2011 SWMU 1 Investigation Report, Former Hampshire Chemical Corp. Facility, Waterloo, New York

PREPARED FOR: The New York State Department of Environmental Conservation

PREPARED BY: CH2M HILL on behalf of The Dow Chemical Company

DATE: April 20, 2012

Introduction

This technical memorandum reports the results of the October 2011 subsurface investigation performed at the former Hampshire Chemical Corp. (HCC) Facility Solid Waste Management Unit 1 (SWMU 1) in Waterloo, New York. The subsurface investigation activities were conducted along the southwestern side of the former HCC facility, now known as the Evans Chemetics Facility (the facility or site). The site is regulated under Title 6 of the New York Code of Rules and Regulations (NYCRR) Part 373 and the Resource Conservation and Recovery Act (RCRA), with the New York State Department of Environmental Conservation (NYSDEC) as the lead agency. RCRA facility investigations (RFIs) have been performed at the facility since 1993 to evaluate the nature and extent of releases to the environment. This RFI was performed pursuant to a Second Amended Order on Consent, Index No. CO 8-20000218-3281, August 12, 2011 (NYSDEC 2011) between HCC and NYSDEC which called for an investigation for additional information to complete the corrective measures study (CMS) for SWMU 1.

The field activities detailed in this technical memorandum were performed in accordance with the procedures provided in the *2011 SWMU 1 Investigation Work Plan* (CH2M HILL 2011), the site-specific quality assurance project plan (CH2M HILL 2009a), and CH2M HILL's site-specific health, safety, and environmental plan.

Background

Site Location and Setting

The site is located at 228 East Main Street in the village of Waterloo, Seneca County, New York (Figure 1). The site is bordered to the north by East Main Street, to the east by Gorham Street, to the west by East Water Street, and to the south by the Seneca-Cayuga Canal. Several interconnected buildings on the site contain offices; a quality control laboratory; manufacturing, maintenance, and shipping/receiving operations; and a chemical treatment plant. The site also includes outside drum storage areas and several aboveground storage tanks.

SWMU 1 Site Background

SWMU 1 is located in the southwestern corner of the facility property. It is bounded to the east by the facility, to the south by the Seneca-Cayuga Canal, to the west by East Water Street, and to the north by the asphalt access road into the facility. Figure 2 shows the location and configuration of SWMU 1 relative to the surrounding features, and the facility boundaries.

Sanborn fire insurance maps of the site indicate that until 1948, a portion of SWMU 1 was occupied by part of the Seneca-Cayuga Canal, a lock, and several raceways (O'Brien & Gere Engineers, Inc. [OBG] 2003). The RCRA Facility Assessment report (A.T. Kearney 1993) indicates that the former Village of Waterloo dump was probably in operation at the western edge of the site until 1951 (OBG 2003). This suggests a maximum operation period of approximately 3 years, during which the Village of Waterloo placed debris, soil, and refuse in this area. The 1964 Sanborn map for the facility shows that the canal and raceways were filled to the western edge of the old lock, and the area is identified as the Village of Waterloo Dump (OBG 2003). Additional material was placed over the former raceways in 1981. Plant personnel have indicated that this material may have been derived from soils excavated during plant construction projects.

Previous Investigations

The RFI report (CH2M HILL 2006) and RFI addendum report (CH2M HILL 2008) present information from previous investigations conducted at SWMU 1. During a field assessment in 2008 some erosion and deposits of small, aged glass bottles along the edge of the canal bank south of the eastern end of the elevated SWMU 1 area were noted (CH2M HILL 2008).

In December 2009, 14 test pits were excavated along the canal on the south side of SWMU 1 to visually delineate fill materials that are within the canal's right-of-way. The test pits were excavated and visually assessed from December 7 through December 9, 2009. The results of the test pit excavations show that fill materials extend onto the canal right-of-way in the area. From that investigation, it has been estimated that approximately 2,500 cubic yards of fill material are present within the canal right–of-way (CH2M HILL 2009b).

Objectives

The general objective of this investigation was to further characterize the soil and top of bedrock at SWMU 1, and to fill in data gaps identified in the 2004, 2006, and 2008 RFIs (CH2M HILL 2004, 2006, 2008).

The following specific RFI objectives for SWMU 1 are discussed in this technical memorandum:

- Map the historical raceways within SWMU 1.
- Evaluate top of bedrock in this area.
- Further evaluate groundwater flow and historical raceway interaction within SWMU 1.
- Collect geotechnical soil samples of existing surface materials within SWMU 1 to support the optimization of the existing soil to evaluate the existing cover.

Field Activities

CH2M HILL mobilized to the site on October 13, 2011, for utility clearance, and on October 17, 2011, for drilling activities. Shortly after arriving onsite, a brief project kickoff meeting, health and safety orientation, and a health and safety toolbox meeting were held and attended by CH2M HILL and subcontractor personnel.

Fieldwork was completed on October 22, 2011. During this period, 14 soil borings were advanced to bedrock, 6 geotechnical soil borings were advanced to a maximum depth of 5 feet below ground surface (ft bgs) (Figure 2), and a land survey was performed at the 14 soil boring locations to determine their locations and elevations. The following sections describe the sequence of field activities that took place during the October 2011 field investigation.

Utility Clearance

The drilling subcontractor, Boart LongYear, contacted Dig Safely of New York to clear the public utility lines in the work area before mobilizing to the site. Additionally, CH2M HILL retained a third-party utility locating service, Enviroscan, to survey the work area and locate underground utilities within the investigation area. When underground utility lines or structures were identified at a proposed drilling location, a second drilling location was selected nearby and checked for utility clearance. CH2M HILL personnel also reviewed site conditions with site personnel to assess the presence of underground utilities near the proposed drilling locations and to coordinate logistics to minimize interruption of facility traffic at the roadway drilling locations.

Soil Borings via Mini Sonic Drilling Technology

An all-terrain-vehicle- mounted 200C mini sonic drill rig with a 3.75-inch barrel and carbide bit was used to advance through the overburden to bedrock at each of the 14 boring locations. At each boring location, continuous soil cores of the overburden were obtained without the use of water, air, or mud. Water was used at a few locations to advance in bedrock and obtain rock cores, while the other bedrock cores were obtained by dry advancement.

Each boring was advanced to a maximum depth of 5 feet in rock to help evaluate whether the boring is in bedrock. Each soil core was photographed, and the soil/rock lithology (including Munsel color description and Unified Soil Classification System description) was noted on a dedicated boring log. Boring logs are provided in Attachment 1 of this document.

Continuous air monitoring was performed during the drilling activities. Each soil core was screened for volatile organic compounds (VOCs) using a photoionziation detector (PID).

Groundwater elevations were measured with a water level meter at each of the 14 soil borings. Additional groundwater elevation information was obtained from surrounding monitoring wells during a concurrent groundwater synoptic event.

At the conclusion of each boring, the drilling subcontractor abandoned the borehole with a cement-bentonite and water mixture. Asphalt patch was used to restore roadway locations to pre-existing conditions, and borings in grassy locations were grouted to surface with a cement-bentonite mixture.

Downhole tools for the drilling rig were decontaminated before and after each use at each sample location by scrubbing and washing the tools in an alconox and water solution, following by potable water rinse.

During offsite drilling activities at boring locations BS-11 and BS-12, and in accordance with the *Technical Memorandum: Community Air Monitoring Plan, Former Hampshire Chemical Corp Facility, Waterloo, New York* (CH2M HILL 2009c), continuous real-time air monitoring upwind and downwind of the immediate work area was conducted for VOCs using a MiniRae 3000 PID equipped with an 11.7-electron volt lamp and for particulates using a PDR-1000 dust detector.

Soil Borings via Direct-Push Technology

Six geotechnical soil borings (GT-01 to GT-06) were advanced on October 19, 2011 using a drill rig equipped with direct-push technology (DPT). At each boring location, the DPT rig collected continuous soil cores to a maximum depth of 5 ft bgs. A CH2M HILL geologist documented the soil lithology using the Unified Soil Classification System (American Society for Testing and Materials [ASTM]-422D). Boring logs are provided in Attachment 1 of this document.

Continuous air monitoring was performed during drilling activities. Each soil core was screened for VOCs using a PID.

Field personnel collected one composite soil sample from each of the six boring locations, one composite sample (GT-07) from boring locations GT-01, GT-02, and GT-03, and another composite sample (GT-08) from boring locations GT-04, GT-05, and GT-06. Disposable equipment was used to collect the soil samples at each boring location.

At the conclusion of each boring, the drilling subcontractor abandoned the borehole using a bentonite-water mixture.

Survey of Boring Locations

A New York -registered professional land surveyor conducted a survey of the 14 soil borings that were advanced to bedrock. The equipment used included a Geodimeter 640 (1 second) robotic total station with the remote prism pole, with the geodimeter alpha/ numeric data collector radio and Right Pier Unit prism holder. Existing suitable and new control points were used to develop coordinates and elevations (X, Y, and Z), to the nearest 0.01 foot. Survey details are summarized in Table 1.

Management of Investigation-Derived Waste

Personal protective equipment, disposable sampling equipment, and drill cuttings were accumulated in two onsite rolloff containers, and investigation-derived waste liquids were accumulated in a 55-gallon drum at the site. CH2M HILL coordinated offsite landfill disposal of the waste created during the investigative activities in December 2011 with a waste management and disposal company.

Geotechnical Testing

The geotechnical soil samples were delivered to the Kenney Geotechnical Engineering Services, PLC (Kenney) laboratory in Syracuse, New York, for geotechnical testing. The

samples were tested for moisture content (ASTM D 2216), Atterberg limits (ASTM D 4318), and grain size sieve analysis with Wash 200 (ASTM D 422). Composite samples GT-07 and GT-08 were tested for modified proctor on soil (ASTM D 1557) and triaxial permeability on recompacted soil samples (ASTM D 5084).

Kenney provided the modified proctor results of samples GT-07 and GT-08 to CH2M HILL before performing the triaxial permeability test on each recompacted sample. The following targets were selected for the preparation of recompacted samples to use in the triaxial permeability tests:

- GT-07 - Target 95 percent of maximum dry density = 111.25 per cubic foot (pcf). At moisture content of ~19 percent.
- GT-08 - Target 95 percent of maximum dry density = 111.9 pcf. At moisture content of ~18 percent.

CH2M HILL instructed Kenney that the desired maximum compaction and molding water content was 95 percent wet of the optimum moisture content for GT-07 and GT-08 for permeability tests.

Findings

Five soil borings (BS-01, BS-02, BS-06, BS-07, and BS-10) were advanced to help identify the location of the historical raceway at the southern area of SWMU 1. Fill material of sand, silt, clay and/or gravel layers, with debris (glass, brick, coal, plastic and/or wood fragments) was present to the top of bedrock at BS-06, BS-07 and BS-10. At BS-01 and BS-02, the fill layer was underlain by a native sand layer with abundant shell fragments to the top of bedrock.

Three soil borings (BS-08, BS-09 and BS-14) were advanced to help identify the northern extent of SWMU 1. At BS-09 and BS-14, fill material of sand, silt, clay and/or gravel layers, with debris (glass, brick, coal, plastic, porcelain, and/or wood fragments) was underlain by a native clay layer overlying the top of bedrock. At BS-08, the fill material extended to the top of bedrock.

Two soil borings (BS-11 and BS-12) were advanced offsite and south of SWMU 1 to confirm the southern extent of SWMU 1. Fill material consisting of silt and/or sand layers with debris (glass, brick, plastic, and/or coal fragments) was underlain by native clay or glacial till layers overlying the top of bedrock.

Three soil borings (BS-03, BS-04 and BS-05) were advanced to help identify the eastern boundary of SWMU 1. Fill material consisting of gravel subbase for the asphalt paved facility road, and some debris (brick, coal, and/or glass fragments) was underlain by native sand, clay and/or glacial till layers to the top of bedrock.

Two soil borings (BS-13, and BS-14) were advanced to help identify the western extent of SWMU 1. Fill material consisting of silt with debris (glass, brick, and/or coal fragments) was underlain by a native clay layer overlying the top of bedrock.

Potential operational waste was identified at the northern extent of SWMU 1 (BS-08 and BS-09). Potential municipal debris was identified at the southern area of SWMU 1 (BS-01, BS-02, BS-06, BS-07, BS-10, BS-11 and BS-12) and included the location of the historical raceway.

No operational or municipal debris was identified at the other locations (BS-03, BS-04, BS-05, BS-13 and BS-14). Geologic cross sections of the southern and western areas of SWMU 1 are presented in Attachment 2. Figure 3 presents the corresponding cross section location map.

Top of bedrock elevations were rounded to 0.1 foot. The elevation of the top of bedrock encountered by the borings varied from 429.4 feet at BS-11 to 416.4 feet at BS-06. The bedrock material appeared to be hard, fresh, fine-grained gray to very dark gray limestone. At the northwestern area of SWMU 1 (BS-09 and BS-14), and at the southwestern area of SWMU 1 (BS-11 and BS-12), the top of bedrock appeared to dip slightly toward the former raceway, with a difference in elevation of approximately 3 feet. The top of bedrock at the eastern side of SWMU 1 appeared to dip in a southeasterly direction toward the canal. A summary of the top of bedrock elevations is presented in Table 2, and the top of bedrock elevations and contour lines are shown of Figure 4. Table 2 and Figure 4 also include the top of bedrock elevations from a predesign investigation conducted in 2011 at boring locations GB-1, GB-2, GB-7, GB-8, GB13 and GB-14. Elevations shown at previous RFI monitoring well locations (except MW-05I, MW-16I and TW-02) indicate refusal and bedrock is anticipated to be at, or at a greater depth than indicated in Table 2 and Figure 4.

Non-monitoring well groundwater elevations were rounded to 0.1 foot. The highest groundwater elevation of the 14 soil borings was measured at BS-09 (435.0 feet above mean sea level [ft amsl]), north of the former raceways. The lowest groundwater elevations were measured at BS-12 (427.2 ft amsl), southwest of the former raceway, and at BS-01 (427.8 ft amsl), southeast of the former raceways. The groundwater flow direction at SWMU 1 was determined to be similar to the direction observed in previous investigations and flows south toward the Seneca – Cayuga Canal. The raceways within SWMU 1 did not appear to be a flow conduit for groundwater because similar groundwater elevations were recorded inside and outside the historical raceway at MW-16I (430.47 ft amsl) and MW-16S (430.86 ft amsl) respectively. A summary of the groundwater elevations is presented in Table 3, and the groundwater elevations, contour lines, and flow direction are shown on Figure 5.

Boring logs and laboratory tests of the geotechnical soil samples show most of the material is a clayey soil with varying amounts of silt, sand, and gravel, plus occasional debris (concrete, asphalt, glass, and wood) that appears to be construction-related. The laboratory results of the geotechnical tests are presented in Attachment 3.

