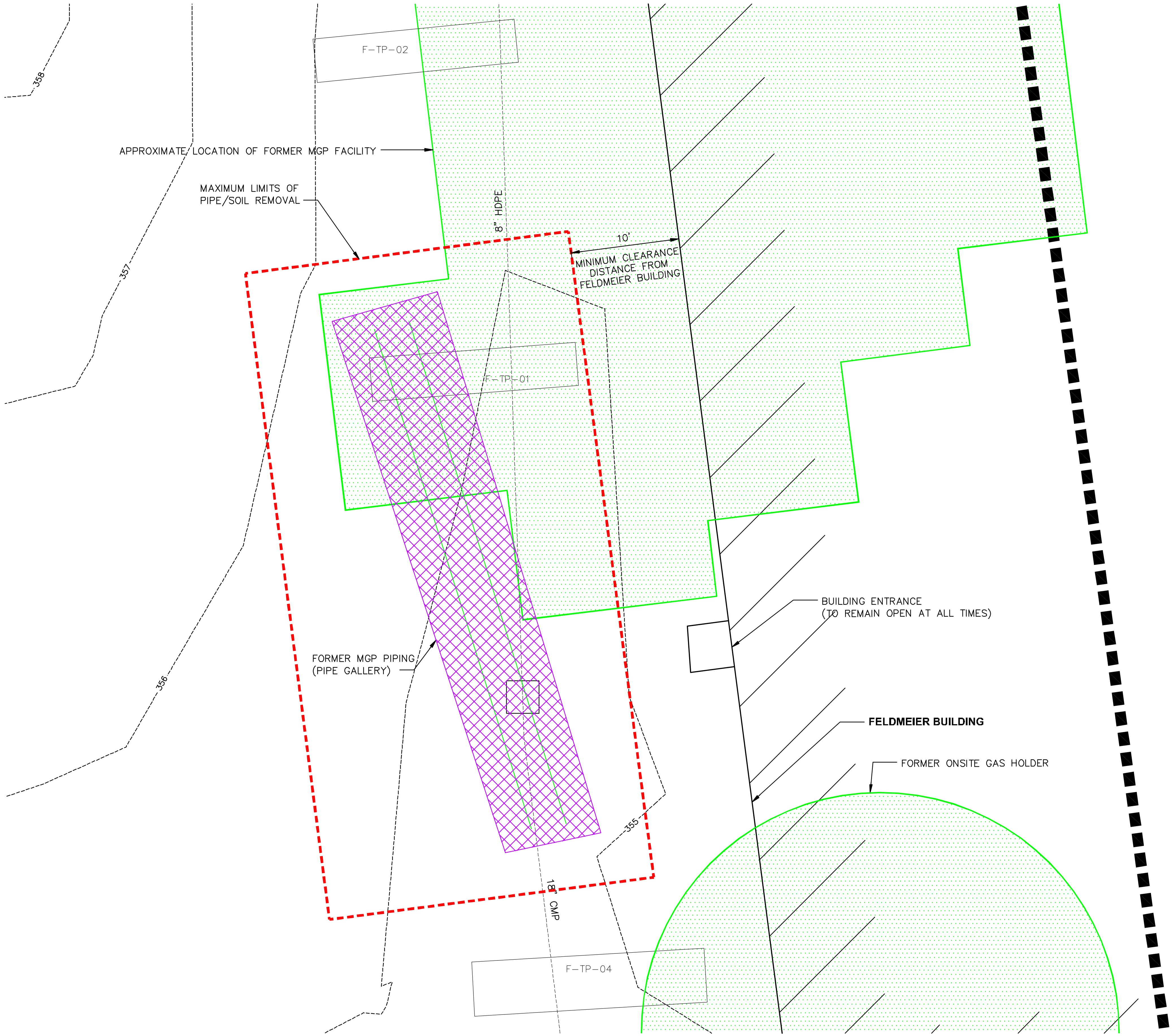
NATIONAL GRID
MILL STREET NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK
REMEDIAL ACTIVITIES

