Orange and Rockland Utilities, Inc. – Suffern Manufactured Gas Plant

ROCKLAND COUNTY

SUFFERN, NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: 344045

Prepared for:

Orange and Rockland Utilities, Inc

SMP Prepared by:

CH2M HILL, Inc

a wholly owned subsidiary of Jacobs Engineering Group Inc.

Revision No. 1 Prepared by:

GEI Consultants Engineering, Geology, Architecture & Landscape Architecture

Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date
1	August 2024	• The frequency of groundwater sampling reduced to a period not to exceed 15 months and the frequency of Periodic Reviews reduced to once every three years • Update Responsible Party contact information • Add the executed Environmental Easement to Appendix E • Update SMP text to incorporate updates available in current SMP Template to address non-routine and emergency maintenance activities • Update Excavation Work Plan to incorporate updates available in current SMP template	05.24.2023

NOVEMBER 2018; REV. AUGUST 2024

CERTIFICATION STATEMENT

I WENDY MOORE certify that I am currently a NYS registered professional engineer and that this Site Management Plan Revision No. 1 was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

WENDY MOORE, P.E.

AUGUST 5, 2024

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SITE MANAGEMENT PLAN

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List of Acronyms

AS	Air Sparging
BGS	Below Ground Surface
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CFR	Code of Federal Regulation
COC	Certificate of Completion; Constituent of Concern
CP	Commissioner Policy
DER	Division of Environmental Remediation
EC	Engineering Control
ECL	Environmental Conservation Law
ENSR	ENSR International
ERP	Environmental Restoration Program
EWP	Excavation Work Plan
FEMA	Federal Emergency Management Agency
HASP	Health and Safety Plan
IC	Institutional Control
ISS	In Situ Stabilization
MG/KG	Milligrams Per Kilogram
MGP	Manufactured Gas Plant
NAPL	Nonaqueous Phase Liquid
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
O&R	Orange and Rockland Utilities, Inc.
PAH	Polycyclic Aromatic Hydrocarbon
PRR	Periodic Review Report

RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RI	Remedial Investigation
ROD	Record of Decision
RP	Remedial Party
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
Site	Former OR-Suffern MGP Site, Suffern, New York
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SVI	Soil Vapor Intrusion
TAL	Target Analyte List
TCL	Target Compound List
USEPA	United States Environmental Protection Agency
VI	Vapor Intrusion

ES EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance, and reporting activities required by this Site Management Plan (SMP):

Site Identification: 344045 OR-Suffern MGP

Institutional Controls:	1. Institutional controls will be imposed in the form of an environmental easement for the on-site and the off-site affected area owned by O&R, and an SMP (subject to agreement) for the State of New Jersey-owned affected property.
	2. The ICs requires the remedial party or site owner to complete and submit to NYSDEC a periodic certification of institutional and engineering controls in accordance with 6 NYCRR Part 375-1.8 (h)(3).
	3. ICs allow for the use and development of the controlled properties for commercial and industrial uses as defined by 6 NYCRR Part 375-1.8(g), although land use is subject to local zoning laws.
	4. Restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by NYSDOH or the county department of health. The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Rockland County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department.
	5. Requires compliance with the NYSDEC-approved SMP.
Engineering Controls:	1. The solidified soil of the ISS and the required cover and backfill system and an Excavation Plan detailing the management and execution of future excavations in areas of solidified soil.
	2. A groundwater monitoring plan to assess performance of remedy (frequency detailed below in "Monitoring" section)

Site Identification: 344045 OR-Suffern MGP

	3. Sparge wells.
Inspections:	Frequency
1. Site inspection including cover and fencing	Annually
2. Sparge wells	Annually
Monitoring:	
1. Post-Remedial Groundwater Monitoring – ongoing implementation of Public Water Supply Protection and Mitigation Plan	Every fifteen months
2. Vapor Intrusion Monitoring of any building developed on or off the site, as required.	As needed
Maintenance:	
1. Site maintenance including cover and fencing	As needed
2. Sparge wells	As needed
Reporting:	
Periodic Review Report	Every three years

Further descriptions of the above requirements are provided in detail in the latter sections of this Site Management Plan.

1.0 INTRODUCTION

1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the Former Orange and Rockland Utilities, Inc. Manufactured Gas Plant (MGP) Site (Site) located in Suffern, New York (hereinafter referred to as the "Site"). See Figure 1. The Site is currently in the New York State (NYS) Superfund Program) Site No. 344045, which is administered by New York State Department of Environmental Conservation (NYSDEC).

Orange and Rockland Utilities, Inc (O&R) entered into a multi-site Consent Order on September 29, 1998, and March 11, 1999 with the NYSDEC to investigate and remediate the site. A figure showing the site location and boundaries of this site is provided in Figure 1. The boundaries of the site are more fully described in the metes and bounds site description are shown on Figure 2 and will be part of the Environmental Easement. This SMP refers to the properties associated with the Site . For New Jersey State owned property, an additional agreement between Orange and Rockland and the State of New Jersey will be negotiated detailing these site management plans.

After completion of the remedial work, some contamination was left at this site, which is hereafter referred to as "remaining contamination". Institutional and Engineering Controls (ICs and ECs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. An Environmental Easement will be developed, granted to the NYSDEC, and recorded with the Rockland County Clerk, which requires compliance with this SMP and all ECs and ICs placed on the site.

This SMP was prepared to manage remaining contamination at the site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC).
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375 and the Order on Consent for the site, and thereby subject to applicable penalties.

All reports associated with the site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the site is provided in Appendix A of this SMP.

The SMP was prepared by CH2M, a wholly owned subsidiary of Jacobs Engineering Group Inc. and Revision No. 1 was prepared by GEI Consultants Engineering, Geology, Architecture & Landscape Architecture, on behalf of O&R, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 3, 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the site.

1.2 Revisions and Alterations

Revisions and alterations to this plan will be proposed in writing to the NYSDEC's project manager. The NYSDEC can also make changes to the SMP or request revisions from the remedial party. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shutdown of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. Approved alterations must conform with Article 145 Section 7209 of the Education Law regarding the application of professional seals and alterations. For example, any changes to as-built drawings must be stamped by a New York State Professional Engineer. In accordance with the Environmental Easement for the site, the NYSDEC will provide a notice of any

approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.3 Notifications

Notifications will be submitted by the property owner to the NYSDEC, as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

- 60-day advance notice of any proposed changes in site use that are required under the terms of the Order on Consent, 6NYCRR Part 375 and/or Environmental Conservation Law.
- 7-day advance notice of any field activity associated with the remedial program.
- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan. If the ground-intrusive activity qualifies as a change of use as defined in 6 NYCRR Part 375, the above mentioned 60-day advance notice is also required.
- Notice within 48-hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Notice within 48 hours of any non-routine maintenance activities.
- Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

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

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the Order on Consent, and all approved work plans and reports, including this SMP.
- Within 15 days after the transfer of all or part of the site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC.

Table 1 on the following page includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in the Appendices.

Table 1: Notifications*

Name	Contact Information
Mr. Matthew Levinson – Con Edison	646-385-1691/LevinsonM@coned.com
Mr. John Spellman - NYSDEC DER Project Manager	518-402-9686/john.spellman@dec.ny.gov
Mr. Anthony Perretta – NYSDOH Ms. Maureen Schuck – NYSDOH	518-402-7860/ BEEI@health.ny.gov
Mr. Dan Miller – Rockland County Department of Health	845-364-2289/millerd@co.rockland.ny.us Environmental Health Office Main 845-364-2608
Mr. Charles Sawicki – Village of Suffern Department of Public Works	845-357-2602/csawicki@suffernvillage.com

* Note: Notifications are subject to change and will be updated as necessary.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

The site is located on Pat Malone Drive in the northwestern portion of the Town of Ramapo, Village of Suffern, Rockland County, New York. Based on information provided by the Village of Suffern Tax Assessment Office, the site and adjacent properties are zoned for manufacturing land use. The site is an approximate 1-acre trapezoidal area encompassing the former MGP; however, two other areas were also affected by the former plant operations, as shown in Figure 1.

1. O&R-owned property outside the site area, including part of the O&R-owned property near the current gate station.
2. New Jersey-owned property (controlled by New Jersey Transit), including an abandoned railroad berm between the site and the gate station, and land to the north and east of the site, which includes the Ramapo Sportsman Association, and part of an open field along the edge of the railroad berm along the active New Jersey Transit Rail line.

The site and adjoining areas consist of portions of the following three parcels of land:

- *Tax Map Parcel Section 54.34-1-4—The Former US Bus Parcel*. Total parcel size is 1 acre. This parcel is owned by O&R, and the majority of the former MGP process operations were performed here. The property is vacant and all aboveground structures have been demolished. The parcel is bounded to the east - northeast by active New Jersey Transit tracks.
- *Tax Map Parcel Section 54.34-1-2—The Former Propane Plant.* Total parcel size is 3.9 acres. Only a portion of the parcel was impacted by the MGP. This parcel is owned by O&R and is used as a natural gas gate station and a gas regulator station. The remainder of the property was used for propane storage, but is no longer active as a storage facility. An abandoned railroad spur owned by The State of New Jersey divides the parcel into two areas.

- *Tax Map Parcel Section 54.34-1-3—The State of New Jersey.* Total parcel size is 13.7 acres. Only a portion of the parcel was impacted by the MGP. The State of New Jersey owns this parcel, which contains an abandoned, raised railroad berm; an active firing range; and an area of vacant land. The parcel is bounded to the east - northeast by active New Jersey Transit tracks.

The Suffern Gas Company MGP conducted gas manufacturing operations from approximately 1902 until 1935. Initially, gas was manufactured using Lowe carbureted water gas processes. Later, the process was updated to coal gas manufacturing. In July 1935, gas production ceased as manufactured gas was replaced with natural gas. By the end of 1935, the Ramapo Gas Corporation transferred ownership of the franchise and distribution system to Rockland Gas Company, Inc. Additional known operations at the former MGP site included an electroplating facility during the 1940s and early 1950s, and a bus manufacturing facility that operated at the former MGP site until 2008.

2.2 Physical Setting

2.2.1 Land Use

Site Features: The MGP Site is an approximate 1-acre trapezoidal area encompassing the former MGP. The site is flat and vacant except for an active gas regulator station occupying a small area in the southwest corner.

A railroad spur was constructed adjacent to the western boundary of the site after MGP operations ceased. Construction of the railroad included an approximate 20-foot-high embankment; the spur is not active, but the embankment is still present.

Current Zoning/Use: The site and adjacent properties are zoned for manufacturing land use. The Village of Suffern water supply wells are located approximately 400 feet west of the site. The nearest residential area is within 800 feet to the east and 1,200 feet to the south. The State of New Jersey (NJ Transit) owns property north and east of the site, as well as the abandoned railroad berm. A firing range is present to the north, and an active commuter railroad is present to the east. Property south of the site is owned by the Village of Suffern and includes active recreation fields.

2.2.2 Geology and Hydrogeology

Unconsolidated alluvial deposits form a thick geologic unit from 5 feet below ground surface (bgs) to approximately 134 feet bgs below the site. The alluvial deposits are highly permeable and form an unconfined aquifer from which the Village of Suffern draws its drinking water. Across most of the site, the alluvial deposits are overlain by approximately 5 feet of fill. In the northwestern area of the site, adjacent to the New Jersey Transit railroad berm, peat and organic soils deposits ranging from 2 to 12 feet in thickness separate the fill from the alluvial deposits. The depth to groundwater is from 8 to 15 feet bgs, dropping from the east-northeast to the southwest across the site. Groundwater flow direction is generally from the east to the southwest towards the Ramapo River, located approximately 600 feet west of the site. Groundwater flow is towards the public water supply well field. A site location map is attached as Figure 1.

2.3 Investigation and Remedial History

The following provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site. Full titles for each of the reports referenced below are provided in Section 8.0 - References.

The project area has been subject to the following environmental investigations:

- 1987—Superfund investigation Suffern Well Field conducted by Environmental Resource Management
- 1996—Initial hazard investigation and assessment conducted by Remediation Technologies, Inc.
- 1997—Preliminary site assessment conducted by Remediation Technologies, Inc.
- 1998−2000—Remedial investigation (RI) conducted by GEI Consultants, Inc.
- 1999−present—Groundwater monitoring; quarterly groundwater monitoring conducted at select project area monitoring wells through 2022; every 15 months thereafter
- 2001—Supplemental RI conducted by Remediation Technologies, Inc.

- 2008—Due diligence evaluation and interim remedial measure conducted by ENSR International (ENSR)
- 2009—RI addendum investigation conducted by ENSR
- 2010—RI addendum investigation conducted by GEI Consultants, Inc.
- 2012—RI revision presented in May 2012 by GEI Consultants, Inc.
- 2013—Feasibility Study conducted by ARCADIS to evaluate remedial alternatives
- 2014 – Record of Decision (ROD), Site No. 344045, issued by NYSDEC and with the concurrence of New York State Department of Health (NYSDOH) in March 2014

Based on these investigations and consistent with the ROD, MGP-impacted materials, including nonaqueous phase liquid (NAPL), primarily coal tar NAPL, are present at the site and are responsible for most of the environmental impacts resulting from the MGP operations. The primary chemical constituents of concern (COCs) associated with coal tar are benzene, toluene, ethyl benzene, xylenes, and polycyclic aromatic hydrocarbons (PAHs). A full description of the nature and extent of the contaminants is provided in the Feasibility Study report and the ROD.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site presented in the feasibility study by ARCADIS in October 2013 and incorporated into the ROD are as follows:

2.4.1 Groundwater

RAOs for Public Health Protection

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

RAOs for Environmental Protection

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Prevent the discharge of contaminants to surface water.
- Remove the source of ground or surface water contamination.

2.4.2 Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

2.4.3 Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion (VI) into buildings at a site.

2.5 Remaining Contamination

The remaining contamination left at the site includes impacted soils at depth, the ISS monolith, and impacted groundwater. Soil impacts below 35 ft. were left in place. Contaminated soil was encapsulated within the ISS monolith in several areas on the site in accordance with the approved Remedial Design for the site. The ISS was completed to the design depths shown in the RA design. As noted in the Pre-Design Investigation Report and Remedial Design Work Plan (RDWP), contamination at the site will remain under the formed ISS monolith. Some remaining contamination was left under the inactive New Jersey Transit railroad berm because of access limitations recognized in the ROD: “Coal tar embedded within the embankment of the abandoned railroad berm on the State of New Jersey property will not require removal due to its greater depth and

apparent immobility, as well as embankment stability concerns." Figures 5, 6, and 7 summarize the results of soil samples remaining at the site after completion of Remedial Action that exceed SCOs, in soil 0-15 ft bgs, 15-45 ft bgs, and greater than 45 ft bgs, respectively.

Review of the Site groundwater conditions indicate limited groundwater impacts in the shallow and deep zones. Cyanide, benzene, toluene, ethylene, xylene, and polyaromatic hydrocarbon compounds have historically been detected in site monitoring wells. Details of groundwater contamination are located within the Groundwater Monitoring Plan.

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

Since remaining contamination exists at the site, Institutional Controls (ICs) and Engineering Controls (ECs) are required to protect human health and the environment. This IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at the site. The IC/EC Plan is one component of the SMP and is subject to revision by the NYSDEC.

This plan provides:

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

3.2 Institutional Controls

A series of ICs is required by the Remedial Design Work Plan to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and (3) limit the use and development of the site to commercial or industrial uses only. Adherence to these ICs on the site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the

Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The SMP, and the Environmental Easements when applicable, will be implemented within the boundaries depicted on Figure 3.

ICs for the site will be imposed in the form of an environmental easement for the site and the offsite affected area owned by O&R, and an SMP (subject to agreement) for the State of New Jersey-owned affected property, that:

1. Requires the remedial party or site owner to complete and submit to NYSDEC a periodic certification of ICs and ECs in accordance with 6 NYCRR Part 375-1.8 (h)(3)
2. Allows the use and development of the controlled properties for commercial and industrial uses as defined by 6 NYCRR Part 375-1.8(g), although land use is subject to local zoning laws
3. Restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by NYSDOH or the county department of health. The use of groundwater underlying the property is prohibited without the necessary water quality treatment as determined by the NYSDOH or the Rockland County Department of Health to render it safe for use as drinking water or for industrial purposes, and the use must first notify and obtain written approval to do so from the Department.
4. Requires compliance with the NYSDEC-approved SMP
    - All ECs must be operated and maintained as specified in this SMP.
    - All ECs must be inspected at a frequency and in a manner defined in the SMP.
    - Groundwater and other environmental or public health monitoring must be performed as defined in this SMP.
    - Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP.

- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP.
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP.
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP.
- Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement.
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 3, and any potential impacts that are identified must be monitored or mitigated.
- Vegetable gardens and farming on the site are prohibited; and
- An evaluation shall be performed to determine the need for further investigation and remediation should large scale redevelopment occur, if any of the existing structures are demolished, or if the subsurface is otherwise made accessible.

3.3 Engineering Controls

ECs include the solidified soil of the ISS, the required cover and backfill system, and sparge wells. This includes, but is not limited to, the following:

1. Solidified soil located within the ISS area.
2. Cover and backfill located throughout the site
3. Sparge wells in place as groundwater contingency measures. Sparge well locations are shown on Figure 4.
4. An excavation plan that details the provisions for management of future excavations in areas of remaining contamination and/or ISS areas.

5. A provision for evaluating the potential for soil VI as defined in the SMP for any buildings developed on affected properties, including provisions for implementing actions recommended to address exposures related to soil VI.
6. Provisions for managing and inspecting the identified ECs.
7. Maintaining site access controls and NYSDEC notification.
8. The steps necessary for the periodic reviews and certification of the ICs and ECs.

3.3.1 Solidified Soil

Excavation, ISS, and jet grouting were used to address impacted soil at depths up to 35 feet bgs. Each ISS treatment area was pre-excavated to an approximate depth of 5 to 10 feet bgs to remove physical obstructions, grossly contaminated soils, soil containing visual coal tar or NAPL, and soil containing PAHs exceeding 500 mg/kg. ISS treatment was conducted using auger mixing, bucket mixing, or jet grouting methods to solidify impacted soil. Following excavation and ISS, the stabilized soil is left in place. All ISS areas include a Site cover. As built drawings, showing excavation extent, ISS extent, and jet grouting locations are provided in Appendix G.

3.3.2 Cover

Exposure to remaining contamination at the site is prevented by a cover system placed over the site. The Excavation Work Plan (EWP) provided in Appendix B outlines the procedures required to be implemented in the event the cover system, and potentially the ISS area, are breached, penetrated or temporarily removed, and any underlying remaining contamination is disturbed. Breach of the site's cover system must be overseen by a Professional Engineer (PE) who is licensed and registered in New York State or a qualified person who directly reports to a PE who is licensed and registered in New York State.

Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and

Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) were prepared and submitted previously to the NYSDEC.

Figure 3 presents the location of the cover system and applicable demarcation layers. Cover thickness varies depending on property and future site use. Details of cover thickness are provided below.

3.3.2.1 Property Owned by O&R

For areas of the site owned by O&R, a site cover was required to allow for commercial use. The cover consists either of the structures such as buildings, pavement, and sidewalks comprising the site development, or a soil and/or gravel cover in areas where the upper 1 foot of exposed surface soil exceeded the applicable soil cleanup objectives (SCOs). Where the cover was required, it consisted of a minimum of 1 foot of soil meeting the SCOs for cover material with gravel top layer, as needed to restore the site, as set forth in 6 NYCRR Part 375-6.7(d) for commercial use. The cover was placed over a demarcation layer, with the upper 6 inches of soil of sufficient quality to maintain a vegetation layer. Where the cover was required over the onsite ISS treatment area, it consisted of a minimum of 4 feet of soil meeting the SCOs for commercial use. Because the site is within a regulated 100-year floodplain, the final elevation after construction of the cover was such that it will not cause an increase in net fill for the site.

3.3.2.2 Property Owned by the State of New Jersey

For areas of the site owned by the State of New Jersey, backfill over the ISS treatment area consist of a minimum of 4 feet of soil. The upper 2 feet meet the SCOs for unrestricted use as set forth in 6 NYCRR Part 375. Below this layer, existing soil on the State of New Jersey-owned property that meets the SCOs for commercial and groundwater protection was used for backfill. Implementation of this backfill requirement is subject to this SMP and an agreement with the State of New Jersey. No soil from the O&R-owned areas of the site was placed on areas owned by the State of New Jersey. Because the site is within a regulated 100-year floodplain, the final elevation after construction of the cover was such that it will not cause an increase in net fill for the site.

3.3.3 Sparge Wells

Sparge wells are installed as groundwater contingency measures. The sparge wells could be utilized at the site to provide a treatment barrier for dissolved-phase contaminants if needed. There are 34 sparge wells, each include four 1-inch sparge points to depths of 100, 75, 50, and 25 feet below grade and six piezometers with three 1-inch monitoring points to depths of 75, 50, and 25 feet below grade. All sparge wells and piezometers were finished at grade with caps, 18-inch diameter heavy-duty steel road boxes, and concrete aprons. Sparge well locations are shown in Figure 4.

3.3.4 Criteria for Completion of Remediation

Generally, remedial processes are considered completed when monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10.

Unless waived by the NYSDEC, confirmation samples of applicable environmental media are required before terminating any remedial actions at the site. Confirmation samples require Category B deliverables and a Data Usability Summary Report (DUSR).

As discussed below, the NYSDEC may approve termination of a groundwater monitoring program. When a remedial party receives this approval, the remedial party will decommission all site-related monitoring, injection and recovery wells as per the NYSDEC CP-43 policy.

The remedial party will also conduct any needed site restoration activities, such as asphalt patching and decommissioning treatment system equipment. In addition, the remedial party will conduct any necessary restoration of vegetation coverage, trees and wetlands, and will comply with NYSDEC and United States Army Corps of Engineers regulations and guidance. Also, the remedial party will ensure that no ongoing erosion is occurring on the site.

3.3.4.1 – ISS Areas and Covers

Covers are permanent controls and the quality and integrity of this system will be inspected at regular intervals in accordance with this SMP until NYSDEC soil cleanup standards have been met

3.3.4.2 – Sparge Wells

All sparge wells and piezometers are temporary controls and the quality and integrity of each well will be inspected at regular intervals in accordance with this SMP until it has been determined that the sparge wells can be decommissioned.

3.3.5 - Monitoring Wells associated with Monitored Natural Attenuation

Monitored natural attenuation is not a component of the ROD; nevertheless, groundwater monitoring activities to assess natural attenuation are currently used, as determined by the NYSDEC with consultation with NYSDOH, until residual groundwater concentrations are found to be consistently below ambient water quality standards, the site SCGs, or have become asymptotic at an acceptable level over an extended period. In the event that monitoring data indicates that monitoring for natural attenuation may no longer be required, a proposal to discontinue the system will be submitted by the remedial party. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional source removal, treatment and/or control measures will be evaluated.

4.0 MONITORING AND SAMPLING PLAN

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the site are included in the Groundwater Monitoring Plan provided in Appendix D.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media.
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards and Part 375 SCOs for soil; and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Sampling locations, protocol and frequency.
- Information on all designed monitoring systems.
- Analytical sampling program requirements.
- Inspection and maintenance requirements for monitoring wells.
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7.0 of this SMP.

4.2 Site – wide Inspection

Site-wide inspections will be performed at a minimum of once per year. Modification to the frequency or duration of the inspections will require approval from NYSDEC. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed. The form will compile sufficient information to assess the following:

- Compliance with all ICs, including site usage.
- An evaluation of the condition and continued effectiveness of ECs.
- General site conditions at the time of the inspection.
- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that site records are up to date.

Inspections of all remedial components installed at the site will be conducted. A comprehensive site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether ECs continue to perform as designed.
- If these controls continue to be protective of human health and the environment.
- Compliance with requirements of this SMP and the Environmental Easement.
- Achievement of remedial performance criteria; and
- If site records are complete and up to date; and

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the site, verbal notice to

the NYSDEC must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs implemented at the site by a qualified environmental professional, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public. The remedial party will submit follow-up status reports to the NYSDEC within 45 days of the event on actions taken to respond to any emergency event requiring ongoing responsive action, describing and documenting actions taken to restore the effectiveness of the ECs.

4.3 Post-Remediation Media Monitoring and Sampling

Samples shall be collected from the groundwater on a routine basis. Sampling locations, required analytical parameters, schedule, detailed sample collection and analytical procedures, and protocols are provided in the Groundwater Monitoring Plan in Appendix D. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

4.4 Groundwater Sampling

Groundwater monitoring will be performed every fifteen months to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

The network of monitoring wells has been installed to monitor upgradient, on-site and downgradient groundwater conditions at the site. Wells identification numbers, as well as the purpose, location, depths, diameter, screened intervals, and monitoring well construction logs of the wells, can be found in the Groundwater Monitoring Plan in Appendix D.

If biofouling or silt accumulation occurs in the on-site and/or off-site monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced, if an event renders the wells unusable.

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

The NYSDEC will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC.

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

Deliverables for the groundwater monitoring program are specified in Section 7.0 – Reporting Requirements.

4.5 Public Water Supply Protection and Mitigation Plan

Due to proximity of the Site to the Village of Suffern public water supply well field, the selected remedy required the development and implementation of a Public Water Supply Protection and Mitigation Plan's purpose is to:

a) Evaluate the existing long-term groundwater monitoring program and determine whether additional sentinel monitoring points and/or increased sampling frequency are necessary to ensure adequate detection and warning of potential MGP-contamination into the public water supply,
b) As necessary, install wellhead treatment systems or comparable alternative measures, or upgrade existing systems, for public water supply wells that are threatened or impacted by MGP related contamination in the future.
c) Provide immediate notification to the New York State Department of Environmental Conservation (NYSDEC), New York State Department of Health (NYSDOH), Rockland County Health Department (RCHD), and the Village of

Suffern if MGP-contaminant concentrations in a sentinel well(s) exceed a specified action level and implement appropriate response actions.

Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the site are included in the Public Water Supply Protection and Mitigation Plan provided in Appendix I.

5.0 OPERATION AND MAINTENANCE PLAN

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

6.0 PERIODIC ASSESSMENTS/EVALUATIONS

6.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climactic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

This section provides a summary of vulnerability assessments that will be conducted for the site during periodic assessments, and briefly summarizes the vulnerability of the site and/or engineering controls to severe storms/weather events and associated flooding.

A brief qualitative assessment of potential areas of climate change vulnerabilities associated with the Site was performed, primarily based on the review of site information, and published case studies and literature relevant to the site's geographic location and physical conditions. Potential vulnerabilities that were considered are the following:

- Flooding: According to the Federal Emergency Management Agency (FEMA) Flood Hazard Boundary map, the Site is located under Zone AE. This zone is described as the 100-year flood level, which "will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year" (FEMA.gov).
- Site Drainage and Storm Water Management: There are no areas of the site that present evidence of flooding during severe rain events due to insufficient groundwater recharge capabilities or inadequate storm water management systems.

- Erosion: There are no areas at the Site that present evidence of erosion or areas that could be susceptible to erosion during periods of severe rain events. The Site is relatively flat.
- High Wind: There are no areas of the Site and remedial systems that may be susceptible to damage from the wind.
- Spill/Contaminant Release: Non-hazardous waste if present at the Site and not immediately removed upon generation, gets drummed and subsequently transported offsite for disposal.

7.0. REPORTING REQUIREMENTS

7.1 Site Management Reports

All site management inspection, maintenance and monitoring events will be recorded on the appropriate site management forms. These forms are subject to NYSDEC revision. Site management inspection, maintenance, and monitoring events will be conducted by a Professional Engineer (PE) who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 7 and summarized in the Periodic Review Report.

Table 7: Schedule of Interim Monitoring/Inspection Reports

Task/Report	**Reporting Frequency***
Groundwater Monitoring Report	Prepared as part of each event, to be attached to Periodic Review Report (every three years) for submittal to NYSDEC
Inspection Report	Prepared as part of each inspection, to be attached to Periodic Review Report (every three years) for submittal to NYSDEC
Periodic Review Report	Every three years

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

All interim monitoring/inspections reports will include, at a minimum:

- Date of event or reporting period.
- Name, company, and position of person(s) conducting monitoring/inspection activities.
- Description of the activities performed.

- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet).
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc).
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.).
- Sampling results in comparison to appropriate standards/criteria.
- A figure illustrating sample type and sampling locations.
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format).
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

Routine maintenance event reporting forms will include, at a minimum:

- Date of event.
- Name, company, and position of person(s) conducting maintenance activities.
- Description of maintenance activities performed.
- Any modifications to the system.
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and,
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event.

- Name, company, and position of person(s) conducting non-routine maintenance/repair activities.
- Description of non-routine activities performed.
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS^{TM} database in accordance with the requirements found at this link http://www.dec.ny.gov/chemical/62440.html.

7.2 Periodic Review Report

A Periodic Review Report (PRR) will be submitted to the Department beginning sixteen (16) months after the Certificate of Completion or equivalent document e.g., Satisfactory Completion Letter, No Further Action Letter, etc.is issued. After the change in schedule conveyed in this SMP Revision No. 1, PRRs shall be submitted every three years to the Department or at another frequency as may be required by the Department. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in the Environmental Easement. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site.
- Results of the required annual site inspections and severe condition inspections, if applicable.

- All applicable site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.
- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.
- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS^{TM} database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html.
- A site evaluation, which includes the following:
    a. The compliance of the remedy with the requirements of the site-specific RAWP, ROD or Decision Document.
    b. The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications.
    c. Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored.
    d. Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan; and

e. Trends in contaminant levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document.

f. The overall performance and effectiveness of the remedy.

7.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a qualified environmental professional or Professional Engineer licensed to practice in New York State will prepare, and include in the Periodic Review Report, the following certification as per the requirements of NYSDEC DER-10:

"*For each institutional or engineering control identified for the site, I certify that all of the following statements are true:*

- *The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction.*
- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department.*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment.*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control.*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control.*
- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document.*
- *Use of the site is compliant with the environmental easement.*

- *The engineering control systems are performing as designed and are effective.*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program and generally accepted engineering practices; and*
- *The information presented in this report is accurate and complete.*

"I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as Owner's/Remedial Party's Designated Site Representative [I have been authorized and designated by all site owners/remedial parties to sign this certification] for the site."

"I certify that the New York State Education Department has granted a Certificate of Authorization to provide Professional Engineering services to the firm that prepared this Periodic Review Report."

At the end of each certifying period, as determined by the NYSDEC, the following certification will be provided to the Department:

"For each institutional identified for the site, I certify that all of the following statements are true:

- *The institutional control employed at this site is unchanged from the date the control was put in place, or last approved by the Department.*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment.*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control.*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control.*

- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document.*

- *Use of the site is compliant with the environmental easement.*

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

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner or Owner's Designated Site Representative]: [and I have been authorized and designated by all site owners to sign this certification] for the site."

The signed certification will be included in the Periodic Review Report.

The Periodic Review Report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located and the NYSDOH Bureau of Environmental Exposure Investigation. The Periodic Review Report may need to be submitted in hard-copy format, as requested by the NYSDEC project manager.

7.3 Corrective Measures Work Plan

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

8.0 REFERENCES

6 NYCRR Part 375, Environmental Remediation Programs. December 14, 2006

ERM, 1987. Remedial Investigation Report, Suffern Well Field, Contract No. D001234.

RETEC, 1996. Initial Hazard Investigation and Assessment: Suffern, Middletown-Fulton Street, and Haverstraw Former Manufactured Gas Plant Sites, prepared for Orange and Rockland Utilities.

RETEC, 1997. Preliminary Site Assessment for Suffern, New York Former Manufactured Gas Plant Site, prepared for Orange and Rockland Utilities.

GEI, 1998. Remedial Investigation Work Plan for the Suffern Former Manufactured Gas Plant Site, Suffern, New York, prepared for Orange and Rockland Utilities. September 1998.

GEI, 2010. Remedial Investigation Report Suffern Former MGP Site, prepared for Orange and Rockland Utilities. October 2010.

NYSDEC DER-10 – "Technical Guidance for Site Investigation and Remediation".

NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).

GEI, 2000. Remedial Investigation Work Plan for the Suffern Former Manufactured Gas Plant Site, Suffern, New York, prepared for Orange and Rockland Utilities. September 2000.

GRI, 1996. Management of Manufactured Gas Plant Sites: The Gas Research Institute's Two Volume Practical Reference Guide, Volumes I & 2 GRI-96/0470.1 & GRI-96/0470.2, Chicago, IL, June 1996.