Based on the laboratory grain size results, the high percentage of silt and clay-sized material indicate this material can be expected to behave more as a clay than a sandy soil. Based on the laboratory Atterberg limits, the plasticity index varies from 6.8 to 24.2 percent and the liquid limit varies from 28.2 to 42.4 percent, which indicates the presence of inorganic clays of low to medium plasticity with a low shrink-swell potential. Permeability test results indicate that soil present up to a maximum depth of 5 ft bgs at the SWMU 1 area is of a low permeability (5.52E-07 to 9.71E-07 centimeters per second (cm/sec), which helps to reduce infiltration.

No elevated VOC readings were measured at any of the 20 soil boring locations with the PID. VOC concentrations varied between 0 and 0.4 ppmv.

Conclusions

The following conclusions have been developed from observations made during the October 2011 site investigation:

- The southernmost former raceway in SWMU 1 was located over an east-west trending low area in the bedrock, which suggests that the raceway was located in a naturally occurring low area, or that the raceway was partially excavated into bedrock in this area. The two northern raceways do not show this relationship to the bedrock surface.
- Groundwater flows to the south, generally following the topography of the ground surface.
- The material encountered to a maximum depth of 5 ft bgs at SWMU 1 is a low-permeability clayey soil with a permeability of 5.52E-07 to 9.71E-07 cm/sec.

Path Forward

- The information gathered in this investigation will be used to develop a corrective measures study, which will evaluate remedial alternatives for the SWMU 1 area, including a leave-in-place remedy.

References

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New York State Department of Environmental Conservation (NYSDEC). 2011. Second Amended Order on Consent, Index Number 8-20000218-3281, between Hampshire Chemical Corp. and New York State Department of Environmental Conservation. August 12.

O'Brien & Gere Engineers, Inc. (OB&G). 2003. *Sampling Visit Report, RCRA Facility Assessment, Hampshire Chemical Corporation Facility, Waterloo, New York.* September.

Tables

Table 1
Boring Locations Coordinates and Elevations
2011 SWMU 1 Investigation, RCRA Facility Investigation
Former Hampshire Corp. Facility, Waterloo, New York

Boring Location	NYS State Plane Northing	NYS State Plane Easting	Elevation (ft amsl)
BS-01	1057479.396	747423.075	436.04
BS-02	1057470.456	747499.1214	434.26
BS-03	1057630.141	747444.6754	445.33
BS-04	1057630.258	747334.9739	443.20
BS-05	1057552.978	747335.4082	441.48
BS-06	1057519.941	747304.1202	442.94
BS-07	1057583.594	747167.8081	448.83
BS-08	1057705.281	747251.2705	444.24
BS-09	1057755.59	747123.0815	443.44
BS-10	1057609.982	747071.861	442.30
BS-11	1057581.57	747012.9218	438.41
BS-12	1057622.04	746895.3562	438.95
BS-13	1057734.754	746915.9163	442.26
BS-14	1057795.634	746980.1382	444.15

Notes:
All boring locations were surveyed to the New York Central state plane coordinate system (NAD 1983).
ft amsl - feet above mean sea level

TABLE 2
Top of Bedrock Elevation Measurements
2011 SWMU 1 Investigation Report
Former Hampshire Chemical Corp Facility, Waterloo, New York

Well Number	Ground Elevation (ft amsl)	Depth to Top of Bedrock (feet bgs)	Top of Bedrock Elevation (feet amsl)	Total Boring Depth (feet bgs)	Comments
MW-01	434.42	17.20	417.22		
MW-05I	445.45	22.00	423.45		OB&G 2003 rpt - Top of bedrock at 415 ft
MW-13	433.91	16.50	417.41		Weathered bedrock at 16.0 to 16.5 ft bgs.
MW-15	443.91	18.00	425.91		Fill to refusal at bedrock
MW-16I	452.80	26.80	426.00		OB&G 2003 rpt - Top of bedrock at 426 ft
MW-17	441.65	12.50	429.15		
MW-18	441.14	10.60	430.54		
MW-26	437.95	10.00	427.95		
MW-27	444.44	13.00	431.44		
MW-28	444.83	15.50	429.33		
TW-01	443.20	18.80	424.40		
TW-02	439.00	10.00	429.00		Fractured rock
GB-1	437.00	8.00	429.00		
GB-2	433.58	17.00	416.60		
GB-7	429.25	14.20	415.10		
GB-8	429.25	14.20	415.10		
GB-13	432.37	8.00	424.40		
GB-14	431.95	13.50	418.50		
BS-01	436.04	17.00	419.00	20.0	
BS-02	434.26	12.50	421.80	16.0	
BS-03	445.33	25.00	420.30	30.0	
BS-04	443.2	19.20	424.00	25.0	
BS-05	441.48	22.00	419.50	27.0	
BS-06	442.94	26.50	416.40	29.0	
BS-07	448.83	23.50	425.30	30.0	
BS-08	444.24	19.00	425.20	27.0	
BS-09	443.44	15.00	428.40	15.6	
BS-10	442.3	16.50	425.80	19.0	
BS-11	438.41	9.00	429.40	13.0	
BS-12	438.95	10.00	429.00	15.0	
BS-13	442.26	14.00	428.30	16.0	
BS-14	444.15	15.50	428.70	18.0	

Notes:
All boring locations were surveyed to the New York Central state plane coordinate system (NAD 1983).
amsl - above mean sea level
bgs - below ground surface
NM - not measured

Bedrock not encountered at maximum boring depth for monitoring wells MW-6 (14 ft bgs), MW-12 (14 ft bgs), MW-14 (18 ft bgs) and MW-25 (17 ft bgs).
Gray shading indicates approximate measurement
Top of bedrock elevations were rounded to 0.1 ft at BS-01 to BS-14.

TABLE 3
Groundwater Elevation Measurements
2011 SWMU 1 Investigation Report
Former Hampshire Chemical Corp Facility, Waterloo, New York

Well Number	Date	Ground Elevation (ft amsl)	Inner Casing Elevation (ft amsl)	Depth to Water (feet TIC)	Groundwater Elevation (feet bgs)	Groundwater Elevation (feet amsl)	Comments
MW-01	10/17/11		434.42	3.85		430.57	
MW-05S	10/17/11		445.40	6.39		439.01	
MW-05I	10/17/11		445.45	12.75		432.70	Not used in generating contours.
MW-06	10/17/11		446.87	5.10		441.77	
MW-12	10/17/11		433.85	3.68		430.17	
MW-13	10/17/11		433.91	3.51		430.40	
MW-14	10/17/12		443.48	10.12		433.36	
MW-15	10/17/11		443.91	NM		NM	Covered by gravel
MW-16S	10/17/11		453.23	22.37		430.86	
MW-16I	10/17/11		452.80	22.33		430.47	Not used in generating contours.
MW-17	10/17/11		441.65	11.52		430.13	
MW-18	10/17/11		441.14	10.50		430.64	
MW-22	10/18/11		433.90	3.75		430.15	Covered by totes on 10/17/11
MW-25	10/17/11		441.32	NM		NM	Covered by gravel
MW-26	10/17/11		440.16	10.48		429.68	
MW-27	10/17/11		444.09	9.37		434.72	
MW-28	10/17/11		444.55	NM		NM	Covered by staged construction materials
TW-01	10/17/11		446.76	16.02		430.74	
TW-02	10/17/11		440.06	10.01		430.05	
BS-01	10/20/11	436.04			8.20	427.80	
BS-02	10/20/11	434.26			3.50	430.80	
BS-03	10/19/11	445.33			11.00	434.30	
BS-04	10/19/11	443.20			11.00	432.20	
BS-05	10/19/11	441.48			11.00	430.50	
BS-06	10/20/11	442.94			12.00	430.90	
BS-07	10/18/11	448.83			18.70	430.10	
BS-08	10/21/11	444.24			9.50	434.70	
BS-09	10/21/11	443.44			8.40	435.00	
BS-10	10/18/11	442.30			10.50	431.80	
BS-11	10/17/11	438.41			5.10	433.30	
BS-12	10/18/11	438.95			11.80	427.20	
BS-13	10/21/11	442.26			9.50	432.80	
BS-14	10/21/11	444.15			11.00	433.20	

Notes:
All boring locations and wells were surveyed to the New York Central state plane coordinate system (NAD 1983).
amsl - above mean sea level
bgs - below ground surface
NM - not measured
TIC - top of inner casing
Non-monitoring well groundwater elevations were rounded to 0.1 ft.

Figures

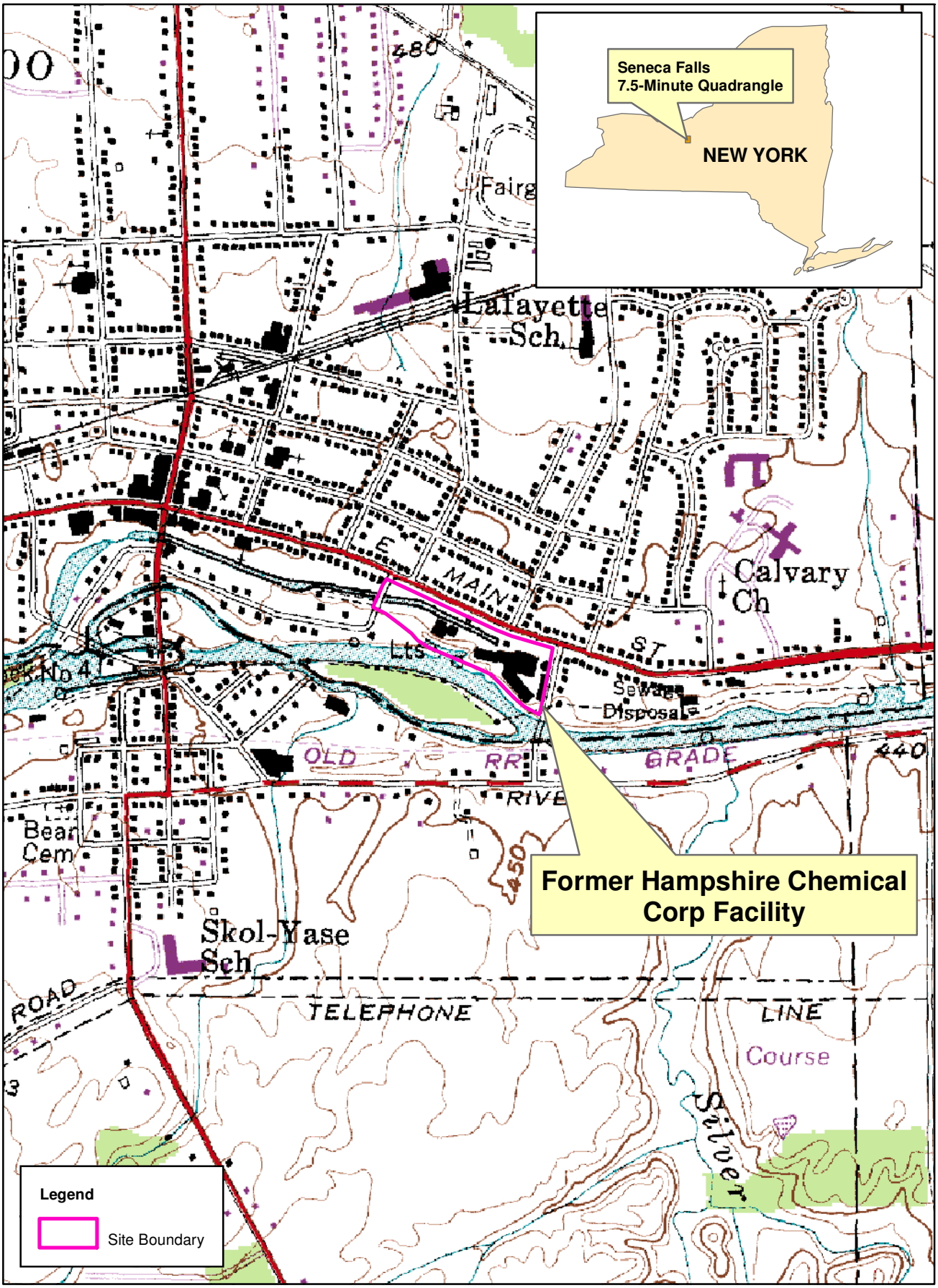

Figure 1
Facility Location Map
Former Hampshire Chemical Corp Facility
Waterloo, New York

\\NORTHEND\PROJ\DOW\WATERLOO\GIS_FOLDERS\MAPFILES\OUTFALL EVALUATION TECH MEMO\FIGURE1_FACILITY_LOCATION.MXD MUNWIN 10/5/10

CH2MHILL

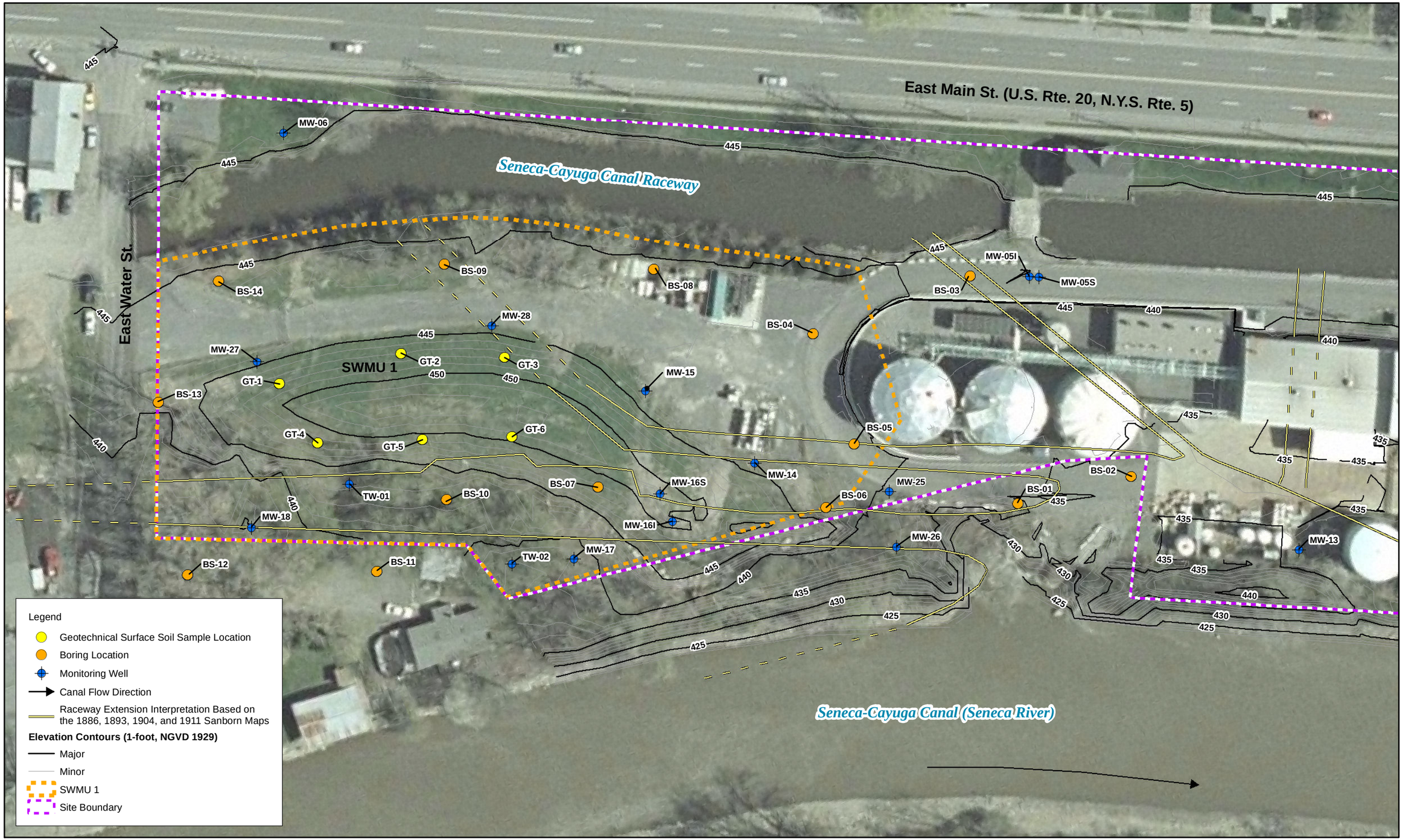

Figure 2
Geotechnical Surface Soil Sample and Soil Boring Locations
2011 SWMU 1 Investigation Technical Memorandum
Former Hampshire Chemical Corp. Facility
Waterloo, New York