EXISTING SITE PLAN

ARCADIS

FIGURE
2

CITY:SYRACUSE DIV/GROUP:141 DB:GHS LAF NES LD: PIC: PM: C. CAMPBELL TM: LYR: ON=*;OFF=*REF*
G:\CAD\ACT\B0036673\0000\00009\DWG\REPORT\36673G01.DWG LAYOUT: 2 SAVED: 5/7/2008 5:52 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: C-LD2B-PDF PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 5/7/2008 5:52 PM BY: SMITHGALL, NANCY
XREFS: IMAGES: PROJECTNAME: ---
36673X02
36673X00

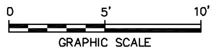


LEGEND:

—·—·—	PROPERTY LINE
▨	BUILDING
-··-··-	EDGE OF WATER
- - - - -	STORM SEWER
🟩	APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
■ ■ ■ ■	LINE OF DEMARCATION
-----352-----	CONTOUR ELEVATION
▩	APPROXIMATE LOCATION OF MGP PIPING TO BE REMOVED
🟥	MAXIMUM LIMITS OF PIPE/SOIL REMOVAL
F-TP-03	PREVIOUS TEST PIT LOCATION
□	CATCH BASIN

NOTES:

1. MAXIMUM LIMITS OF PIPE/SOIL REMOVAL WITHIN THE FORMER MGP PIPE GALLERY ARE APPROXIMATELY 30 FT. x 60 FT. EXCAVATION WILL NOT BE PERFORMED BELOW THE GROUNDWATER TABLE.
2. IF CATCH BASINS AND ASSOCIATED STORM SEWER PIPING ARE REMOVED DURING EXCAVATION ACTIVITIES, THE EXISTING CATCH BASIN SHALL BE REMOVED, STORED, AND REINSTALLED DURING BACKFILL OPERATIONS. STORM SEWER PIPING THAT IS REMOVED SHALL BE REPLACED WITH NEW PIPING OF SIMILAR MATERIALS.



NATIONAL GRID
MILL STREET NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK
REMEDIAL ACTIVITIES

PIPE GALLERY REMOVAL AREA

ARCADIS

FIGURE
3

CITY:SYRACUSE DIV/GROUP:141 DB:GHS LAF NES LD: PIC: PM:C. CAMPBELL TM: LYR:ON=*;OFF=*REF*
G:\CAD\ACT\B0036673\0000\00009\DWG\REPORT\36673G02.DWG LAYOUT: 3 SAVED: 5/7/2008 5:32 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: C-LD2B-PDF PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 5/7/2008 5:33 PM BY: SMITHGALL, NANCY
XREFS: IMAGES: PROJECTNAME: ---
36673X02
36673X00

LEGEND:

- PROPERTY LINE
- BUILDING
- EDGE OF WATER
- SANITARY SEWER
- SMH ○ SANITARY MANHOLE
- STORM SEWER
- APPROXIMATE LOCATION OF HISTORICAL MGP STRUCTURES
- ■ ■ ■ LINE OF DEMARCATION
- ----352---- CONTOUR ELEVATION
- APPROXIMATE EXTENT OF ISS TREATMENT
- (10') APPROXIMATE MAXIMUM DEPTH OF ISS TREATMENT
- MW 102R ⊕ RI MONITORING WELL LOCATION
- F-TP-03 ☒ PREVIOUS TEST PIT LOCATION
- SB-18 ⊕ PREVIOUS MONITORING WELL LOCATION
- GABION WALL
- ☐ CATCH BASIN

NOTES:

1. CATCH BASINS AND ASSOCIATED STORM SEWER PIPING IS TO BE REMOVED DURING EXCAVATION ACTIVITIES. THE EXISTING CATCH BASIN SHALL BE REMOVED, STORED, AND REINSTALLED DURING BACKFILL OPERATIONS. STORM SEWER PIPING IS TO BE REPLACED WITH NEW PIPING OF SIMILAR MATERIALS.
2. MONITORING WELLS WITHIN THE ISS TREATMENT AREA WILL BE DECOMMISSIONED PRIOR TO CONSTRUCTION ACTIVITIES.