RETEC, 2001. Supplemental Remedial Investigation Work Plan for Suffern Former Manufactured Gas Plant Site, Suffern, NY, prepared for Orange and Rockland Utilities. November 2001.

NYSDEC, 2002. Management of Coal Tar Waste and Coal Tar Contaminated Soils and Sediment from Former Manufactured Gas Plants (DER-4), January 11, 2002.

NYSDEC, 2004. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (TOGS 1.1.1), Reissued June 1998 and addended April 2000 and June 2004.

NYSDEC, 2006a. Rules and Regulations, 6 NYCRR Subpart 375-6, Remedial Program Soil Cleanup Objectives, dated December 14, 2006.

NYSDEC, 2010. DER-10 Technical Guidance for Site Investigation and Remediation. May 3, 2010.

NYSDEC, 2010, CP-51 Soil Cleanup Guidance, October 21, 2010

USEPA, 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, October 1988.

APPENDIX A – LIST OF SITE CONTACTS

Name	Phone/Email Address
Mr. Matthew Levinson – Con Edison	646-385-1691/LevinsonM@coned.com
Mr. John Spellman - NYSDEC DER Project Manager	518-402-9686/john.spellman@dec.ny.gov
Mr. Anthony Perretta – NYSDOH Ms. Maureen Schuck – NYSDOH	518-402-7860/ BEEI@health.ny.gov
Mr. Dan Miller – Rockland County Department of Health	845-364-2289/millerd@co.rockland.ny.us Environmental Health Office Main 845-364-2608
Mr. Charles Sawicki – Village of Suffern Department of Public Works	845-357-2602/csawicki@suffernvillage.com

APPENDIX B – EXCAVATION WORK PLAN (EWP)

B-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination or breach or alter the site's cover system, the site owner or their representative will notify the NYSDEC. Table B-1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix A.

Table B-1: Notifications*

Mr. John Spellman - NYSDEC DER Project Manager	518-402-9686/john.spellman@dec.ny.gov

* Note: Notifications are subject to change and will be updated as necessary.

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated modifications of truck routes, and any work that may impact an engineering control.

- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling.

- A schedule for the work, detailing the start and completion of all intrusive work and submittals (e.g., reports) to the NYSDEC documenting the completed intrusive work.

- A summary of the applicable components of this EWP, 29 CFR 1910.120 and 29 CFR 1926 Subpart P.
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120.
- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP submitted previously to the NYSDEC.
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with the required request to import form (Appendix B-1) and supporting documentation including, but not limited to, all required chemical testing results.

The NYSDEC project manager will review the notification and may impose additional requirements for the excavation that are not listed in this EWP. The alteration, restoration and modification of engineering controls must conform with Article 145 Section 7209 of the Education Law regarding the application professional seals and alterations.

B-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a qualified environmental professional during all excavations into known or potentially contaminated material (remaining contamination) or a breach of the cover system. A qualified environmental professional as defined in 6 NYCRR Part 375, a PE who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State will perform the screening. Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to

determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil.

B-3 SOIL STAGING METHODS

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

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

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

B-4 MATERIALS EXCAVATION AND LOAD-OUT

A qualified environmental professional as defined in 6 NYCRR Part 375, a PE who is licensed and registered in New York State, or person who directly reports to a PE who is licensed and registered in New York State will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and remedial party (if applicable) and its contractors are responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site. A utility stakeout will be completed prior to ground intrusive activities.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements). Trucks transporting contaminated soil must have either tight-fitting opaque covers that are secured on the sides and/or back, or opaque covers that are locked on all sides.

A truck wash will be operated on-site, as appropriate. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials. Material accumulated from the street cleaning and egress cleaning activities will be disposed off-site at a permitted landfill facility in accordance with all applicable local, State, and Federal regulations.

B-5 MATERIALS TRANSPORT OFF-SITE

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded. Material transported by trucks exiting the site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

Truck transport route is shown in Figure B-1. All trucks loaded with site materials will exit the vicinity of the site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport; [(g) community input where necessary.

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

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

Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

B-6 MATERIALS DISPOSAL OFF-SITE

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

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

Non-hazardous historic fill and contaminated soils taken off-site will be handled consistent with 6 NYCRR Parts 360, 361, 362, 363, 364 and 365, as a Municipal Solid Waste per 6NYCRR Part 360-1.2 at minimum. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State C&D debris recovery facility (6NYCRR Part 360-15 registered or permitted Facility).

B-7 MATERIALS REUSE ON-SITE

The qualified environmental professional, as defined in 6 NYCRR Part 375, will ensure that procedures defined for materials reuse in this SMP are followed and that

unacceptable material does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover system, within landscaping berms. Contaminated on-site material may only be used beneath the site cover or as backfill for subsurface utility lines with prior approval from the DEC project manager.

Proposed materials for reuse on-site must be sampled for full suite analytical parameters including per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane. The sampling frequency will be in accordance with DER-10 Table 5.4(e)10 unless prior approval is obtained from the NYSDEC project manager for modification of the sampling frequency. The analytical results of soil/fill material testing must meet the site use criteria presented in NYSDEC DER-10 Appendix 5 – Allowable Constituent Levels for Imported Fill or Soil for all constituents listed, and the NYSDEC Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances [November 2022 or date of current version, whichever is later] guidance values. Approvals for modifications to the analytical parameters must be obtained from the NYSDEC project manager prior to the sampling event.

Soil/fill material for reuse on-site will be segregated and staged as described in Sections B-2 and B-3 of this EWP. The anticipated size and location of stockpiles will be provided in the 15-day notification to the NYSDEC project manager. Stockpile locations will be based on the location of site excavation activities and proximity to nearby site features. Material reuse on-site will comply with requirements of NYSDEC DER-10 Section 5.4(e)4. Any modifications to the requirements of DER-10 Section 5.4(e)4 must be approved by the NYSDEC project manager.

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

B-8 FLUIDS MANAGEMENT

All liquids to be removed from the site, including but not limited to, excavation dewatering, decontamination waters and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the site, and will be managed off-site at a permitted facility, unless prior approval is obtained from NYSDEC.

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

B-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the RDWP and Record of Decision. For areas of the site owned by O&R, the existing site cover consist either of the structures such as buildings, pavement, sidewalks comprising the site development, or a soil cover of a minimum of 1 foot of soil meeting the SCOs for cover material as set forth in 6 NYCRR Part 375-6.7(d) for commercial use. The soil cover was placed over a demarcation layer, with the upper 6 inches of soil of sufficient quality to maintain a vegetation layer. Where the soil cover was required over the onsite ISS treatment area, it consisted of a minimum of 4 feet of soil meeting the SCOs for commercial use.

For areas of the site owned by the State of New Jersey, backfill over the ISS treatment area consist of a minimum of 4 feet of soil. The upper 2 feet meet the SCOs for unrestricted use as set forth in 6 NYCRR Part 375. Below this layer, existing soil on the State of New Jersey-owned property that meets the SCOs for commercial and groundwater protection was used for backfill.

The demarcation layer, consisting of orange snow fencing material, white geotextile or equivalent material, etc. will be replaced to provide a visual reference to the top of the remaining contamination zone, the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this SMP. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of

the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP. The alteration, restoration and modification of engineering controls must conform with Article 145 Section 7209 of the Education Law regarding the application professional seals and alterations.

B-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional, as defined in 6 NYCRR Part 375, and will be in compliance with provisions in this SMP prior to receipt at the site. A Request to Import/Reuse Fill or Soil form, which can be found at http://www.dec.ny.gov/regulations/67386.html, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review. A copy of the form is presented in Attachment B-1

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

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d) and DER-10 Appendix 5 for commercial use. Based on an evaluation of the land use, protection of groundwater and protection of ecological resources criteria, the resulting soil quality standards are listed in 6NYCRR 375-6.7(d) and DER-10 Appendix 5. Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Soil material will be sampled for the full suite of analytical parameters, including PFAS and 1, 4-dioxane. Solid waste will not be imported onto the site.

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

B-11 STORMWATER POLLUTION PREVENTION

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at

the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

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

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

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

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

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

B-12 EXCAVATION CONTINGENCY PLAN

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

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; TCL volatiles and semi-volatiles [including 1,4-dioxane], TCL pesticides, PCBs, and PFAS), unless the site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling. Tanks will be closed as per NYSDEC regulations and guidance, if encountered.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone within two

hours to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

B-13 COMMUNITY AIR MONITORING PLAN

The CAMP for the Remedial Action was developed by AECOM and previously submitted and approved by NYSDEC. Future excavation activities, if needed, would be performed in accordance with the CAMP; however, portable or fixed monitoring equipment could be used depending on the extent and duration of the work.

B-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the remedial party's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

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

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

B-15 DUST CONTROL PLAN

Particulate monitoring must be conducted according to the Community Air Monitoring Plan (CAMP) provided in Section B-13. If particulate levels at the site exceed the thresholds listed in the CAMP or if airborne dust is observed on the site or leaving the site, the dust suppression techniques listed below will be employed. The remedial party will also take measures listed below to prevent dust production on the site.

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

1. Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
2. Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
3. Gravel will be used on roadways to provide a clean and dust-free road surface.
4. On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

Field generation of contaminated or uncontaminated dust and mobilization of volatile organic compounds may be reduced by new and traditional Best Management Practices (BMPs) such as:

- Covering excavated areas with biodegradable fabric that also can control erosion and serve as a substrate for favorable ecosystems, or with synthetic material that can be reused for other onsite or offsite purposes.
- Spraying water in vulnerable areas, in conjunction with water conservation and runoff management techniques.

- Securing and covering material in open trucks while hauling excavated material, and reusing the covers.
- Revegetating excavated areas as quickly as possible; and
- Limiting onsite vehicle speeds to 10 miles per hour.

Other approaches can be implemented with the approval of NYSDEC's Project Manager.

B-16 OTHER NUISANCES

A plan for rodent control will be developed and utilized by the contractor prior to and during site clearing and site grubbing, and during all remedial work.

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinances.

APPENDIX C
RESPONSIBILITIES of
OWNER and REMEDIAL PARTY

Responsibilities

The responsibilities for implementing the Site Management Plan ("SMP") for the OR – Suffern MGP site (the "site"), number 344045, are divided between the site owner(s) and a Remedial Party, as defined below. The owner(s) is/are currently listed as:

Orange and Rockland Utilities, Inc. (the "owner").

Solely for the purposes of this document and based upon the facts related to a particular site and the remedial program being carried out, the term Remedial Party ("RP") refers to any of the following: certificate of completion holder, volunteer, applicant, responsible party, and, in the event the New York State Department of Environmental Conservation ("NYSDEC") is carrying out remediation or site management, the NYSDEC and/or an agent acting on its behalf. The RP is:

Orange and Rockland Utilities, Inc.

Nothing on this page shall supersede the provisions of an Environmental Easement, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the site.

Site Owner's Responsibilities:

1.0 The owner shall follow the provisions of the SMP as they relate to future construction and excavation at the site.

2.0 In accordance with a periodic time frame determined by the NYSDEC, the owner shall periodically certify, in writing, that all Institutional Controls set forth in a(n) Environmental Easement remain in place and continue to be complied with. The owner shall provide a written certification to the RP, upon the RP's request, in order to allow the RP to include the certification in the site's Periodic Review Report (PRR) certification to the NYSDEC.

3.0 In the event the site is delisted, the owner remains bound by the Environmental Easement and shall submit, upon request by the NYSDEC, a written certification that the Environmental Easement is still in place and has been complied with.

4.0 The owner shall grant access to the site to the RP and the NYSDEC and its agents for the purposes of performing activities required under the SMP and assuring compliance with the SMP.

5.0 The owner is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components or vandalism is evident, the owner shall notify the site's RP and the NYSDEC in accordance with the timeframes indicated in Section 1.3-Notifications.

6.0 In the event some action or inaction by the owner adversely impacts the site, the owner must notify the site's RP and the NYSDEC in accordance with the time frame indicated in Section 1.3- Notifications and (ii) coordinate the performance of necessary corrective actions with the RP.

7.0 The owner must notify the RP and the NYSDEC of any change in ownership of the site property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the site properties. 6 NYCRR Part contains notification requirements applicable to any construction or activity changes and changes in ownership. Among the notification requirements is the following: Sixty days prior written notification must be made to the NYSDEC. Notification is to be submitted to the NYSDEC Division of Environmental Remediation's Site Control Section. Notification requirements for a change in use are detailed in Section 2.4 of the SMP. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html.

8.0 In accordance with the tenant notification law, within 15 days of receipt, the owner must supply a copy of any vapor intrusion data, that is produced with respect to structures and that exceeds NYSDOH or OSHA guidelines on the site, whether produced by the NYSDEC, RP, or owner, to the tenants on the property. The owner must otherwise comply with the

tenant and occupant notification provisions of Environmental Conservation Law Article 27, Title 24.

Remedial Party Responsibilities

- The RP must follow the SMP provisions regarding any construction and/or excavation it undertakes at the site.
- The RP shall report to the NYSDEC all activities required for remediation, operation, maintenance, monitoring, and reporting. Such reporting includes, but is not limited to, periodic review reports and certifications, electronic data deliverables, corrective action work plans and reports, and updated SMPs.
- Before accessing the site property to undertake a specific activity, the RP shall provide the owner advance notification that shall include an explanation of the work expected to be completed. The RP shall provide to (i) the owner, upon the owner's request, (ii) the NYSDEC, and (iii) other entities, if required by the SMP, a copy of any data generated during the site visit and/or any final report produced.
- If the NYSDEC determines that an update of the SMP is necessary, the RP shall update the SMP and obtain final approval from the NYSDEC. Within 5 business days after NYSDEC approval, the RP shall submit a copy of the approved SMP to the owner(s).
- The RP shall notify the NYSDEC and the owner of any changes in RP ownership and/or control and of any changes in the party/entity responsible for the operation, maintenance, and monitoring of and reporting with respect to any remedial system (Engineering Controls). The RP shall provide contact information for the new party/entity. Such activity constitutes a Change of Use pursuant to 375-1.11(d) and requires 60-days prior notice to NYSDEC. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html .
- The RP shall notify the NYSDEC of any damage to or modification of the systems as required under Section 1.3- Notifications of the SMP.

- Prior to a change in use that impacts the remedial system or requirements and/or responsibilities for implementing the SMP, the RP shall submit to the NYSDEC for approval an amended SMP.
- Any change in use, change in ownership, change in site classification (*e.g.*, delisting), reduction or expansion of remediation, and other significant changes related to the site may result in a change in responsibilities and, therefore, necessitate an update to the SMP and/or updated legal documents. The RP shall contact the Department to discuss the need to update such documents.

Change in RP ownership and/or control and/or site ownership does not affect the RP's obligations with respect to the site unless a legally binding document executed by the NYSDEC releases the RP of its obligations.

Future site owners and RPs and their successors and assigns are required to carry out the activities set forth above.

FIGURES

GENERAL NOTE

1. LIMITS OF VEGETATION ARE NOT SHOWN ON THIS DRAWING FOR CLARITY AND ARE SHOWN ON OTHER DRAWINGS.

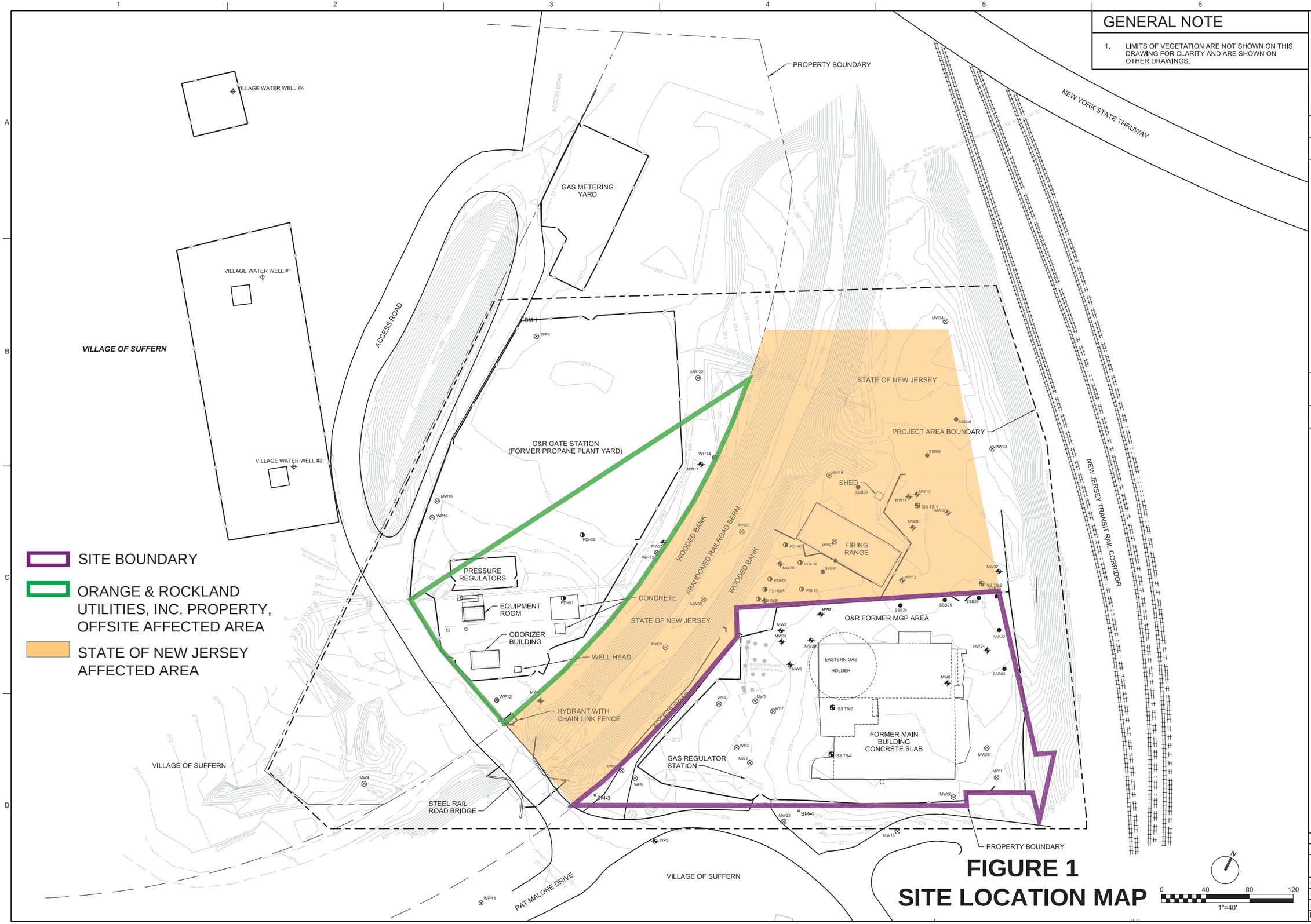


FIGURE 1
SITE LOCATION MAP

0 40 80 120
1"=40'

FILENAME: C-100.dgn PLOT DATE: 12/7/2015 PLOT TIME: 7:41:04 AM

STATE OF NEW YORK — KEVIN ROSEBROOK — 079460 — LICENSED PROFESSIONAL ENGINEER

NO.	REVISION	BY	APVD

DSGN SA MAHOFER | DR MA REICHERT | CHK EA MCKENNA | APVD KR ROSEBROOK | DATE

CH2MHILL®

CIVIL

Site Location Map

SUFFERN FORMER MGP SITE
ORANGE & ROCKLAND UTILITIES, INC.
SUFFERN, NEW YORK

100% DESIGN - FOR CONSTRUCTION

1"=40'
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	NOVEMBER 2015
PROJ	650199
DWG	C-100
Figure	1 of 3

General Notes:

1. *This survey is referenced horizontally to the North American Datum of 1983, 2011 adjustment (NAD83/2011) and projected on the New York State Plane Coordinate System (East Zone), and vertically to the North American Vertical Datum of 1988 (NAVD88).*
2. *North arrow as shown indicates Grid North referenced to NAD83/2011 and projected on the New York State Plane Coordinate System (East Zone).*
3. *The reference horizontal and vertical control station is a Continuously Operating Reference Station (CORS) designated as VALHALLA CORS ARP (NYVH). NYVH was established by the New York State Department of Transportation (NYSDOT) and last adjusted by the National Geodetic Survey in August 2011. Elevation 309.25 feet.*
4. *Location of spot elevation is indicated by the tick "+" mark located adjacent to the elevation.*
5. *The subsurface utilities shown hereon are of Quality Level "C" as defined by the American Society of Civil Engineers (ASCE) in the "Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data". The subsurface utilities shown hereon are based on physical evidence located during the field survey and existing utility drawings. The surveyor further does not warrant or certify that the subsurface utilities are in the exact location indicated although he does certify that they are depicted as accurately as possible from the information available. This surveyor has not physically located the subsurface utilities.*
6. *Elevations and contours shown reference the North American Vertical Datum of 1988 (NAVD88-Geoid12A).*
7. *Contours shown hereon were generated from a Digital Terrain Model utilizing Autodesk Civil 3D Surveying and Engineering software.*
8. *All of the monitoring wells are flush mount. The top of casing elevations for the monitoring wells represent the rim elevation of the curb boxes. The elevations do not represent the top of the riser pipe.*
9. *The information shown hereon is based on an instrument survey completed on December 19, 2014.*

Benchmarks:

Site Benchmark No. 1: Yellow Bench Tie set in the easterly face of Utility Pole No. 54832 located at the northwesterly corner of the Orange & Rockland Gate Station, approximately 2 feet northerly of the northwesterly chain link fence corner. Elevation = 272.21 feet

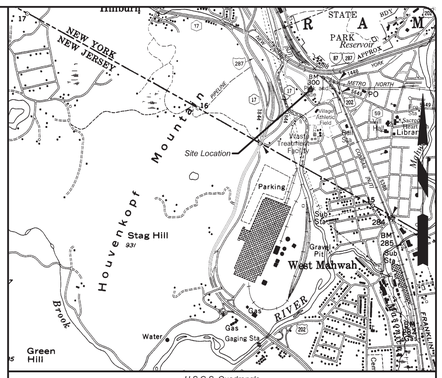
Site Benchmark No. 2: Yellow Bench Tie set in the northwesterly face of Utility Pole No. 54848 located on the southerly side of the Orange & Rockland Gate Station, approximately 30 feet southerly of the southerly chain link fence . Elevation = 272.95 feet

Site Benchmark No. 3: Yellow Bench Tie set in the southeasterly face of Utility Pole No. 54862 located on the southerly side of the abandoned steel railroad bridge, approximately 40.5 feet easterly of the northeasterly corner of the bridge. Elevation = 274.92 feet

Site Benchmark No. 4: Railroad spike set in the westerly face of Utility Pole No. 54878 located on the easterly side of the entrance to the former Orange & Rockland MGP site, approximately 27 feet easterly of the easterly edge of pavement. Elevation = 275.79 feet

Legend:

- Property Line
- Adjoiners Deed Line
- Interior Deed Line
- Major Contour Line
- Minor Contour Line
- Chainlink Fence
- Wood Fence
- Found Iron (Pipe, Rebar, et cetera)
- Concrete Monument
- Set 5/8-inch Rebar with 1 1/4-inch Diameter Red Plastic Cap Marked "Thew Associates Canton NY"
- Set Mag Nail
- (M) Measured Distance
- (D) Deeded Distance
- Utility Pole
- Utility Pole with Light
- Guy Anchor
- Fire Hydrant
- Water Valve
- Water Shutoff
- Water Manhole
- Gas Valve
- Gas Test Station
- Gas Marker
- Catch Basin
- Sign
- Deciduous Tree
- OHU — Overhead Utilities (Electric, Communications, CATV)
- OHE — Overhead Electric
- GAS — Gas Line
- W — water Line
- COMM — Underground Communications (Telephone, CATV, Fiber)
- Concrete Surface
- RCP — Reinforced Concrete Pipe
- Monitoring Well Location
- Boring Location



U.S.G.S. Quadrangle
Ramsey, New York
No Scale

Reference Drawings:

1. *AutoCAD.DWG mapping designated as 43030X01; DWG provided by representatives of CH2M HILL.*
2. *"Plan of Property to be Acquired From Erie Land and Improvement Company", dated August 21, 1953, prepared by Rockland Light and Power Company - NYACK, N.Y. and is distinguished as Drawing No. N 2 4140.*
3. *"Property Acquired for Suffern Gas Plant", dated December 12, 1961, prepared by Orange and Rockland Utilities.*
4. *Titled "Rockland Light & Power To Erie Railroad Co.", dated April 2, 1954, prepared by Rockland Light and Power Co., NYACK, N.Y. and is distinguished as File No. 751.*
5. *"Boundary Survey, Orange and Rockland Utilities, inc. and Economy-Truck Body and Equipment", dated April 16, 2008, prepared by C.T. Male Associates, P.C.*
6. *"Boundary and Topographic Survey, Orange and Rockland Utilities, Inc., Suffern Gate Station Survey Plan", dated February 6, 2012, prepared by C.T. Male Associates, P.C.*

- SITE BOUNDARY
- ORANGE & ROCKLAND UTILITIES, INC. PROPERTY, OFFSITE AFFECTED AREA
- STATE OF NEW JERSEY AFFECTED AREA

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

FIGURE 2
METES & BOUNDS SURVEY

SCALE: 1" = 40'
DATE: 2/3/2015
PROJECT NUMBER: UK521-11-14

Village of Suffern
County of Rockland
State of New York

REV	DESCRIPTION	DATE

Thew Associates LAND SURVEYORS
www.ThewAssociates.com
P.O. Box 463, 6431 US Highway 11, Canton, New York 13617, T: 315/386-2776, F: 315/386-1012
9478 River Road, Marcy, New York 13403, T: 315/733-7278, F: 315/797-1957

FIGURE 3

To: CREAMER ENVIRONMENTAL to the best of my professional knowledge and belief, this map or plan is the result of a field survey made during 2016 & 2017, by me or under my direct supervision, in accordance with the rules and regulations promulgated by the " State Board of Professional Engineers and Land Surveyors".

The information shown hereon correctly represents the conditions found at, and as of the date of the field survey, except such improvements or easements, if any, below the surface and not visible.

CAUTION:
If this document does not contain a raised impression seal of the professional, it is not an authorized original document and may have been altered.

By: Louis J. Weber Professional Land Surveyor No. 33183

NOTES:
1) HORIZONTAL AND VERTICLE DATUM PROVIDED BY OWNER; CONTROL POINTS RECOVERED AND HELD IN FIELD.

HORIZONTAL
6 7
N 831666.5860 N 831448.1966
E 586487.8493 E 586714.8510
EL. 278.11 EL. 269.90
MNS-6

VERTICLE:SITE BENCHMARK NO. 3
ELEVATION 274.92

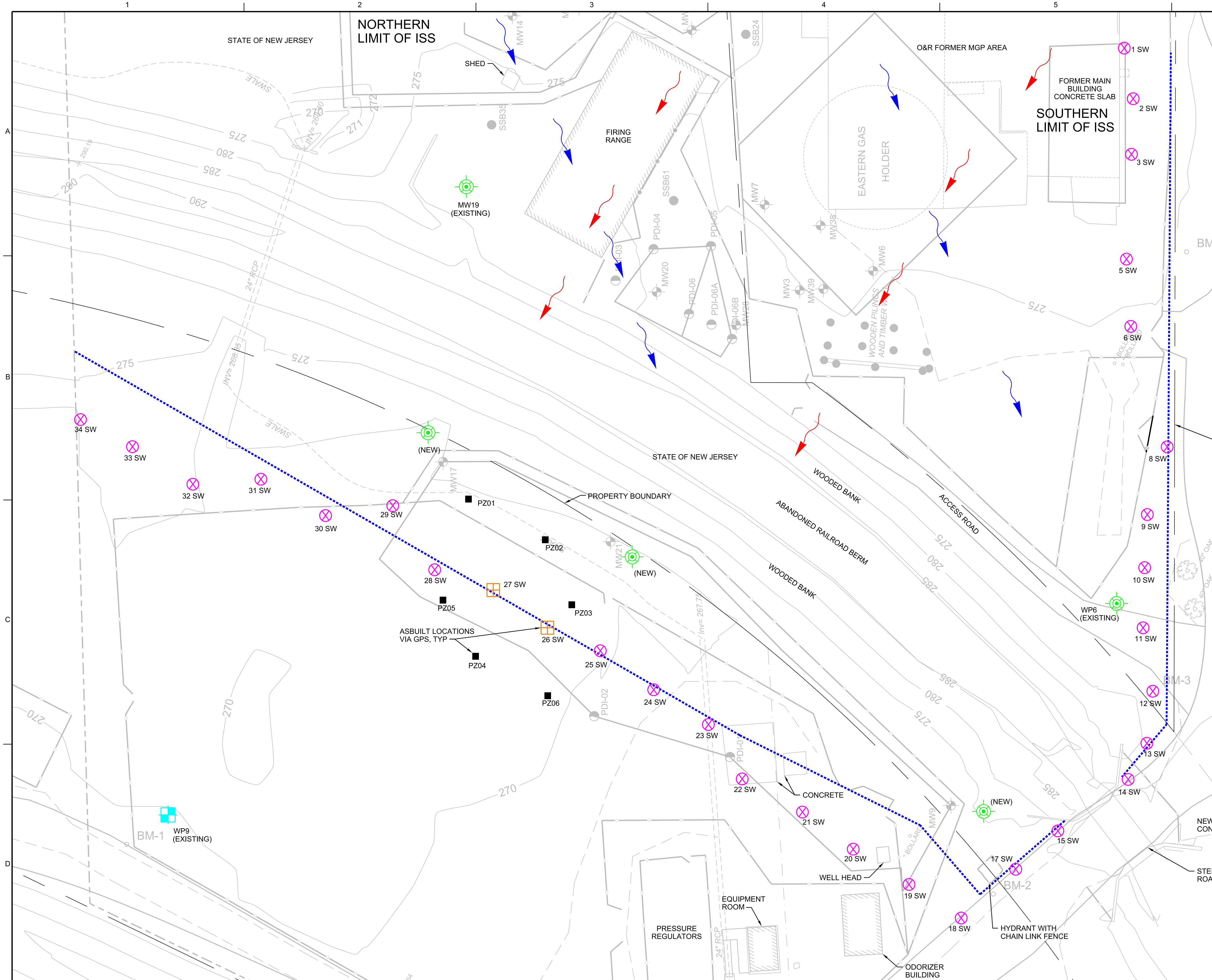
2) LOUIS J WEBER AND ASSOCIATES IS IN AGREEMENT WITH THE EXISTING CONDITIONS SUPPLIED IN REGARD AND LIMITED TO TOPOGRAPHICAL FEATURES AND PHYSICAL ATTRIBUTES VISIBLE AND ABOVE GROUND FOR UNDERGROUND LOCATIONS OF UTILITIES, ONLY OBSERVATIONS TAKEN AT TEST PIT LOCATIONS SHALL BE CONSIDERED AN ACCURATE REPRESENTATION OF THE ACTUAL CONDITIONS. ALL OTHER UNDERGROUND LOCATIONS (ONE CALL MARK OUT) IN WHICH PHYSICAL ATTRIBUTES ARE NOT VISIBLE SHALL BE SUBJECT TO ALL ASSUMPTIONS THAT MAY PREVAIL.

TESTS PITS LABELED WHERE PROVIDED.
UTILITY LOCATIONS PROVIDED BY MARK OUT ONE CALL SYSTEM.

3) LOUIS J WEBER AND ASSOCIATES HAS MADE NO ATTEMPT TO VERIFY TITLE, ACTUAL LEGAL OWNERSHIP, SERVITUDES, EASEMENTS, RIGHT-OF-WAYS, OR OTHER BURDENS ON THE PROPERTY OTHER THAN THAT FURNISHED BY THE CLIENT AND/OR HIS REPRESENTATIVES.