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E:\DOW\WATERLOO\GIS_FOLDERS\MAPFILES\2011\SWMU1_INVESTIGATIONWP\FIGURE 02 - GEOTECHNICAL SURFACE SOIL SAMPLE AND SOIL BORING LOCATIONS.MXD JHANSEN1 11/2/2011 2:47:24 PM

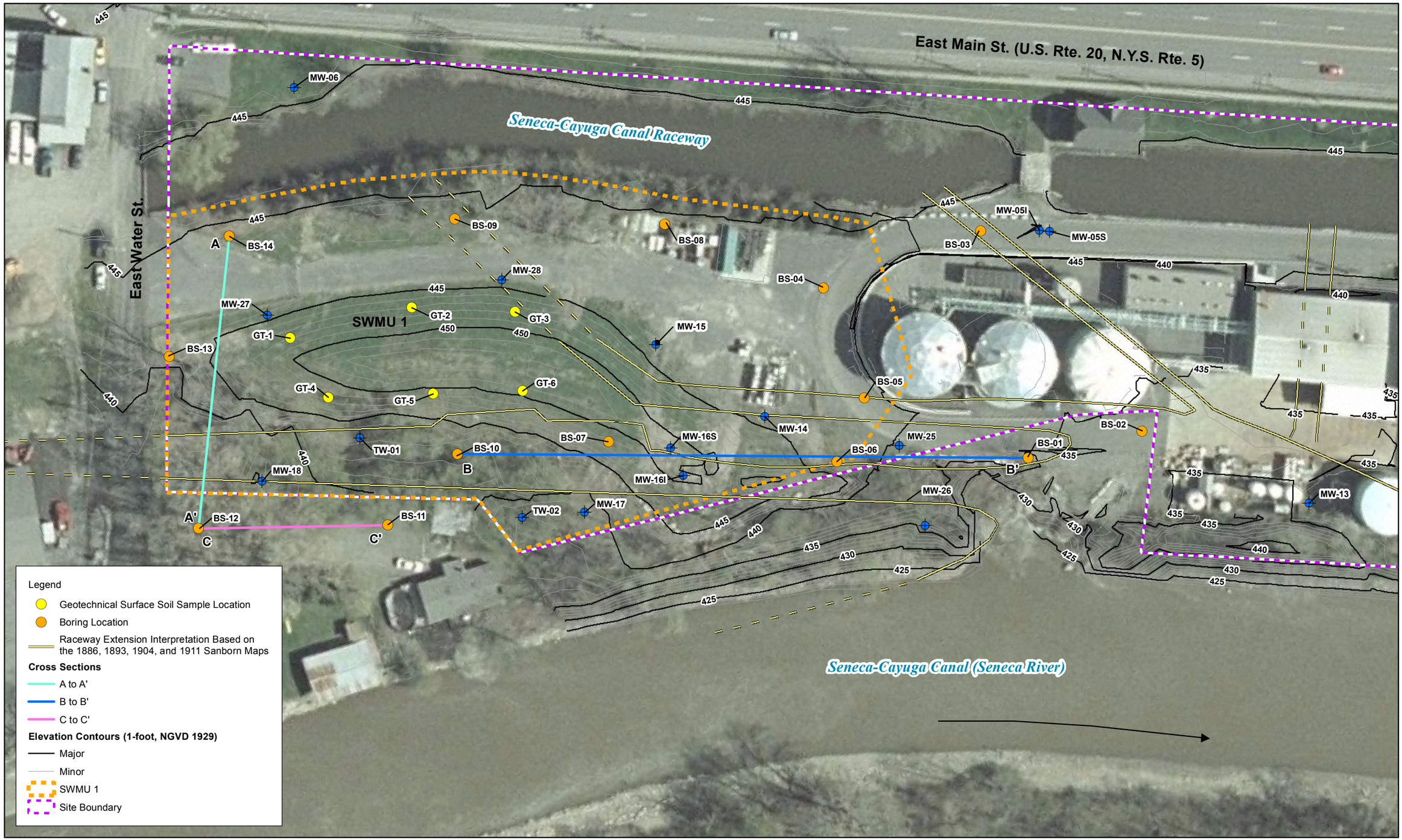

Figure 3
Cross Section Location Map
2011 SWMU 1 Investigation Technical Memorandum
Former Hampshire Chemical Corp. Facility
Waterloo, New York

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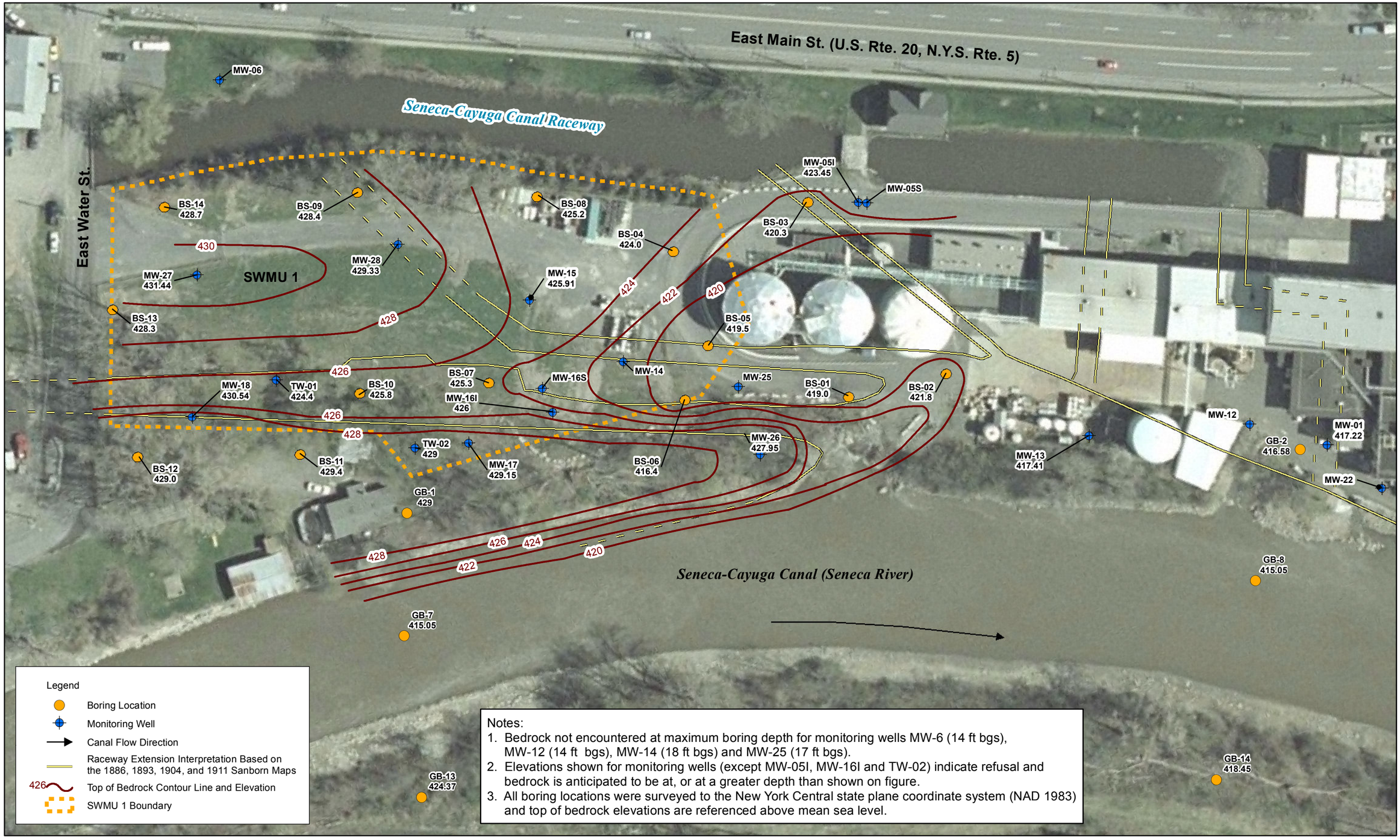

Figure 4
SWMU 1 Top of Bedrock Contour Map
2011 SWMU 1 Investigation Technical Memorandum
Former Hampshire Chemical Corp. Facility
Waterloo, New York

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East Main St. (U.S. Rte. 20, N.Y.S. Rte. 5)

Seneca-Cayuga Canal Raceway

East Water St.

SWMU 1

MW-06 441.77

BS-14 433.2

BS-09 435.0

BS-08 434.7

BS-03 434.3

MW-05I (432.70)

MW-05S 439.01

BS-04 432.2

MW-28 NM

MW-27 434.72

MW-15 NM

MW-14 433.36

BS-05 430.5

BS-13 432.8

MW-25 NM

BS-02 430.8

MW-18 430.64

TW-01 430.74

BS-10 431.8

BS-07 430.1

MW-16S 430.86

MW-16I (430.47)

MW-12 430.17

MW-01 430.57

BS-11 (433.3)

TW-02 430.05

BS-06 430.9

BS-01 427.8

MW-26 429.68

MW-13 430.40

BS-12 427.2

MW-17 430.13

MW-22 430.15

Seneca-Cayuga Canal (Seneca River)

434

432

430

428

Legend

433.31	Groundwater Elevation (ft amsl)
(432.70)	Elevation not used in Generating Contours
NM	Not Measured
	Boring Location
	Monitoring Well
	Canal Flow Direction
	Groundwater Flow Direction
	Raceway Extension Interpretation Based on the 1886, 1893, 1904, and 1911 Sanborn Maps
	Water Table Elevation Contour (ft amsl) (Dashed where inferred)
	SWMU 1 Boundary

N

0 70 140

Feet

Figure 5

Groundwater Elevation Contour Map - October 2011

2011 SWMU 1 Investigation Technical Memorandum

Former Hampshire Chemical Corp. Facility

Waterloo, New York

CH2MHILL

Attachment 1 – Boring Logs

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-01 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation
LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057479.4 N, 747423.1 E)

ELEVATION : 436.0 ft
DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit
ORIENTATION : Vertical

WATER LEVELS : ▼ 8.2 ft bgs
START : 10/20/11 15:15
END : 10/20/11 16:10
LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
436.0	0.0						
		49.2	S-1		**Fill - Clayey Sand (FILL/SC)** 0-5' - very dark gray, (2.5Y 3/1), moist, with coarse angular to subrounded gravel, some cobbles, wood, brick, organic matter, large brick fragment at 4 ft.		PID: 0.1 BZ: 0.0 Above Hole: 0.0
5	5.0						
431.0		24.0	S-2		**Fill - Gravelly Sand (FILL/GP)** 5-7' - very dark gray, (2.5Y 3/1), moist, with coarse angular to subrounded gravel, some cobbles, wood, brick, organic matter, large brick fragment at 4 ft.		
	7.0						
		36.0	S-3		**Fill - Sandy Clay (FILL/CL)** 7-10' - black, (2.5Y 2.5/1), moist, very soft, some silt, some brick, medium plasticity, carbon fragments - possible anthracite > 2".		PID: 0.1 BZ: 0.0 Above Hole: 0.0 ▼
10	10.0						
426.0		8.4	S-4		**Fill - Wood (fibrous)** 10-10.7' - wet, in gravelly matrix **Fill - Brick Fragment** 10.7-10.9' - wet **No Recovery** 10.9-15'		Driller indicates would cap may have impeded full recovery
15	15.0						
421.0		24.0	S-5		**Fill - Medium To Fine Sand (FILL/SP)** 15-15.4' - black, (2.5Y 2.5/1), wood fragments, coarse poorly sorted angular to subangular gravel, bottle cap (plastic), glass (bottles) **Medium To Fine Sand (SW)** 15.4-16.5' - very dark brown, (10YR 2/2), abundant shell fragments		
	17.0						
		36.0	S-6		**Woody Sand (SW)** 16.5-17' - black, moist, with abundant organic matter, medium to fine **Limestone** 17-20' - gray, (N3), hard, fresh, fine grained, mechanical breaks, RQD 14%, clayey matrix formed by drilling process		Driller informs difficult drilling, possible rock reacts with HCl Rock Coring from 17-20 ft PID: 0.1 BZ: 0.0 Above Hole: 0.0 PID: 0.0 BZ: 0.0 Above Hole: 0.0 Coring rate 0.1 ft/min, dry advance
20	20.0						
416.0					Bottom of Boring at 20.0 ft bgs on 10/20/11 15:15		

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-02 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation
LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057470.5 N, 747499.1 E)

ELEVATION : 434.3 ft
DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit
ORIENTATION : Vertical