0 5' 10'
GRAPHIC SCALE

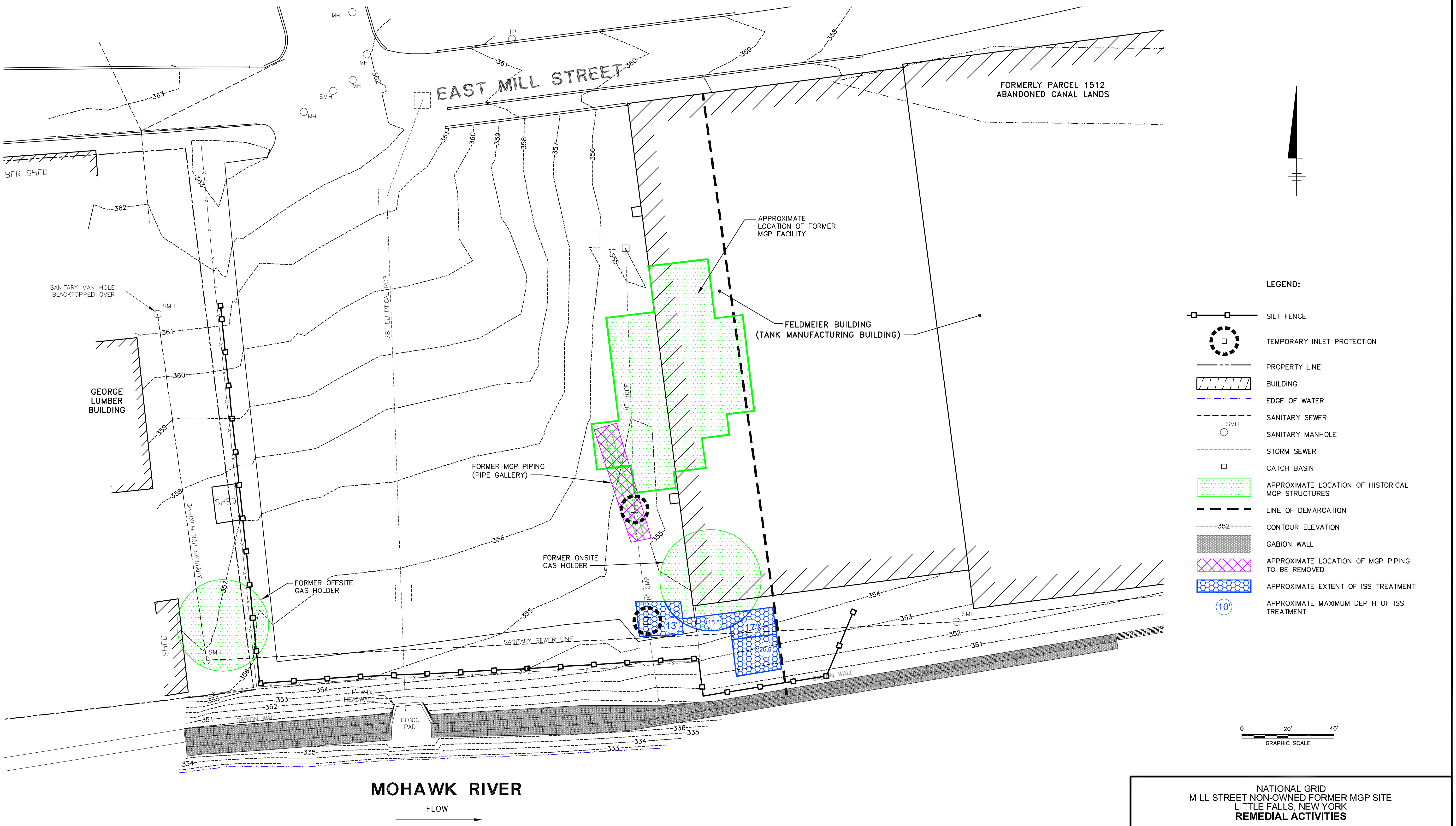
NATIONAL GRID
MILL STREET NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK
REMEDIAL ACTIVITIES

IN-SITU SOIL STABILIZATION AREA

ARCADIS

FIGURE
4

CITY:SYRACUSE DIV/GROUP:141 DB:GHS KLS LAF LD: PIC: PM: C. CAMPBELL TM: LYR:ON=*;OFF=*REF*
G:\CAD\ACT\B0036673\0000\00009\DWG\REPORT\36673G03.DWG LAYOUT: 4 SAVED: 5/2/2008 10:36 AM ACADVER: 17.0S (LMS TECH) PAGESETUP: C-LD2B-PDF PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 5/2/2008 10:40 AM BY: FORAKER, LYDIA
XREFS: 36673X02 36673X00 IMAGES: PROJECTNAME: ----