REFERENCES:
1) Cad File Titled : C-600.dwg
Supplied by CH2M HILL Constructors, Inc.
Address: 22 Cortlandt St # 31, New York, NY 10007

DRAWN BY: DW	CHECKED BY: JDG	APPROVED BY	Institutional Control Boundaries and Environmental Control Location
CALC. BY: L.JW		REVISIONS NO. / DATE	SUFFERN FORMER MGP SITE
JOSEPH D. GREENAWAY			SUFFERN, NEW YORK
			PREPARED FOR CREAMER ENVIRONMENTAL, INC. REMEDIATION CONTRACTORS 12 OLD BRIDGE ROAD, CEDAR GROVE, NEW JERSEY 07009
N.Y. PROFESSIONAL LAND SURVEYOR NO. 50311			LOUIS J. WEBER & ASSOCIATES, INC. BOUNDARY & CONSTRUCTION SURVEYING SPARTA, NEW JERSEY 07871-2417 CERTIFICATE OF AUTHORIZATION NO. 24GA27935300 BUS. NO.(973)726-4240 FAX NO.(973)726-4239 EMAIL: mail@webersurveying.com
SCALE 1" =40'	DATE: 10/09/17	REVISION 0	FILE = SUFFERN



NORTHERN LIMIT OF ISS
STATE OF NEW JERSEY
SHED
FIRING RANGE
O&R FORMER MGP AREA
EASTERN GAS HOLDER
FORMER MAIN BUILDING CONCRETE SLAB
SOUTHERN LIMIT OF ISS
MW19 (EXISTING)
1 SW
2 SW
3 SW
5 SW
6 SW
8 SW
9 SW
10 SW
11 SW
12 SW
13 SW
14 SW
15 SW
17 SW
18 SW
19 SW
20 SW
21 SW
22 SW
23 SW
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26 SW
27 SW
28 SW
29 SW
30 SW
31 SW
32 SW
33 SW
34 SW
(NEW)
PZ01
PZ02
PZ03
PZ04
PZ05
PZ06
PROPERTY BOUNDARY
PROJECT AREA BOUNDARY
STATE OF NEW JERSEY
WOODED BANK
ABANDONED RAILROAD BERM
ACCESS ROAD
VILLAGE OF SUFFERN
WP6 (EXISTING)
WP9 (EXISTING)
ASBUILT LOCATIONS VIA GPS, TYP
CONCRETE
WELL HEAD
EQUIPMENT ROOM
PRESSURE REGULATORS
ODORIZER BUILDING
HYDRANT WITH CHAIN LINK FENCE
NEW MULTICHANNEL CONFIRMATION WELL
STEEL RAIL ROAD BRIDGE
PAT MALONE DRIVE
BM-1
BM-2
BM-3
0 20 40 60
SCALE IN FEET

GENERAL SHEET NOTE

1. WELLS 4SW, 7SW AND 16SW WERE NOT INSTALLED.

LEGEND

- SENTINEL WELL
- CONFIRMATION WELL
- OS PIPING - FUTURE
- PILOT STUDY INITIAL WELL
- SPARGE WELL (25' SPACING)
- MULTI-LEVEL PIEZOMETER TO SUPPORT PILOT STUDY (TRIPLE SCREEN) 20-50-75
- SHALLOW GROUNDWATER FLOW DIRECTION
- DEEP GROUNDWATER FLOW DIRECTION

NO.	DATE	REVISION	BY	APVD
2	07-08-2016	AS-BUILT	PAK	KRR
1	03-22-2016	WORK PLAN	PAK	KRR

DSGN: T OLEAN | DR: PA KARABAN | CHK | APVD

SUFFERN FORMER MGP SITE
ORANGE & ROCKLAND UTILITIES, INC.
SUFFERN, NEW YORK

CH2MHILL®

CIVIL

Sparge Well Locations

1"=20'
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.

DATE: MARCH 2016
PROJ: 650199

FIGURE 4

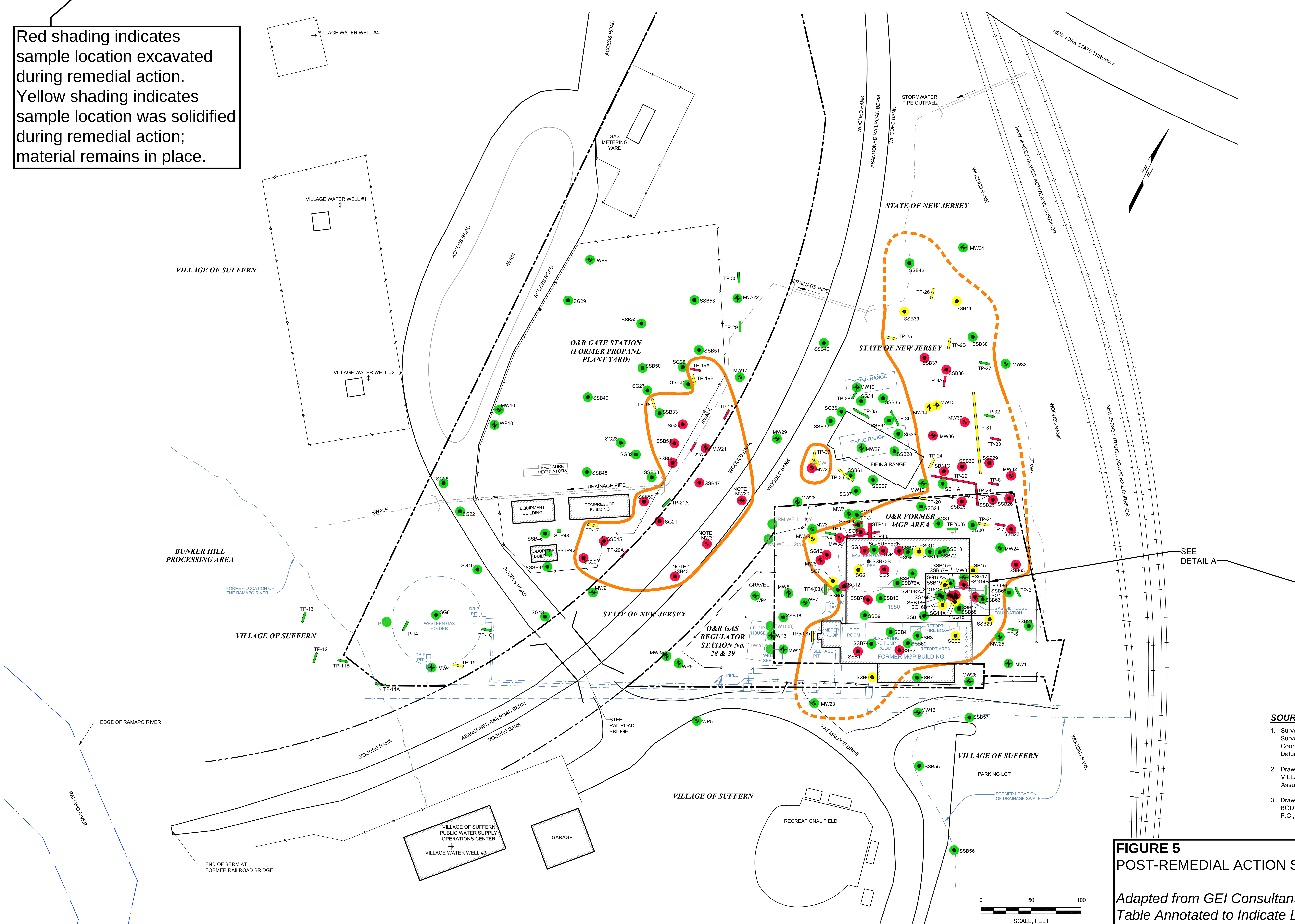
FILENAME: FIG01-03-16-16_650199.dgn
PLOT DATE: 2016\07\08
PLOT TIME: 9:03:42 AM

SAMPLE DESIGNATION	TP04	TP05	TP07	TP08	TP17	TP19	TP21	TP22	TP22A	TP25	TP30	TP36	TP37	TP39	STP42	TP01	TP02	TP03	TP04	TP05	SB01	SB02	SB03	SB04	SB11A
SAMPLE DEPTH (ft bgs)	5	2	11	9	4	3	5	0.5	5	11	9.5	10-12	11-12	11-12	3.5-3.75	4-5	4-5	4-5	4-4.5	7.5-8.0	12-14	10-12	2-4	4-6	14-17
NO EXCEEDENCES OF SCOS	X									X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
EXCEEDENCES OF UNR		X	X	X	X	X	X	X	X														X		
EXCEEDENCES R IND		X	X	X	X			X	X														X		
EXCEEDENCES PGW		X	X	X	X	X	X	X	X														X		
BTEX (mg/Kg)	0.02	ND	17.8	279	ND	0.15	0.01	78.8	1,565	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.04	ND	ND	0.01	ND	ND
TPAH (mg/Kg)	5.10	386.20	1,965	10,160	326.30	4.43	26.99	2,798	16,610	1.36	ND	ND	1.58	ND	0.94	NA	NA	NA	NA	NA	ND	5.39	1,204.20	4.09	ND

SAMPLE DESIGNATION	SB11C	SG15	SG18	SG20	SG28	SG29	SG32	SG33	SG35	SG36	SSB05	SSB06	SSB07	SSB09	SSB15	SSB16	SSB16	SSB19	SSB20	SSB21	SSB27	SSB31	SSB33	SSB37	SSB39
SAMPLE DEPTH (ft bgs)	15-17	10.5-11.5	10.5-11	4-4.5	11-11.5	8-8.5	11.5-12	12-14	14-16	12-14	13-15	14-16	14-16	5-7	8-10	13-15	13-15	10.6-11.2	13-15	14-15	7-8	5-6	5-6	13-14	5-6
NO EXCEEDENCES OF SCOS			X		X	X	X	X	X	X		X	X			X	X		X	X	X	X		X	
EXCEEDENCES OF UNR	X	X		X										X	X			X					X		X
EXCEEDENCES R IND	X			X										X	X			X					X		X
EXCEEDENCES PGW	X	X		X							X			X	X			X					X		X
BTEX (mg/Kg)	0.12	0.62	ND	198	ND	ND	ND	0.02	ND	ND	50.12	ND	ND	3.06	39,000	0.0018	0.0013	1.651	0.0019	ND	ND	ND	ND	ND	ND
TPAH (mg/Kg)	38.84	NA	ND	31,540	ND	ND	ND	4.81	ND	ND	0.98	16.33	ND	2,462	65,140	0.79	0.215	418.5	ND	ND	0.29	1.14	17.47	ND	40.55

SAMPLE DESIGNATION	SSB39	SSB41	SSB42	SSB44	SSB45	SSB46	SSB47	SSB49	SSB50	SSB51	SSB52	SSB53	SSB56	SSB58	SSB59	SSB60	TW01	TW02	MW09	MW10	MW23	MW26	MW27	MW35	MW36
SAMPLE DEPTH (ft bgs)	13-14	7-8	6-7	6-7	14-15	6-8	4-5	8-9	9-10	8-9	7-9	6-7	6-8	2-3	2-3	4-5	10-11	10-11	3-3.3	10-12	8-10	6-8	14-16	9-10	12-13
NO EXCEEDENCES OF SCOS				X	X	X		X	X	X	X	X				X	X	X	X	X	X	X			
EXCEEDENCES OF UNR	X	X	X				X						X	X	X								X	X	X
EXCEEDENCES R IND	X	X	X				X							X	X										X
EXCEEDENCES PGW	X	X	X				X							X	X										X
BTEX (mg/Kg)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.84	1.41	0.01	ND	ND	0.00	ND	0.0016	0.0044	ND	ND	0.02
TPAH (mg/Kg)	22.01	21.78	70.01	0.02	0.65	0.02	760.87	0.41	ND	2.93	0.03	0.15	8.08	19,980	8,030	12.02	NA	NA	NA	ND	0.049	1.854	ND	NA	1,248

Red shading indicates sample location excavated during remedial action. Yellow shading indicates sample location was solidified during remedial action; material remains in place.



LEGEND:

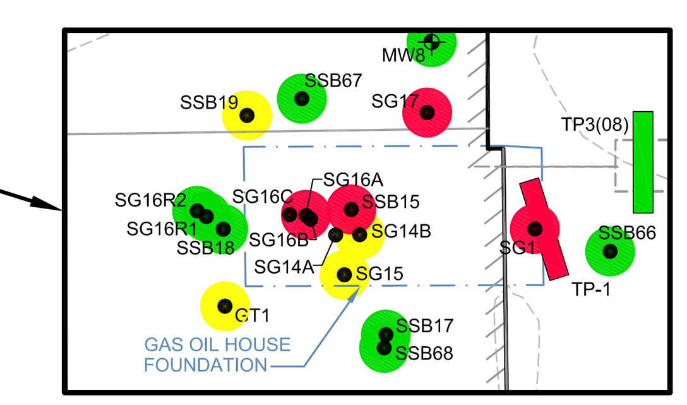
APPROXIMATE PROPERTY BOUNDARY
HISTORIC STRUCTURE
CHAIN-LINK FENCE
SWALE
RAILROAD TRACK
VILLAGE WATER WELL #1 — PUBLIC SUPPLY WELL LOCATION
MW1 — MONITORING WELL LOCATION
TW1(08) — TEMPORARY MONITORING WELL LOCATION
ERM WELL L1, TW1(08) — ABANDONED MONITORING WELL LOCATION
SG1, SSB1 — SOIL BORING LOCATION
TP-1 — TEST PIT LOCATION
NO VISIBLE HYDROCARBON IMPACTS OBSERVED
HYDROCARBON STAIN, SHEEN OR NAPL BLEBS
COAL TAR OR NAPL COATED OR SATURATED SOIL
APPROXIMATE LIMIT OF VOCs AND SVOCs IN CONCENTRATIONS EXCEEDING NYSDEC UNRESTRICTED SCOs
DASHED WHERE INFERRED

NYSDEC	NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
NAPL	NON-AQUEOUS PHASE LIQUID
NA	NOT ANALYZED
ND	NOT DETECTED
mg/kg	milligram per kilogram
BTEX	BENZENE, TOLUENE, ETHLYBENZENE, AND XYLENE
PAHs	POLYCYCLIC AROMATIC HYDROCARBONS
COC	COMPOUNDS OF CONCERN
SCO	SOIL CLEANUP OBJECTIVE
UNR	UNRESTRICTED SCO
R IND	RESTRICTED RESIDENTIAL SCO
PGW	PROTECTION OF GROUNDWATER SCO
VOCs	VOLATILE ORGANIC COMPOUNDS
SVOCs	SEMI-VOLATILE ORGANIC COMPOUNDS

"NYSDEC Rules and Regulations, 6 NYCRR Subpart 375-6, Remedial Program Soil Cleanup Objectives" dated December 14, 2006 [NYSDEC, 2006a].

NOTES:

1. SSB43, MW31, AND MW30 TAR IMPACTED SOIL BENEATH THE RAILROAD BERM OBSERVED AT A SIMILAR ELEVATION AS BORINGS TO THE WEST.
2. SHOWN UTILITY LINES ARE APPROXIMATE; VERIFY IN FIELD.



DETAIL A
1"=20'

SOURCES:

1. Survey of existing conditions and sample locations conducted by GEI Consultants, Inc. in 1999, 2009 and 2010. Survey by New York state licensed land surveyor number 050146. Horizontal Datum: New York State Plane Coordinate System (East Zone, North American Datum (NAD) 83). Vertical Datum: North American Vertical Datum (NAVD) 88.
2. Drawing titled WELL & SAMPLE SURVEY OF THE FORMER SUFFERN MGP SITE, THE RETEC GROUP, INC., VILLAGE OF SUFFERN, survey conducted by Donald Stedge, L.S., P.C. dated 12/10/2002. Horizontal datum: Assumed. Vertical datum: NAVD 88 from NGS benchmark.
3. Drawing titled BOUNDARY SURVEY, ORANGE AND ROCKLAND UTILITIES, INC. AND ECONOMY-TRUCK BODY AND EQUIPMENT, VILLAGE OF SUFFERN-ROCKLAND COUNTY, NEW YORK, by C.T.Male Associates, P.C., Latham, New York dated 2008.

FIGURE 5
POST-REMEDIAL ACTION SUBSURFACE SOIL IMPACTS, 0-15 FT BGS

Adapted from GEI Consultants' October 2010 Map;
Table Annotated to Indicate Locations Removed or Solidified

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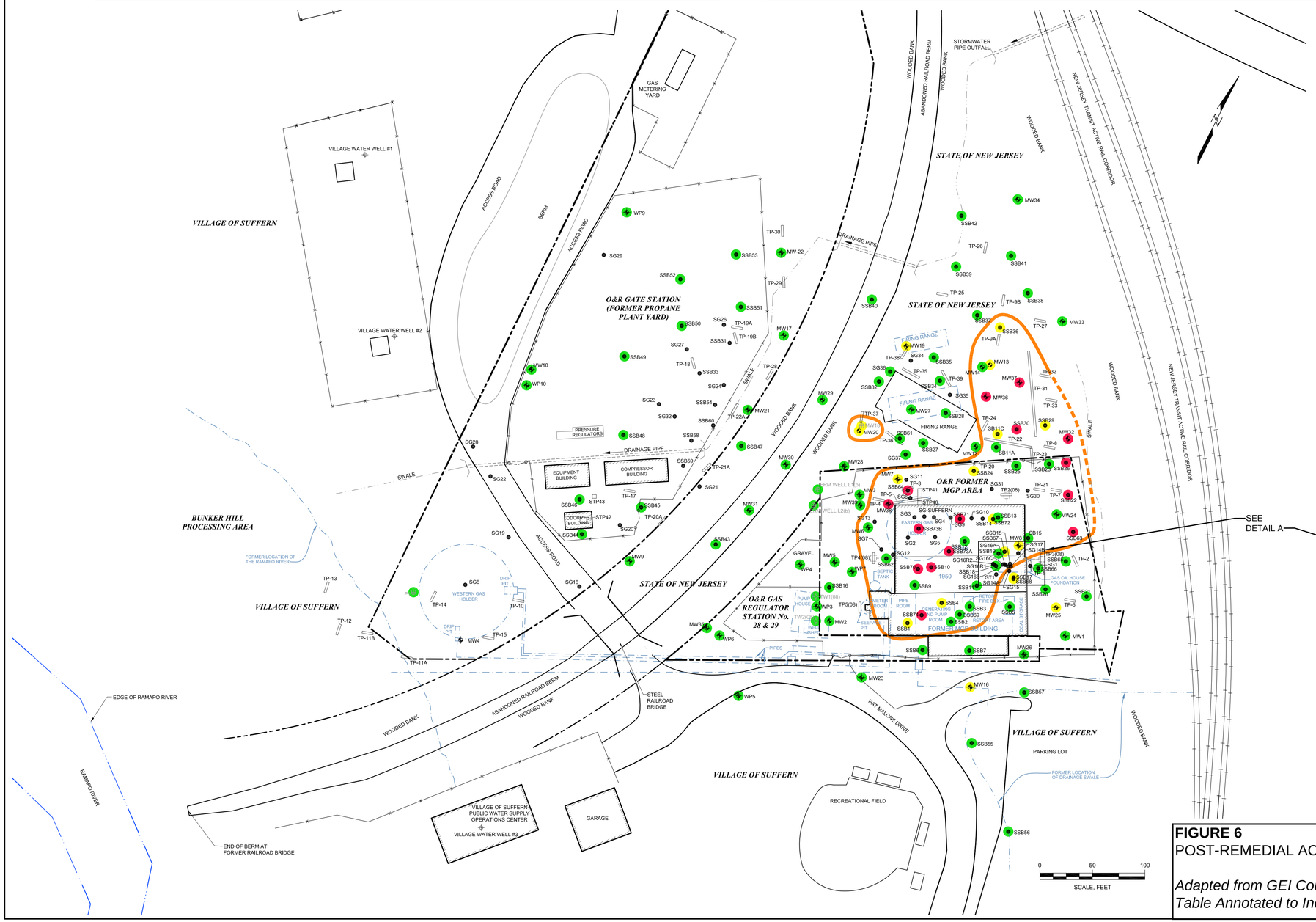
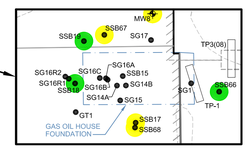
Yellow shading indicates sample locations solidified remedial action; material remains in place

SAMPLE LOCATION	SG34	SG37	SSB01	SSB01	SSB02	SSB02	SSB02	SSB03	SSB04	SSB04	SSB05	SSB06	SSB07	SSB09	SSB10	SSB10	SSB11	SSB11	SSB12	SSB12	SSB13	SSB13	SSB16	SSB17	SSB18	SSB18	SSB19	SSB20	SSB22	SSB23	SSB24	SSB24	SSB25	SSB26	SSB27	SSB28	SSB29	SSB30	SSB30	SSB32	SSB34	SSB35	SSB36	SSB37	SSB38	SSB40	SSB43	SSB43	SSB44	SSB48	SSB55	SSB57	SSB61	SSB62	SSB63	SSB64
SAMPLE DEPTH (ft bgs)	16-18	22-24	15-17	27-29	16-18	16-18	24-25	16-17	19-21	25-27	20-22	22-24	20-22	19-21	17-19	28-29	15-17	22-23	15-17	21-23	15-17	21-23	39-41	15-17	16-17	21-22	17-19	23-24	27-28	25-27	15-17	80-82	18-19	33-35	103-105	27-28	17-18	35-37	94-95	115-117	103-105	28-30	55,5-56,5	99-101	18-19	49-50	20-21	20-21	29-30	19-20	33-35	33-35	15-17	18-20	23-24	97-98
NO EXCEEDENCES OF SCOS	X	X					X				X	X	X				X	X	X	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
EXCEEDENCES OF UNR			X	X	X	X			X	X				X	X																	X												X	X					X			X
EXCEEDENCES OF R IND			X	X	X	X			X					X	X																																					X	X	X
EXCEEDENCES OF PGW			X	X	X	X			X	X				X	X														X			X												X	X					X	X		X
BTEX (mg/Kg)	ND	ND	108,8	ND	0,007	0,038	ND	ND	0,0017	0,0019	ND	ND	ND	ND	2,97	ND	ND	ND	0,0023	0,0013	0,0018	0,0013	0,0023	ND	ND	ND	0,0049	0,0017	0,54	ND	ND	0,01	ND	0,003	ND	ND	0,03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0,16	0,15	ND	ND	0,002	0,02	ND	0,78	0,18	1,43
TPAH (mg/Kg)	ND	ND	1.320,5	1.669	1.242	681,1	0,302	ND	33,63	0,055	ND	0,072	ND	42,77	1.078,6	13,38	ND	ND	ND	0,078	ND	ND	0,172	ND	ND	ND	0,891	ND	47,62	0,30	19,37	ND	29,39	3,24	ND	0,03	8,42	0,07	ND	ND	ND	ND	36,17	0,07	ND	0,02	521,20	509,40	0,17	ND	ND	ND	0,12	68,65	62,98	275,80

SAMPLE LOCATION	SSB65	SSB66	SSB66	SSB67	SSB67	SSB68	SSB68	SSB69	SSB69	SSB70	SSB70	SSB71	SSB71	SSB72	SSB72	SSB73	SSB73	SSB74	SSB74	MW05	MW06	MW07	MW09	MW13	MW13	MW16	MW17	MW18	MW18	MW19	MW19	MW21	MW21	MW22	MW22	MW23	MW26	MW28	MW28	MW29	MW29	MW30	MW31	MW31	MW32	MW32	MW33	MW34	MW35	MW36	MW37	MW38	MW39	TW01	TW02	WP10
SAMPLE DEPTH (ft bgs)	24-25	25-26	74-75	21-22	97-98	24-25	102-103	16-17	109-110	34-35	81-82	65,5-66,5	95-96	16-17	98-99	25-26	93-94	54,5-55	103-104	17-18	18-20	30'-32	16,8-17	16-18	30'-32	33-34	112-114	23-24	114-115	105-107	111,7-112	110-111	114-116	103-105	106-107	38-40	15-16	18-19	36-37	20-21	20-21	20-22	19,5-22,0	19,5-22,0	27-28	49-50	19-20	24-25	17-18	80-83	23-25	99-101	104-106	16-17	18-19	130-131
NO EXCEEDENCES OF SCOS	X	X	X		X	X	X		X		X	X	X	X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X
EXCEEDENCES OF UNR				X				X				X	X				X	X					X					X										X						X	X	X	X				X	X					
EXCEEDENCES OF R IND				X						X		X	X				X	X					X					X																		X	X	X	X								
EXCEEDENCES OF PGW				X						X		X	X				X	X					X					X																		X	X	X	X								
BTEX (mg/Kg)	ND	ND	ND	2,32	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0,23	0,078	ND	ND	ND			0,002	0,04	ND	ND	ND	0,12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0,99	ND	ND	ND	ND	3,72	0,51	0,62	1,21	ND	ND	ND	ND	0,01	0,01	0,79	ND	ND	ND
TPAH (mg/Kg)	ND	0,0235	0,013	408,50	ND	ND	5,259	ND	ND	457,60	ND	140,60	786,10	ND	14,447	108,67	1.555,70	85,90	ND	ND			0,46	8,37	ND	ND	ND	284,50	0,16	ND	NA	ND	ND	ND	ND	ND	ND	1,07	ND	0,03	ND	3,469	4,987	3,659	62,93	0,01	0,34	ND	NA	189,05	196,20	1.405,30	0,01	NA	NA	ND





DETAIL A
1"=20'

LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- HISTORIC STRUCTURE
- CHAIN-LINK FENCE
- SWALE
- RAILROAD TRACK
- VILLAGE WATER WELL #1 — PUBLIC SUPPLY WELL LOCATION
- MW1 — MONITORING WELL LOCATION
- TW1(08) — TEMPORARY MONITORING WELL LOCATION
- ERM WELL L1 / TW1(08) — ABANDONED MONITORING WELL LOCATION
- SG1 / SSB1 — SOIL BORING LOCATION
- TP-1 — TEST PIT LOCATION
- NO VISIBLE HYDROCARBON IMPACTS OBSERVED
- HYDROCARBON STAIN, SHEEN OR NAPL BLEBS
- COAL TAR OR NAPL COATED OR SATURATED SOIL
- APPROXIMATE LIMIT OF VOCs AND SVOCs IN CONCENTRATIONS EXCEEDING NYSDEC UNRESTRICTED SCOs
- DASHED WHERE INFERRED

NYSDEC	NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
NAPL	NON-AQUEOUS PHASE LIQUID
NA	NOT ANALYZED
ND	NOT DETECTED
mg/kg	milligram per kilogram
BTEX	BENZENE, TOLUENE, ETHLYBENZENE, AND XYLENE
PAHs	POLYCYCLIC AROMATIC HYDROCARBONS
COC	COMPOUNDS OF CONCERN
SCO	SOIL CLEANUP OBJECTIVE
UNR	UNRESTRICTED SCO
R IND	RESTRICTED RESIDENTIAL SCO
PGW	PROTECTION OF GROUNDWATER SCO
VOCs	VOLATILE ORGANIC COMPOUNDS
SVOCs	SEMI-VOLATILE ORGANIC COMPOUNDS

"NYSDEC Rules and Regulations, 6 NYCRR Subpart 375-6, Remedial Program Soil Cleanup Objectives" dated December 14, 2006 [NYSDEC, 2006a].

NOTES:

1. SSB43, MW31, AND MW30 TAR IMPACTED SOIL BENEATH THE RAILROAD BERM OBSERVED AT A SIMILAR ELEVATION AS BORINGS TO THE WEST.
2. SHOWN UTILITY LINES ARE APPROXIMATE; VERIFY IN FIELD.

SOURCES:

1. Survey of existing conditions and sample locations conducted by GEI Consultants, Inc. In 1999, 2009 and 2010. Survey by New York state licensed land surveyor number 050146. Horizontal Datum: New York State Plane Coordinate System (East Zone, North American Datum (NAD) 83). Vertical Datum: North American Vertical Datum (NAVD) 88.
2. Drawing titled WELL & SAMPLE SURVEY OF THE FORMER SUFFERN MGP SITE, THE RETEC GROUP, INC., VILLAGE OF SUFFERN, survey conducted by Donald Stedge, L.S., P.C. dated 12/10/2002. Horizontal datum: Assumed. Vertical datum: NAVD 88 from NGS benchmark.
3. Drawing titled BOUNDARY SURVEY, ORANGE AND ROCKLAND UTILITIES, INC. AND ECONOMY-TRUCK BODY AND EQUIPMENT, VILLAGE OF SUFFERN-ROCKLAND COUNTY, NEW YORK, by C.T.Male Associates, P.C., Latham, New York dated 2008.