WATER LEVELS : ▼ 3.5 ft bgs
START : 10/20/11 11:30
END : 10/20/11 14:00
LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
434.3	0.0				**Fill - Subgrade Gravel** 0-4' - under road, fine to coarse gravel, little cobbles in loose sandy matrix, moist at 1.8 ft, brick, tree roots, coal, sharp contact at 4ft.		
		60.0	S-1				PID: 0.2 BZ: 0.2 Above Hole: 0.2
5	5.0				**Fill - Sandy Silt (FILL/SM)** 4-5' - very dark grayish brown, (2.5Y 3/2), moist, dense, some clay, some brick and coal		
429.3					**Fill - Sandy Clay (FILL/CL)** 5-7.5' - very dark gray, (2.5Y 3/1), moist, very soft, some gravel, medium plasticity, some brick		Reacts with HCL
		54.0	S-2		**Clayey Sand (SC)** 7.5-8.3' - (10YR 2/2), moist, well rounded coarse gravel, abundant thin white shell fragments		PID: 0.4 BZ: 0.4 Above Hole: 0.4
					No Recovery 8.3-10'		
10	10.0						
424.3					**Silty Clay (CL)** 10-12.5' - with mechanically broken limestone, very dark gray (GLEY 1 3/N), very soft, medium plasticity, 1/2" thick decomposed wood fibers at 13.5 (N3).		Driller indicates rock at 12.5 ft bgs and fracture zone at 11-12 ft bgs Casing run to 15 ft bgs to remove slough Reacts with HCl
		48.0	S-3		**Limestone** 12.5-15' - very dark gray, (GLEY1 3/N), horizontal mechanical breaks		Rock Coring 12.5-16ft bgs
15	15.0						
419.3		9.6	R-4		**Limestone** 15-16' - Same as 12.5 except very dark gray, (GLEY1 3/N), hard, fresh, fine grained		15-15.1 Asphalt patch recovered Coring rate 0.08 ft/min
	16.0				Bottom of Boring at 16.0 ft bgs on 10/20/11 11:30		
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-03 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057630.1 N, 747444.7 E)

ELEVATION : 445.3 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 11.0 ft bgs

START : 10/19/11 12:37

END : 10/19/11 14:30

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
445.3	0.0				**Fill** 0-3' - gravel subbase for road, poorly sorted, angular, some cobbles		
		42.0	S-1				PID: 0.0 BZ: 0.0 Above Hole: 0.0
					Silty Sand (SW) 3-5' - yellowish brown, (10YR 5/4), moist, black plastic membrane at contact between gravel and underlying Silty Sand, fine to very fine, trace angular fine gravel, well sorted, very fine coal seams, reddish orange sandy lense		
5	5.0						
440.3					**Silty Sand (SW)** 5-10' - Same as 3 except but transitions to very stiff Clay from 6.1 to very soft at 10 ft. Dark grayish brown (10YR 4/2), high plasticity, moist (CL)		
		51.6	S-2				PID: 0.0 BZ: 0.0 Above Hole: 0.0 Reacts with HCl
10	10.0						
435.3					**Clay (CL)** 10-15' - Same as 5 except brown, (10YR 4/3), wet, high plasticity, hard (CH) Fat, 1mm light gray lenses of silt and orange brown lenses of silty fine sand		
		63.6	S-3				PID: 0.1 BZ: 0.0 Above Hole: 0.0 Reacts with HCl
15	15.0						
430.3					**Clay (CL)** 15-20' - Same as 10 except soft, bottom 4" angular to well rounded gravel		
		33.0	S-4				PID: 0.1 BZ: 0.0 Above Hole: 0.0
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-03 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057630.1 N, 747444.7 E)

ELEVATION : 445.3 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 11.0 ft bgs

START : 10/19/11 12:37

END : 10/19/11 14:30

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
425.3	20.0				**Gravel (GW)** 20-22' - moist, coarse to fine, some cobbles in medium to coarse sand matrix, subrounded to subangular		
		55.2	S-5		**Gravel (GW)** 22-25' - Same as 20 except with clay		PID: 0.0 BZ: 0.0 Above Hole: 0.0
25	25.0						
420.3		9.0	R-6		**Limestone** 25-28' - dark gray, (N3), mechanical breaks, longest section is 2", hard, fresh, fine grained, poor recovery, calcite		PID: 0.0 BZ: 0.0 Above Hole: 0.0 Reacts with HCl Rock coring from 25-30 ft
	28.0						
	29.0	21.0	R-7		**Limestone** 28-29' - Same as 25 except cobble to coarse gravel, calcite		Driller indicates additional recovery from prior run reacts with HCl Rock coring from 29-34'
30 415.3		34.8	R-8		**Limestone** 29-34' - Same as 28 except abundant calcite inclusions, slight oxidation, all mechanical breaks less than 4", subangular to angular, very strong		Advance with water coring rate approximately 0.1 ft/min smooth hard drilling
	34.0						
35 410.3					Bottom of Boring at 30.0 ft bgs on 10/19/11 12:37		
40							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-04 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057630.3 N, 747335.0 E)

ELEVATION : 443.2 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 11.0 ft bgs

START : 10/19/11 08:30

END : 10/19/11 10:30

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
443.2	0.0				**Fill - Asphalt** 0-0.5'		PID: 0.1 BZ: 0.0 Above hole: 0.0
		45.0	S-1		**Fill - Gravel Subbase** 0.5-5' - gray, poorly sorted, angular		0'-5' Roadway asphalt and gravel
5	5.0						
438.2					**Fill - Cobbles To Coarse Gravel** 5-7.2' - dry, little brick mixed with silty clay		PID: 0.0 BZ: 0.0 Above hole: 0.0
		30.0	S-2		**Fill - Silty Clay (FILL/CL)** 7.2-9.3' - very dark grayish brown, (2.5Y 3/2), moist, medium stiff, medium plasticity, some orange brown sandy silt lenses, angular cobbles, glass		
10	10.0				**Fill - Silty Clay (FILL/CL)** 9.3-10' - Same as 7.2 except abundant brick and coal, wood		
433.2		7.0	S-3		**Fill - Wood & Cobbles In Silty Clay Matrix** 10-11.5' - very dark grayish brown, (2.5Y 3/2), wet		Driller needs to clear to 11.5' to continue drilling ▼
	11.5						
		45.0	S-4		**Clay (CL)** 11.5-15' - dark grayish brown to dark gray at bottom, (2.5 4/2, 2.5 3/1), moist, very soft to stiff at bottom, high plasticity, coal, subangular to well rounded coarse gravel. Top - orange gray mottling with sandy silt lenses. Bottom - abundant coal fragments		PID: 0.0 BZ: 0.0 Above hole: 0.0 Reacts with HCl
15	15.0						
428.2					**Clay (CL)** 15-19.2' - Same as 11.5 except cobbles present and 16' to 16.6' well rounded gravel to subangular, very dark gray (GLEY1 3/3) matrix of coarse to medium sand, wet		
		46.0	S-5				
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-04 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057630.3 N, 747335.0 E)

ELEVATION : 443.2 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 11.0 ft bgs

START : 10/19/11 08:30

END : 10/19/11 10:30

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
423.2	20.0	10.0	R-6		**Limestone** 19.2-20' - medium gray, (N5, GLEY 1 6/N), horizontal mechanical breaks, longest section is 2.5", hard, fresh, fine grained		PID: 0.0 BZ: 0.0 Above hole: 0.0 Driller indicates top of bedrock at 19ft Advance in dry Reacts with HCl Rock coring from 19-25' Carbide bit with smaller and more closely spaced rounds than at BS-07, wet advance Reacts with HCl Smooth, hard drilling Coring rate approximately 0.15 ft/min
	21.0				**Limestone** 20-21' - Same as 19.2		
		37.2	R-7		**Limestone** 21-25' - Same as 20 except RQD 52%, fresh, very hard, fine grained, calcite inclusions, no fractures, near horizontal mechanical breaks		
25 418.2	25.0				Bottom of Boring at 25.0 ft bgs on 10/19/11 08:30		
30 413.2							
35 408.2							
40							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-05 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057553.0 N, 747335.4 E)

ELEVATION : 441.5 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 11.0 ft bgs

START : 10/19/11 15:30

END : 10/19/11 18:00

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
441.5	0.0	54.0	S-1		**Fill - Subgrade Gravel Under Road** 0-3.3' - fine to coarse gravel, some cobbles in sandy matrix		PID: 0.1 BZ: 0.0 Above hole: 0.0
					Fill - Clay (FILL/CL) 3.3-4.5' - dark brown, (10YR 3/3), moist, hard, little silt, some fine to medium gravel angular, brick, coal, wood, reddish orange yellow mottling of fine sand lenses		
5	5.0	33.0	S-2		**Fill - Silty Clay (FILL/CL)** 4.5-5' - dark brown, (10YR 3/3), abundant rounded brick fragments, coal, wood, little coarse sand to fine gravel		PID: 0.0 BZ: 0.0 Above hole: 0.0
436.5					**Fill - Silty Gravel (FILL/GP)** 5-6.5' - very dark brown, (10YR 2/2), abundant brick fragments, 2" brick fragments at 6.8'		
	8.0	15.6	S-3		**Fill - Silty Gravel (FILL/GP)** 6.5-8' - Same as 5 except moist, abundant cobbles, poorly sorted		
10	10.0	35.4	S-4		**Fill - Silty Gravel (FILL/GP)** 8-10' - Same as 6.5 except wet, and 2" light gray 2.5Y 7/1 sandy layer		
431.5					**Fill - Silty Gravel (FILL/GP)** 10-15' - Same as 8 except very wet		
15	15.0	24.0	S-5				PID: 0.0 BZ: 0.0 Above hole: 0.0
426.5					**Fill - Silty Gravel (FILL/GP)** 15-20' - Same as 10 except abundant brick fragments, little sand		
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-05 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057553.0 N, 747335.4 E)

ELEVATION : 441.5 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 11.0 ft bgs

START : 10/19/11 15:30

END : 10/19/11 18:00

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
421.5	20.0	27.6	S-6		**Fill - Coarse To Medium Sand (FILL/SW)** 20-20.6' - very dark brown, (10 YR 2/2), moist, abundant thin shell fragments, brick, little coal, wood		PID: 0.0 BZ: 0.0 Above hole: 0.0 Driller indicates Rock, wet advance
	22.0				**Clayey Gravel (GC)** 20.6-22' - very dark brown, (10YR 2/2), wet, soft, cobbles, sub rounded to sub angular, bottom 6" is angular to sub angular		Reacts with HCl Rock coring from 22-27'
		14.4	R-7		**Limestone** 22-25' - dark gray, (N3), fresh, hard, mechanical lenses, calcite lenses		
25	25.0						
416.5		12.0	R-8		**Limestone** 25-27' - Same as 22		Drilling rate 1 hr/5 ft - 0.08 ft/min Smooth hard drilling
	27.0						
					Bottom of Boring at 27.0 ft bgs on 10/19/11 15:30		
30							
411.5							
35							
406.5							
40							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-06 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057519.9 N, 747304.1 E)

ELEVATION : 442.9 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 12.0 ft bgs

START : 10/20/11 17:00

END : 10/21/11 10:30

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
442.9	0.0						
		24.0	S-1		**Fill - Sandy Clay And Coarse Gravel (FILL/SC)** 0-2' - very dark gray, (2.5Y 3/1), moist, angular to subangular, fine roots, brick, cobbles		PID: 0.1 BZ: 0.0 Above hole: 0.0
	2.0						
					Fill - Limestone Cobbles 2-2.8'		
					Fill - Clayey Silt (FILL/ML) 2.8-3.3' - dark brown, (7.5YR 3/3), moist, some sand, glass from broken bottles, roots, wood, coal		
		24.0	S-2		**Fill - Coal** 3.3-4' - black, dry		
5	5.0				**No Recovery** 4-5'		Driller indicates rubber tire impeded full recovery at 4 ft bgs
437.9					**Fill - Clayey Silt (FILL/ML)** 5-7.3' - Same as 2.8		PID: 0.1 BZ: 0.0 Above hole: 0.0
			S-3		**Fill - Silty Sand (FILL/SP)** 7.3-8.1' - dark reddish brown, (5YR 3/4), moist, loose, with coarse to fine gravel, subrounded to subangular, glass fragments, wood, brick, poorly graded		
					Fill - Silty Sand (FILL/SP) 8.1-10' - Same as 7.3 except black		
10	10.0						
432.9					**Fill - Silty Sand (FILL/SP)** 10-12' - Same as 8.1 except 1 1/2" glass fragments		PID: 0.0 BZ: 0.0 Above hole: 0.0
		48.0	S-4		**Fill - Clayey Sand (FILL/SC)** 12-15' - reddish brown to gray, moist, with glass fragments, some rounded gravel, white plastic fragments and brick		12 ft DTW ▼
15	15.0						
427.9					**Fill - Sand Silt Matrix** 15-16.6' - dark grayish brown, (10YR 3/1), very loose wet crushed glass from broken bottles in, brick fragments, metal wire		PID: 0.1 BZ: 0.0 Above hole: 0.0
					Fill 16.6-20' - Same as 15 except gray, (GLEY1 6/6), larger glass fragments		
		60.0	S-5				
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-06 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation
LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057519.9 N, 747304.1 E)

ELEVATION : 442.9 ft
DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit
ORIENTATION : Vertical

WATER LEVELS : ▼ 12.0 ft bgs
START : 10/20/11 17:00
END : 10/21/11 10:30
LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
422.9	20.0				**Fill** 20-22' - Same as 16.6		PID: 0.1 BZ: 0.0 Above hole: 0.0
		24.0	S-6				
	22.0				**Fill** 22-25' - 4 1/2" long brick fragment in wet crushed glass matrix, black water, metal wire		Wet grainy material impeded full recovery
		12.0	S-7				
25	25.0						
417.9					**Fill** 25-26.5' - Same as 20		
		42.0	R-8		**Limestone** 26.5-29' - dark gray, (N3), hard, fresh, fine grained, mechanical breaks, RQD 34%, clayey matrix formed by drilling process, wet		Rock coring from 26.5-29' Coring rate 0.1ft/min on 10/20/11 at 19:00 Cored at 29ft on 10/20/11 Could not retrieve core due to broken bolts on rig head on 10/20/11 Core retrieved on 10/21/11 at 10:30 Reacts with HCl
	29.0						
					Bottom of Boring at 29.0 ft bgs on 10/20/11 17:00		
30 412.9							
35 407.9							
40							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-07 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation
LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057583.6 N, 747167.8 E)

ELEVATION : 448.8 ft
DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit
ORIENTATION : Vertical