NATIONAL GRID
MILL STREET NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK
REMEDIAL ACTIVITIES

EROSIONS AND SEDIMENT CONTROL PLAN

ARCADIS

FIGURE
5

CITY:SYRACUSE DIV/GROUP:141 DB:GHS KLS LAF LD: PIC: PM:C. CAMPBELL TM: LYR:ON=*;OFF=*REF*
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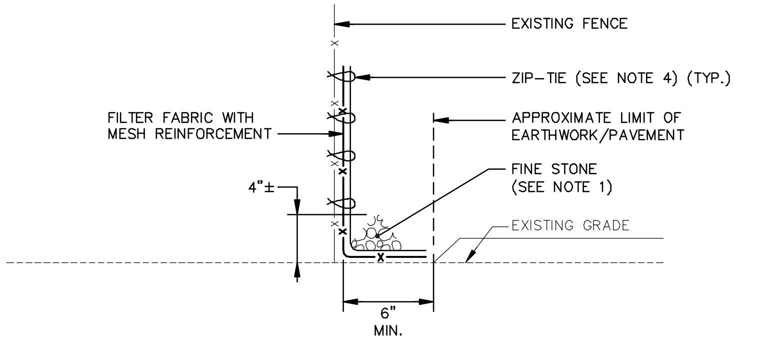
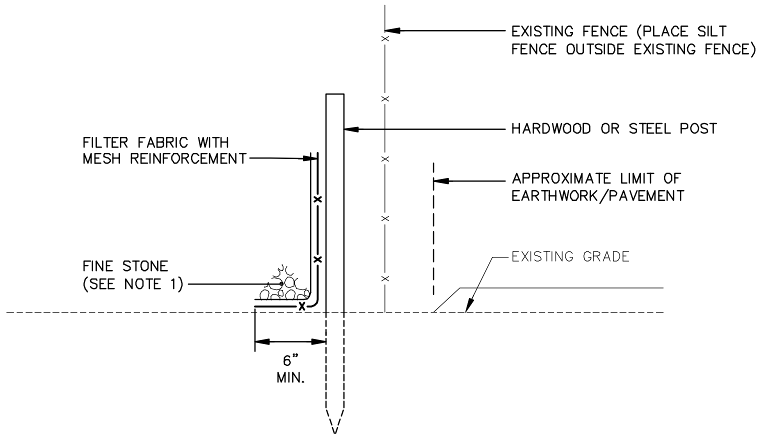


ATTACHED TO EXISTING CHAIN-LINK FENCE



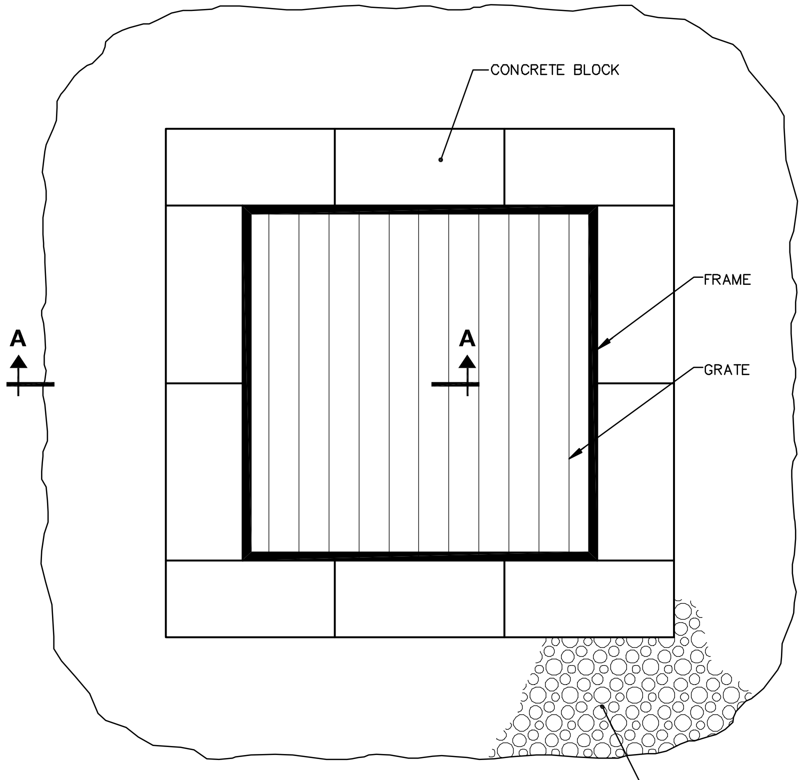
FREE STANDING SILT FENCE

NOTES:

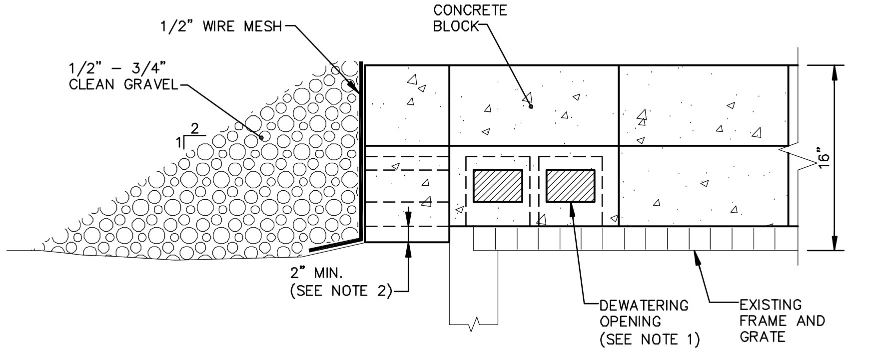
1. GEOTEXTILE AND MESH REINFORCEMENT FLAP SHALL BE LAID FLAT AS SHOWN AND HELD IN PLACE WITH A CONTINUOUS MOUND OF FINE STONE.
2. WHEN TWO SECTIONS OF FILTER FABRIC ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED A MINIMUM OF 6 INCHES AND FOLDED.
3. APPROVED EQUAL SILT FENCE PRODUCT SHALL MEET THE REQUIREMENTS OF THE TECHNICAL SPECIFICATIONS AND THE LATEST EDITION OF THE NEW YORK STATE STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL. INSTALLATION SHALL BE AS SHOWN ABOVE.
4. SILT FENCE MAY BE INSTALLED USING EXISTING CHAIN–LINK FENCING FOR SUPPORT (AS SHOWN). SILT FENCE SHALL BE FASTENED TO THE EXISTING CHAIN–LINK FENCE USING PLASTIC ZIP–TIES (OR OTHER APPROVED MEANS) AS NECESSARY TO PROVIDE SUFFICIENT SUPPORT OF SILT FENCE.
5. FINE STONE SHALL BE NYSDOT NO. 2 STONE GRADATION. AN ALTERNATE GRADATION MAY BE SUBMITTED TO NATIONAL GRID FOR CONSIDERATION.

REINFORCED SILT FENCE ①

NOT TO SCALE



PLAN



SECTION A-A

NOTES:

1. LAY ONE BLOCK ON EACH SIDE OF THE STRUCTURE ON ITS SIDE FOR DEWATERING.
2. PERIMETER BLOCKS SHALL BE PLACED 2" BELOW THE TOP OF INLET FOR SUPPORT.
3. APPROPRIATE ALTERNATIVE METHODS FOR SEDIMENT CONTROL AT INLET STRUCTURES MAY BE PROPOSED BY CONTRACTOR AND SUBMITTED TO NATIONAL GRID FOR CONSIDERATION.
4. PRIOR TO COMMENCING SOIL DISTURBANCE ACTIVITIES, TEMPORARY INLET PROTECTION SHALL BE INSTALLED AROUND CATCH BASINS WITHIN AND ADJACENT TO WORK AREA WHERE SHOWN ON DRAWING 4.

TEMPORARY INLET PROTECTION ②

NOT TO SCALE

GNG RCB

NATIONAL GRID
MILL STREET NON-OWNED FORMER MGP SITE
LITTLE FALLS, NEW YORK
REMEDIAL ACTIVITIES

SECTIONS AND DETAILS

ARCADIS

FIGURE
6