FIGURE 6
POST-REMEDIAL ACTION SUBSURFACE SOIL IMPACTS, 15-45 FT BGS

Adapted from GEI Consultants' October 2010 Map;
Table Annotated to Indicate Locations Solidified

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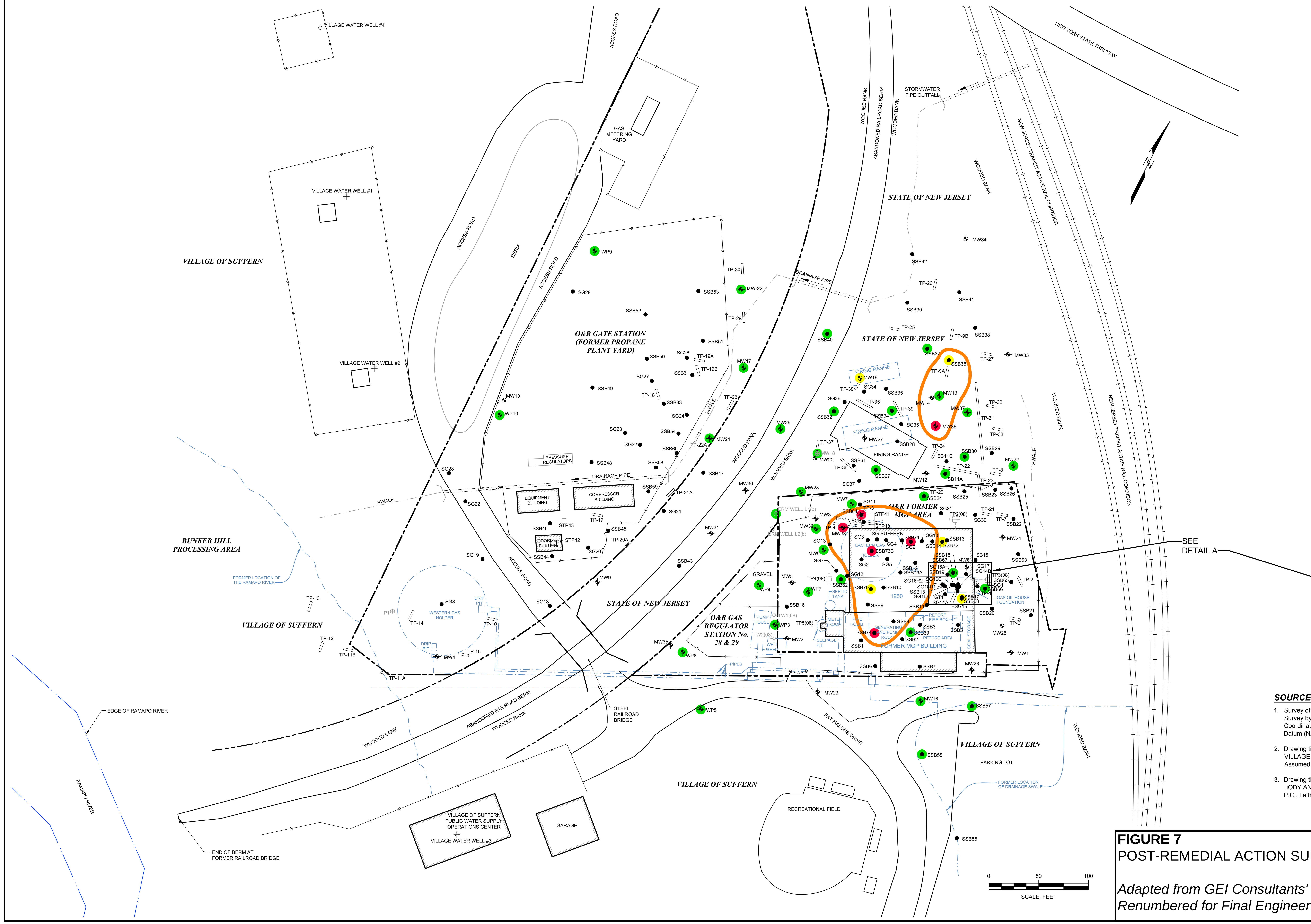
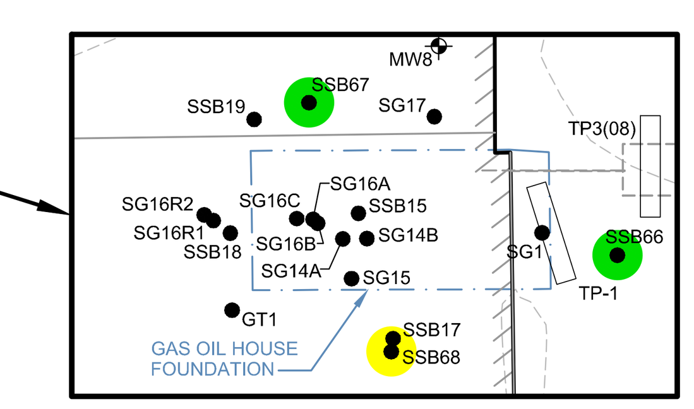
SAMPLE LOCATION	SS□24	SS□27	SS□30	SS□32	SS□34	SS□36	SS□37	SS□40	SS□64	SS□66	SS□67
SAMPLE DEPTH (ft bgs)	80-82	103-105	94-95	115-117	103-105	55.5-56.5	99-101	49-50	97-98	74-75	97-98
NO EXCEEDENCES OF SCOS	X	X	X	X	X		X	X		X	X
EXCEEDENCES OF UNR						X			X		
EXCEEDENCES OF R IND						X			X		
EXCEEDENCES OF PGW						X			X		
BTEX (mg/Kg)	0.01	ND	ND	ND	ND	ND	ND	ND	1.43	ND	ND
TPAH (mg/Kg)	ND	ND	ND	ND	ND	36.17	0.07	0.02	275.80	0.013	ND

SAMPLE LOCATION	SS□68	SS□69	SS□70	SS□71	SS□71	SS□72	SS□73	SS□74	SS□74	MW17	MW18
SAMPLE DEPTH (ft bgs)	102-103	109-110	81-82	65.5-66.5	95-96	98-99	93-94	54.5-55	103-104	112-114	114-115
NO EXCEEDENCES OF SCOS	X	X	X			X			X	X	X
EXCEEDENCES OF UNR				X	X		X	X			
EXCEEDENCES OF R IND				X	X		X	X			
EXCEEDENCES OF PGW				X	X		X	X			
BTEX (mg/Kg)	ND	ND	ND	ND	ND	ND	0.078	ND	ND	ND	ND
TPAH (mg/Kg)	5.259	ND	ND	140.60	798.10	14.447	1,555.70	85.90	ND	ND	0.16

SAMPLE LOCATION	MW19	MW19	MW21	MW21	MW22	MW22	MW32	MW36	MW38	MW39	WP10
SAMPLE DEPTH (ft bgs)	105-107	111.7-112	110-111	114-116	103-105	106-107	49-50	80-83	99-101	104-106	130-131
NO EXCEEDENCES OF SCOS	X	X	X	X	X	X				X	X
EXCEEDENCES OF UNR							X	X	X		
EXCEEDENCES OF R IND								X	X		
EXCEEDENCES OF PGW								X	X		
BTEX (mg/Kg)	ND	ND	ND	ND	ND	ND	ND	0.01	0.79	ND	ND
TPAH (mg/Kg)	ND	NA	ND	ND	ND	ND	0.01	189.05	1,405.30	0.01	ND





DETAIL A
1"=20'

LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- HISTORIC STRUCTURE
- CHAIN-LINK FENCE
- SWALE
- RAILROAD TRACK
- VILLAGE WATER WELL #1 — PUBLIC SUPPLY WELL LOCATION
- MW1 — MONITORING WELL LOCATION
- TW1(08) — TEMPORARY MONITORING WELL LOCATION
- ERM WELL L1 / TW1(08) — ABANDONED MONITORING WELL LOCATION
- SG1 SSB1 — SOIL BORING LOCATION
- TP-1 — TEST PIT LOCATION
- NO VISIBLE HYDROCARBON IMPACTS OBSERVED
- HYDROCARBON STAIN, SHEEN OR NAPL BLEBS
- COAL TAR OR NAPL COATED OR SATURATED SOIL
- APPROXIMATE LIMIT OF VOCs AND SVOCs IN CONCENTRATIONS EXCEEDING NYSDEC UNRESTRICTED SCOs
- DASHED WHERE INFERRED

NYSDEC	NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
NAPL	NON-AQUEOUS PHASE LIQUID
NA	NOT ANALYZED
ND	NOT DETECTED
mg/kg	milligram per kilogram
BTEX	BENZENE, TOLUENE, ETHLYBENZENE, AND XYLENE
PAHs	POLYCYCLIC AROMATIC HYDROCARBONS
COC	COMPOUNDS OF CONCERN
SCO	SOIL CLEANUP OBJECTIVE
UNR	UNRESTRICTED SCO
R IND	RESTRICTED RESIDENTIAL SCO
PGW	PROTECTION OF GROUNDWATER SCO
VOCs	VOLATILE ORGANIC COMPOUNDS
SVOCs	SEMI-VOLATILE ORGANIC COMPOUNDS

"NYSDEC Rules and Regulations, 6 NYCRR Subpart 375-6, Remedial Program Soil Cleanup Objectives" dated December 14, 2006 [NYSDEC, 2006a].

□O□E:

1. SHOWN UTILITY LINES ARE APPRO□IMATE□VERIFY IN FIELD.

SOURCES:

1. Survey of existing conditions and sample locations conducted by GEI Consultants, Inc. in 1999, 2009 and 2010. Survey by New York state licensed land surveyor number 050146. Horizontal Datum: New York State Plane Coordinate System (East Zone, North American Datum (NAD) 83). Vertical Datum: North American Vertical Datum (NAVD) 88.
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3. Drawing titled □OUNDARY SURVEY, ORANGE AND ROCKLAND UTILITIES, INC. AND ECONOMY-TRUCK □ODY AND EQUIPMENT, VILLAGE OF SUFFERN-ROCKLAND COUNTY, NEW YORK, by C.T.Male Associates, P.C., Latham, New York dated 2008.

FIGURE 7

POST-REMEDIAL ACTION SUBSURFACE SOIL IMPACTS, 45+ FT BGS

Adapted from GEI Consultants' October 2010 Map;
Renumbered for Final Engineering Report

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APPENDIX A – LIST OF SITE CONTACTS

Name	Phone/Email Address
Mr. Matthew Levinson – Con Edison	646-385-1691/LevinsonM@coned.com
Mr. John Spellman - NYSDEC DER Project Manager	518-402-9686/john.spellman@dec.ny.gov
Mr. Anthony Perretta – NYSDOH Ms. Maureen Schuck – NYSDOH	518-402-7860/ BEEI@health.ny.gov
Mr. Dan Miller – Rockland County Department of Health	845-364-2289/millerd@co.rockland.ny.us Environmental Health Office Main 845-364-2608
Mr. Charles Sawicki – Village of Suffern Department of Public Works	845-357-2602/csawicki@suffernvillage.com

APPENDIX B – EXCAVATION WORK PLAN (EWP)

B-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination or breach or alter the site's cover system, the site owner or their representative will notify the NYSDEC. Table B-1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix A.

Table B-1: Notifications*

Mr. John Spellman - NYSDEC DER Project Manager	518-402-9686/john.spellman@dec.ny.gov

* Note: Notifications are subject to change and will be updated as necessary.

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated modifications of truck routes, and any work that may impact an engineering control;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work and submittals (e.g., reports) to the NYSDEC documenting the completed intrusive work;

- A summary of the applicable components of this EWP, 29 CFR 1910.120 and 29 CFR 1926 Subpart P;
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;
- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP submitted previously to the NYSDEC.
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with the required request to import form (Appendix B-1) and supporting documentation including, but not limited to, all required chemical testing results.

The NYSDEC project manager will review the notification and may impose additional requirements for the excavation that are not listed in this EWP. The alteration, restoration and modification of engineering controls must conform with Article 145 Section 7209 of the Education Law regarding the application professional seals and alterations.

B-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a qualified environmental professional during all excavations into known or potentially contaminated material (remaining contamination) or a breach of the cover system. A qualified environmental professional as defined in 6 NYCRR Part 375, a PE who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State will perform the screening. Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to

determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil.

B-3 SOIL STAGING METHODS

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

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

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

B-4 MATERIALS EXCAVATION AND LOAD-OUT

A qualified environmental professional as defined in 6 NYCRR Part 375, a PE who is licensed and registered in New York State, or person who directly reports to a PE who is licensed and registered in New York State will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and remedial party (if applicable) and its contractors are responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site. A utility stakeout will be completed prior to ground intrusive activities.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements). Trucks transporting contaminated soil must have either tight-fitting opaque covers that are secured on the sides and/or back, or opaque covers that are locked on all sides.

A truck wash will be operated on-site, as appropriate. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials. Material accumulated from the street cleaning and egress cleaning activities will be disposed off-site at a permitted landfill facility in accordance with all applicable local, State, and Federal regulations.

B-5 MATERIALS TRANSPORT OFF-SITE

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded. Material transported by trucks exiting the site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

Truck transport route is shown in Figure B-1. All trucks loaded with site materials will exit the vicinity of the site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport; [(g) community input where necessary.

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

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

Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

B-6 MATERIALS DISPOSAL OFF-SITE

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

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

Non-hazardous historic fill and contaminated soils taken off-site will be handled consistent with 6 NYCRR Parts 360, 361, 362, 363, 364 and 365, as a Municipal Solid Waste per 6NYCRR Part 360-1.2 at minimum. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State C&D debris recovery facility (6NYCRR Part 360-15 registered or permitted Facility).

B-7 MATERIALS REUSE ON-SITE

The qualified environmental professional, as defined in 6 NYCRR Part 375, will ensure that procedures defined for materials reuse in this SMP are followed and that

unacceptable material does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover system, within landscaping berms. Contaminated on-site material may only be used beneath the site cover or as backfill for subsurface utility lines with prior approval from the DEC project manager.

Proposed materials for reuse on-site must be sampled for full suite analytical parameters including per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane. The sampling frequency will be in accordance with DER-10 Table 5.4(e)10 unless prior approval is obtained from the NYSDEC project manager for modification of the sampling frequency. The analytical results of soil/fill material testing must meet the site use criteria presented in NYSDEC DER-10 Appendix 5 – Allowable Constituent Levels for Imported Fill or Soil for all constituents listed, and the NYSDEC Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances [November 2022 or date of current version, whichever is later] guidance values. Approvals for modifications to the analytical parameters must be obtained from the NYSDEC project manager prior to the sampling event.

Soil/fill material for reuse on-site will be segregated and staged as described in Sections B-2 and B-3 of this EWP. The anticipated size and location of stockpiles will be provided in the 15-day notification to the NYSDEC project manager. Stockpile locations will be based on the location of site excavation activities and proximity to nearby site features. Material reuse on-site will comply with requirements of NYSDEC DER-10 Section 5.4(e)4. Any modifications to the requirements of DER-10 Section 5.4(e)4 must be approved by the NYSDEC project manager.

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

B-8 FLUIDS MANAGEMENT

All liquids to be removed from the site, including but not limited to, excavation dewatering, decontamination waters and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the site, and will be managed off-site at a permitted facility, unless prior approval is obtained from NYSDEC.

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

B-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the RDWP and Record of Decision. For areas of the site owned by O&R, the existing site cover consist either of the structures such as buildings, pavement, sidewalks comprising the site development, or a soil cover of a minimum of 1 foot of soil meeting the SCOs for cover material as set forth in 6 NYCRR Part 375-6.7(d) for commercial use. The soil cover was placed over a demarcation layer, with the upper 6 inches of soil of sufficient quality to maintain a vegetation layer. Where the soil cover was required over the onsite ISS treatment area, it consisted of a minimum of 4 feet of soil meeting the SCOs for commercial use.

For areas of the site owned by the State of New Jersey, backfill over the ISS treatment area consist of a minimum of 4 feet of soil. The upper 2 feet meet the SCOs for unrestricted use as set forth in 6 NYCRR Part 375. Below this layer, existing soil on the State of New Jersey-owned property that meets the SCOs for commercial and groundwater protection was used for backfill.

The demarcation layer, consisting of orange snow fencing material, white geotextile or equivalent material, etc. will be replaced to provide a visual reference to the top of the remaining contamination zone, the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this SMP. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of

the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP. The alteration, restoration and modification of engineering controls must conform with Article 145 Section 7209 of the Education Law regarding the application professional seals and alterations.

B-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional, as defined in 6 NYCRR Part 375, and will be in compliance with provisions in this SMP prior to receipt at the site. A Request to Import/Reuse Fill or Soil form, which can be found at http://www.dec.ny.gov/regulations/67386.html, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review. A copy of the form is presented in Attachment B-1

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

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d) and DER-10 Appendix 5 for commercial use. Based on an evaluation of the land use, protection of groundwater and protection of ecological resources criteria, the resulting soil quality standards are listed in 6NYCRR 375-6.7(d) and DER-10 Appendix 5. Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Soil material will be sampled for the full suite of analytical parameters, including PFAS and 1, 4-dioxane. Solid waste will not be imported onto the site.

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

B-11 STORMWATER POLLUTION PREVENTION

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at

the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

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

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

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

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

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

B-12 EXCAVATION CONTINGENCY PLAN

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

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; TCL volatiles and semi-volatiles [including 1,4-dioxane], TCL pesticides, PCBs, and PFAS), unless the site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling. Tanks will be closed as per NYSDEC regulations and guidance, if encountered.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone within two

hours to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

B-13 COMMUNITY AIR MONITORING PLAN

The CAMP for the Remedial Action was developed by AECOM and previously submitted and approved by NYSDEC. Future excavation activities, if needed, would be performed in accordance with the CAMP; however, portable or fixed monitoring equipment could be used depending on the extent and duration of the work.

B-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the remedial party's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

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

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

B-15 DUST CONTROL PLAN

Particulate monitoring must be conducted according to the Community Air Monitoring Plan (CAMP) provided in Section B-13. If particulate levels at the site exceed the thresholds listed in the CAMP or if airborne dust is observed on the site or leaving the site, the dust suppression techniques listed below will be employed. The remedial party will also take measures listed below to prevent dust production on the site.

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

1. Dust suppression will be achieved though the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
2. Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
3. Gravel will be used on roadways to provide a clean and dust-free road surface.
4. On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

Field generation of contaminated or uncontaminated dust and mobilization of volatile organic compounds may be reduced by new and traditional Best Management Practices (BMPs) such as:

- Covering excavated areas with biodegradable fabric that also can control erosion and serve as a substrate for favorable ecosystems, or with synthetic material that can be reused for other onsite or offsite purposes;
- Spraying water in vulnerable areas, in conjunction with water conservation and runoff management techniques;

- Securing and covering material in open trucks while hauling excavated material, and reusing the covers;
- Revegetating excavated areas as quickly as possible; and
- Limiting onsite vehicle speeds to 10 miles per hour.

Other approaches can be implemented with the approval of NYSDEC's Project Manager.

B-16 OTHER NUISANCES

A plan for rodent control will be developed and utilized by the contractor prior to and during site clearing and site grubbing, and during all remedial work.

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinances.

GENERAL SHEET NOTE

1. TRUCKS WILL BE REQUIRED TO ENTER AND EXIT THE SITE USING ONLY THE SPECIFIED ROUTE TO REMOVE IMPACTED MATERIAL FROM THE SITE, TRANSPORT CLEAN BACKFILL ONTO THE SITE, AND DELIVER/ REMOVE EQUIPMENT AND SUPPLIES. WHEN DEPARTING THE SITE, TRUCKS WILL USE THE FOLLOWING ROUTE:

   - TRUCKS WILL EXIT THE SITE ONTO RAMAPO AVENUE
   - STAY RIGHT ON RAMAPO AVENUE
   - RIGHT ON US-202S
   - LEFT TURN ONTO NJ-17S

   TRUCKS RETURNING TO THE SITE WILL FOLLOW THE ABOVE TRAFFIC PATTERN IN REVERSE.

IMAGE ©2015 DIGITAL GLOBE ©2015 GOOGLE EARTH

PLAN
NTS

FIGURE B-1

NO.	DATE	REVISION	BY	APVD
DSGN	SA MAIHOFER	DR PA KARABAN	CHK EA MCKENNA	APVD KR ROSEBROOK

SUFFERN FORMER MGP SITE
ORANGE & ROCKLAND UTILITIES, INC.
SUFFERN, NEW YORK

CH2MHILL®

CIVIL
Truck Transport Route

DRAFT 100% DESIGN

NOT TO SCALE
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	AUGUST 2015
PROJ	650199
DWG	C-300
Figure	B-1

FILENAME: C-300.dgn PLOT DATE: 8/7/2015 PLOT TIME: 12:23:14 PM

Attachment B-1

Request to Import Form

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Request to Import/Reuse Fill or Soil

This form is based on the information required by DER-10, Section 5.4(e) and 6NYCRR Part 360.13. Use of this form is not a substitute for reading the applicable regulations and Technical Guidance document.

SECTION 1 – SITE BACKGROUND

The allowable site use is: Choose an item

Have Ecological Resources been identified? Choose an item

Is this soil originating from the site? Choose an item

How many cubic yards of soil will be imported/reused? Choose an item

If greater than 1000 cubic yards will be imported, enter volume to be imported:

SECTION 2 – MATERIAL OTHER THAN SOIL

Is the material to be imported gravel, rock or stone? Choose an item

Does it contain less than 10%, by weight, material that passes a size 100 sieve? Choose an item

Is this virgin material from a permitted mine or quarry? Choose an item

Is this material recycled concrete or brick from a DEC registered processing facility? Choose an item

SECTION 3 - SAMPLING

Provide a brief description of the number and type of samples collected in the space below:

Example Text: 5 discrete samples were collected and analyzed for VOCs. 2 composite samples were collected and analyzed for SVOCs, Inorganics & PCBs/Pesticides.

If the material meets requirements of DER-10 section 5.4(e)5 (other material), no chemical testing needed.

SECTION 3 CONT'D - SAMPLING

Provide a brief written summary of the sampling results or attach evaluation tables (compare to DER-10, Appendix 5):

Example Text: Arsenic was detected up to 17 ppm in 1 (of 5) samples; the allowable level is 16 ppm.

If Ecological Resources have been identified use the "If Ecological Resources are Present" column in Appendix 5.

SECTION 4 – SOURCE OF FILL

Name of person providing fill and relationship to the source:

Location where fill was obtained:

Identification of any state or local approvals as a fill source:

If no approvals are available, provide a brief history of the use of the property that is the fill source:

Provide a list of supporting documentation included with this request:

The information provided on this form is accurate and complete.

_____ _____

Signature Date

_____

Print Name

_____

Firm

Revised April 2023

APPENDIX C
RESPONSIBILITIES of OWNER and REMEDIAL PARTY

Responsibilities

The responsibilities for implementing the Site Management Plan ("SMP") for the OR – Suffern MGP site (the "site"), number 344045, are divided between the site owner(s) and a Remedial Party, as defined below. The owner(s) is/are currently listed as:

Orange and Rockland Utilities, Inc. (the "owner").

Solely for the purposes of this document and based upon the facts related to a particular site and the remedial program being carried out, the term Remedial Party ("RP") refers to any of the following: certificate of completion holder, volunteer, applicant, responsible party, and, in the event the New York State Department of Environmental Conservation ("NYSDEC") is carrying out remediation or site management, the NYSDEC and/or an agent acting on its behalf. The RP is:

Orange and Rockland Utilities, Inc.

Nothing on this page shall supersede the provisions of an Environmental Easement, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the site.

Site Owner's Responsibilities:

1.0 The owner shall follow the provisions of the SMP as they relate to future construction and excavation at the site.

2.0 In accordance with a periodic time frame determined by the NYSDEC, the owner shall periodically certify, in writing, that all Institutional Controls set forth in a(n) Environmental Easement remain in place and continue to be complied with. The owner shall provide a written certification to the RP, upon the RP's request, in order to allow the RP to include the certification in the site's Periodic Review Report (PRR) certification to the NYSDEC.

3.0 In the event the site is delisted, the owner remains bound by the Environmental Easement and shall submit, upon request by the NYSDEC, a written certification that the Environmental Easement is still in place and has been complied with.

4.0 The owner shall grant access to the site to the RP and the NYSDEC and its agents for the purposes of performing activities required under the SMP and assuring compliance with the SMP.

5.0 The owner is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components or vandalism is evident, the owner shall notify the site's RP and the NYSDEC in accordance with the timeframes indicated in Section 1.3-Notifications.

6.0 In the event some action or inaction by the owner adversely impacts the site, the owner must notify the site's RP and the NYSDEC in accordance with the time frame indicated in Section 1.3- Notifications and (ii) coordinate the performance of necessary corrective actions with the RP.

7.0 The owner must notify the RP and the NYSDEC of any change in ownership of the site property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the site properties. 6 NYCRR Part contains notification requirements applicable to any construction or activity changes and changes in ownership. Among the notification requirements is the following: Sixty days prior written notification must be made to the NYSDEC. Notification is to be submitted to the NYSDEC Division of Environmental Remediation's Site Control Section. Notification requirements for a change in use are detailed in Section 2.4 of the SMP. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html.

8.0 In accordance with the tenant notification law, within 15 days of receipt, the owner must supply a copy of any vapor intrusion data, that is produced with respect to structures and that exceeds NYSDOH or OSHA guidelines on the site, whether produced by the NYSDEC, RP, or owner, to the tenants on the property. The owner must otherwise comply with the

tenant and occupant notification provisions of Environmental Conservation Law Article 27, Title 24.

Remedial Party Responsibilities

- The RP must follow the SMP provisions regarding any construction and/or excavation it undertakes at the site.
- The RP shall report to the NYSDEC all activities required for remediation, operation, maintenance, monitoring, and reporting. Such reporting includes, but is not limited to, periodic review reports and certifications, electronic data deliverables, corrective action work plans and reports, and updated SMPs.
- Before accessing the site property to undertake a specific activity, the RP shall provide the owner advance notification that shall include an explanation of the work expected to be completed. The RP shall provide to (i) the owner, upon the owner's request, (ii) the NYSDEC, and (iii) other entities, if required by the SMP, a copy of any data generated during the site visit and/or any final report produced.
- If the NYSDEC determines that an update of the SMP is necessary, the RP shall update the SMP and obtain final approval from the NYSDEC. Within 5 business days after NYSDEC approval, the RP shall submit a copy of the approved SMP to the owner(s).
- The RP shall notify the NYSDEC and the owner of any changes in RP ownership and/or control and of any changes in the party/entity responsible for the operation, maintenance, and monitoring of and reporting with respect to any remedial system (Engineering Controls). The RP shall provide contact information for the new party/entity. Such activity constitutes a Change of Use pursuant to 375-1.11(d) and requires 60-days prior notice to NYSDEC. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html .
- The RP shall notify the NYSDEC of any damage to or modification of the systems as required under Section 1.3- Notifications of the SMP.

- Prior to a change in use that impacts the remedial system or requirements and/or responsibilities for implementing the SMP, the RP shall submit to the NYSDEC for approval an amended SMP.
- Any change in use, change in ownership, change in site classification (*e.g.*, delisting), reduction or expansion of remediation, and other significant changes related to the site may result in a change in responsibilities and, therefore, necessitate an update to the SMP and/or updated legal documents. The RP shall contact the Department to discuss the need to update such documents.

Change in RP ownership and/or control and/or site ownership does not affect the RP's obligations with respect to the site unless a legally binding document executed by the NYSDEC releases the RP of its obligations.

Future site owners and RPs and their successors and assigns are required to carry out the activities set forth above.

APPENDIX D – GROUNDWATER MONITORING PLAN

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Remediation, Remedial Bureau C
625 Broadway, 11th Floor, Albany, NY 12233-7014
P: (518) 402-9662 I F: (518) 402-9679
www.dec.ny.gov

November 8, 2017

Maribeth McCormick
Technical Manager – Environmental Services
Orange & Rockland Utilities, Inc.
3 Old Chester Road
Goshen, NY 10924

RE: Suffern Former MGP Site, Suffern, Rockland Co.
Site No. 344045
Post Remedial Quarterly Groundwater Monitoring

Dear Ms. McCormick:

Thank you and James Edwards for GEI Consultant's October 13, 2017 Work Plan for groundwater monitoring at the Suffern Former MGP Site. The Work Plan is approved.

Please provide the schedule for field activity.

Sincerely,

John Spellman, P.E.
Project Manager
Division of Environmental Remediation

ec: James Edwards

GEI Consultants

October 13, 2017

Consulting
Engineers and
Scientists

Mr. John Spellman, P.E.
Division of Environmental Remediation
New York State Department of Environmental Conservation
625 Broadway
Albany, NY 12233-7014

Re: Proposed Scope of Work
Post-Remedial Quarterly Groundwater Monitoring
Suffern Former MGP Site
NYSDEC Site # 3-44-045

Dear Mr. Spellman:

This work plan has been prepared by GEI Consultants, Inc., P.C. (GEI) for Orange and Rockland Utilities, Inc. (O&R) to present a proposed scope of work for post-remedial quarterly groundwater monitoring at the former manufactured gas plant (MGP) site in Suffern, New York.

Background

The final tasks for the implementation of the remedy for the Suffern MGP site were completed in late July 2017. The first post-remedial quarterly groundwater monitoring event was performed in early August 2017 (3rd Quarter 2017 Event). A report for the quarterly event (dated August 25, 2017) was submitted to the New York State Department of Environmental Conservation (NYSDEC).

The NYSDEC and the New York State Department of Health (NYSDOH) have required that quarterly monitoring continue at the site following implementation of the remedy. A proposed scope for the event planned for November 2017 (4th Quarter 2017) event is described below. The scope of work described below for some site wells has been modified from the scope included in the 2016 Groundwater Monitoring Work Plan (GMWP) [NRT, 2016]. The proposed modifications are based on a review of the 2016/2017 Bi-Weekly and Quarterly groundwater results, and are anticipated to more completely evaluate groundwater quality at locations between the remedial area and the adjacent, downgradient Village of Suffern municipal water extraction wells.

The post-remedial groundwater scope of work described in this work plan may be further modified, if necessary, during preparation and NYSDEC approval of the Site Management Plan (SMP) for the Suffern MGP site.

Proposed Quarterly Field Monitoring Activities

Monitoring Well Elevation Gauging

Seventeen monitoring wells installed at the site will continue to be gauged to map the direction of groundwater flow. The direction of groundwater flow for the shallow and deeper portions of the aquifer will continue to be mapped for each event.

GEI Consultants, Inc., P.C.
1301 Trumansburg Road, Suite N, Ithaca, New York 14850
607.216.8955 fax: 607.274.7577

NAPL Monitoring

The seventeen wells remaining at the site will continue to be gauged for the presence or absence of non-aqueous phase liquids (NAPLs). Gauging will be performed for both light non-aqueous phase liquid (LNAPL), and dense non-aqueous phase liquid (DNAPL).

Village of Suffern Well Pumping Data

The Village of Suffern Water Department will be contacted for each event. Well pumping data and extraction rates for the Village water extraction wells will continue to be provided in the quarterly reports.

Groundwater Sampling and Analyses

The monitoring wells and multi-channel well ports proposed for post-remedial monitoring are shown in Figure 1. The wells and CMT ports to be sampled are identified in Table 1. Included in the table are the well designations, the analyses to be performed (VOCs, SVOCs, and/or total cyanide). Also included in the table are the sampling rationales for each well or CMT port.

The samples will continue to be sent to a certified laboratory which will perform analyses under the NYSDOH Environmental Laboratory Approval Program (ELAP). The methods used for the analyses, and the quality control measures performed, will continue to be consistent with the specifications provided in the NYSDEC Analytical Services Protocol (ASP).

Schedule

The next sampling event planned for the site (4th Quarter event) is targeted for November 2017. The NYSDEC will be notified of the proposed dates within the notification period specified by the Department.

If the proposed scope of work described above is acceptable, please provide approval for the proposed plan. If you have any questions regarding the proposed scope of work for the sampling, please do not hesitate to contact me at (607) 216-8958. Please direct the Department's official response to Maribeth McCormick of O&R.

Sincerely,

GEI CONSULTANTS, INC., P.C.

James Edwards, P.G.
Geologist/Project Manager

JHE:amm

Attachments: Table 1 – Post-Remedial Quarterly Groundwater Sampling Plan
Figure 1 – Post-Remedial Quarterly Monitoring Plan

c: Maribeth McCormick – Orange and Rockland Utilities, Inc.
Anthony Perretta – NYSDOH
Maureen Schuck – NYSDOH

Table

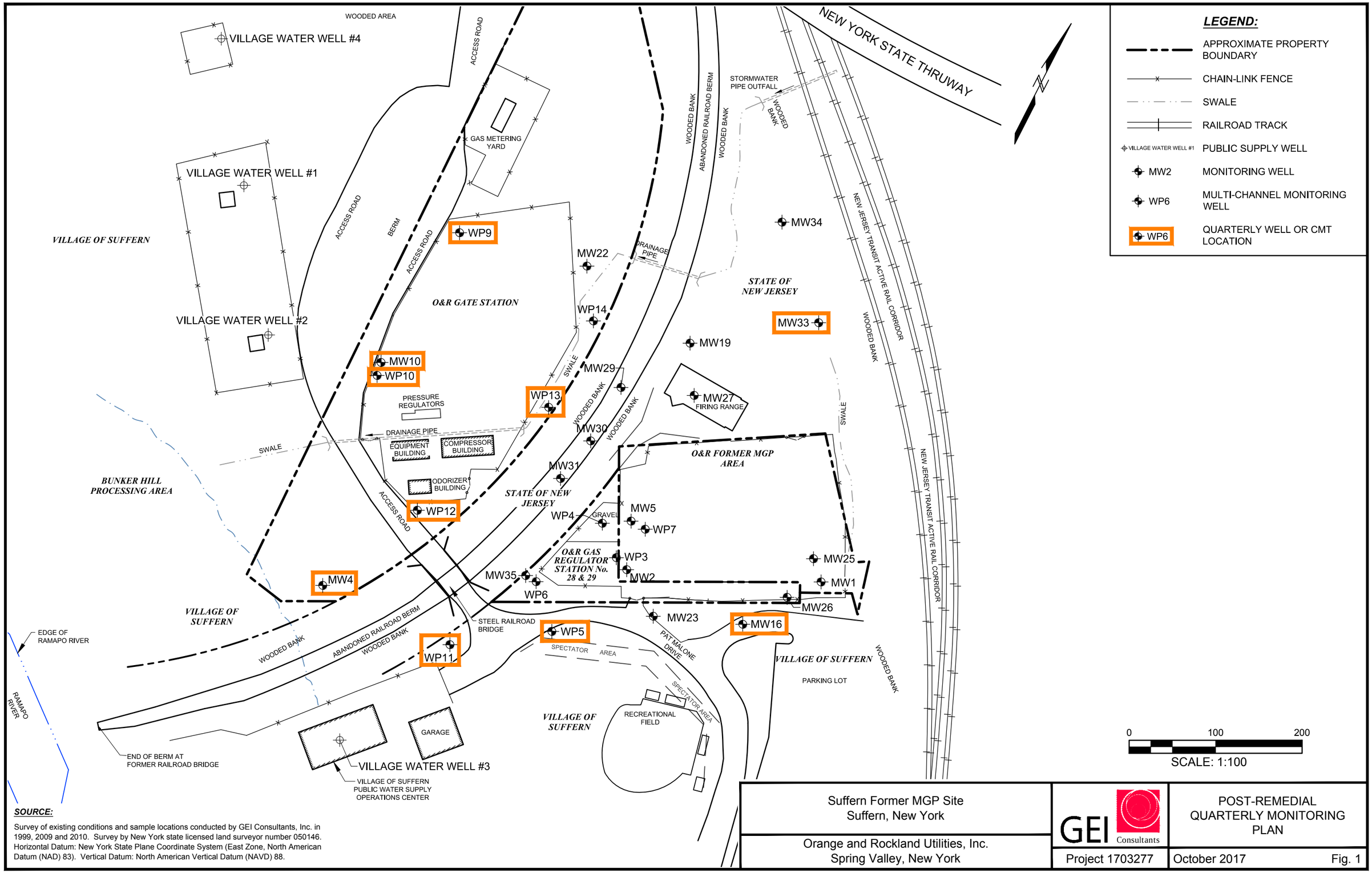
Table 1. Post-Remedial Quarterly Groundwater Sampling Plan
Suffern MGP Site

Well or CMT	VOC	SVOC	Total Cyanide	Rationale
MW4			X	Sentinel Well. Down gradient concentrations of total cyanide.
MW10	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at location between remedial area and Village Well # 2. MW10 will monitor groundwater quality at the water table, and the WP10 ports will monitor deeper groundwater quality at this location.
MW16	X	X	X	Deep Zone up gradient groundwater quality. VOCs, SVOCs, and total cyanide.
MW33	X	X	X	Shallow Zone up gradient groundwater quality. VOCs, SVOCs, and total cyanide.
WP5(19)	X	X	X	Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, SVOCs, and total cyanide. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP5(32)	X	X	X	Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, SVOCs, and total cyanide. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP5(45)	X	X		Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, and SVOCs. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP5(58)	X	X		Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, and SVOCs. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP5(71)	X	X		Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, and SVOCs. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP5(84)	X	X		Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, and SVOCs. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP5(97)	X	X		Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, and SVOCs. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP9(12)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at a location between remedial area and Village Well # 4.
WP9(29.5)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at a location between remedial area and Village Well # 4.
WP9(47)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 4.
WP9(64.5)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 4.
WP9(82)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 4.
WP9(99.5)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 4.
WP9(117)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 4.
WP10(32)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at a location between remedial area and Village Well # 2. This port and MW10 will monitor the shallow groundwater zone for total cyanide.
WP10(49)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 2.
WP10(66)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 2.
WP10(83)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 2.
WP10(100)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 2.
WP10(117)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 2.