WATER LEVELS : ▼ 18.7 ft bgs
START : 10/18/11 15:30
END : 10/18/11 17:30
LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
448.8	0.0						
	1.0	9.0	S-1		**Fill - Clay (FILL/CL)** 0-1' - dark brown, (10YR 3/3), very stiff, some coarse to medium gravel, plastic, little silt, trace roots, iron oxide staining, brick		PID: 0.0 BZ: 0.0 Above hole: 0.0
					Fill - Clay (FILL/CL) 1-5' - Same as 0		
		34.8	S-2				
5	5.0						
443.8					**Fill - Clay (FILL/CL)** 5-7.5' - Same as 1		PID: 0.0 BZ: 0.0 Above hole: 0.0
		34.8	S-3				
	7.5						approximately 7 ft above BS-10 elevation Carbide bit with larger round points than at BS-12
					Fill - Clay (FILL/CL) 7.5-10' - Same as 5 except bottom inch medium to fine sand, dark reddish (5YR 2.5/2), dry, small glass fragments, coal, white and yellow mottling (SP)		PID: 0.0 BZ: 0.0 Above hole: 0.0
		30.0	S-4				
10	10.0						
438.8					**Fill - Medium To Fine Sand (FILL/SP)** 10-13.1' - At bottom inch, brick and glass, rubber gasket		PID: 0.0 BZ: 0.0 Above hole: 0.0
		31.2	S-5				
					Fill - Sand (FILL/SP) 13.1-14.2' - Same as 10 except gray (GLEY 1 6/N), coal, orange and red mottling, seems like coal, ash and brick mixture, 4" long screw with square head		
15	15.0				**Fill - Sand (FILL/SP)** 14.2-15' - Same as 13.1 except reddish yellow (7.5 YR 6/8)		
433.8					**Fill - Sand (FILL/SP)** 15-17.1' - Same as 14.2 except with glass fragments, brick, some silt, little clay, some poorly sorted angular gravel, very dark grayish brown (10YR 3/1)		PID: 0.0 BZ: 0.0 Above hole: 0.0
		58.8	S-6		**Fill - Sand (FILL/SP)** 17.1-20' - Same as 15 except medium to coarse gravel more noticeable, angular brick, wood, and coal, black (GLEY 1 2.5/N), moist		PID: 0.0 BZ: 0.0 Above hole: 0.0
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-07 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057583.6 N, 747167.8 E)

ELEVATION : 448.8 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 18.7 ft bgs

START : 10/18/11 15:30

END : 10/18/11 17:30

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
428.8	20.0	50.4	S-7		**Fill - Sand (FILL/SP)** 20-23.5' - Same as 17.1 except larger pieces of debris at 20-23.5', wet		PID: 0.0 BZ: 0.0 Above hole: 0.0
25 423.8	25.0	48.0	R-8		**Limestone** 23.5-25' - fragments slightly weathered, calcite veins, dark gray (N3), hard, in powdered medium to fine sandy matrix **Limestone** 25-30' - gray, (N3), hard, fresh, fine grained, mechanical breaks, pale brown medium grained sandstone lense at 27', 2.5Y 8/2 approximately 1" thick and at 29.5', approximately 6" thick, all fragments less than 4" (Limestone)		23.5' Driller indicates top of bedrock change carbide bit to one used at BS-12 Rock coring from 23.5-30' Wet advance Limestone similar to BS-12 and slightly darker than BS-10 Reacts with HCl Drilling rate approximately 0.1 ft/min, slow
30 418.8	30.0				Bottom of Boring at 30.0 ft bgs on 10/18/11 15:30		PID: 0.0 BZ: 0.0 Above hole: 0.0
35 413.8							
40							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-08 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057705.3 N, 747251.3 E)

ELEVATION : 444.2 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 9.5 ft bgs

START : 10/20/11 07:45

END : 10/20/11 09:50

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
444.2	0.0				**Fill - Gravelly Fine To Medium Sand (FILL/SP)**		PID: 0.1 BZ: 0.0 Above hole: 0.0
		27.0	S-1		0-3' - very dark grayish brown, (2.5Y 3/2), dry, loose, little cobbles, poorly sorted, brick, coal, bottom 3" very dense fine sand and silt, some coarse gravel, brick, coal, iron oxidation around some gravel		
	3.0						
		25.0	S-2		**Fill - Gravelly Fine To Medium Sand (FILL/SP)** 3-4.5' - Same as 0 except but 4.5' reddish brown (5YR 4/4), 3-3.8' some clear glass		
5	5.0				**Fill** 4.5-5' - abundant glass, brick, wood, rubber, coal, tree roots, metal (glass - clear, iridescent, green, amber)		
439.2					**Fill** 5-7.5' - Same as 4.5 except very loose, 4" long piece of brick		
		24.0	S-3				
					Fill 7.5-10' - Same as 5 except very dark grayish brown, (10YR 3/2), wet, abundant amber glass bottles with black plastic black caps		
10	10.0						Water table at 9.5 ft bgs
434.2					**Fill** 10-11.25' - Same as 7.5		PID: 0.1 BZ: 0.0 Above hole: 0.0
		21.0	S-4		**Clay (CL)** 11.25-12.25' - very dark grayish brown, (2.5Y 3/2), wet, medium plasticity, and gravel, little cobble, some glass		
	12.5						
		24.0	S-5		**Clay (CL)** 12.5-13' - Same as 11.25		PID: 0.1 BZ: 0.0 Above hole: 0.0
	14.0				**Silty Clay (CL)** 13-14' - reddish brown, (5YR 4/4), moist, very soft, medium plasticity, subrounded coarse gravel to cobbles, some coal		
		12.0	S-6				PID: 0.3 BZ: 0.0 Above hole: 0.0 possible anthracite fragement < 0.2"
15	15.0				**Sandy Gravel (GP)**		
429.2					14-15' - dark yellowish brown, (10 YR 4/4), wet, little silt, subrounded to angular, lenses of fine sand with iron oxidation stain		
					Fill 15-16.6' - Same as 7.5 except dark yellowish brown, (10 YR 4/4)		
		55.2	S-7		**Fill** 16.6-19' - Same as 14 except moist		
					Limestone 19-20' - medium light gray, (GLEY 1 6/N), moist, mechanical breaks, silty matrix (N6)		
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-08 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057705.3 N, 747251.3 E)

ELEVATION : 444.2 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 9.5 ft bgs

START : 10/20/11 07:45

END : 10/20/11 09:50

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
424.2	20.0	42.0	R-8		**Limestone** 20-25' - Same as 19 except moist, hard, fine grained fragments		Rock coring from 19-27' Reacts with HCl Driller indicates hard drilling at 19 ft Driller indicates matrix due to sonic drilling Dry advance Drilling rate approximately <1 ft/min
25	25.0						
419.2		36.0	R-9		**Limestone** 25-27' - Same as 20 except 1 ft recovery from previous run is wet, clayey silt matrix some oxidation stains noted in material		Reacts with HCl
	27.0				Bottom of Boring at 27.0 ft bgs on 10/20/11 07:45		
30 414.2							
35 409.2							
40							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-09 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057755.6 N, 747123.1 E)

ELEVATION : 443.4 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 8.4 ft bgs

START : 10/21/11 10:00

END : 10/21/11 12:45

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
443.4	0.0				**Fill - Clayey Silt (FILL/ML)** 0-2.2' - very dark gray, (7.5 YR 3/1), slight plasticity, some gravel, brick, glass fragments, porcelain		PID: 0.0 BZ: 0.0 Above hole: 0.0
		54.0	S-1		**Fill** 2.2-3.2' - coal, wood, roots, reddish orange oxidation stains		
					No Recovery 3.2-5'		
5	5.0						
438.4					**Fill - Silty Clay (FILL/CL)** 5-7.1' - very dark gray, (7.5YR 3/1), stiff, transitions to very soft medium to high plasticity clay, trace brick, roots		PID: 0.0 BZ: 0.0 Above hole: 0.0
		39.0	S-2		**Coal Layer** 7.1-8.1' - soft, friable, yellowish red clay, some silt, medium plasticity underlying coal layer, trace roots, cobbles, wood, glass, porcelain (Fill/CL)		
					No Recovery 8.1-10'		
10	10.0						
433.4					**Clay (CH)** 10-11.75' - very dark gray, moist, very soft, medium to high plasticity, little silt, wood cap from tree at 11.75'		Reacts with HCl
					No Recovery 11.75-12'		
		45.0	S-3		**Matrix Of Sandy Clay** 12-13.75' - very dark gray, (GLEY 1 3/3), very wet, soft, mechanically broken limestone, grayish black (N2)		Fracture Zone from 12.5-14.5 ft in approximately three 6" zones of hard rock Reacts with HCl
					No Recovery 13.75-15'		Rock coring from 14.1-15.6'
15	15.0						Driller indicates rock Drilling rate of 0.02 ft/min
428.4	15.6	0.0	R-4		**No Recovery** 15-15.6' - apparent Limestone, grayish black (N2)		Could not retrieve rock core after 2 attempts; carbide bit worn. Driller indicates rock is as hard as at BS-10.
					Bottom of Boring at 15.6 ft bgs on 10/21/11 10:00		
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-10 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation
LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057610.0 N, 747071.9 E)

ELEVATION : 442.3 ft
DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit
ORIENTATION : Vertical

WATER LEVELS : ▼ 10.5 ft bgs
START : 10/18/11 11:40
END : 10/18/11 14:20
LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
442.3	0.0				**Fill - Silty Clay (FILL/CL)** 0-2.6' - very dark gray, (7.5 YR 3/1), with poorly sorted subangular to angular gravel, debris (concrete, plastic), some coal (CL)		PID: 0.0 BZ: 0.0 Above hole: 0.0
		51.0	S-1		**Fill - Medium To Fine Sand (FILL/SP)** 2.6-5' - dark reddish brown, (5YR 2.5/2), moist, with some poorly sorted gravel, abundant debris (plastic, glass, brick, nail), fine roots, coal, iron oxide mottling (SP)		
5	5.0						
437.3		56.4	S-2		**Fill - Medium To Fine Sand (FILL/SP)** 5-7.7' - Same as 2.6 except more abundant glass and base is dark reddish brown 5YR 3/2 with lots of iron oxide staining		PID: 0.0 BZ: 0.0 Above hole: 0.0
					Fill - Medium To Fine Sand (FILL/SP) 7.7-8.7' - Same as 5 except black (GLEY 1 2.5/2.5) with abundant coal fragments, less glass, nail, porcelain, moist, foul odor		
10	10.0				**Fill - Medium To Fine Sand (FILL/SP)** 8.7-9' - Same as 7.7 except gray (GLEY 1 6/N) with yellow, red and white mottling		
432.3					**Fill - Medium To Fine Sand (FILL/SP)** 9-10' - Same as 7.7 except gradation from gray (GLEY 1 6/N) to reddish yellow (7.5 YR 5/8)		PID: 0.0 BZ: 0.0 Above hole: 0.0 ▼
					Fill - Medium To Fine Sand (FILL/SP) 10-11.5' - Same as 9		
		30.0	S-3		**Silty Fine To Medium Sand (FILL/SM)** 11.5-13' - same as above at 8.7-9' at top, but gradation to 7.5 YR 5/8 reddish yellow (SM), wet		
					No Recovery 13-15' - very wet, soft		fast drilling
15	15.0						
427.3					**Fill - Fine To Medium Gravel (FILL/GP)** 15-16.5' - wet, stiff, angular, gray (GLEY 1 1/N) in matrix of silty clay, iron oxide and lith gray mottling, debris (nail, trace glass, porcelain), coal, wet from groundwater		PID: 0.0 BZ: 0.0 Above hole: 0.0 Drilling in dry to 18'
		36.0	S-4		**Limestone** 16.5-18' - medium light gray, (N6), RQD 66%, fair, fresh, very hard, calcite veins and lenses, mechanical breaks, no staining		Difficult drilling Reacts with HCl Rock coring from 16.5-19'
	18.0						
	19.0	0.0	R-5		**No Recovery** 18-19' - worn bit		Cored to 19' with hard drilling approximately 0.04 ft/min
20					Bottom of Boring at 19.0 ft bgs on 10/18/11 11:40		

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-11 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057581.6 N, 747012.9 E)

ELEVATION : 438.4 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 5.1 ft bgs

START : 10/17/11 14:10

END : 10/17/11 15:00

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
438.4	0.0	58.8	S-1		**Fill - Silt With Very Fine Sand (FILL/ML)** 0-5' - dark brown, (7.5YR 3/2), moist, some angular gravel, poorly sorted, brick, glass, plastic, bottle cap, wood debris		PID: 0.1 BZ: 0.0 Above hole: 0.0
5 433.4	5.0	46.8	S-2		**Clay (CH)** 5-6.8' - very dark grayish green, (GLEY 1 2.5/N), some gravel, angular, max 4"x2"x1", trace roots, piece of metal, coal		PID: 0.1 BZ: 0.0 Above hole: 0.0 ▼
					Silt With Medium To Fine Sand (ML) 6.8-9' - dark grayish brown, (2.5Y 4/2), moist, some gravel (max 3')		
10 428.4	10.0	18.0	R-3		**Limestone** 9-10' - white, (GLEY 1 8/N), dry, some silt **Limestone** 10-11.5' - Same as 9 except gray, (GLEY 1 6/N), abundant gravel, poorly sorted		Driller indicates top of bedrock, grinding sound. Difficult to drill. Reacts with HCL Rock coring from 9-13' Driller notes result of mechanical breaks
	11.5	18.0	R-4		**Limestone** 11.5-13' - medium gray, (N5), some calcite, fresh, hard, mechanical breaks less than 10", near horizontal		Advance with water to improve recovery. Reacts with HCl Used approximately 80 gallons of water at 0.1 ft/min in rock. Slow, consistent drilling. No casing used.
	13.0				Bottom of Boring at 13.0 ft bgs on 10/17/11 14:10		
15 423.4							
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-12 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057622.0 N, 746895.4 E)

ELEVATION : 439.0 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 11.8 ft bgs

START : 10/17/11 16:15

END : 10/17/11 17:30

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
439.0	0.0				**Fill - Sandy Silt (FILL/ML)** 0-2.1' - very dark brown, (7.5 YR 2.5/2), moist, abundant organics, trace roots, trace brick and coal, some coarse to fine gravel		PID: 0.0 BZ: 0.0 Above hole: 0.0
		60.0	S-1		**Fill - Fine To Medium Sand With Gravel (FILL/SP)** 2.1-5' - dark grayish brown, (2.5 Y 4/2), dry, poorly sorted, angular fine to coarse gravel, trace fine roots, brick, glass (clear, green, amber), coal		
5	5.0						
434.0		54.0	S-2		**Fill - Fine To Medium Sand With Silt (FILL/SM)** 5-8.8' - brown, (10 YR 4/3), dry, glass (amber, green), fragments, trace roots		PID: 0.0 BZ: 0.0 Above hole: 0.0
					8.8-9.5' - 2" thick piece of coal		
10	10.0				**Angular Fine To Coarse Gravel In Silty Sand Matrix** 9.5-10' - very pale brown, (10 YR 7/4)		
429.0		0.0	S-3		**No Recovery** 10-12'		10' Driller notes hard drilling, possible rock. Drilling fluid not returned, possible formation fracture Rock coring from 10-15'
	12.0						
		12.0	R-4		**Limestone** 12-13' - gray, (N3), RQD 58%, fair, 7" core retrieved, hard, fresh, fine grained, mechanical breaks on remaining core pieces		12' Reacts with HCl
	13.0	12.0	R-5		**Limestone** 13-14' - Same as 12 except rounded due to worn carbide bit		
	14.0	12.0	R-6		**Limestone** 14-15' - Same as 13 except dark gray, (N3), soft, calcite		Change bit for 14-15'. Advance with water. Casing at 12 ft. WL at ~ 10 ft. Approximately 0.1 ft/min in rock, very slow driling PID: 0.0 BZ: 0.0 Above hole: 0.0
15	15.0						
424.0					Bottom of Boring at 15.0 ft bgs on 10/17/11 16:15		
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-13 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation
LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057734.8 N, 746915.9 E)

ELEVATION : 442.3 ft
DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit
ORIENTATION : Vertical

WATER LEVELS : ▼ 9.5 ft bgs
START : 10/21/11 16:10
END : 10/21/11 17:20
LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
442.3	0.0				**Fill - Clayey Silt (FILL/ML)** 0-2' - very dark gray, (7.5 YR 3/1), moist, trace gravel, compact, very stiff, trace coal and glass fragments (amber, clear), large brick fragment at 1.8 ft		PID: 0.0 BZ: 0.0 Above hole: 0.0
		60.0	S-1		**Fill - Fine Gravel (FILL/GP)** 2-5' - subangular to angular, fine roots, limestone cobbles at 2.5 ft		
5	5.0						
437.3					**Fill - Fine Gravel (FILL/GP)** 5-5.5' - Same as 2 except wet		PID: 0.1 BZ: 0.0 Above hole: 0.0
					Fill (FILL/OH) 5.5-6.1' - black, black organic layer, roots, silt, some clay, bottom transitions to reddish brown 2.5 YR 4/3, very stiff clay, little sand, some brick, coal		
		42.0	S-2		**No Recovery** 6.1-9'		
	9.0						
					Weathered Bedrock (limestone) 9-11.5' - light olive brown, (2.5Y 5/8)		PID: 0.0 BZ: 0.0 Above hole: 0.0 Reacts HCl
10 432.3							
		36.0	S-3		**Weathered Bedrock (limestone)** 11.5-14' - Same as 9 except light gray to gray at base, (GLEY 1 7/N, GLEY 1 6/N), olive brown oxidation stain in clayey matrix, soft, trace coal		
	14.0						
					Limestone 14-15.5' - light gray, (N7), dry, hard, loose powdery matrix, fine grained, fresh, mechanical breaks 1/2 to 1 1/2" thick rock fragments		Rock coring from 14-16' Driller indicates bedrock at 14 ft bgs Slow, rough coring Drilling rate 0.1 ft/min Reacts wtih HCl
15 427.3		18.0	R-4				
	16.0				**No Recovery** 15.5-16'		Could not recover 15.5-16
					Bottom of Boring at 16.0 ft bgs on 10/21/11 16:10		
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	BS-14 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation

LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY (1057795.6 N, 746980.1 E)

ELEVATION : 444.2 ft

DRILLING CONTRACTOR : Boart Longyear

DRILLING EQUIPMENT AND METHOD : 3 3/4" Barrel, 200C Mini Sonic Rig, Carbide Bit

ORIENTATION : Vertical

WATER LEVELS : ▼ 11.0 ft bgs

START : 10/21/11 14:30

END : 10/21/11 15:30

LOGGER : L. La Fortune

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
444.2	0.0	48.0	S-1		**Fill - Clayey Silt (FILL/ML)** 0-5' - very dark gray, (7.5 YR 3/1), moist, bottom 6" has large brick fragments over-lying greenish white (tinge yellow) loose fine sandy material, some cobbles, wood, roots, very few glass fragments, coal, nail		PID: 0.0 BZ: 0.0 Above hole: 0.0
5	5.0						
439.2		60.0	S-2		**Fill - Very Fine Silty Sand (FILL/SM)** 5-9' - very dark gray to yellowish brown, (10 YR 3/1, 10 YR 5/6), little glass, brick, well sorted, very loose except at 6.5-7' - very compact, yellow oxidation at 7 ft bgs		
					Clay (FILL/ML) 9-10' - very dark gray, (10 YR 3/1), moist, medium stiff, abundant coal, roots, trace brick		
10	10.0						
434.2		24.0	S-3		**Clay (CL)** 10-15' - very wet 9-10', some coal, very soft, high plasticity, oxidation streaks (reddish brown), gravel size fragments of limestone, fat clay, lenses of moist brown organic clay		Lost full recovery while retrieving sample Reacts with HCL ▼
15	15.0						
429.2		36.0	R-4		**Clay (CL)** 15-15.5' - Same as 10 except transitions from grayish brown (10 YR 5/2) to gray (GLEY 1 5/N), moist, very stiff silty clay matrix with limestone fragments **Limestone** 15.5-18' - very dark gray when wet, light gray with dry, (N4), hard, mechanical breaks every 1 1/2 to 2", fresh, hard, fine grained		PID: 0.0 BZ: 0.0 Above hole: 0.0 Reacts with HCl Drilling rate 0.1 ft/min Driller indicates bedrock at 16.5 ft bgs Rock coring from 16.5-18'
	18.0				Bottom of Boring at 18.0 ft bgs on 10/21/11 14:30		
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
416903.03.05	GT-01	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation
LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY
ELEVATION :
DRILLING CONTRACTOR : Parratt Wolffe, Inc.
DRILLING EQUIPMENT AND METHOD : DPT
ORIENTATION : Vertical
WATER LEVELS : ▼ ---
START : 10/19/2011
END : 10/19/2011
LOGGER : WHM

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft) / RECOVERY (in) / #TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	S-1		0-1'		
			Sand With Silt (SM) 1-2' - brown to dark brown, medium to fine grained, poorly sorted, little medium to coarse gravel and angular cobbles (1-2" diameter) (concrete pieces), moderately dense, trace organics, glass (fill)		BZ = 0 ppm, Above Hole = 0 ppm
			Sand With Silt (SM) 2-3' - SAA with brick pieces (fill)		BZ = 0 ppm, Above Hole = 0 ppm
			Sand With Silt (SM) 3-4' - SAA with wood pieces (fill)		
			Sand With Silt (SM) 4-5' - SAA		Collected sample: GT-01-10192011 at 13:30
5			Bottom of Boring at 5.0 ft bgs on 10/19/2011		Note: No Munsell available
10					
15					
20					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	GT-02 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation
LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY
ELEVATION :
DRILLING CONTRACTOR : Parratt Wolffe, Inc.
DRILLING EQUIPMENT AND METHOD : DPT
ORIENTATION : Vertical
WATER LEVELS : ▼ ---
START : 10/19/2011
END : 10/19/2011
LOGGER : WHM

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			S-1		**Silt (ML)** 0-0.5' - brown to dark brown, damp, moderatly dense, low plasticity		BZ = 0 ppm, Above Hole = 0 ppm
					Silt (ML) 0.5-5' - SAA with trace dark gray medium to fine silty sand, poorly sorted, concrete pieces (fill), trace coarse gravel and cobbles (1-2" diameter), asphalt, coal pieces, brick pieces, damp		BZ = 0 ppm, Above Hole = 0 ppm
5							Collect sample: GT-02-10192011 at 16:20
					Bottom of Boring at 5.0 ft bgs on 10/19/2011		Note: No Munsell available
10							
15							
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
416903.03.05	GT-03	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation
LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY
ELEVATION :
DRILLING CONTRACTOR : Parratt Wolffe, Inc.
DRILLING EQUIPMENT AND METHOD : DPT
ORIENTATION : Vertical
WATER LEVELS : ▼ ---
START : 10/19/2011
END : 10/19/2011
LOGGER : WHM

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft) / RECOVERY (in) / #TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	S-1		**Lean Clay (CL)** 0-1' - dark brown to bright brown, low elastics, low to moderate density, damp		BZ = 0 ppm, Above Hole = 0 ppm
			Lean Clay (CL) 1-5' - SAA with some coarse gravel and cobbles (1-2" diameter) concrete pieces (fill), little fine to coarse sand, poorly sorted, coal pieces, construction debris, brick pieces, wood pieces, damp		BZ = 0 ppm, Above Hole = 0 ppm Collected sample: GT-03-10192011 at 15:40
5			Bottom of Boring at 5.0 ft bgs on 10/19/2011		Note: No Munsell available
10					
15					
20					

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	GT-04 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation
LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY
ELEVATION :
DRILLING CONTRACTOR : Parratt Wolffe, Inc.
DRILLING EQUIPMENT AND METHOD : DPT
ORIENTATION : Vertical
WATER LEVELS : ▼ ---
START : 10/19/2011
END : 10/19/2011
LOGGER : WHM

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			S-1		**Silt (ML)** 0-1' - brown to dark brown, concrete pieces (fill), trace clay, moderate density, damp, low elasticity		BZ = 0 ppm, Above Hole = 0 ppm
					Silt (ML) 1-5' - SAA with some fine to coarse sand, poorly sorted, brick pieces (fill), coal pieces, construction debris		BZ = 0 ppm, Above Hole = 0 ppm
5							Collected sample: GT-04-10192011 at 10:10
					Bottom of Boring at 5.0 ft bgs on 10/19/2011		Note: No Munsell available
10							
15							
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	GT-05 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation
LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY
ELEVATION :
DRILLING CONTRACTOR : Parratt Wolffe, Inc.
DRILLING EQUIPMENT AND METHOD : DPT
ORIENTATION : Vertical
WATER LEVELS : ▼ ---
START : 10/19/2011
END : 10/19/2011
LOGGER : WHM

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			S-1		**Silt (ML)** 0-1' - brown to dark brown, brick and glass pieces (fill), moderately dense, low to medium elasticity, trace coarse sand, damp		BZ = 0 ppm, Above Hole = 0 ppm
					Silt (ML) 1-5' - SAA with coal pieces (fill), concrete pieces (1-2" diameter), damp		BZ = 0 ppm, Above Hole = 0 ppm
5							Collected sample: GT-05-10192011 at 14:00
					Bottom of Boring at 5.0 ft bgs on 10/19/2011		Note: No Munsell available
10							
15							
20							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
416903.03.05	GT-06 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : RFI 2011 SWMU 1 Investigation
LOCATION : Former Hampshire Chemical Corp. Facility, Waterloo, NY
ELEVATION :
DRILLING CONTRACTOR : Parratt Wolffe, Inc.
DRILLING EQUIPMENT AND METHOD : DPT
ORIENTATION : Vertical
WATER LEVELS : ▼ ---
START : 10/19/2011
END : 10/19/2011
LOGGER : WHM

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N_{60})	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			S-1		**Silt (ML)** 0-5' - brown to light brown, some medium to finw sand, some medium to fine gravel and 1-2" diameter cobbles (concrete pieces) (fill), poorly sorted, low elasticity, moderate density, brick pieces, coal pieces, wood pieces, damp		BZ = 0 ppm, Above Hole = 0 ppm BZ = 0 ppm, Above Hole = 0 ppm Collected sample: GT-06-10192011 at 15:20
5					Bottom of Boring at 5.0 ft bgs on 10/19/2011		Note: No Munsell available
10							
15							
20							

Attachment 2 – Geologic Cross Sections

A

A'

N

S

Elevation (ft)

446
444
442
440
438
436
434
432
430
428
426
424
422

0 20 40 60 80 100 120 140 160 180 200 220

BS-14
GSE = 444.15 ft

FILL/ML
FILL/SM
FILL/ML
CL
CL

Depth = 18 ft
Elevation = 426.15 ft
10/21/2011 2:30:00 PM

BS-13
GSE = 442.26 ft

FILL/ML
FILL/GP
FILL/GP
FILL/CH

Depth = 16 ft
Elevation = 426.26 ft
10/21/2011 4:10:00 PM

BS-12
GSE = 438.95 ft

FILL/ML
FILL/SP
FILL/SM

Depth = 15 ft
Elevation = 423.95 ft
10/17/2011 4:15:00 PM

FILL

NATIVE

BEDROCK

Distance (ft)

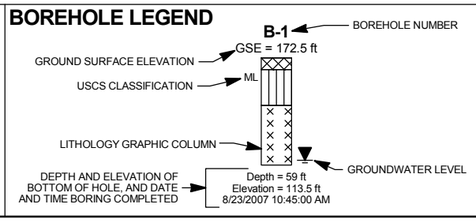
VERTICAL SCALE: 1" = 3.5'
HORIZONTAL SCALE: 1" = 17.1'

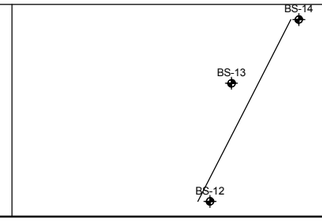
CH2MHILL

LITHOLOGY GRAPHICS

- Fill
- Poorly Graded Sand
- Silty Sand
- Limestone
- Bedrock
- Lean Clay

BOREHOLE LEGEND





Section A-A'

2011 SWMU 1 Investigation Technical Memorandum
RCRA Facility Investigation
Former Hampshire Chemical Corp. Facility
Waterloo, New York

Project Number: 416903.03.05

11X17 STICK LOG WITH LEGEND RFI 2011 SWMU 1 INVESTIGATION.GPJ CH2M GEOTECH-REVISED.GDT 11/2/11

B

B'

W

E

Elevation (ft)

BS-10
GSE = 442.3 ft

FILL/CL
FILL/SP
FILL/SP
FILL/SP
FILL/SP
FILL/SP
FILL/SM
FILL/GP

Depth = 19 ft
Elevation = 423.3 ft
10/18/2011 11:40:00 AM

BS-07
GSE = 448.83 ft

FILL/CL
FILL/CL
FILL/CL
FILL/CL
FILL/SP
FILL/SP
FILL/SP
FILL/SP
FILL/SP

Depth = 30 ft
Elevation = 418.83 ft
10/18/2011 3:30:00 PM

BS-06
GSE = 442.94 ft

FILL/SC
FILL/ML
FILL/ML
FILL/SP
FILL/SP
FILL/SP
FILL/SC

Depth = 29 ft
Elevation = 413.94 ft
10/20/2011 5:00:00 PM

BS-01
GSE = 436.04 ft

FILL/SC
FILL/GP
FILL/CL
FILL/SP
SW
SW

Depth = 20 ft
Elevation = 416.04 ft
10/20/2011 3:15:00 PM

FILL

BEDROCK

NATIVE

Distance (ft)

VERTICAL SCALE: 1" = 5.8'
HORIZONTAL SCALE: 1" = 31.0'

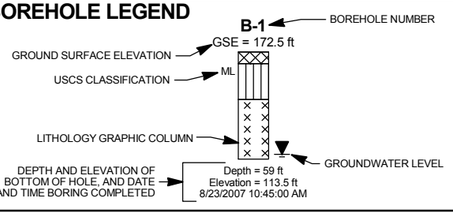
11X17 STICK LOG WITH LEGEND_RFI 2011 SWMU 1 INVESTIGATION.GPJ_CH2M GEOTECH-REVISED.GDT_11/2/11