Table 1. Post-Remedial Quarterly Groundwater Sampling Plan
Suffern MGP Site

Well or CMT	VOC	SVOC	Total Cyanide	Rationale
WP10(134)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 2.
WP11(12)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at location between remedial area and Village Well # 3.
WP11(27)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at location between remedial area and Village Well # 3.
WP11(43)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at location between remedial area and Village Well # 3.
WP11(58)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at location between remedial area and Village Well # 3.
WP11(73)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at location between remedial area and Village Well # 3.
WP11(88)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at location between remedial area and Village Well # 3.
WP11(104)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at location between remedial area and Village Well # 3.
WP12(12)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at a location between remedial area and Village Wells # 2 and # 3.
WP12(34)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at a location between remedial area and Village Wells # 2 and # 3.
WP12(54)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Wells # 2 and # 3.
WP12(74)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Wells # 2 and # 3.
WP12(94)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Wells # 2 and # 3.
WP12(114)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Wells # 2 and # 3.
WP12(134)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Wells # 2 and # 3.
WP13(12)	X	X	X	Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, SVOCs, and total cyanide.
WP13(29)	X	X	X	Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, SVOCs, and total cyanide.
WP13(47)	X	X		Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, and SVOCs.
WP13(64)	X	X		Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, and SVOCs.
WP13(82)	X	X		Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, and SVOCs.
WP13(99)	X	X		Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, and SVOCs.
WP13(117)	X	X		Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, and SVOCs.
Trip Blank (Date)	X			QA / QC
Trip Blank (Date)	X			QA / QC
Trip Blank (Date)	X			QA / QC

Figure



SOURCE:

Survey of existing conditions and sample locations conducted by GEI Consultants, Inc. in 1999, 2009 and 2010. Survey by New York state licensed land surveyor number 050146. Horizontal Datum: New York State Plane Coordinate System (East Zone, North American Datum (NAD) 83). Vertical Datum: North American Vertical Datum (NAVD) 88.

Suffern Former MGP Site
Suffern, New York

Orange and Rockland Utilities, Inc.
Spring Valley, New York

GEI Consultants

POST-REMEDIAL QUARTERLY MONITORING PLAN

Project 1703277 | October 2017 | Fig. 1

\\gtb1v-fs01\ I:\Project\ORANGE & ROCKLAND\Suffern\Quarterly GW\Suffern-Post-Remd.dwg - 8/25/2017

APPENDIX E – ENVIRONMENTAL EASEMENTS

E1. 71 Brook Avenue Parcel

E2. 3 Pat Malone Parcel

Donna Gorman Silberman, Act Cnty Clk
1 South Main St., Ste. 100
New City, NY 10956
(845) 638-5070

Rockland County Clerk Recording Cover Sheet

Received From :
KENSINGTON-VANGUARD NATIONAL LAND
39 WEST 37TH STREET
7TH FLOOR
NEW YORK, NY 10018

Return To :
KENSINGTON-VANGUARD NATIONAL LAND
39 WEST 37TH STREET
7TH FLOOR
NEW YORK, NY 10018

Method Returned : ERECORDING

First GRANTOR
ORANGE & ROCKLAND UTILITIES

First GRANTEE
NYS DEPT OF ENVIRONMENTAL CONSERVATION

Index Type : Land Records

Instr Number : 2020-00018900

Book : **Page :**

Type of Instrument : Easement
Type of Transaction : Ease, R-Way, Asmt Rent-Lease
Recording Fee: $116.00
Recording Pages : 14

The Property affected by this instrument is situated in Ramapo, in the County of Rockland, New York

Real Estate Transfer Tax	
RETT # :	5977
Deed Amount :	$0.00
RETT Amount :	$0.00
Total Fees :	$116.00

State of New York

County of Rockland

I hereby certify that the within and foregoing was recorded in the Clerk's office for Rockland County, New York

On (Recorded Date) : 07/09/2020

At (Recorded Time) : 2:43:00 PM

Donna Gorman Silberman
Act Cnty Clk

This sheet constitutes the Clerks endorsement required by Section 319 of Real Property Law of the State of New York

Entered By: NYROCKLANDUSER15 Printed On : 07/09/2020 At : 2:47:41PM

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this 16th day of June, 2020, between Owner(s) Orange and Rockland Utilities, Inc., having an office at 1 Blue Hill Plaza, Pearl River, New York 10965 , County of Rockland, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee"), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 71 Brook Avenue in the Village of Suffern, County of Rockland and State of New York, known and designated on the tax map of the County Clerk of Rockland as tax map parcel number: Section 54.34 Block 1 Lot 2, being the same as that property conveyed to Grantor by the following two deeds:

A deed dated July 1, 1954 and recorded in the Rockland County Clerk's Office in Liber and Page 585/199.

A deed dated December 31, 1952 and recorded in the Rockland County Clerk's Office in Liber and Page 553/75.

The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 4.007 +/- acres, and is hereinafter more fully described in the Land Title Survey dated October 31, 2018 and last revised on February 6, 2020 prepared by Joseph D. Greenaway P.L.S, which will be attached to the Site Management Plan. The Controlled Property

description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Order on Consent Index Number: D3-0001-98-03 and D3-0001-99-01, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement").

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Rockland County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.

B. The Controlled Property shall not be used for Residential or Restricted Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i) and (ii), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the Environmental Conservation Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5) the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: 344045
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway

Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

11. Consistency with the SMP. To the extent there is any conflict or inconsistency between the terms of this Environmental Easement and the SMP, regarding matters specifically addressed by the SMP, the terms of the SMP will control.

Remainder of Page Intentionally Left Blank

IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

Orange and Rockland Utilities, Inc:

By: Laurie Silberfeld

Print Name: Laurie Silberfeld

Title: Director, Real Estate Date: 6/1/2020

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF Nassau)

On the 1st day of June, in the year 20 20, before me, the undersigned, personally appeared Laurie Silberfeld, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

Notary Public - State of New York

MICHAEL S. DAVI
Notary Public, State of New York
No. 01DA6314221
Qualified in Nassau County
Commission Expires Nov. 3, 2022

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting by and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: _____
Michael J. Ryan, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the 16th day of June, in the year 2021 before me, the undersigned, personally appeared Michael J. Ryan, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

_____
Notary Public - State of New York

JENNIFER ANDALORO
Notary Public, State of New York
No. 02AN6098246
Qualified in Albany County
Commission Expires January 14, 2024

SCHEDULE "A" PROPERTY DESCRIPTION

Environmental Easement
To Be Acquired By
New York Statement Department of Environmental Conservation
From Orange & Rockland Utilities, Inc.
Parcel No. 1(a) and 1(b)
Contains: 3.653 and 0.354 acres

All that tract or parcel of land situate in the Village of Suffern, Town of Ramapo, County of Rockland, State of New York, and being more precisely described as follows:

Beginning at a 5/8-inch rebar with a 1 1/4-inch diameter red plastic cap marked "Thew Associates – Canton NY" (hereinafter referred to as a 5/8-inch rebar) set on the southerly line of a parcel of land conveyed by the County of Rockland to Michael Stewart by deed dated June 5, 1997 and recorded in the Rockland County Clerk's Office on June 5, 1997 as Instrument No. 1997-21480, said rebar having New York State plane coordinates (NAD83/2011 – East Zone) of 832,118.69 feet North and 586,459.26 feet East;

thence North 66 degrees 23 minutes 55 seconds East, along the southerly line of Michael Stewart, a distance of 124.45 feet to a 5/8-inch rebar set on the westerly line of a parcel of land conveyed by the Consolidated Rail Corporation to the State of New Jersey by deed dated March 31, 1979 and recorded in the Rockland County Clerk's Office on May 5, 1983 in Liber 6741 of Deeds at Page 682;

thence along the westerly line of the State of New Jersey, the following three courses and distances:

1. South 39 degrees 49 minutes 05 seconds East a distance of 132.33 feet to a set 5/8-inch rebar;

2. along a curve deflecting to the right, non-tangent to the previous course, having a central angle of 34 degrees 52 minutes 33 seconds and a radius of 714.49 feet, an arc distance of 434.91 feet to a set 5/8-inch rebar (chord: South 04 degrees 31 minutes 15 seconds East, 428.23 feet);

3. continuing along a curve deflecting to the right, having a central angle of 21 degrees 54 minutes 06 seconds and a radius of 714.49 feet, an arc distance of 273.12 feet to a 5/8-inch rebar set at an angle point on the easterly line of a parcel of land conveyed by Erie Land and Improvement Company to the Village of Suffern by deed dated July 26, 1957 and recorded in the Rockland County Clerk's Office on August 19, 1957 in Liber 654 of Deeds at Page 240 (chord: South 23 degrees 52 minutes 05 seconds West, 271.46 feet);

thence along the easterly line of the Village of Suffern, the following four courses and distances:

1. South 63 degrees 19 minutes 55 seconds West a distance of 68.86 feet to a set 5/8-inch rebar;

2. North 79 degrees 10 minutes 05 seconds West a distance of 50.00 feet to a set 5/8-inch rebar;

3. North 01 degrees 05 minutes 05 seconds West a distance of 138.40 feet to a set 5/8-inch rebar;

4. North 00 degrees 53 minutes 05 seconds West a distance of 610.16 feet to the **Point of Beginning.**

To contain 3.653 acres of land, more or less, as surveyed by Jeremy L. Sweeney, Licensed Land Surveyor No. 050863.

Also all that tract or parcel of land situate in the Village of Suffern, Town of Ramapo, County of Rockland, State of New York, and being more precisely described as follows:

Beginning at a 5/8-inch rebar with a 1 1/4-inch diameter red plastic cap marked "Thew Associates – Canton NY" (hereinafter referred to as a 5/8-inch rebar) set on the northerly line of a parcel of land conveyed by Stern & Stern, LLC to the Village of Suffern by deed dated July 30, 2010 and recorded in the Rockland County Clerk's Office on October 12, 2010 as Instrument No. 2010-37130, said rebar having New York State plane coordinates (NAD83/2011 – East Zone) of 831,630.61 feet North and 587,057.56 feet East;

thence South 63 degrees 19 minutes 55 seconds West, along the northerly line of the Village of Suffern, a distance of 357.83 feet to a 5/8-inch rebar set on the easterly line of a parcel of land conveyed by the Consolidated Rail Corporation to the State of New Jersey by deed dated March 31, 1979 and recorded in the Rockland County Clerk's Office on May 5, 1983 in Liber 6741 of Deeds at Page 682;

thence along a curve deflecting to the left, non-tangent to the previous course, having a central angle of 15 degrees 04 minutes 07 seconds and a radius of 814.49 feet, an arc distance of 214.21 feet to a 5/8-inch rebar (0.5 feet below grade) found on the westerly line of a parcel of land conveyed by Econo Truck Body and Equipment, Inc. to Orange and Rockland Utilities, Inc. by deed dated December 12, 2008 and recorded in the Rockland County Clerk's Office on December 19, 2008 as Instrument No. 2008-54413 (chord: North 17 degrees 12 minutes 01 seconds East, 213.59 feet);

thence along the westerly and southerly lines of Orange and Rockland Utilities, Inc., the following three courses and distances:

1. South 26 degrees 38 minutes 46 seconds East a distance of 129.90 feet to a point;

2. North 63 degrees 21 minutes 14 seconds East a distance of 210.00 feet to a point;

3. South 26 degrees 20 minutes 39 seconds East a distance of 24.00 feet to the **Point of Beginning**, said course passing over a 5/8-inch rebar set at 12.00 feet.

To contain 0.354 acres of land, more or less, as surveyed by Jeremy L. Sweeney, Licensed Land Surveyor No. 050863.

The above described parcels of land are intended to be the same premises conveyed by Erie Land and Improvement Company to Rockland Light and Power Company by deed dated July 1, 1954 and recorded in the Rockland County Clerk's Office on August 9, 1954 in Liber 585 of Deeds at Page 199, and deed dated December 31, 1952 and recorded in the Rockland County Clerk's Office on December 31, 1952 in Liber 553 of Deeds at page 75.

The above mentioned coordinates, bearings, and distances are referenced to the North American Datum of 1983, 2011 adjustment (NAD83/2011), and projected on the New York State Plane Coordinate System (East Zone).

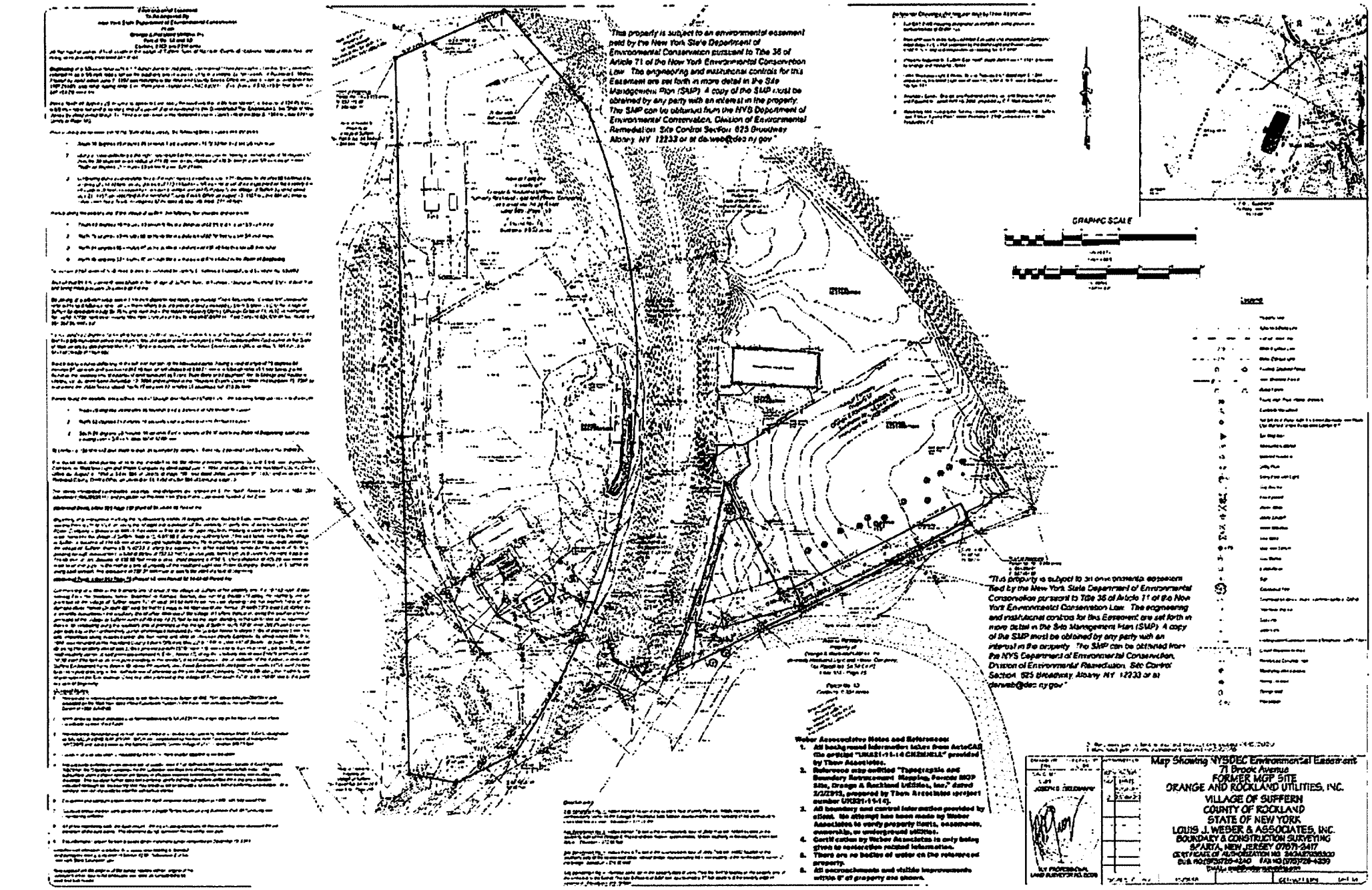
Historical Deed: Liber 585 Page 199 (Part of 54.34-01-02 Parcel 1(a))

Beginning at a monument marking the northwesterly corner of property of the Rockland Light and Power Company, and running thence (1) N 1°27' W along the straight line extension of the westerly property line of said Rockland Light and Power Company a distance of 610.16 feet more or less to an iron pipe reputedly marking a point in the northerly line of lands owned by the Village of Suffern; thence (2) N 65°50' E along the northerly line of the said lands owned by the Village of Suffern a distance of 124.45 feet to an iron pipe reputedly marking the northeasterly corner of the said lands owned by the Village of Suffern; thence (3) S 40°23' E along the easterly line of the said lands owned by the Village of Suffern, passing through a monument, a total distance of 132.33 feet to an iron pipe; thence (4) on a curve to the right (radius of 714.49 feet, an arc distance of 436.06 feet more or less, chord bearing S 4°55'E, chord distance of 429.29 feet more or less) to an iron pipe, in the northerly line of property of the Rockland Light and Power Company; thence (5) S 58°56' W along said northerly line a distance of 257.37 feet more or less to the point or place of beginning.

Historical Deed: Liber 553 Page 75 (Parcel 1(b) and part of 54.34-01-02 Parcel 1(a))

Commencing at a point in the northerly line of lands of the Village of Suffern in the westerly line of a 16 foot right of way running from the premises herein described to Ramapo Avenue, and running thence (1) along the northerly line of premises of the Village of Suffern south 74°30' west 341.94 feet to an iron pipe standing near the easterly bank of the Ramapo River; thence (2) north 68° west 50 feet to a point in the Ramapo River; thence (3) north 10°5' east 138.40 feet to a concrete monument in the southerly line of other premises of the Village of Suffern; thence (4) along the southerly line of premises of the Village of Suffern north 70°40' east 72.25 feet to an iron pipe standing in the center line of an easement; thence (5) continuing along the southerly line of premises of the Village of Suffern north 70°40' east 298.75 feet to an iron pipe standing in the northwesterly corner of premises conveyed by the Grantor herein to Meyer Entin and Bessie Entin, his wife, copartners doing business under the firm name and style of Tfenclark Realty Company, by deed dated May 21st, 1946, and recorded in the Rockland County Clerk's Office on May 22, 1946 in Liber 447 of Deeds, at page 119; thence (6) along the westerly line of said Entin's premises south 15°30' east 156 feet more or less to an iron pipe standing in the southwesterly corner of said premises conveyed to Entin; thence (7) along the southerly line of said Entin's premises north 74°30' east 210 feet to an iron pipe standing in the westerly line of premises now or formerly of the Catherine Henrietta Suffern Endowment Fund; thence (8) along the westerly line of said Endowment Fund's premises south 14°35' east 24 feet to an iron pipe

standing in the northerly line of premises of the Erie Railroad Company; thence (9) along the northerly line of premises of the Erie Railroad Company and premises of the Village of Suffern south 74°30' west 258.06 feet to the point or place of beginning.


"This property is subject to an environmental easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the New York Environmental Conservation Law. The engineering and institutional controls for this Easement are set forth in more detail in the Site Management Plan (SMP). A copy of the SMP must be obtained by any party with an interest in the property. The SMP can be obtained from the NYS Department of Environmental Conservation, Division of Environmental Remediation, Site Control Section, 625 Broadway, Albany, NY 12233 or at derweb@dec.ny.gov."
GRAPHIC SCALE
LEGEND
"This property is subject to an environmental easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the New York Environmental Conservation Law. The engineering and institutional controls for this Easement are set forth in more detail in the Site Management Plan (SMP). A copy of the SMP must be obtained by any party with an interest in the property. The SMP can be obtained from the NYS Department of Environmental Conservation, Division of Environmental Remediation, Site Control Section, 625 Broadway, Albany, NY 12233 or at derweb@dec.ny.gov"
Weber Associates Notes and References:
1. All bearing record information taken from AutoCAD file entitled "LINA21-11-14 CHENIELL" provided by Theer Associates.
2. Reference was entitled "Topographic and Boundary Retracement Mapping, Former MGP Site, Orange & Rockland Utilities, Inc." dated 2/22/2013, prepared by Theer Associates project number LIN221-11-14.
3. All boundary and control information provided by others. No attempt has been made by Weber Associates to verify property lines, easements, ownership, or underground utilities.
4. Certification by Weber Associates is only being given to representation related information.
5. There are no bodies of water on the referenced property.
6. All encroachments and visible improvements within 5' of property are shown.
Map Showing NYSDEC Environmental Easement
71 Brook Avenue
FORMER MGP SITE
ORANGE AND ROCKLAND UTILITIES, INC.
VILLAGE OF SUFFERN
COUNTY OF ROCKLAND
STATE OF NEW YORK
LOUIS J. WEBER & ASSOCIATES, INC.
BOUNDARY & CONSTRUCTION SURVEYING
SPARTA, NEW JERSEY 07871-2417

Donna Gorman Silberman, Act Cnty Clk
1 South Main St., Ste. 100
New City, NY 10956
(845) 638-5070

Rockland County Clerk Recording Cover Sheet

Received From :
KENSINGTON-VANGUARD NATIONAL LAND
39 WEST 37TH STREET
7TH FLOOR
NEW YORK, NY 10018

Return To :
KENSINGTON-VANGUARD NATIONAL LAND
39 WEST 37TH STREET
7TH FLOOR
NEW YORK, NY 10018

Method Returned : ERECORDING

First GRANTOR
ORANGE & ROCKLAND UTILITIES

First GRANTEE
NYS DEPT OF ENVIRONMENTAL CONSERVATION

Index Type : Land Records

Instr Number : 2020-00018901

Book : **Page :**

Type of Instrument : Easement
Type of Transaction : Ease, R-Way, Asmt Rent-Lease

Recording Fee:	$111.00
Recording Pages :	13

The Property affected by this instrument is situated in Ramapo, in the County of Rockland, New York

Real Estate Transfer Tax	
RETT # :	5978
Deed Amount :	$0.00
RETT Amount :	$0.00
Total Fees :	$111.00

State of New York

County of Rockland

I hereby certify that the within and foregoing was recorded in the Clerk's office for Rockland County, New York

On (Recorded Date) : 07/09/2020

At (Recorded Time) : 2:47:00 PM

Donna Gorman Silberman
Act Cnty Clk

This sheet constitutes the Clerks endorsement required by Section 319 of Real Property Law of the State of New York

Entered By: NYROCKLANDUSER15 Printed On : 07/09/2020 At : 2:47:44PM

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this 16th day of June, 2020 between Owner(s) Orange and Rockland Utilities, Inc., having an office at 1 Blue Hill Plaza, Pearl River, New York 10965 , County of Rockland, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee"), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 3 Pat Malone Drive in the Village of Suffern, County of Rockland and State of New York, known and designated on the tax map of the County Clerk of Rockland as tax map parcel number: Section 54.34 Block 1 Lot 4, being the same as that property conveyed to Grantor by deed dated December 12, 2008 and recorded in the Rockland County Clerk's Office in Instrument No. 2008-00054413. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 1.008 +/- acres, and is hereinafter more fully described in the Land Title Survey dated October 31, 2018 and last revised on February 6, 2020 prepared by Joseph D. Greenaway P.L.S, which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is

extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Order on Consent Index Number: D3-0001-98-03 and D3-0001-99-01, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement").

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Rockland County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining

contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.

B. The Controlled Property shall not be used for Residential or Restricted Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i) and (ii), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation

pursuant to Title 36 of Article 71 of the Environmental Conservation Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5) the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: 344045
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and

communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

11. Consistency with the SMP. To the extent there is any conflict or inconsistency between the terms of this Environmental Easement and the SMP, regarding matters specifically addressed by the SMP, the terms of the SMP will control.

Remainder of Page Intentionally Left Blank

IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

Orange and Rockland Utilities, Inc:

By: _____

Print Name: Laurie Silberfeld

Title: Director, Real Estate Date: 6/1/2020

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF Nassau)

On the 1st day of June, in the year 20 20 before me, the undersigned, personally appeared Laurie Silberfeld, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

_____
Notary Public - State of New York

MICHAEL S. DAVI
Notary Public, State of New York
No. 01DA8314221
Qualified in Nassau County
Commission Expires Nov. 3, 2022

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting by and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: _____
Michael J. Ryan, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the 16th day of June, in the year 2020 before me, the undersigned, personally appeared Michael J. Ryan, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

_____
Notary Public - State of New York

JENNIFER ANDALORO
Notary Public, State of New York
No. 02AN6098246
Qualified in Albany County
Commission Expires January 14, 2024

SCHEDULE "A" PROPERTY DESCRIPTION

Environmental Easement
To Be Acquired By
New York Statement Department of Environmental Conservation
From Orange & Rockland Utilities, Inc.
Parcel No. 2
Contains: 1.008 acres

All that tract or parcel of land situate in the Village of Suffern, County of Rockland, State of New York, and being more precisely described as follows:

Beginning at a 5/8-inch rebar with a 1 1/4-inch diameter yellow plastic cap marked "Donald R. Stedge LSPC (0.1 feet below grade) found on the easterly line of a parcel of land conveyed by Stern & Stern, LLC to the Village of Suffern by deed dated July 30, 2010 and recorded in the Rockland County Clerks Office on October 12, 2010 as Instrument No. 2010-37130, said rebar having New York State plane coordinates (NAD83/2011 – East Zone) of 831,649.99 feet North and 587,122.56 feet East;

thence along the northerly lines of the Village of Suffern, the following two courses and distances:

1. North 42 degrees 23 minutes 07 seconds West a distance of 24.77 feet to a found 5/8-inch rebar with a 1 1/4 –inch diameter yellow plastic cap marked "Donald R. Stedge LSPC" (flush with grade);

2. South 63 degrees 20 minutes 49 seconds West a distance of 60.00 feet to a 5/8-inch with a 1 1/4-inch diameter red plastic cap marked "Thew Associates – Canton NY" (hereinafter referred to as a 5/8-inch rebar) set on the easterly line of a parcel of land conveyed by Erie Land and Improvement Company to Rockland Light and Power Company be deed dated July 1, 1954 and recorded in the Rockland County Clerk's Office on August 9, 1954 in Liber 585 of Deeds at Page 199

thence along the easterly and northerly lines of the Rockland Light and Power Company, the following three courses and distances:

1. North 26 degrees 20 minutes 39 seconds West a distance of 12.00 feet to a point;

2. South 63 degrees 21 minutes 14 seconds West a distance of 210.00 feet to a point;

3. North 26 degrees 38 minutes 46 seconds West a distance of 156.00 feet to a 1-inch iron pipe (0.3 feet below grade) found on the easterly line of a parcel of land conveyed by Consolidated Rail Corporation to the State of New Jersey by deed dated March 31, 1979 and recorded in the Rockland County Clerk's Office on May 5, 1983 in Liber 6741 of Deeds at Page 682, said course passing over a 5/8-inch rebar (0.5 feet below grade) found at a distance of 129.90 feet;

thence along the northerly and easterly lines of the State of New Jersey, the following four courses and distances:

1. North 59 degrees 22 minutes 29 seconds East a distance of 239.00 feet to a set 5/8-inch rebar;

2. South 39 degrees 42 minutes 01 seconds East a distance of 152.70 feet to a found 1-inch iron pipe (extends 0.1 feet above grade);

3. North 58 degrees 29 minutes 46 seconds East a distance of 17.05 feet to a found 5/8-inch rebar with a 1 1/4-inch diameter yellow plastic cap marked "Donald R. Stedge LSPC" (flush with grade);

4. South 14 degrees 24 minutes 55 seconds East a distance of 62.53 feet to the **Point of Beginning**.

To contain 1.008 acres of land, more or less, as surveyed by Jeremy L. Sweeney, Licensed Land Surveyor No. 050863.

The above described parcel of land is intended to be the same premises conveyed by Econo Truck Body and Equipment, Inc. to Orange and Rockland Utilities, Inc. by deed dated December 12, 2008 and recorded in the Rockland County Clerk's Office on December 19, 2008 as Instrument No. 2008-54413.

The above mentioned coordinates, bearings, and distances are referenced to the North American Datum of 1983, 2011 adjustment (NAD83/2011), and projected on the New York State Plan Coordinate System (East Zone).

Historic Deed: Instrument No. 2008-00054413

All that certain plot, piece or parcel of land situate in the Village of Suffern, Town of Ramapo, County of Rockland, State of New York, being more particularly bounded and described as follows:

Commencing at a point on the corner formed by the intersection of the easterly side of Orange Avenue with the southerly side of Lafayette Avenue;

Running thence from said point, North 19 degrees 50 minutes West, 82.68 feet;

Thence North 70 degrees 10 minutes East, 207.63 feet to the point or place of beginning;

Running thence South 03 degrees 10 minutes 20 seconds East, 62.50 feet;

Thence North 30 degrees 56 minutes 00 seconds West, 24.84 feet;

Thence South 75 degrees 07 minutes 00 seconds West, 60.00 feet;

Thence North 14 degrees 35 minutes 00 seconds West, 12.00 feet;

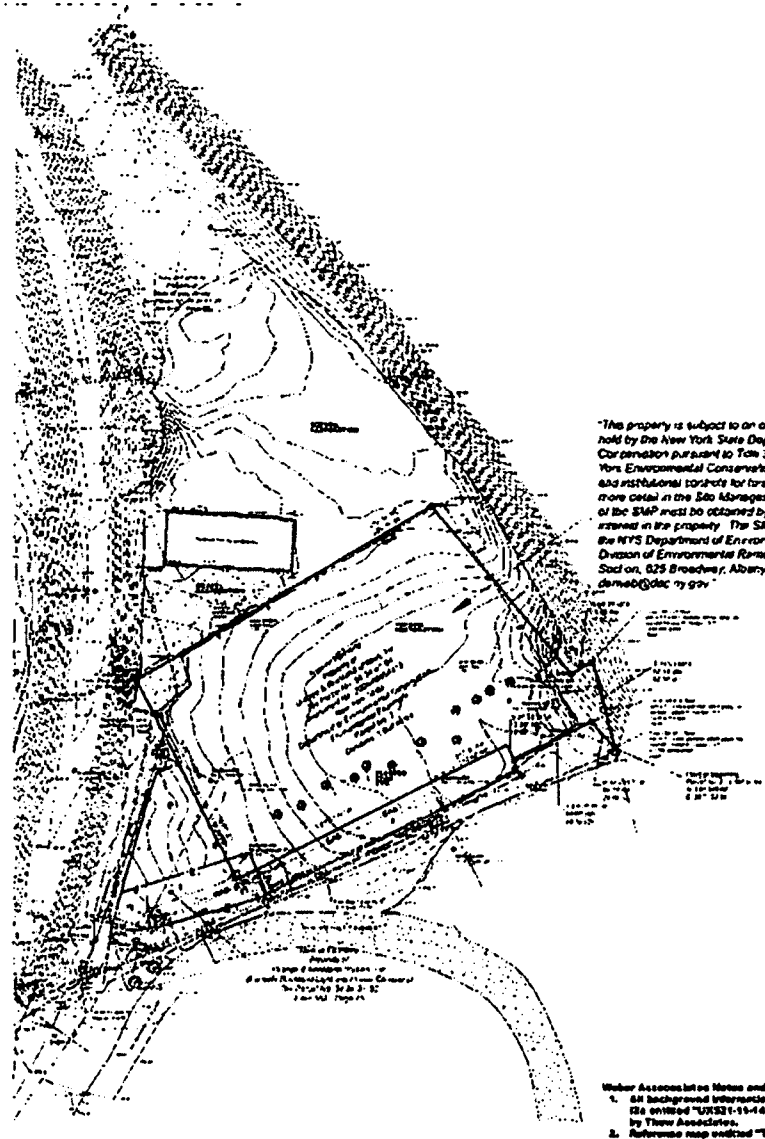
Thence South 74 degrees 30 minutes 00 seconds West, 210.00 feet;

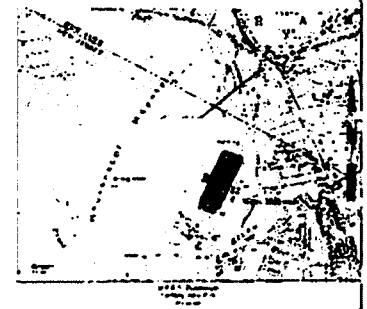
Thence North 15 degrees 30 minutes 00 seconds West, 156.00 feet;

Thence North 70 degrees 40 minutes 00 seconds East, 239.00 feet;

Thence South 28 degrees 30 minutes 00 seconds East, 152.70 feet;

Thence North 70 degrees 10 minutes 00 seconds East, 17.00 feet to the point or place of beginning.





GRAPHIC SCALE

"This property is subject to an environmental easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the New York Environmental Conservation Law. The engineering and institutional controls for this Easement are set forth in a more detail in the Site Management Plan (SMP). A copy of the SMP must be obtained by any party with an interest in the property. The SMP can be obtained from the NYS Department of Environmental Conservation Division of Environmental Remediation, Site Control Section, 625 Broadway, Albany, NY 12233 or at derweb@dec.ny.gov."

Weber Associates Notes and References:

1. All background information taken from AutoCAD file entitled "UKS21-11-14 CH2MHILL" provided by Thew Associates.
2. Reference map entitled "Topographic and Boundary Encroachment Mapping, Former MGP Site, Orange & Rockland Utilities, Inc." dated 9/30/15, prepared by Thew Associates (Project number UKS21-11-14).
3. All boundary and control information provided by client. No attempt has been made by Weber Associates to verify property limits, easements, ownership, or underground utilities.
4. Certification by Weber Associates is only being given to restoration related information.
5. There are no bodies of water on the referenced property.
6. All encroachments and visible improvements within 5' of property are shown.

Map Showing NYSDEC Environmental Easement
5 Pat Malone Drive
FORMER MGP SITE
ORANGE AND ROCKLAND UTILITIES, INC.
VILLAGE OF SUFFERN
COUNTY OF ROCKLAND
STATE OF NEW YORK

LOUIS J. WEBER & ASSOCIATES, INC.
BOUNDARY & CONSTRUCTION SURVEYING
RIFARTA, NEW JERSEY 07677-2447
CERTIFICATE OF AUTHORIZATION NO. 24GA27936300
BUS. NO. (973) 758-1340 FAX NO (973) 758-1339

APPENDIX F
PERMITS AND/OR PERMIT EQUIVALENT

Appendix F: Permits and/or Permit Equivalent
Suffern Manufactured Gas Plant, Suffern, New York

Triggering Activity	Sub-Activities	Required Permit/Approval Name	Applicable Regulation	Compliance Requirement
Wells	Decommissioning and Installation	Rockland County Department of Health (RCDOH) Well Installation and Decommissioning Permit		Some of the existing monitoring wells will be decommissioned prior to remedial activities by the an O&R contractor. Project specifications will require contractor or their drilling subcontractor to obtain required permit prior to well decommissioning. Additional wells may be installed as part of the Public Water Supply Protection Plan. RCDOH Installation permits will be obtained by the selected drilling subcontractor.
Building Construction	Construction or demolition of structures	Local Building Permits	Uniform Construction Code; Rockland County Codes; Town of Ramapo (Village of Suffern) Codes	Local authorities may require a building permit for any permanent or semi-permanent structure, such as the temporary fabric structure. The specifications will require the remedial contractor to obtain this permit prior to building erection. Demolition permits may be required for demolition of remaining building slabs and foundations. The specifications will require the remedial contractor to obtain this permit prior to demolition activities. Substantive requirements of the building codes will be followed if a permit is not required.
Consultations Related to the Remedial Action.				
Protected Species and Habitats	Rare Animals and Plants	NY Natural Heritage consultation	NY Environmental Conservation Law	The Site is in a potential area of rare animals and plants per the Environmental Resource Mapper. Also, as part of a Fish and Wildlife review, the NY Natural Heritage Program was consulted during the Remedial Investigation. A New York State listed plant species was potentially identified, and further consultation is appropriate to confirm that there are no concerns regarding potential impacts from implementing the Record of Decision. The Engineer will consult the appropriate authorities.

Assumptions:
1. No State of NJ Permits will be required, consistent with the Record of Decision.
2. Assumes that a Community and Environmental Response plan (CERP) per DER-10 is not required; pending receipt of consultations described above.

APPENDIX G
CONTRACTOR AS-BUILTS
and TABLES

Property of
Orange & Rockland Utilities, Inc.
Parcel No. 1A and 1B
Contains: 3.653 and 0.354 acres

All that tract or parcel of land situate in the Village of Suffern, Town of Ramapo, County of Rockland, State of New York, and being more precisely described as follows:

Beginning *at a 5/8-inch rebar with a 1 1/4-inch diameter red plastic cap marked "Thew Associates - Canton NY" (hereinafter referred to as a 5/8-inch rebar) set on the southerly line of a parcel of land conveyed by the County of Rockland to Michael Stewart by deed dated June 5, 1997 and recorded in the Rockland County Clerk's Office on June 5, 1997 as Instrument No. 1997-21480, said rebar having New York State plane coordinates (NAD83/2011 - East Zone) of 832,118.69 feet North and 586,459.26 feet East;*

thence North 66 degrees 23 minutes 55 seconds East, along the southerly line of Michael Stewart, a distance of 124.45 feet to a 5/8-inch rebar set on the westerly line of a parcel of land conveyed by the Consolidated Rail Corporation to the State of New Jersey by deed dated March 31, 1979 and recorded in the Rockland County Clerk's Office on May 5, 1983 in Liber 6741 of Deeds at Page 682;

thence along the westerly line of the State of New Jersey, the following three courses and distances:

1. *South 39 degrees 49 minutes 05 seconds East a distance of 132.33 feet to a set 5/8-inch rebar;*
2. *along a curve deflecting to the right, non-tangent to the previous course, having a central angle of 34 degrees 52 minutes 33 seconds and a radius of 714.49 feet, an arc distance of 434.91 feet to a set 5/8-inch rebar (chord: South 04 degrees 31 minutes 15 seconds East, 428.23 feet);*
3. *continuing along a curve deflecting to the right, having a central angle of 21 degrees 54 minutes 06 seconds and a radius of 714.49 feet, an arc distance of 273.12 feet to a 5/8-inch rebar set at an angle point on the easterly line of a parcel of land conveyed by Erie Land and Improvement Company to the Village of Suffern by deed dated July 26, 1957 and reocrded in the Rockland County Clerk's Office on August 19, 1957 in Liber 654 of Deeds at Page 240 (chord: South 23 degrees 52 minutes 05 seconds West, 271.46 feet);*

thence along the easterly line of the Village of Suffern, the following four courses and distances:

1. *South 63 degrees 19 minutes 55 seconds West a distance of 68.86 feet to a set 5/8-inch rebar;*
2. *North 79 degrees 10 minutes 05 seconds West a distance of 50.00 feet to a set 5/8-inch rebar;*
3. *North 01 degrees 05 minutes 05 seconds West a distance of 138.40 feet to a set 5/8-inch rebar;*
4. *North 00 degrees 53 minutes 05 seconds West a distance of 610.16 feet to the* ***Point of Beginning****.*

To contain 3.653 acres of land, more or less, as surveyed by Jeremy L. Sweeney, Licensed Land Surveyor No. 050863.

Also all that tract or parcel of land situate in the Village of Suffern, Town of Ramapo, County of Rockland, State of New York, and being more precisely described as follows:

Beginning at a 5/8-inch rebar with a 1 1/4-inch diameter red plastic cap marked "Thew Associates - Canton NY" (hereinafter referred to as a 5/8-inch rebar) set on the northerly line of a parcel of land conveyed by Stern & Stern, LLC to the Village of Suffern by deed dated July 30, 2010 and recorded in the Rockland County Clerk's Office on October 12, 2010 as Instrument No. 2010-37130, said rebar having New York State plane coordinates (NAD83/2011 - East Zone) of 831,630.61 feet North and 587,057.56 feet East;

thence South 63 degrees 19 minutes 55 seconds West, along the northerly line of the Village of Suffern, a distance of 357.83 feet to a 5/8-inch rebar set on the easterly line of a parcel of land conveyed by the Consolidated Rail Corporation to the State of New Jersey by deed dated March 31, 1979 and recorded in the Rockland County Clerk's Office on May 5, 1983 in Liber 6741 of Deeds at Page 682;

thence along a curve deflecting to the left, non-tangent to the previous course, having a central angle of 15 degrees 04 minutes 07 seconds and a radius of 814.49 feet, an arc distance of 214.21 feet to a 5/8-inch rebar (0.5 feet below grade) found on the westerly line of a parcel of land conveyed by Econo Truck Body and Equipment, Inc. to Orange and Rockland Utilities, Inc. by deed dated December 12, 2008 and recorded in the Rockland County Clerk's Office on Decebmer 19, 2008 as Instrument No. 2008-54413 (chord: North 17 degrees 12 minutes 01 seconds East, 213.59 feet);

thence along the westerly and southerly lines of Orange and Rockland Utilities, Inc., the following three courses and distances:

1. *South 26 degrees 38 minutes 46 seconds East a distance of 129.90 feet to a point;*
2. *North 63 degrees 21 minutes 14 seconds East a distance of 210.00 feet to a point;*
3. *South 26 degrees 20 minutes 39 seconds East a distance of 24.00 feet to the* ***Point of Beginning****, said course passing over a 5/8-inch rebar set at 12.00 feet.*

To contain 0.354 acres of land, more or less, as surveyed by Jeremy L. Sweeney, Licensed Land Surveyor No. 050863.

The above described parcels of land are intended to be the same premises conveyed by Erie Land and Improvement Company to Rockland Light and Power Company by deed dated July 1, 1954 and recorded in the Rockland County Clerk's Office on August 9, 1954 in Liber 585 of Deeds at Page 199.

The above mentioned coordinates, bearings, and distances are referenced to the North American Datum of 1983, 2011 adjustment (NAD83/2011), and projected on the New York State Plane Coordinate System (East Zone).

Property of
Orange & Rockland Utilities, Inc.
Parcel No. 2
Contains: 1.008 acres

All that tract or parcel of land situate in the Village of Suffern, County of Rockland, State of New York, and being more precisely described as follows:

Beginning *at a 5/8-inch rebar with a 1 1/4-inch diameter yellow plastic cap marked "Donald R. Stedge LSPC (0.1 feet below grade) found on the easterly line of a parcel of land conveyed by Stern & Stern, LLC to the Village of Suffern by deed dated July 30, 2010 and recorded in the Rockland County Clerks Office on October 12, 2010 as Instrument No. 2010-37130, said rebar having New York State plane coordinates (NAD83/2011 - East Zone) of 831,649.99 feet North and 587,122.56 feet East;*

thence along the northerly lines of the Village of Suffern, the following two courses and distances:

1. *North 42 degrees 23 minutes 07 seconds West a distance of 24.77 feet to a found 5/8-inch rebar with a 1 1/4-inch diameter yellow plastic cap marked "Donald R. Stedge LSPC" (flush with grade);*
2. *South 63 degrees 20 minutes 49 seconds West a distance of 60.00 feet to a 5/8-inch with a 1 1/4-inch diameter red plastic cap marked "Thew Associates - Canton NY" (hereinafter referred to as a 5/8-inch rebar) set on the easterly line of a parcel of land conveyed by Erie Land and Improvement Company to Rockland Light and Power Company by deed dated July 1, 1954 and recorded in the Rockland County Clerk's Office on August 9, 1954 in Liber 585 of Deeds at Page 199*

thence along the easterly and northerly lines of the Rockland Light and Power Company, the following three courses and distances:

1. *North 26 degrees 20 minutes 39 seconds West a distance of 12.00 feet to a point;*
2. *South 63 degrees 21 minutes 14 seconds West a distance of 210.00 feet to a point;*
3. *North 26 degrees 38 minutes 46 seconds West a distance of 156.00 feet to a 1-inch iron pipe (0.3 feet below grade) found on the easterly line of a parcel of land conveyed by Consolidated Rail Corporation to the State of New Jersey by deed dated March 31, 1979 and recorded in the Rockland County Clerk's Office on May 5, 1983 in Liber 6741 of Deeds at Page 682, said course passing over a 5/8-inch rebar (0.5 feet below grade) found at a distance of 129.90 feet;*

thence along the northerly and easterly lines of the State of New Jersey, the following four courses and distances:

1. *North 59 degrees 22 minutes 29 seconds East a distance of 239.00 feet to a set 5/8-inch rebar;*
2. *South 39 degrees 42 minutes 01 seconds East a distance of 152.70 feet to found 1-inch iron pipe (extends 0.1 feet above grade);*
3. *North 58 degrees 29 minutes 46 seconds East a distance of 17.05 feet to a found 5/8-inch rebar with a 1 1/4-inch diameter yellow plastic cap marked "Donald R. Stedge LSPC" (flush with grade);*
4. *South 14 degrees 24 minutes 55 seconds East a distance of 62.53 feet to the* ***Point of Beginning****.*

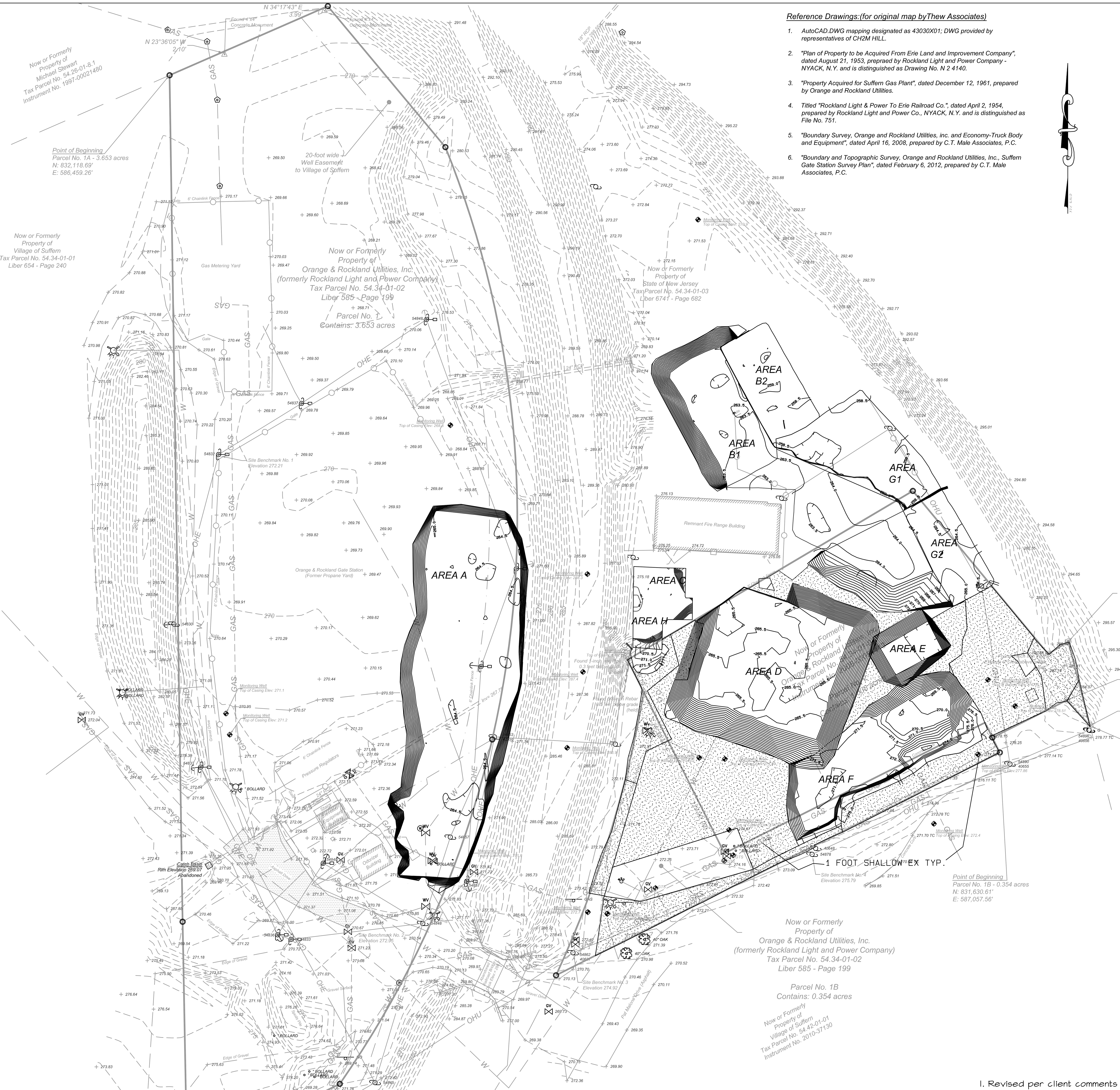
To contain 1.008 acres of land, more or less, as surveyed by Jeremy L. Sweeney, Licensed Land Surveyor No. 050863.

The above described parcel of land is intended to be the same premises conveyed by Econo Truck Body and Equipment, Inc. to Orange and Rockland Utilities, Inc. by deed dated December 12, 2008 and recorded in the Rockland County Clerk's Office on December 19, 2008 as Instrument No. 2008-54413.

The above mentioned coordinates, bearings, and distances are referenced to the North American Datum of 1983, 2011 adjustment (NAD83/2011), and projected on the New York State Plane Coordinate System (East Zone).

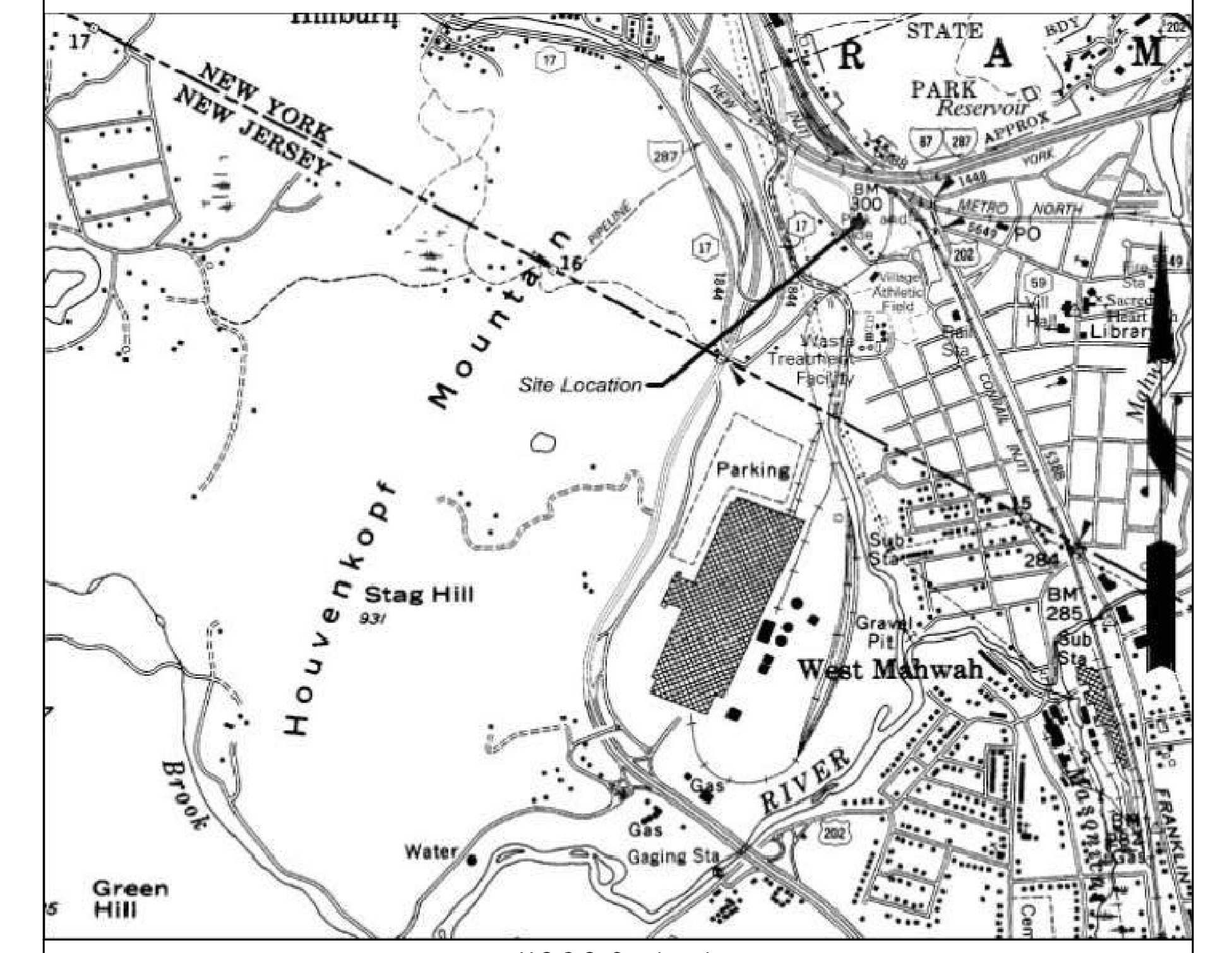
General Notes:

1. This survey is referenced horizontally to the North American Datum of 1983, 2011 adjustment (NAD83/2011) and projected on the New York State Plane Coordinate System (East Zone), and vertically to the North American Vertical Datum of 1988 (NAVD88).
2. North arrow as shown indicates Grid North referenced to NAD83/2011 and projected on the New York State Plane Coordinate System (East Zone).
3. The reference horizontal and vertical control station is a Continuously Operating Reference Station (CORS) designated as VALHALLA CORS ARP (NYVH). NYVH was established by the New York State Department of Transportation (NYSDOT) and last adjusted by the National Geodetic Survey in August 2011. Elevation 309.25 feet.
4. Location of spot elevation is indicated by the tick "+" mark located adjacent to the elevation.
5. The subsurface utilities shown hereon are of Quality Level "C" as defined by the American Society of Civil Engineers (ASCE) in the "Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data". The subsurface utilities shown hereon are based on physical evidence located during the field survey and existing utility drawings. The surveyor further does not warrant or certify that the subsurface utilities are in the exact location indicated although he does certify that they are depicted as accurately as possible from the information available. This surveyor has not physically located the subsurface utilities.
6. Elevations and contours shown reference the North American Vertical Datum of 1988 (NAVD88-Geoid12A).
7. Contours shown hereon were generated from a Digital Terrain Model utilizing Autodesk Civil 3D Surveying and Engineering software.
8. All of the monitoring wells are flush mount. The top of casing elevations for the monitoring wells represent the rim elevation of the curb boxes. The elevations do not represent the top of the riser pipe.
9. The information shown hereon is based on an instrument survey completed on December 19, 2014.



Reference Drawings:(for original map byThew Associates)

1. AutoCAD.DWG mapping designated as 43030X01; DWG provided by representatives of CH2M HILL.
2. "Plan of Property to be Acquired From Erie Land and Improvement Company", dated August 21, 1953, prepraed by Rockland Light and Power Company - NYACK, N.Y. and is distinguished as Drawing No. N 2 4140.
3. "Property Acquired for Suffern Gas Plant", dated December 12, 1961, prepared by Orange and Rockland Utilities.
4. Titled "Rockland Light & Power To Erie Railroad Co.", dated April 2, 1954, prepared by Rockland Light and Power Co., NYACK, N.Y. and is distinguished as File No. 751.
5. "Boundary Survey, Orange and Rockland Utilities, inc. and Economy-Truck Body and Equipment", dated April 16, 2008, prepared by C.T. Male Associates, P.C.
6. "Boundary and Topographic Survey, Orange and Rockland Utilities, Inc., Suffern Gate Station Survey Plan", dated February 6, 2012, prepared by C.T. Male Associates, P.C.



U.S.G.S. Quadrangle
Ramsey, New York
No Scale

Legend:

- 1' Cut Excavation/Demarcation Fabric
- Property Line
- Adjoiners Deed Line
- Interior Deed Line
- Major Contour Line (270)
- Minor Contour Line (271)
- Chainlink Fence
- Wood Fence
- Found Iron (Pipe, Rebar, et cetera)
- Concrete Monument
- Set 5/8-inch Rebar with 1 1/4-inch Diameter Red Plastic Cap Marked "Thew Associates Canton NY"
- Set Mag Nail
- (M) Measured Distance
- (D) Deeded Distance
- Utility Pole
- Utility Pole with Light
- Guy Anchor
- Fire Hydrant
- Water Valve
- Water Shutoff
- Water Manhole
- GV Gas Valve
- GTS Gas Test Station
- Gas Marker
- Catch Basin
- Sign
- Deciduous Tree
- OHU Overhead Utilities (Electric, Communications, CATV)
- OHE Overhead Electric
- GAS Gas Line
- W water Line
- COMM Underground Communications (Telephone, CATV, Fiber)
- Gravel Restoration Area
- RCP Reinforced Concrete Pipe
- Monitoring Well Location
- Boring Location

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

Benchmarks:

Site Benchmark No. 1: Yellow Bench Tie set in the easterly face of Utility Pole No. 54832 located at the northwesterly corner of the Orange & Rockland Gate Station, approximately 2 feet northerly of the northwesterly chain link fence corner. Elevation = 272.21 feet

Site Benchmark No. 2: Yellow Bench Tie set in the northwesterly face of Utility Pole No. 54848 located on the southerly side of the Orange & Rockland Gate Station, approximately 30 feet southerly of the southerly chain link fence . Elevation = 272.95 feet

Site Benchmark No. 3: Yellow Bench Tie set in the southeasterly face of Utility Pole No. 54862 located on the southerly side of the abandoned steel railroad bridge, approximately 40.5 feet easterly of the northeasterly corner of the bridge. Elevation = 274.92 feet

Site Benchmark No. 4: Railroad spike set in the westerly face of Utility Pole No. 54878 located on the easterly side of the entrance to the former Orange & Rockland MGP site, approximately 27 feet easterly of the easterly edge of pavement. Elevation = 275.79 feet

Weber Assocociates Notes and References:

1. **All background information taken from AutoCAD file entitled "UK521-11-14 CH2MHILL" provided by Thew Associates.**
2. **Reference map entitled "Topographic and Boundary Retracement Mapping, Former MGP Site, Orange & Rockland Utilities, Inc." dated 2/3/2015, prepared by Thew Associates.**
3. **All boundary and control information provided by client. No attempt has been made by Weber Associates to verify property limits, easements, ownership, or underground utilities.**
4. **Certification by Weber Associates is only being given to excavtion related information.**

1. Revised per client comments dated 11/05/2018

DRAWN BY: DW	CHECKED BY: LJW	APPROVED BY	FINAL EXCAVATIONS SURVEY FORMER MGP SITE ORANGE AND ROCKLAND UTILITIES, INC.
CALC. BY: LJW		REVISIONS NO. DATE	
JOSEPH D. GREENAWAY		1 11/08/18	VILLAGE OF SUFFERN COUNTY OF ROCKLAND STATE OF NEW YORK
N.Y. PROFESSIONAL LAND SURVEYOR NO. 50311			LOUIS J. WEBER & ASSOCIATES, INC. BOUNDARY & CONSTRUCTION SURVEYING SPARTA, NEW JERSEY 07871-2417 CERTIFICATE OF AUTHORIZATION NO. 24GA27935300 BUS. NO.(973)726-4240 FAX NO.(973)726-4239 EMAIL: mail@webersurveying.com
SCALE 1" =40'	10/31/18		CEI-SUFFERN SHT 1/1

Property of
Orange & Rockland Utilities, Inc.
Parcel No. 1A and 1B
Contains: 3.653 and 0.354 acres

All that tract or parcel of land situate in the Village of Suffern, Town of Ramapo, County of Rockland, State of New York, and being more precisely described as follows:

Beginning *at a 5/8-inch rebar with a 1 1/4-inch diameter red plastic cap marked "Thew Associates - Canton NY" (hereinafter referred to as a 5/8-inch rebar) set on the southerly line of a parcel of land conveyed by the County of Rockland to Michael Stewart by deed dated June 5, 1997 and recorded in the Rockland County Clerk's Office on June 5, 1997 as Instrument No. 1997-21480, said rebar having New York State plane coordinates (NAD83/2011 - East Zone) of 832,118.69 feet North and 586,459.26 feet East;*

thence North 66 degrees 23 minutes 55 seconds East, along the southerly line of Michael Stewart, a distance of 124.45 feet to a 5/8-inch rebar set on the westerly line of a parcel of land conveyed by the Consolidated Rail Corporation to the State of New Jersey by deed dated March 31, 1979 and recorded in the Rockland County Clerk's Office on May 5, 1983 in Liber 6741 of Deeds at Page 682;

thence along the westerly line of the State of New Jersey, the following three courses and distances:

1. *South 39 degrees 49 minutes 05 seconds East a distance of 132.33 feet to a set 5/8-inch rebar;*
2. *along a curve deflecting to the right, non-tangent to the previous course, having a central angle of 34 degrees 52 minutes 33 seconds and a radius of 714.49 feet, an arc distance of 434.91 feet to a set 5/8-inch rebar (chord: South 04 degrees 31 minutes 15 seconds East, 428.23 feet);*
3. *continuing along a curve deflecting to the right, having a central angle of 21 degrees 54 minutes 06 seconds and a radius of 714.49 feet, an arc distance of 273.12 feet to a 5/8-inch rebar set at an angle point on the easterly line of a parcel of land conveyed by Erie Land and Improvement Company to the Village of Suffern by deed dated July 26, 1957 and recorded in the Rockland County Clerk's Office on August 19, 1957 in Liber 654 of Deeds at Page 240 (chord: South 23 degrees 52 minutes 05 seconds West, 271.46 feet);*

thence along the easterly line of the Village of Suffern, the following four courses and distances:

1. *South 63 degrees 19 minutes 55 seconds West a distance of 68.86 feet to a set 5/8-inch rebar;*
2. *North 79 degrees 10 minutes 05 seconds West a distance of 50.00 feet to a set 5/8-inch rebar;*
3. *North 01 degrees 05 minutes 05 seconds West a distance of 138.40 feet to a set 5/8-inch rebar;*
4. *North 00 degrees 53 minutes 05 seconds West a distance of 610.16 feet to the* ***Point of Beginning****.*

To contain 3.653 acres of land, more or less, as surveyed by Jeremy L. Sweeney, Licensed Land Surveyor No. 050863.

Also all that tract or parcel of land situate in the Village of Suffern, Town of Ramapo, County of Rockland, State of New York, and being more precisely described as follows:

Beginning at a 5/8-inch rebar with a 1 1/4-inch diameter red plastic cap marked "Thew Associates - Canton NY" (hereinafter referred to as a 5/8-inch rebar) set on the northerly line of a parcel of land conveyed by Stern & Stern, LLC to the Village of Suffern by deed dated July 30, 2010 and recorded in the Rockland County Clerk's Office on October 12, 2010 as Instrument No. 2010-37130, said rebar having New York State plane coordinates (NAD83/2011 - East Zone) of 831,630.61 feet North and 587,057.56 feet East;

thence South 63 degrees 19 minutes 55 seconds West, along the northerly line of the Village of Suffern, a distance of 357.83 feet to a 5/8-inch rebar set on the easterly line of a parcel of land conveyed by the Consolidated Rail Corporation to the State of New Jersey by deed dated March 31, 1979 and recorded in the Rockland County Clerk's Office on May 5, 1983 in Liber 6741 of Deeds at Page 682;

thence along a curve deflecting to the left, non-tangent to the previous course, having a central angle of 15 degrees 04 minutes 07 seconds and a radius of 814.49 feet, an arc distance of 214.21 feet to a 5/8-inch rebar (0.5 feet below grade) found on the westerly line of a parcel of land conveyed by Econo Truck Body and Equipment, Inc. to Orange and Rockland Utilities, Inc. by deed dated December 12, 2008 and recorded in the Rockland County Clerk's Office on Decebmer 19, 2008 as Instrument No. 2008-54413 (chord: North 17 degrees 12 minutes 01 seconds East, 213.59 feet);

thence along the westerly and southerly lines of Orange and Rockland Utilities, Inc., the following three courses and distances:

1. *South 26 degrees 38 minutes 46 seconds East a distance of 129.90 feet to a point;*
2. *North 63 degrees 21 minutes 14 seconds East a distance of 210.00 feet to a point;*
3. *South 26 degrees 20 minutes 39 seconds East a distance of 24.00 feet to the* ***Point of Beginning****, said course passing over a 5/8-inch rebar set at 12.00 feet.*

To contain 0.354 acres of land, more or less, as surveyed by Jeremy L. Sweeney, Licensed Land Surveyor No. 050863.