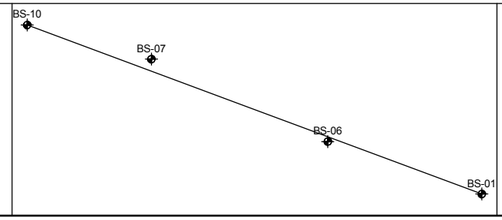
CH2MHILL

LITHOLOGY GRAPHICS

- Clayey Sand
- Poorly Graded Gravel
- Lean Clay
- Fill
- Poorly Graded Sand
- Well-Graded Sand
- Limestone
- Boulders and cobbles

BOREHOLE LEGEND





Section B-B'

2011 SWMU 1 Investigation Technical Memorandum
RCRA Facility Investigation
Former Hampshire Chemical Corp. Facility
Waterloo, New York

Project Number: 416903.03.05

C

C'

W

E

BS-12
GSE = 438.95 ft

BS-11
GSE = 438.41 ft

FILL/ML

FILL/SP

FILL/SM

FILL/ML

CH

ML

FILL

NATIVE

BEDROCK

Depth = 15 ft
Elevation = 423.95 ft
10/17/2011 4:15:00 PM

Depth = 13 ft
Elevation = 425.41 ft
10/17/2011 2:10:00 PM

Elevation (ft)

440 438 436 434 432 430 428 426 424 422

0 10 20 30 40 50 60 70 80 90 100 110 120 130

Distance (ft)

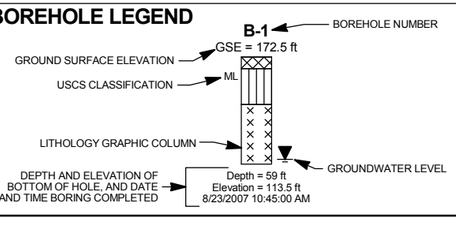
VERTICAL SCALE: 1" = 2.6'
HORIZONTAL SCALE: 1" = 10.1'

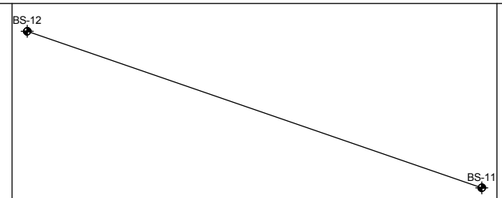
CH2MHILL

LITHOLOGY GRAPHICS

- Silt
- Fat Clay
- Limestone
- Fill
- Poorly Graded Sand
- Silty Sand

BOREHOLE LEGEND





Section C-C'

2011 SWMU 1 Investigation Technical Memorandum
RCRA Facility Investigation
Former Hampshire Chemical Corp. Facility
Waterloo, New York

Project Number: 416903.03.05

11X17 STICK LOG WITH LEGEND RFI 2011 SWMU 1 INVESTIGATION.GPJ CH2M GEOTECH-REVISED.GDT 11/2/11

Attachment 3 – Geotechnical Test Results

Kenney Geotechnical Engineering Services, PLLC
Office: 7246 State Fair Blvd., Syracuse, NY 13209
Mail :P.O. Box 156 Baldwinsville, N.Y. 13027
Phone: (315) 638-2706 Fax: (315) 638-1544

Kenney Geotechnical Services

December 7, 2011

CH2M Hill
<via email>

Attn.: Lisa LaFortune, Brian Carling

Re.: Laboratory Soil Testing Results
Former Hampshire Chemical Corporation Facility
Waterloo, NY

Please find attached the results of laboratory testing performed upon soil and rock samples delivered to our office by Parratt-Wolff, Inc., on October 20, 2011. As requested, we have performed:

- Grain Size Analysis (ASTM D-422)
- Atterberg Limits Determination (ASTM D-4318)
- Natural Moisture Content (ASTM D-2216)
- Modified Proctor Testing (ASTM D-1557)
- Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (ASTM D-5084)

Thank you for the opportunity to be of service. We look forward to answering any questions you may have.

Respectfully submitted,
KENNEY GEOTECHNICAL ENGINEERING SERVICES, PLLC

Christopher M. Kenney, P.E.
President

CH2MHILL
CHAIN OF CUSTODY RECORD
AND AGREEMENT TO PERFORM SERVICES

COC # 1

Project # or Purchase Order #: Per CH2M HILL PO	
Project Name: 2011 SWMU 1 Investigation, Former Hampshire Chemical Corp. Facility, Waterloo, New York	
Company Name: CH2M HILL 119 Cherry Hill Rd, Suite 300 Parsippany, NJ	
Project Manager or Contact & Phone # David Newman at 973-316-3538	**Report Copy to:** Lisa.LaFortune@ch2m.com David.Newman@ch2m.com
Turnaround Time ☐24 hours ☐48 hours ☐72 hours ☒7 days ☐14 days ☐21 days	Drinking Water? Yes ☐ No ☒ Sample Disposal: Dispose ☒ Return ☐

Sampling		Type		Matrix				TOTAL # OF CONTAINERS	Requested Geotechnical Test Method #										THIS AREA FOR LAB USE ONLY		
									Moisture Content (ASTM D2216)	Atterberg Limits (ASTM D4318)	Grain Size Sieve Analysis with Wash 200 (ASTM D422)	Modified Proctor on Soil Sample (ASTM D 1557)	Triaxial Permeability Test on Recompacted Soil Sample (ASTM D5084)[1]						Lab #	Page	of
									Preservative												
Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID		UNPRES	UNPRES	UNPRES	UNPRES	UNPRES						Geotechnical Tests		
																			Alternate Description		Lab ID
10/19/11	1350	X			X		GT-01-10192011	1	X	X	X										
	1620	X			X		GT-02-10192011	1	X	X	X										
	1540	X			X		GT-03-10192011	1	X	X	X										
	1610	X			X		GT-04-10192011	1	X	X	X										
	1400	X			X		GT-05-10192011	1	X	X	X										
	1500	X			X		GT-06-10192011	1	X	X	X										
	1700	X			X		GT-07-10192011	1	X	X	X	X	X	composite of GT-01, 02, 03							
↓	1630	X			X		GT-08-10192011	1	X	X	X	X	X	composite of GT 04, 05, 06							

Possible Hazard Identification: ☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Volatile Contaminants/Odorous ☐ Biohazard ☐ Other _____

Relinquished By	Date/Time 10/20/11 1100	**Received By**	**Date/Time**
Sampled By and Title B Moore (Please sign and print name)	Date/Time 10/20/11 1100	**Relinquished By** (Please sign and print name)	**Date/Time**
Received By (Please sign and print name)	**Date/Time**	**Relinquished By** (Please sign and print name)	**Date/Time**
Received By (Please sign and print name)	**Date/Time**	**Shipped Via** UPS Fed-Ex Other_____	**Shipping #**

Special Instructions: 7 Calendar days for all analyses except permeability tests

Permeability tests will have a TAT of 10 Calendar days

[1] Testing pressures are to be set to produce a hydraulic gradient of 2.

Subconsultant will provide the Modified Proctor results of the two soil samples to CH2M HILL prior to performing the triaxial permeability test on each recompacted sample, so that CH2M HILL can instruct the laboratory of the desired % of maximum compaction and molding water content, wet of the optimum moisture content.

Kenney Geotechnical Engineering Services, PLLC
Mail: P.O. Box 156 Baldwinsville, New York 13027
Office: 7246 State Fair Blvd., Syracuse, N.Y. 13209
Phone: (315) 638-2706 Fax: (315) 638-1544
cmk@kenneygeotechnical.com

Kenney Geotechnical Services

Date: 12-7-11

To: CH2M HILL

Fr: Chris Kenney, P.E.

Re: Atterberg Limits and Natural Moisture Content Testing
Former Hampshire Chemical Corp. Facility
Waterloo, NY

Atterberg Limits testing (ASTM D 4318) and Natural Moisture Content testing (ASTM D 2166) for your project has been completed. Results are as follows:

Natural Moisture Content and Atterberg Limits				
Former Hampshire Chemical Corporation Facility				
Waterloo, New York				
Sample	**w_n (%)**	**LL**	**PL**	**PI**
GT-01-10192011	21.2	35.7	17.9	17.8
GT-02-10192011	14.8	36.4	18.6	17.8
GT-03-10192011	16.5	32.2	20.5	11.7
GT-04-10192011	19.6	28.2	21.4	6.8
GT-05-10192011	14.8	42.4	18.2	24.2
GT-06-10192011	17.9	28.5	17.3	11.2
GT-07-10192011	11.0	37.1	22.2	14.9
GT-08-10192011	14.1	30.6	20.2	10.4
NP = Non-plastic				

Thank you for the opportunity to be of service.

Kenney Geotechnical Services
7246 State Fair Blvd
Baldwinsville, N.Y. 13209
Telephone: 315-638-2706
Fax: 315-638-1544

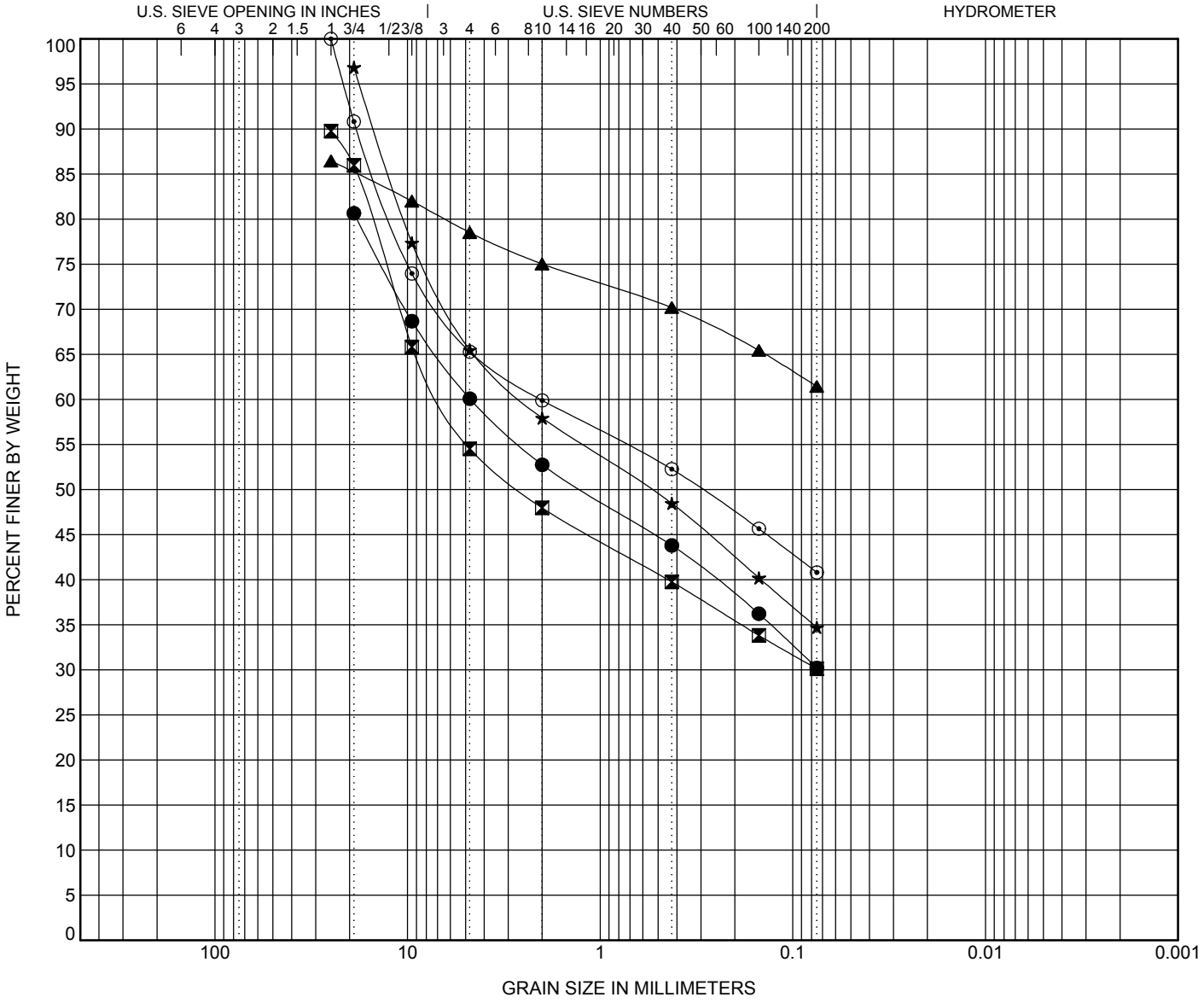
GRAIN SIZE DISTRIBUTION

CLIENT CH2M HILL

PROJECT NAME FORMER HAMPSHIRE CHEMICAL CORP. FACILITY

PROJECT NUMBER 2011-063

PROJECT LOCATION Waterloo, NY



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**GT-01-10192011 1.0**	Clayey SAND with gravel (SC)					
⊠	**GT-02-10192011 1.0**	Clayey GRAVEL with sand (GC)					
▲	**GT-03-10192011 1.0**	Lean CLAY with sand (CL)					
★	**GT-04-10192011 1.0**	Clayey GRAVEL with sand (GC)					
⊙	**GT-05-10192011 1.0**	Clayey GRAVEL with sand (GC)					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**GT-01-10192011 1.0**	**19**	**4.707**			**20.6**	**29.9**	**30.2**	
⊠	**GT-02-10192011 1.0**	**25**	**6.651**			**35.3**	**24.4**	**30.1**	
▲	**GT-03-10192011 1.0**	**25**				**7.9**	**17.1**	**61.4**	
★	**GT-04-10192011 1.0**	**19**	**2.535**			**31.4**	**30.8**	**34.7**	
⊙	**GT-05-10192011 1.0**	**25**	**2.037**			**34.7**	**24.5**	**40.8**	

Kenney Geotechnical Services
7246 State Fair Blvd
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Telephone: 315-638-2706
Fax: 315-638-1544

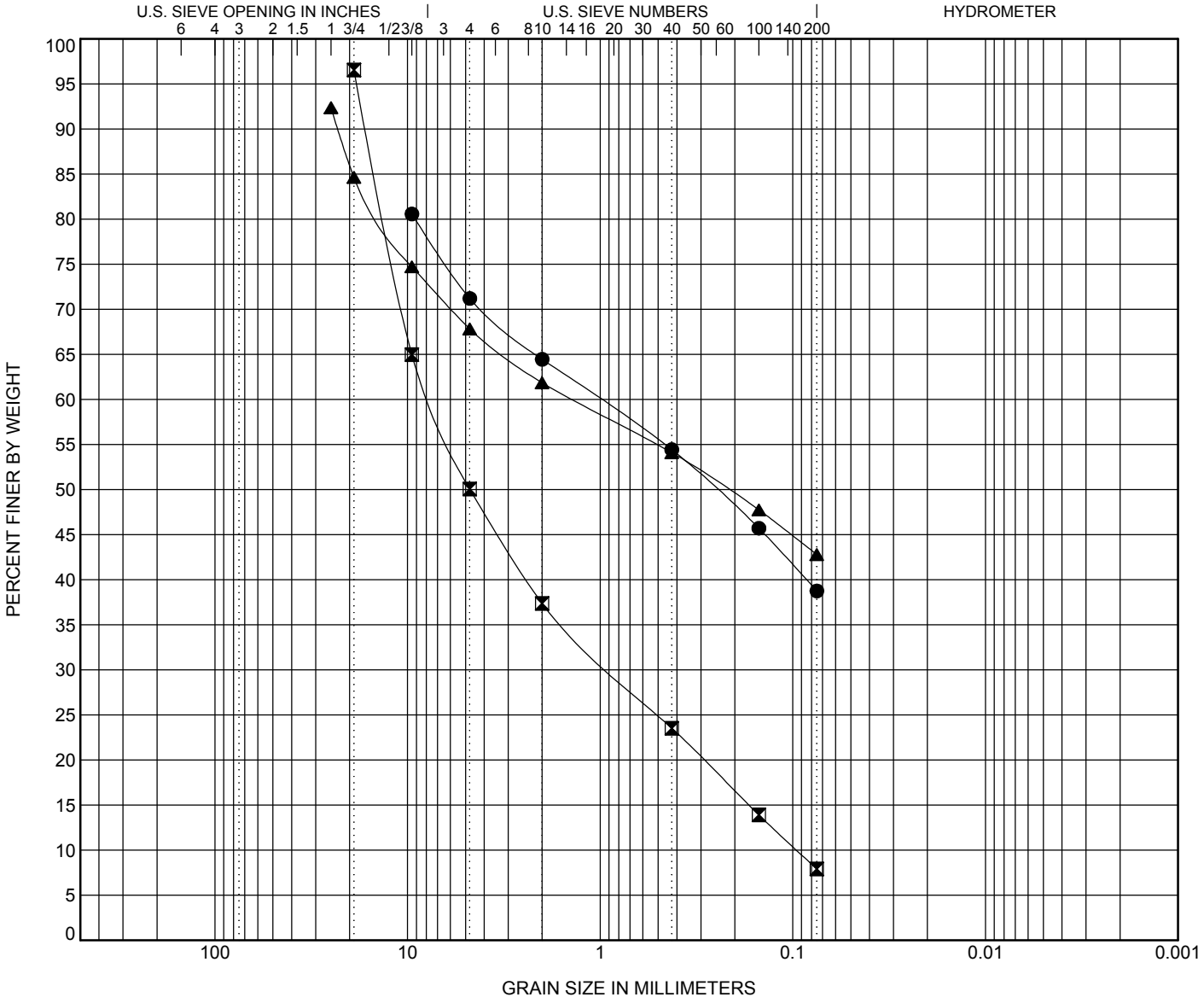
GRAIN SIZE DISTRIBUTION

CLIENT CH2M HILL

PROJECT NAME FORMER HAMPSHIRE CHEMICAL CORP. FACILITY

PROJECT NUMBER 2011-063

PROJECT LOCATION Waterloo, NY



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **GT-06-10192011**	**1.0**	Clayey SAND (SC)					
⊠ **GT-07-10192011**	**1.0**	Well-graded GRAVEL with clay and sand (GW-GC)				**1.07**	**78.97**
▲ **GT-08-10192011**	**1.0**	Gravelly lean CLAY with sand (CL)					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **GT-06-10192011**	**1.0**	**9.5**	**1.006**			**9.4**	**32.4**	**38.8**	
⊠ **GT-07-10192011**	**1.0**	**19**	**7.539**	**0.878**	**0.095**	**46.5**	**42.1**	**7.9**	
▲ **GT-08-10192011**	**1.0**	**25**	**1.382**			**24.5**	**25.0**	**42.8**	

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MOISTURE-DENSITY RELATIONSHIP

CLIENT CH2M HILL

PROJECT NAME FORMER HAMPSHIRE CHEMICAL CORP. FACILITY

PROJECT NUMBER 2011-063

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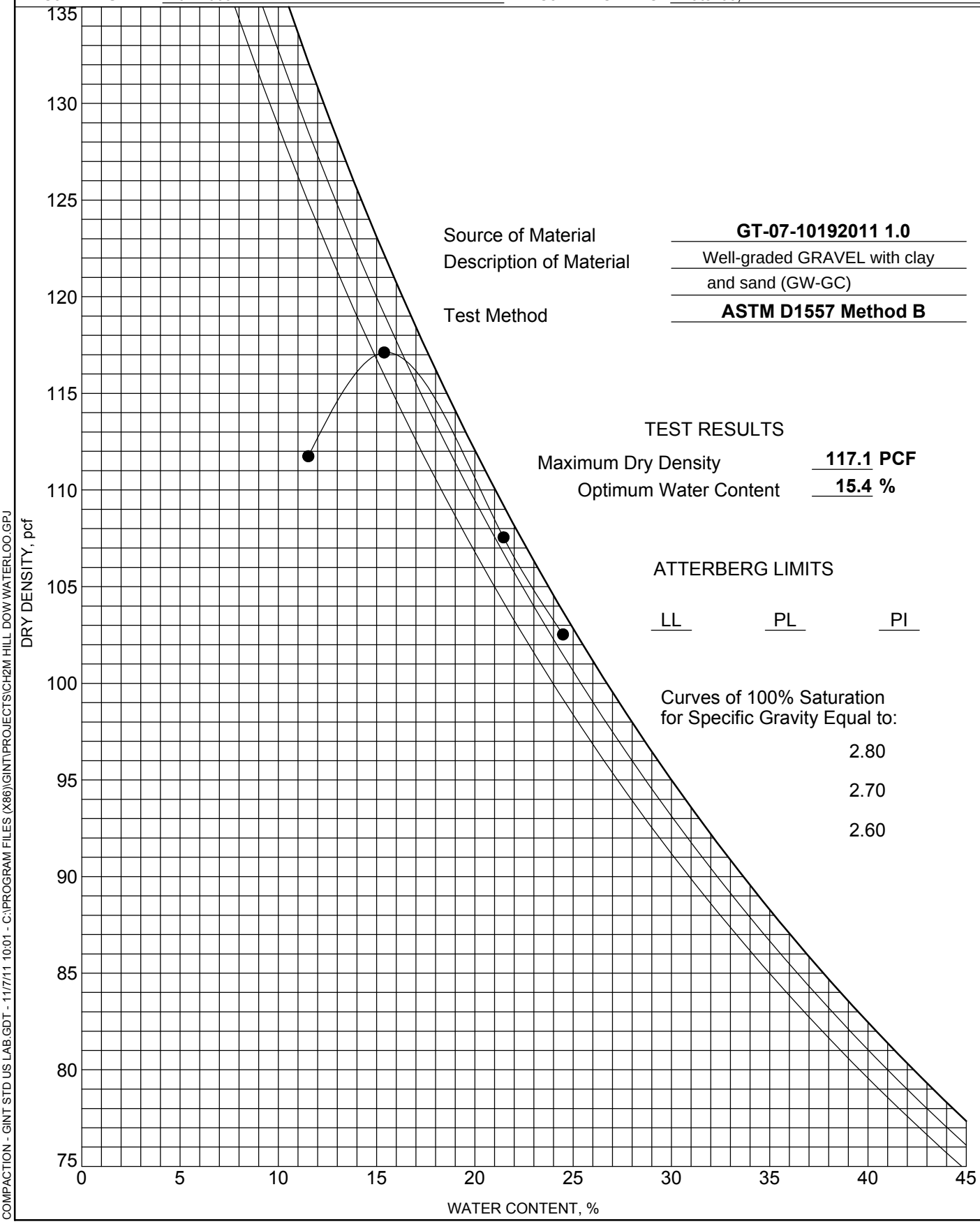

Source of Material: **GT-07-10192011 1.0**

Description of Material: Well-graded GRAVEL with clay and sand (GW-GC)

Test Method: **ASTM D1557 Method B**

TEST RESULTS

Maximum Dry Density: **117.1** **PCF**

Optimum Water Content: **15.4** **%**

ATTERBERG LIMITS

LL	PL	PI

Curves of 100% Saturation for Specific Gravity Equal to:

2.80

2.70

2.60

COMPACTION - GINT STD US LAB.GDT - 11/7/11 10:01 - C:\PROGRAM FILES (X86)\GINT\PROJECTS\CH2M HILL DOW WATERLOO.GPJ

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MOISTURE-DENSITY RELATIONSHIP

CLIENT CH2M HILL

PROJECT NAME FORMER HAMPSHIRE CHEMICAL CORP. FACILITY

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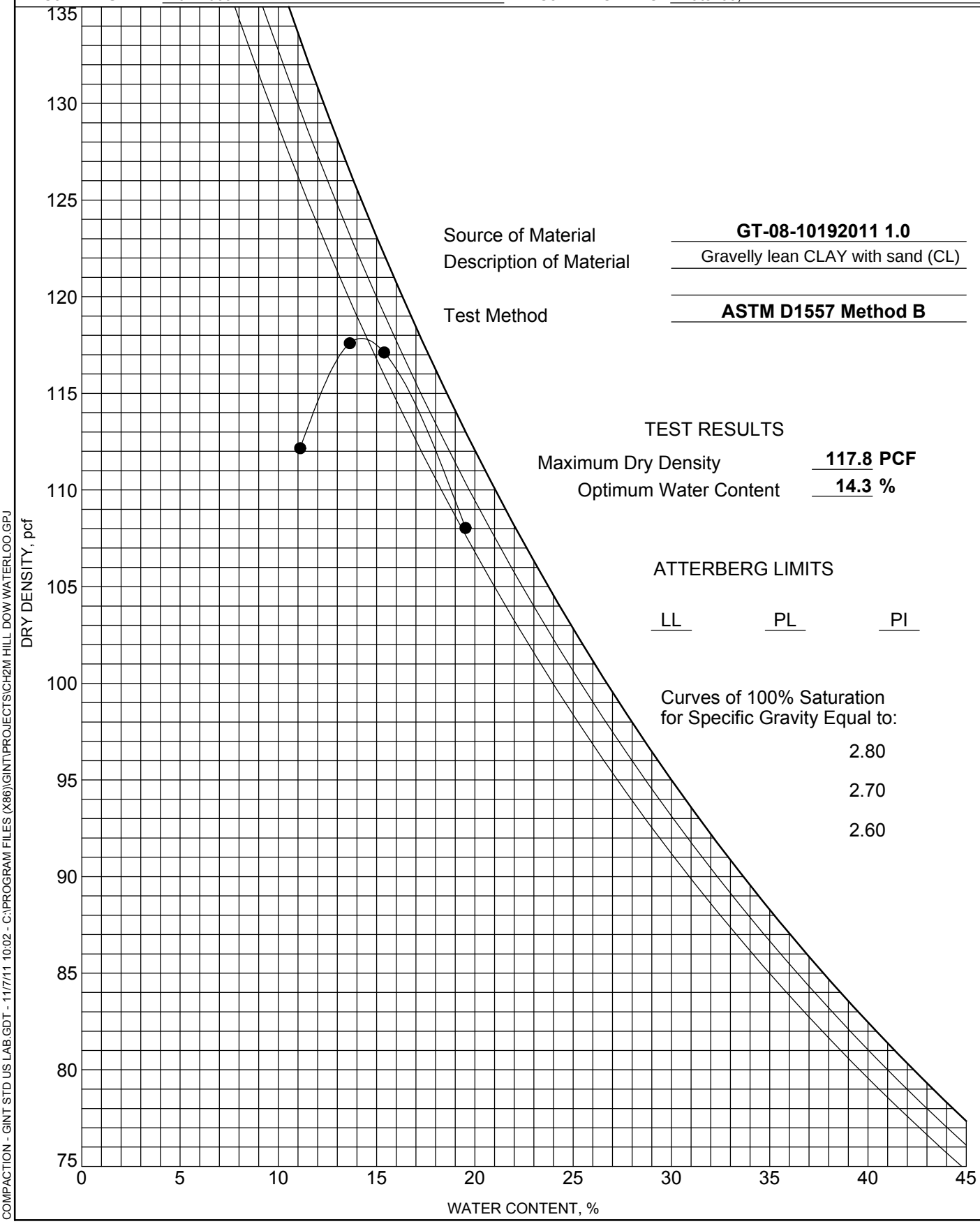

Source of Material: **GT-08-10192011 1.0**

Description of Material: Gravelly lean CLAY with sand (CL)

Test Method: **ASTM D1557 Method B**

TEST RESULTS

Maximum Dry Density: **117.8** **PCF**

Optimum Water Content: **14.3** **%**

ATTERBERG LIMITS

LL	PL	PI

Curves of 100% Saturation for Specific Gravity Equal to:

2.80

2.70

2.60

COMPACTION - GINT STD US LAB.GDT - 11/7/11 10:02 - C:\PROGRAM FILES (X86)\GINT\PROJECTS\CH2M HILL DOW WATERLOO.GPJ

Kenney Geotechnical Engineering Services, PLLC

Mail: P.O. Box 156 Baldwinsville, New York 13027
Office: 7246 State Fair Blvd., Syracuse, N.Y. 13209
Phone: (315) 638-2706 Fax: (315) 638-1544
cmk@kenneygeotechnical.com

Kenney Geotechnical Services

Date: 12-7-11

To: CH2M HILL

Fr: Chris Kenney, P.E.

Re: Permeability Testing
Former Hampshire Chemical Corp. Facility
Waterloo, NY

Permeability testing (ASTM D 5084) for your project has been completed. Results are as follows:

Sample I.D.:	GT-07-10192011	GT-08-10192011
Description	Well-Graded GRAVEL with clay and sand	Gravelly lean Clay with sand
Diameter (inches)	2.87	2.87
Length (inches)	5.19	5.62
Weight (grams)	1149.8	1279.6
Wet Unit Weight (pcf)	130.8	134.4
Prepped Moisture Content (%)	15.4	17.0
Dry Unit Weight (pcf)	113.3	114.9
% Max. Dry Density	96.7	97.5
Confining Pressure (psi)	20.0	20.0
Test Duration (sec)	345600	345600
Volume Passed (cc)	9.8	4.8
Headwater Pressure (psi)	14.6	14.5
Tailwater Pressure (psi)	10.1	10.3
Hydraulic Gradient	4.5	3.9
Permeability (cm/sec)	**9.71E-07**	**5.52E-07**
Notes:	Glass in sample caused membrane leakage and re-test	

Please notify us if you have any questions. Thank you for the opportunity to be of service.