The above described parcels of land are intended to be the same premises conveyed by Erie Land and Improvement Company to Rockland Light and Power Company by deed dated July 1, 1954 and recorded in the Rockland County Clerk's Office on August 9, 1954 in Liber 585 of Deeds at Page 199.

The above mentioned coordinates, bearings, and distances are referenced to the North American Datum of 1983, 2011 adjustment (NAD83/2011), and projected on the New York State Plane Coordinate System (East Zone).

Property of
Orange & Rockland Utilities, Inc.
Parcel No. 2
Contains: 1.008 acres

All that tract or parcel of land situate in the Village of Suffern, County of Rockland, State of New York, and being more precisely described as follows:

Beginning *at a 5/8-inch rebar with a 1 1/4-inch diameter yellow plastic cap marked "Donald R. Stedge LSPC (0.1 feet below grade) found on the easterly line of a parcel of land conveyed by Stern & Stern, LLC to the Village of Suffern by deed dated July 30, 2010 and recorded in the Rockland County Clerks Office on October 12, 2010 as Instrument No. 2010-37130, said rebar having New York State plane coordinates (NAD83/2011 - East Zone) of 831,649.99 feet North and 587,122.56 feet East,*

thence along the northerly lines of the Village of Suffern, the following two courses and distances:

1. *North 42 degrees 23 minutes 07 seconds West a distance of 24.77 feet to a found 5/8-inch rebar with a 1 1/4-inch diameter yellow plastic cap marked "Donald R. Stedge LSPC" (flush with grade);*
2. *South 63 degrees 20 minutes 49 seconds West a distance of 60.00 feet to a 5/8-inch with a 1 1/4-inch diameter red plastic cap marked "Thew Associates - Canton NY" (hereinafter referred to as a 5/8-inch rebar) set on the easterly line of a parcel of land conveyed by Erie Land and Improvement Company to Rockland Light and Power Company by deed dated July 1, 1954 and recorded in the Rockland County Clerk's Office on August 9, 1954 in Liber 585 of Deeds at Page 199*

thence along the easterly and northerly lines of the Rockland Light and Power Company, the following three courses and distances:

1. *North 26 degrees 20 minutes 39 seconds West a distance of 12.00 feet to a point;*
2. *South 63 degrees 21 minutes 14 seconds West a distance of 210.00 feet to a point;*
3. *North 26 degrees 38 minutes 46 seconds West a distance of 156.00 feet to a 1-inch iron pipe (0.3 feet below grade) found on the easterly line of a parcel of land conveyed by Consolidated Rail Corporation to the State of New Jersey by deed dated March 31, 1979 and recorded in the Rockland County Clerk's Office on May 5, 1983 in Liber 6741 of Deeds at Page 682, said course passing over a 5/8-inch rebar (0.5 feet below grade) found at a distance of 129.90 feet;*

thence along the northerly and easterly lines of the State of New Jersey, the following four courses and distances:

1. *North 59 degrees 22 minutes 29 seconds East a distance of 239.00 feet to a set 5/8-inch rebar;*
2. *South 39 degrees 42 minutes 01 seconds East a distance of 152.70 feet to found 1-inch iron pipe (extends 0.1 feet above grade);*
3. *North 58 degrees 29 minutes 46 seconds East a distance of 17.05 feet to a found 5/8-inch rebar with a 1 1/4-inch diameter yellow plastic cap marked "Donald R. Stedge LSPC" (flush with grade),*
4. *South 14 degrees 24 minutes 55 seconds East a distance of 62.53 feet to the* ***Point of Beginning****.*

To contain 1.008 acres of land, more or less, as surveyed by Jeremy L. Sweeney, Licensed Land Surveyor No. 050863.

The above described parcel of land is intended to be the same premises conveyed by Econo Truck Body and Equipment, Inc. to Orange and Rockland Utilities, Inc. by deed dated December 12, 2008 and recorded in the Rockland County Clerk's Office on December 19, 2008 as Instrument No. 2008-54413.

The above mentioned coordinates, bearings, and distances are referenced to the North American Datum of 1983, 2011 adjustment (NAD83/2011), and projected on the New York State Plane Coordinate System (East Zone).

General Notes:

1. *This survey is referenced horizontally to the North American Datum of 1983, 2011 adjustment (NAD83/2011) and projected on the New York State Plane Coordinate System (East Zone), and vertically to the North American Vertical Datum of 1988 (NAVD88).*
2. *North arrow as shown indicates Grid North referenced to NAD83/2011 and projected on the New York State Plane Coordinate System (East Zone).*
3. *The reference horizontal and vertical control station is a Continuously Operating Reference Station (CORS) designated as VALHALLA CORS ARP (NYVH). NYVH was established by the New York State Department of Transportation (NYSDOT) and last adjusted by the National Geodetic Survey in August 2011. Elevation 309.25 feet.*
4. *Location of spot elevation is indicated by the tick "+" mark located adjacent to the elevation.*
5. *The subsurface utilities shown hereon are of Quality Level "C" as defined by the American Society of Civil Engineers (ASCE) in the "Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data". The subsurface utilities shown hereon are based on physical evidence located during the field survey and existing utility drawings. The surveyor further does not warrant or certify that the subsurface utilities are in the exact location indicated although he does certify that they are depicted as accurately as possible from the information available. This surveyor has not physically located the subsurface utilities.*
6. *Elevations and contours shown reference the North American Vertical Datum of 1988 (NAVD88-Geoid12A).*
7. *Contours shown hereon were generated from a Digital Terrain Model utilizing Autodesk Civil 3D Surveying and Engineering software.*
8. *All of the monitoring wells are flush mount. The top of casing elevations for the monitoring wells represent the rim elevation of the curb boxes. The elevations do not represent the top of the riser pipe.*
9. *The information shown hereon is based on an instrument survey completed on December 19, 2014.*

Unauthorized alteration or addition to a survey map bearing a licensed land surveyors seal is a violation of Section 7209, Subdivision 2 of the New York State Education Law.

Only copies from the original of this survey marked with an original of the surveyor's inked seal or his embossed seal shall be considered to be valid and true copies.

Benchmarks:

Site Benchmark No. 1: Yellow Bench Tie set in the easterly face of Utility Pole No. 54832 located at the northwesterly corner of the Orange & Rockland Gate Station, approximately 2 feet northerly of the northwesterly chain link fence corner. Elevation = 272.21 feet

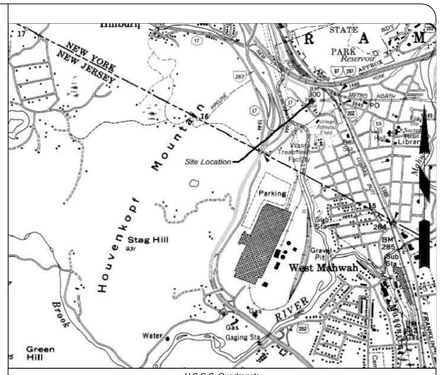
Site Benchmark No. 2: Yellow Bench Tie set in the northwesterly face of Utility Pole No. 54848 located on the southerly side of the Orange & Rockland Gate Station, approximately 30 feet southerly of the southerly chain link fence . Elevation = 272.95 feet

Site Benchmark No. 3: Yellow Bench Tie set in the southeasterly face of Utility Pole No. 54862 located on the southerly side of the abandoned steel railroad bridge, approximately 40.5 feet easterly of the northeasterly corner of the bridge. Elevation = 274.92 feet

Site Benchmark No. 4: Railroad spike set in the westerly face of Utility Pole No. 54878 located on the easterly side of the entrance to the former Orange & Rockland MGP site, approximately 27 feet easterly of the easterly edge of pavement. Elevation = 275.79 feet

Reference Drawings:(for original map byThew Associates)

1. *AutoCAD.DWG mapping designated as 43030X01; DWG provided by representatives of CH2M HILL.*
2. *"Plan of Property to be Acquired From Erie Land and Improvement Company", dated August 21, 1953, prepared by Rockland Light and Power Company - NYACK, N.Y. and is distinguished as Drawing No. N 2 4140.*
3. *"Property Acquired for Suffern Gas Plant", dated December 12, 1961, prepared by Orange and Rockland Utilities.*
4. *Titled "Rockland Light & Power To Erie Railroad Co.", dated April 2, 1954, prepared by Rockland Light and Power Co., NYACK, N.Y. and is distinguished as File No. 751.*
5. *"Boundary Survey, Orange and Rockland Utilities, inc. and Economy-Truck Body and Equipment", dated April 16, 2008, prepared by C.T. Male Associates, P.C.*
6. *"Boundary and Topographic Survey, Orange and Rockland Utilities, Inc., Suffern Gate Station Survey Plan", dated February 6, 2012, prepared by C.T. Male Associates, P.C.*



U.S.G.S. Quadrangle
Ramsey, New York
No Scale

Legend:

- *Property Line*
- *Adjoiners Deed Line*
- *Interior Deed Line*
- *Major Contour Line*
- *Minor Contour Line*
- *Existing Chainlink Fence*
- *New Chainlink Fence*
- *Wood Fence*
- *Found Iron (Pipe, Rebar, et cetera)*
- *Concrete Monument*
- *Set 5/8-inch Rebar with 1 1/4-inch Diameter Red Plastic Cap Marked "Thew Associates Canton NY"*
- *Set Mag Nail*
- *(M) Measured Distance*
- *(D) Deeded Distance*
- *Utility Pole*
- *Utility Pole with Light*
- *Guy Anchor*
- *Fire Hydrant*
- *Water Valve*
- *Water Shutoff*
- *Water Manhole*
- *Gas Valve*
- *GTS Gas Test Station*
- *Gas Marker*
- *Catch Basin*
- *Sign*
- *Deciduous Tree*
- *OHU Overhead Utilities (Electric, Communications, CATV)*
- *OHE Overhead Electric*
- *GAS Gas Line*
- *W water Line*
- *COMM Underground Communications (Telephone, CATV, Fiber)*
- *Gravel Restoration Area*
- *RCP Reinforced Concrete Pipe*
- *Monitoring Well Location*
- *Boring Location*
- *Sparge Well*
- *PZ Piezometer*

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

Weber Assocociates Notes and References:

1. **All background information taken from AutoCAD file entitled "UK521-11-14 CH2MHILL" provided by Thew Associates.**
2. **Reference map entitled "Topographic and Boundary Retracement Mapping, Former MGP Site, Orange & Rockland Utilities, Inc." dated 2/3/2015, prepared by Thew Associates.**
3. **All boundary and control information provided by client. No attempt has been made by Weber Associates to verify property limits, easements, ownership, or underground utilities.**
4. **Certification by Weber Associates is only being given to restoration related information.**

1. Revised per client comments dated 11/05/2018

DRAWN BY: DW	CHECKED BY: LJW	APPROVED BY
CALC. BY: LJW		REVISIONS
		NO. 1 DATE 11/08/18

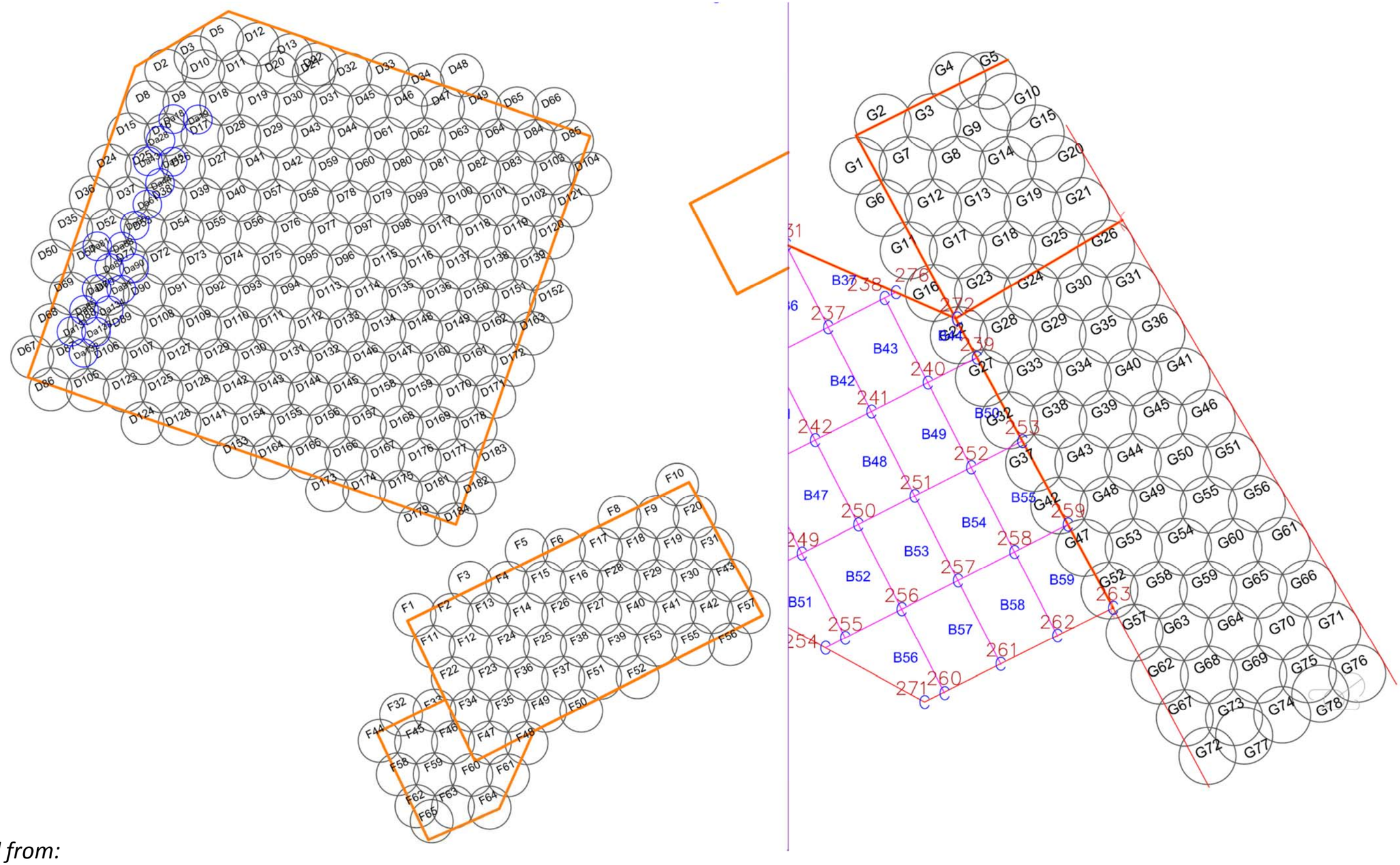
JOSEPH D. GREENAWAY
N.Y. PROFESSIONAL LAND SURVEYOR NO. 50311

RESTORATION AREA MAP
FORMER MGP SITE
ORANGE AND ROCKLAND UTILITIES, INC.

VILLAGE OF SUFFERN
COUNTY OF ROCKLAND
STATE OF NEW YORK

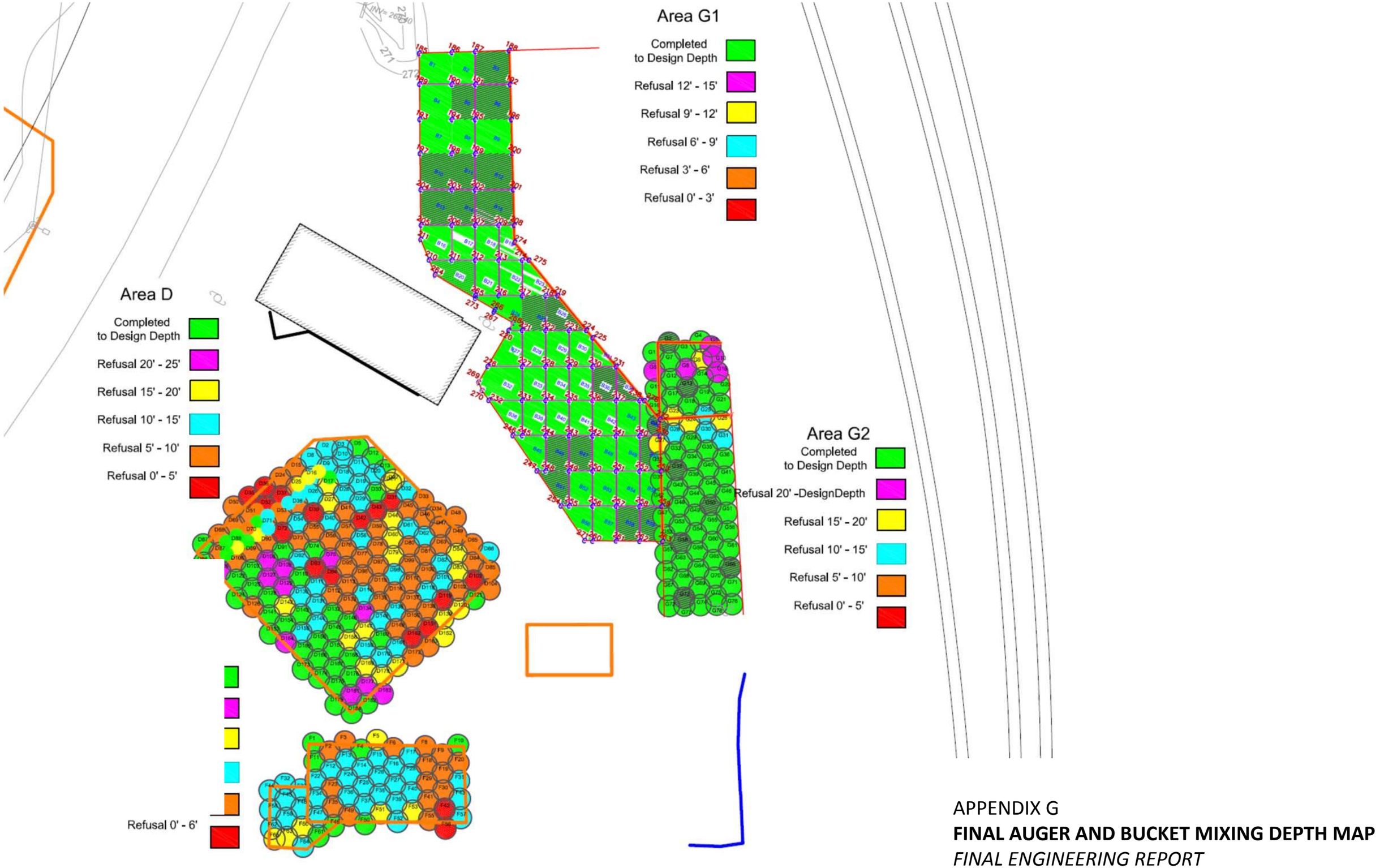
LOUIS J. WEBER & ASSOCIATES, INC.
BOUNDARY & CONSTRUCTION SURVEYING
SPARTA, NEW JERSEY 07871-2417
CERTIFICATE OF AUTHORIZATION NO. 24GA27935300
BUS. NO.(973)726-4240 FAX NO.(973)726-4239
EMAIL: mail@webersurveying.com

SCALE 1" =40'	10/31/18		CEI-SUFFERN	SHT 1/1



Adapted from:
Geo-Solutions Auger Final Layout
Project No. 15-131
04/11/2018

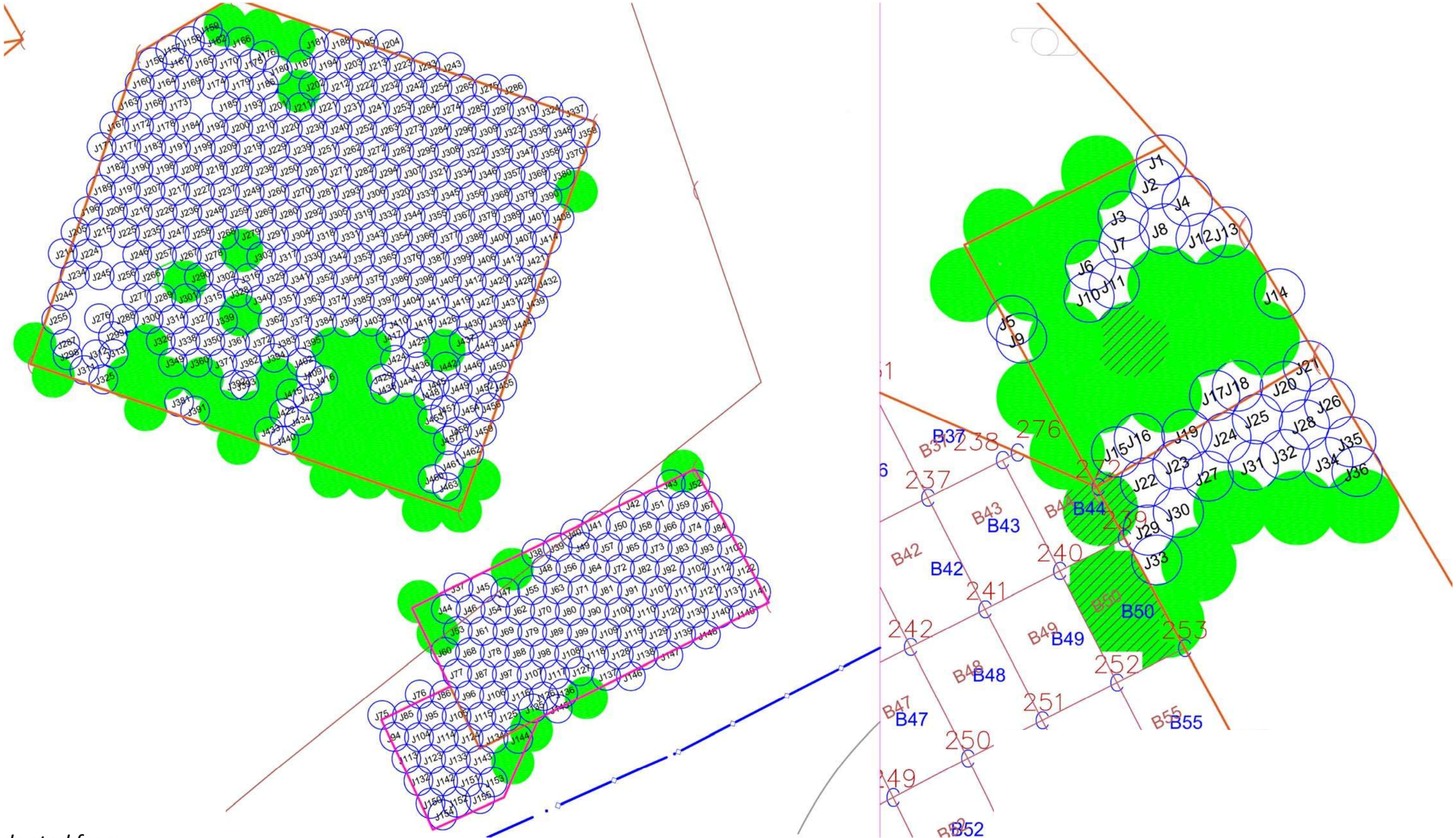
APPENDIX G
AUGER ISS FINAL COLUMN LAYOUT
FINAL ENGINEERING REPORT



APPENDIX G

FINAL AUGER AND BUCKET MIXING DEPTH MAP

FINAL ENGINEERING REPORT



Adapted from:
Geo-Solutions Jet Grouting Final Column Layout
Project No. 15-131
04/11/2018

APPENDIX G

FINAL JET GROUTING COLUMN LAYOUT

FINAL ENGINEERING REPORT

Geo-Solutions
Soil and Groundwater Problems Solved

1250 Fifth Avenue, New Kensington, PA 15068
T 724-335-7273 **F** 724-335-7271
www.geo-solutions.com

TRANSMITTAL

DATE: 04/11/2018

REFERENCE NO.: Transmittal 028

PROJECT NAME: Former Suffern MGP

TO: Vincent Albanese
Creamer Environmental,Inc.
12 Old Bridge Road
Cedar Grove, NJ 07009
(201)–481-9308

Please find enclosed:

- ☐ Draft
- ☒ Final
- ☐ Originals
- ☐ Prints
- ☐ Other Close Out Documentation

Sent via:

- ☐ Mail
- ☐ Overnight Courier
- ☐ Same Day Courier
- ☒ Other Via e-mail VAlbanese@creamerenvironmental.com

QUANTITY	DESCRIPTION
1	*Specifications section 02196 Part 1-1.5 Section E.*

- ☒ For Approval
- ☐ For Your Use
- ☐ For Review and Comment
- ☐
- ☐

COMMENTS:
Attached are the grouting lengths for auger ISS and jet grouting with the corresponding final column layouts.

Copy to: Darin Payne, Thomas LaViano, Justin Janicek, Luke Tamburello

Completed by: Trae Deri Signed: Trae Deri

Auger ISS Column Data			
Column ID	Top of Col	Bottom of Col	As-Built Depth
	ELEV	*ELEV*	*FT*
G72	265.0	244.0	21.0
G77	264.5	243.8	20.7
G74	264.5	243.9	20.6
G78	264.5	243.8	20.7
G73	264.3	243.6	20.7
G76	264.5	244.0	20.5
G75	264.0	244.0	20.0
G67	265.4	243.9	21.5
G69	265.0	244.0	21.0
G71	265.1	243.9	21.2
G68	264.7	243.8	20.9
G70	264.8	244.0	20.8
G66	265.2	244.0	21.2
G62	265.4	243.9	21.5
G64	264.6	243.9	20.7
G63	265.0	243.9	21.1
G65	265.3	243.9	21.4
G57	265.0	244.0	21.0
G59	264.8	243.9	20.9
G61	265.4	243.9	21.5
G58	265.0	244.0	21.0
G60	265.5	243.9	21.6
G52	265.5	244.0	21.5
G56	265.6	244.0	21.7
G54	265.0	243.8	21.2
G32	265.2	243.8	21.4
G33	265.2	243.9	21.3
G35	265.3	243.9	21.4
G36	265.4	243.9	21.5
G34	265.2	244.0	21.2
G37	265.4	244.0	21.4
G40	265.8	243.9	21.9
G38	265.4	244.0	21.4
G41	265.0	244.0	21.0
G39	265.5	243.9	21.6
G47	265.5	243.9	21.6
G46	265.0	244.0	21.0
G42	265.5	244.0	21.5
G45	265.8	244.0	21.9
G43	265.4	243.9	21.5
G44	265.5	244.0	21.5
G50	265.5	243.9	21.6

Column ID	Top of Col	Bottom of Col	As-Built Depth
	ELEV	***ELEV***	***FT***
G48	265.4	243.9	21.5
G51	265.0	244.0	21.0
G49	265.1	243.8	21.3
G55	265.4	243.9	21.5
G53	265.4	243.9	21.5
D179	265.9	240.9	25.0
D184	265.9	240.9	25.0
D182	265.9	240.9	25.0
D183	265.9	245.3	20.6
D181	265.4	242.3	23.1
D174	264.8	241.0	23.8
D175	265.4	241.0	24.4
D173	266.0	241.0	25.0
D165	265.5	241.0	24.5
D167	265.4	241.0	24.4
D166	265.4	240.9	24.5
D177	265.5	245.4	20.1
D176	265.7	241.0	24.7
D178	265.6	245.9	19.7
D171	265.4	247.6	17.8
D156	265.8	241.6	24.2
D157	265.5	240.9	24.6
D168	265.5	240.9	24.6
D169	265.5	246.5	19.0
D145	265.5	241.0	24.5
D158	265.5	248.2	17.3
D159	265.5	254.0	11.5
D170	265.5	253.8	11.7
D146	265.5	240.9	24.6
D147	265.5	247.3	18.2
D160	265.6	241.0	24.6
D172	266.0	260.4	5.6
D161	265.5	253.3	12.2
D163	266.0	258.1	7.9
D134	265.6	242.4	23.2
D148	265.7	255.1	10.6
D114	265.5	254.8	10.7
D48	266.0	260.5	5.5
D66	266.0	255.8	10.2
D104	266.2	260.9	5.3
D144	265.5	254.0	11.5
D132	265.6	241.0	24.6
D133	265.6	256.8	8.8

Column ID	Top of Col	Bottom of Col	As-Built Depth
	ELEV	***ELEV***	***FT***
D121	266.0	240.9	25.1
D120	266.1	248.3	17.8
D152	266.0	246.7	19.3
D139	265.7	249.9	15.8
D74	265.0	241.0	24.0
D58	265.2	253.3	11.9
D75	264.9	242.1	22.8
D131	265.5	253.2	12.3
D77	265.3	257.8	7.5
D112	265.5	257.9	7.6
D2	265.0	253.0	12.0
D5	265.0	241.0	24.0
D3	265.0	250.7	14.3
D10	265.0	252.2	12.8
D16	264.9	252.3	12.6
D9	264.9	251.0	13.9
D12	265.4	240.7	24.7
D11	264.9	251.4	13.6
D18	264.9	252.1	12.8
D17	264.8	245.1	19.7
D13	265.0	241.0	24.0
D26	265.4	255.2	10.2
D19	265.3	252.8	12.5
D20	265.2	253.9	11.3
D22	265.3	249.0	16.3
D28	265.3	251.3	14.0
D32	265.6	250.7	14.9
D30	265.5	241.0	24.5
D21	265.5	250.2	15.3
D27	265.5	248.7	16.8
D29	265.4	252.0	13.4
D155	265.6	253.6	12.0
D164	265.8	242.5	23.3
D153	265.7	241.0	24.7
D143	265.9	240.9	25.0
D154	265.7	241.0	24.7
D111	265.7	254.2	11.5
D141	265.5	240.7	24.8
D50	267.5	260.4	7.1
D51	265.5	259.3	6.2
D68	265.3	256.0	9.3
D69	265.3	258.5	6.8
D67	266.0	241.0	25.0
D71	265.9	258.2	7.7

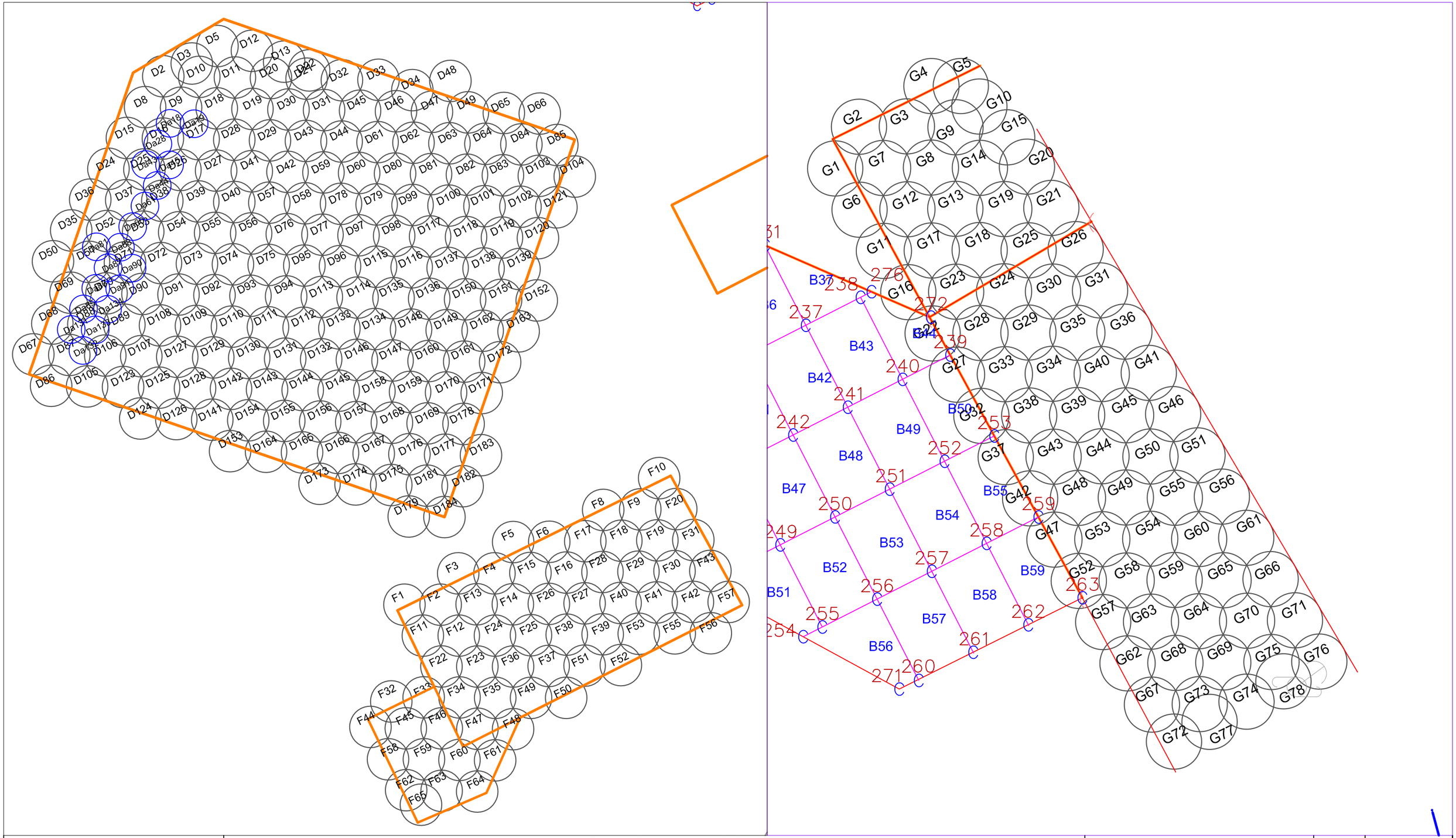
Column ID	Top of Col	Bottom of Col	As-Built Depth
	ELEV	***ELEV***	***FT***
D87	265.0	256.9	8.1
D86	265.8	240.9	24.9
D90	265.4	257.6	7.8
D106	265.1	259.8	5.3
D89	265.2	256.5	8.7
D105	265.2	242.2	23.0
D91	265.5	240.9	24.6
D107	265.4	241.0	24.4
D108	265.5	242.9	22.6
D123	265.3	241.0	24.3
D92	265.3	250.9	14.4
D124	265.8	241.0	24.8
D109	265.5	244.6	20.9
D125	265.4	240.8	24.6
D127	265.3	244.6	20.7
D93	265.4	261.1	4.3
D126	265.5	255.8	9.7
D129	265.5	245.5	20.0
D128	265.5	240.9	24.6
D110	265.7	241.0	24.7
D130	265.8	254.7	11.1
D142	265.7	250.4	15.3
D151	265.5	261.2	4.3
D150	265.3	255.9	9.4
D136	265.5	255.3	10.2
D135	265.4	256.7	8.7
D162	265.6	260.7	4.9
D149	265.8	258.6	7.2
D8	266.0	253.0	13.0
D24	265.8	260.2	5.6
D15	265.8	256.9	8.9
D35	266.1	263.1	3.0
D36	266.0	263.3	2.7
D25	265.9	257.0	8.9
D52	266.0	261.6	4.4
D37	265.8	261.9	3.9
D38	266.0	257.5	8.5
D53	265.4	258.3	7.1
D72	266.3	262.2	4.1
D39	265.8	262.4	3.4
D54	265.8	253.6	12.2
D41	265.9	257.1	8.8
D55	266.0	257.6	8.4
D73	265.9	259.0	6.9

Column ID	Top of Col	Bottom of Col	As-Built Depth
	ELEV	***ELEV***	***FT***
D40	265.9	255.9	10.0
D31	265.7	261.2	4.5
D43	265.8	261.0	4.8
D42	265.8	261.9	3.9
D57	265.9	258.2	7.7
D44	265.7	246.9	18.8
D56	265.8	260.7	5.1
D33	265.8	256.7	9.1
D45	265.6	260.2	5.4
D59	265.8	259.4	6.4
D76	265.8	258.3	7.5
D34	265.5	256.1	9.4
D61	265.8	254.1	11.7
D46	265.4	256.9	8.5
D60	265.7	248.8	16.9
D78	265.8	256.5	9.3
D94	266.1	262.0	4.1
D85	266.4	261.2	5.2
D65	266.1	260.9	5.2
D49	266.3	260.4	5.9
D47	266.0	256.7	9.3
D84	265.0	257.5	7.5
D103	265.0	261.8	3.2
D64	265.0	248.8	16.2
D63	265.0	256.5	8.5
D62	265.5	253.9	11.6
D83	265.5	249.3	16.2
D102	265.5	257.2	8.3
D82	265.3	255.2	10.1
D81	265.8	258.9	6.9
D80	265.5	256.2	9.3
D101	265.9	251.3	14.6
D100	265.6	257.3	8.3
D119	265.3	261.0	4.3
D99	265.3	259.2	6.1
D79	266.1	250.7	15.4
D118	265.5	251.7	13.8
D117	265.5	257.7	7.8
D98	265.6	255.4	10.2
D97	265.9	258.4	7.5
D95	266.6	261.4	5.2
D138	266.5	257.8	8.7
D137	266.6	258.4	8.2
D116	266.5	258.1	8.4

Column ID	Top of Col	Bottom of Col	As-Built Depth
	ELEV	***ELEV***	***FT***
D115	266.0	260.5	5.5
D96	266.8	260.8	6.0
D113	266.0	261.0	5.0
F57	271.9	256.2	15.7
F10	271.7	243.0	28.7
F31	271.8	259.8	12.0
F20	271.9	261.0	10.9
F43	272.2	257.0	15.2
F58	272.2	258.3	13.9
F65	271.5	249.3	22.2
F62	271.7	256.9	14.8
F44	272.1	256.9	15.2
F63	272.4	249.7	22.7
F32	272.0	258.6	13.4
F59	272.2	257.9	14.3
F45	272.0	258.2	13.8
F64	272.0	258.2	13.8
F1	271.3	243.0	28.3
F61	272.0	243.0	29.0
F60	271.8	253.5	18.3
F33	271.8	259.0	12.8
F46	271.8	258.8	13.0
F11	271.8	243.0	28.8
F34	271.8	257.3	14.5
F22	271.8	257.3	14.5
F47	272.0	256.3	15.7
F48	272.0	243.0	29.0
F2	272.3	264.0	8.3
F12	272.0	257.7	14.3
F35	272.4	266.1	6.3
F23	272.0	261.5	10.5
F3	272.4	262.3	10.1
F49	272.0	265.6	6.4
F24	272.0	256.6	15.4
F13	272.3	259.0	13.3
F36	272.0	259.8	12.2
F4	272.3	243.0	29.3
F50	272.0	243.0	29.0
F14	272.3	257.3	15.0
F25	272.5	258.4	14.1
F37	272.3	256.9	15.4
F5	271.9	253.4	18.5
F15	272.5	258.6	13.9
F26	271.6	257.7	13.9

Column ID	Top of Col	Bottom of Col	As-Built Depth
	ELEV	***ELEV***	***FT***
F51	272.4	249.8	22.6
F38	272.5	257.3	15.2
F6	271.8	260.6	11.2
F16	271.7	258.5	13.2
F27	271.8	259.3	12.5
F52	272.0	259.4	12.6
F39	272.0	259.6	12.4
F17	272.1	259.9	12.2
F28	271.8	260.5	11.3
F53	272.3	252.9	19.4
F40	272.4	259.8	12.6
F8	272.1	264.2	7.9
F29	272.5	262.9	9.6
F18	272.2	262.1	10.1
F55	272.2	264.4	7.8
F41	272.2	260.7	11.5
F9	272.0	263.0	9.0
F30	272.2	264.9	7.3
F19	272.3	262.9	9.4
F56	272.0	266.9	5.1
F42	272.2	268.1	4.1
G21	259.5	244.0	15.5
G16	259.0	244.0	15.0
G18	259.5	244.0	15.5
G17	259.5	244.0	15.5
G19	259.5	244.0	15.5
G20	259.5	244.0	15.5
G11	259.5	244.0	15.5
G13	259.5	244.0	15.5
G12	259.5	244.0	15.5
G14	259.5	244.0	15.5
G15	259.5	245.6	13.9
G8	259.5	245.0	14.5
G6	259.5	245.6	13.9
G9	259.5	250.5	9.0
G10	259.5	247.1	12.4
G7	259.5	243.9	15.6
G5	259.0	246.5	12.5
G3	259.0	243.9	15.1
G1	259.0	243.9	15.1
G4	259.0	243.9	15.1
G2	259.0	244.0	15.0
G31	264.6	250.3	14.3
G27	265.0	247.5	17.5

Column ID	Top of Col	Bottom of Col	As-Built Depth
	ELEV	***ELEV***	***FT***
G29	265.0	244.0	21.0
G30	265.0	251.3	13.7
G28	265.0	251.4	13.6
G26	265.0	248.5	16.5
G24	265.0	248.8	16.2
G22	265.0	244.0	21.0
G25	265.0	252.7	12.3
G23	265.0	250.0	15.0



Geo-Solutions

SHEET 1 OF 1

Drawing Name: Auger Final Lyout

Former Suffern, NY MGP SIte
Auger ISS

Auger ISS Final Column Layout

Suffern, NY

GEO-SOLUTIONS PROJECT #15-131

REVISIONS			
REV	DESCRIPTION		
a	Reviewed:	Chkd:	Appr.:
b	Reviewed:	Chkd:	Appr.:
c	Reviewed:	Chkd:	Appr.:

DRAWN BY: TLD 04/11/2018
CHECKED:
APPROVED:

Jet Grouting Column Data						
Column ID	**Start Depth**	**Stop Depth**	**Total Drill Depth**	**Bot of JG Col**	**Top of JG Col**	**Grout Length**
	El. FT	**El. FT**	**FBGS**	**El. FT**	**EL. FT**	**LF**
J11	273.8	244.0	29.9	244.0	245.0	1.0
J14	273.8	244.0	29.8	244.0	259.0	15.0
J12	273.8	244.0	29.8	244.0	245.6	1.6
J13	273.8	244.0	29.8	244.0	245.6	1.6
J4	273.8	244.0	29.8	244.0	247.1	3.1
J1	273.8	244.0	29.8	244.0	247.1	3.1
J2	273.8	244.0	29.8	244.0	246.5	2.5
J3	273.8	244.0	29.8	244.0	250.5	6.5
J8	273.8	244.0	29.8	244.0	250.5	6.5
J6	273.8	244.0	29.8	244.0	245.0	1.0
J7	273.8	244.0	29.8	244.0	250.5	6.5
J10	273.8	244.0	29.8	244.0	245.0	1.0
J9	273.8	244.0	29.8	244.0	245.6	1.6
J5	273.8	244.0	29.8	244.0	245.6	1.6
J36	274.4	244.0	30.4	244.0	250.3	6.3
J35	274.4	244.0	30.4	244.0	250.3	6.3
J26	274.4	244.0	30.4	244.0	250.3	6.3
J34	274.4	244.0	30.4	244.0	250.3	6.3
J28	274.4	244.0	30.4	244.0	250.3	6.3
J20	274.4	244.0	30.4	244.0	248.5	4.5
J18	274.4	244.0	30.4	244.0	252.7	8.7
J21	274.4	244.0	30.4	244.0	248.5	4.5
J25	274.4	244.0	30.4	244.0	252.7	8.7
J32	274.4	244.0	30.4	244.0	251.3	7.3
J24	274.4	244.0	30.4	244.0	252.7	8.7
J31	274.4	244.0	30.4	244.0	251.3	7.3
J19	274.4	244.0	30.4	244.0	248.8	4.8
J16	274.4	244.0	30.4	244.0	250.0	6.0
J23	274.4	244.0	30.4	244.0	251.4	7.4
J27	274.4	244.0	30.4	244.0	251.4	7.4
J30	274.4	244.0	30.4	244.0	251.4	7.4
J17	274.4	244.0	30.4	244.0	252.7	8.7
J15	274.4	244.0	30.4	244.0	250.0	6.0
J22	274.4	244.0	30.4	244.0	251.4	7.4
J29	274.4	244.0	30.4	244.0	251.4	7.4
J33	274.4	244.0	30.4	244.0	247.5	3.5
J158	267.6	241.0	26.6	241.0	252.2	11.2
J157	267.3	241.0	26.3	241.0	253.0	12.0
J162	267.7	241.0	26.7	241.0	252.2	11.2
J165	267.5	241.0	26.5	241.0	244.0	3.0
J165	269.3	241.0	28.3	241.0	252.2	11.2
J161	269.5	241.0	28.5	241.0	253.0	12.0
J164	269.3	241.0	28.3	241.0	253.0	12.0
J168	269.1	241.0	28.1	241.0	256.9	15.9
J167	269.2	241.0	28.2	241.0	260.2	19.2

Column ID	Start Depth	Stop Depth	Total Drill Depth	Bot of JG Col	Top of JG Col	Grout Length
	El. FT	El. FT	FBGS	El. FT	EL. FT	LF
J166	269.9	241.0	28.9	241.0	251.4	10.4
J169	269.5	241.0	28.5	241.0	251.0	10.0
J173	269.3	241.0	28.3	241.0	253.0	12.0
J172	269.4	241.0	28.4	241.0	256.9	15.9
J170	269.7	241.0	28.7	241.0	252.2	11.2
J174	269.5	241.0	28.5	241.0	252.1	11.1
J178	269.0	241.0	28.0	241.0	252.3	11.3
J177	269.2	241.0	28.2	241.0	260.2	19.2
J171	269.1	241.0	28.1	241.0	260.2	19.2
J182	268.8	241.0	27.8	241.0	263.3	22.3
J183	268.8	241.0	27.8	241.0	257.0	16.0
J180	269.9	241.0	28.9	241.0	253.9	12.9
J176	270.0	241.0	29.0	241.0	253.9	12.9
J175	269.8	241.0	28.8	241.0	251.4	10.4
J460	267.3	241.0	26.3	241.0	242.3	1.3
J463	267.3	241.0	26.3	241.0	242.3	1.3
J461	267.2	241.0	26.2	241.0	245.4	4.4
J462	267.3	241.0	26.3	241.0	245.4	4.4
J458	267.5	241.0	26.5	241.0	246.5	5.5
J459	267.5	241.0	26.5	241.0	245.4	4.4
J454	267.6	241.0	26.6	241.0	246.5	5.5
J456	267.8	241.0	26.8	241.0	247.6	6.6
J452	267.7	241.0	26.7	241.0	253.8	12.8
J455	267.5	241.0	26.5	241.0	247.6	6.6
J450	267.2	241.0	26.2	241.0	260.4	19.4
J457	267.2	241.0	26.2	241.0	246.5	5.5
J453	267.2	241.0	26.2	241.0	246.5	5.5
J451	267.2	240.4	26.8	240.4	245.9	5.5
J449	267.2	241.0	26.2	241.0	253.8	12.8
J446	267.3	240.2	27.1	240.2	253.0	12.8
J447	267.6	241.0	26.6	241.0	260.4	19.4
J443	267.0	241.0	26.0	241.0	253.3	12.3
J444	267.2	241.0	26.2	241.0	260.7	19.7
J270	269.0	240.8	28.2	240.8	258.4	17.6
J260	269.2	240.5	28.7	240.5	258.1	17.6
J250	269.3	241.0	28.3	241.0	261.9	20.9
J238	269.3	241.0	28.3	241.0	258.2	17.2
J239	269.3	240.9	28.4	240.9	261.8	20.9
J229	269.7	241.0	28.7	241.0	261.9	20.9
J219	269.5	241.0	28.5	241.0	257.1	16.1
J209	269.3	241.0	28.3	241.0	248.7	7.7
J220	269.5	241.0	28.5	241.0	252.0	11.0
J210	269.8	241.0	28.8	241.0	257.1	16.1
J200	269.3	241.0	28.3	241.0	251.3	10.3
J192	269.5	241.0	28.5	241.0	245.1	4.1
J211	270.0	241.0	29.0	241.0	261.0	20.0
J201	269.7	241.0	28.7	241.0	252.8	11.8

GSI Jet Grouting
Column Master Sheet

Column ID	Start Depth	Stop Depth	Total Drill Depth	Bot of JG Col	Top of JG Col	Grout Length
	El. FT	El. FT	FBGS	El. FT	EL. FT	LF
J193	269.8	241.0	28.8	241.0	252.8	11.8
J185	269.5	241.0	28.5	241.0	252.1	11.1
J186	270.1	241.0	29.1	241.0	252.8	11.8
J179	270.0	241.0	29.0	241.0	252.8	11.8
J181	270.3	241.0	29.3	241.0	249.0	8.0
J300	270.0	240.9	29.1	240.9	256.4	15.5
J288	269.8	241.0	28.8	241.0	256.5	15.5
J299	269.9	241.0	28.9	241.0	259.8	18.8
J276	269.8	241.0	28.8	241.0	259.8	18.8
J313	269.8	240.9	28.9	240.9	259.7	18.8
J312	269.8	240.9	28.9	240.9	259.7	18.8
J325	269.6	241.0	28.6	241.0	242.2	1.2
J311	269.8	241.0	28.8	241.0	242.2	1.2
J244	269.8	241.0	28.8	241.0	258.5	17.5
J255	270.0	241.0	29.0	241.0	256.0	15.0
J287	269.8	241.0	28.8	241.0	256.9	15.9
J298	269.9	240.9	29.0	240.9	256.8	15.9
J440	268.7	240.9	27.8	240.9	242.4	1.5
J433	268.7	240.9	27.8	240.9	242.4	1.5
J434	268.9	240.9	28.0	240.9	253.5	12.6
J422	268.9	240.9	28.0	240.9	253.5	12.6
J423	268.9	240.8	28.1	240.8	253.8	13.0
J415	268.9	241.0	27.9	241.0	254.0	13.0
J435	266.6	240.9	25.7	240.9	248.1	7.2
J429	266.7	241.0	25.7	241.0	248.2	7.2
J441	266.7	240.8	25.9	240.8	253.8	13.0
J436	267.2	241.0	26.2	241.0	254.0	13.0
J448	267.3	241.0	26.3	241.0	254.0	13.0
J445	267.2	241.0	26.2	241.0	254.0	13.0
J442	267.4	241.0	26.4	241.0	254.0	13.0
J417	266.8	241.0	25.8	241.0	247.2	6.2
J424	266.7	241.0	25.7	241.0	248.2	7.2
J425	266.8	241.0	25.8	241.0	255.1	14.1
J432	267.8	241.0	26.8	241.0	246.7	5.7
J421	267.9	241.0	26.9	241.0	249.9	8.9
J439	267.8	241.0	26.8	241.0	261.2	20.2
J428	267.3	241.0	26.3	241.0	261.2	20.2
J413	267.6	241.0	26.6	241.0	257.8	16.8
J431	267.7	241.0	26.7	241.0	261.2	20.2
J406	267.1	241.0	26.1	241.0	258.4	17.4
J418	267.3	241.0	26.3	241.0	255.1	14.1
J402	266.7	241.0	25.7	241.0	254.0	13.0
J409	266.9	241.0	25.9	241.0	254.0	13.0
J416	267.1	241.0	26.1	241.0	254.0	13.0
J231	270.5	241.0	29.5	241.0	261.2	20.2
J222	270.3	241.0	29.3	241.0	261.2	20.2
J221	270.5	241.0	29.5	241.0	261.2	20.2

GSI Jet Grouting
Column Master Sheet

Column ID	Start Depth	Stop Depth	Total Drill Depth	Bot of JG Col	Top of JG Col	Grout Length
	El. FT	El. FT	FBGS	El. FT	EL. FT	LF
J202	271.2	241.0	30.2	241.0	261.2	20.2
J212	270.5	241.0	29.5	241.0	261.2	20.2
J213	271.2	241.0	30.2	241.0	260.2	19.2
J203	271.0	241.0	30.0	241.0	250.7	9.7
J194	270.1	241.0	29.1	241.0	250.2	9.2
J204	271.1	241.0	30.1	241.0	256.7	15.7
J195	271.2	241.0	30.2	241.0	250.7	9.7
J188	271.0	241.0	30.0	241.0	250.7	9.7
J187	270.1	241.0	29.1	241.0	253.9	12.9
J159	269.6	241.0	28.6	241.0	250.7	9.7
J156	269.4	241.0	28.4	241.0	253.0	12.0
J160	269.0	241.0	28.0	241.0	253.0	12.0
J163	269.0	241.0	28.0	241.0	256.9	15.9
J391	269.3	241.0	28.3	241.0	255.8	14.8
J381	269.2	241.0	28.2	241.0	255.8	14.8
J393	269.0	240.9	28.1	240.9	250.3	9.4
J392	269.0	241.0	28.0	241.0	250.4	9.4
J394	270.0	241.0	29.0	241.0	254.7	13.7
J382	269.4	241.0	28.4	241.0	254.7	13.7
J371	269.4	241.0	28.4	241.0	250.4	9.4
J360	269.2	241.0	28.2	241.0	245.5	4.5
J349	269.1	241.0	28.1	241.0	244.6	3.6
J338	269.3	241.0	28.3	241.0	244.6	3.6
J383	270.2	241.0	29.2	241.0	254.7	13.7
J372	270.0	241.0	29.0	241.0	254.7	13.7
J361	269.7	241.0	28.7	241.0	254.7	13.7
J350	270.0	241.0	29.0	241.0	245.5	4.5
J326	270.0	241.0	29.0	241.0	244.6	3.6
J362	270.2	241.0	29.2	241.0	254.2	13.2
J339	270.1	241.0	29.1	241.0	245.5	4.5
J327	269.5	241.0	28.5	241.0	244.6	3.6
J314	270.2	241.0	29.2	241.0	242.9	1.9
J351	270.2	241.0	29.2	241.0	262.0	21.0
J340	270.3	241.0	29.3	241.0	261.1	20.1
J328	270.2	241.0	29.2	241.0	261.1	20.1
J315	270.1	241.0	29.1	241.0	250.9	9.9
J329	270.3	241.0	29.3	241.0	262.0	21.0
J316	270.2	241.0	29.2	241.0	261.1	20.1
J302	270.2	241.0	29.2	241.0	250.9	9.9
J290	270.2	241.0	29.2	241.0	259.0	18.0
J223	270.8	241.0	29.8	241.0	256.7	15.7
J233	270.8	241.0	29.8	241.0	256.1	15.1
J243	271.0	240.9	30.1	240.9	256.6	15.7
J232	270.0	241.0	29.0	241.0	260.2	19.2
J242	270.6	241.0	29.6	241.0	256.9	15.9
J254	270.9	241.0	29.9	241.0	256.7	15.7
J265	271.0	241.0	30.0	241.0	260.5	19.5

GSI Jet Grouting
Column Master Sheet

Column ID	Start Depth	Stop Depth	Total Drill Depth	Bot of JG Col	Top of JG Col	Grout Length
	El. FT	El. FT	FBGS	El. FT	EL. FT	LF
J275	271.0	241.0	30.0	241.0	260.4	19.4
J286	271.2	241.0	30.2	241.0	260.9	19.9
J253	271.0	241.0	30.0	241.0	260.2	19.2
J264	270.6	240.6	30.0	240.6	256.5	15.9
J274	271.0	241.0	30.0	241.0	256.7	15.7
J285	271.1	241.0	30.1	241.0	260.4	19.4
J297	271.0	241.0	30.0	241.0	260.9	19.9
J273	270.4	241.0	29.4	241.0	256.2	15.2
J284	270.4	241.0	29.4	241.0	253.9	12.9
J295	270.8	241.0	29.8	241.0	258.9	17.9
J296	270.9	241.0	29.9	241.0	256.5	15.5
J309	271.0	241.0	30.0	241.0	256.5	15.5
J263	269.8	241.0	28.8	241.0	254.1	13.1
J199	269.4	241.0	28.4	241.0	255.3	14.3
J208	269.3	241.0	28.3	241.0	262.5	21.5
J217	269.8	241.0	28.8	241.0	257.5	16.5
J226	269.9	241.0	28.9	241.0	258.4	17.4
J235	269.9	241.0	28.9	241.0	262.4	21.4
J184	269.3	241.0	28.3	241.0	255.3	14.3
J191	269.8	241.0	28.8	241.0	257.1	16.1
J198	269.8	241.0	28.8	241.0	257.5	16.5
J207	269.9	241.0	28.9	241.0	261.9	20.9
J216	269.8	241.0	28.8	241.0	261.6	20.6
J225	269.8	241.0	28.8	241.0	261.6	20.6
J190	270.0	241.0	29.0	241.0	262.0	21.0
J197	270.0	241.0	29.0	241.0	249.5	8.5
J197	262.5	241.0	21.5	241.0	254.6	13.6
J206	270.0	241.0	29.0	241.0	261.8	20.8
J215	269.9	241.0	28.9	241.0	261.7	20.7
J224	270.0	241.0	29.0	241.0	259.5	18.5
J234	270.1	241.0	29.1	241.0	258.9	17.9
J189	269.9	241.0	28.9	241.0	263.3	22.3
J196	269.9	241.0	28.9	241.0	263.3	22.3
J205	269.9	241.0	28.9	241.0	263.3	22.3
J214	269.8	241.0	28.8	241.0	260.7	19.7
J363	271.2	241.0	30.2	241.0	262.3	21.3
J373	271.2	241.0	30.2	241.0	258.1	17.1
J330	271.5	241.0	30.5	241.0	261.4	20.4
J342	271.2	241.0	30.2	241.0	261.3	20.3
J365	271.2	241.0	30.2	241.0	260.7	19.7
J376	271.2	241.0	30.2	241.0	260.7	19.7
J387	271.2	241.0	30.2	241.0	258.5	17.5
J399	271.2	241.0	30.2	241.0	258.9	17.9
J341	271.2	241.0	30.2	241.0	262.0	21.0
J352	271.5	241.0	30.5	241.0	250.9	9.9
J364	271.2	241.0	30.2	241.0	261.0	20.0
J375	271.2	241.0	30.2	241.0	255.1	14.1

Column ID	Start Depth	Stop Depth	Total Drill Depth	Bot of JG Col	Top of JG Col	Grout Length
	El. FT	El. FT	FBGS	El. FT	EL. FT	LF
J386	271.2	241.0	30.2	241.0	256.7	15.7
J398	271.5	241.0	30.5	241.0	258.4	17.4
J405	271.2	240.7	30.5	240.7	256.0	15.3
J412	271.2	241.0	30.2	241.0	259.1	18.1
J420	271.2	241.0	30.2	241.0	262.4	21.4
J374	270.7	241.0	29.7	241.0	260.7	19.7
J385	270.7	241.0	29.7	241.0	256.8	15.8
J397	270.7	241.0	29.7	241.0	256.7	15.7
J404	270.7	241.0	29.7	241.0	256.7	15.7
J411	270.7	241.0	29.7	241.0	256.7	15.7
J419	270.7	241.0	29.7	241.0	258.6	17.6
J427	270.7	241.0	29.7	241.0	260.8	19.8
J384	270.9	241.0	29.9	241.0	258.0	17.0
J395	270.8	241.0	29.8	241.0	258.1	17.1
J396	270.8	241.0	29.8	241.0	256.8	15.8
J403	270.7	241.0	29.7	241.0	256.9	15.9
J410	270.7	241.0	29.7	241.0	247.2	6.2
J426	270.7	241.0	29.7	241.0	258.6	17.6
J437	270.6	241.0	29.6	241.0	258.6	17.6
J430	271.0	241.0	30.0	241.0	258.8	17.8
J438	270.5	241.0	29.5	241.0	260.7	19.7
J357	272.4	241.0	31.4	241.0	256.0	15.0
J370	272.4	241.0	31.4	241.0	261.8	20.8
J358	272.3	241.0	31.3	241.0	261.8	20.8
J347	272.4	241.0	31.4	241.0	249.3	8.3
J335	272.5	241.0	31.5	241.0	255.2	14.2
J359	272.5	241.0	31.5	241.0	261.3	20.3
J348	272.4	241.0	31.4	241.0	261.8	20.8
J336	272.5	241.0	31.5	241.0	257.6	16.6
J323	272.4	241.0	31.4	241.0	248.8	7.8
J337	272.5	241.0	31.5	241.0	261.4	20.4
J324	272.4	240.8	31.6	240.8	260.9	20.1
J310	272.4	241.0	31.4	241.0	260.9	19.9
J346	272.6	241.0	31.6	241.0	257.3	16.3
J334	272.7	240.9	31.8	240.9	258.8	17.9
J345	272.4	240.8	31.6	240.8	259.3	18.5
J333	272.5	240.9	31.6	240.9	259.1	18.2
J320	272.7	240.9	31.8	240.9	250.7	9.8
J321	272.7	241.0	31.7	241.0	259.2	18.2
J307	272.5	241.0	31.5	241.0	259.3	18.3
J294	272.7	241.0	31.7	241.0	256.2	15.2
J322	272.6	240.9	31.7	240.9	258.9	18.0
J301	271.4	241.0	30.4	241.0	244.6	3.6
J289	271.8	241.0	30.8	241.0	257.6	16.6
J277	271.6	241.0	30.6	241.0	257.6	16.6
J266	271.7	241.0	30.7	241.0	257.6	16.6
J256	271.7	241.0	30.7	241.0	258.3	17.3

GSI Jet Grouting
Column Master Sheet

Column ID	Start Depth	Stop Depth	Total Drill Depth	Bot of JG Col	Top of JG Col	Grout Length
	El. FT	El. FT	FBGS	El. FT	EL. FT	LF
J245	271.7	240.8	30.9	240.8	259.3	18.5
J278	271.2	241.0	30.2	241.0	259.0	18.0
J267	271.5	241.0	30.5	241.0	258.9	17.9
J257	271.7	241.0	30.7	241.0	262.3	21.3
J246	271.6	241.0	30.6	241.0	258.2	17.2
J268	271.3	241.0	30.3	241.0	259.1	18.1
J258	271.6	241.0	30.6	241.0	259.0	18.0
J247	271.6	241.0	30.6	241.0	262.1	21.1
J236	271.7	241.0	30.7	241.0	253.6	12.6
J227	271.6	241.0	30.6	241.0	262.5	21.5
J218	271.7	241.0	30.7	241.0	262.5	21.5
J248	271.7	241.0	30.7	241.0	257.6	16.6
J237	271.6	241.0	30.6	241.0	262.4	21.4
J228	271.6	241.0	30.6	241.0	257.1	16.1
J259	271.6	241.0	30.6	241.0	260.9	19.9
J249	271.6	241.0	30.6	241.0	255.9	14.9
J279	271.5	241.0	30.5	241.0	260.7	19.7
J269	271.5	241.0	30.5	241.0	260.9	19.9
J303	271.6	241.0	30.6	241.0	261.1	20.1
J291	271.5	241.0	30.5	241.0	260.7	19.7
J280	271.7	241.0	30.7	241.0	260.7	19.7
J317	271.7	241.0	30.7	241.0	242.4	1.4
J304	271.7	241.0	30.7	241.0	261.4	20.4
J292	271.9	241.0	30.9	241.0	258.3	17.3
J281	272.3	241.0	31.3	241.0	253.3	12.3
J318	272.1	241.0	31.1	241.0	261.4	20.4
J305	272.3	241.0	31.3	241.0	257.8	16.8
J293	272.7	241.0	31.7	241.0	256.5	15.5
J282	272.7	241.0	31.7	241.0	259.4	18.4
J331	272.3	241.0	31.3	241.0	260.8	19.8
J319	272.3	241.0	31.3	241.0	258.4	17.4
J306	272.6	241.0	31.6	241.0	258.5	17.5
J353	272.3	241.0	31.3	241.0	260.8	19.8
J343	272.2	241.0	31.2	241.0	260.7	19.7
J332	272.0	241.0	31.0	241.0	258.5	17.5
J230	272.0	241.0	31.0	241.0	261.0	20.0
J240	272.6	241.0	31.6	241.0	261.0	20.0
J271	272.5	241.0	31.5	241.0	259.4	18.4
J262	272.6	241.0	31.6	241.0	259.4	18.4
J252	272.7	240.4	32.3	240.4	247.0	6.6
J241	272.8	241.0	31.8	241.0	260.3	19.3
J261	271.9	241.0	30.9	241.0	261.9	20.9
J251	272.5	241.0	31.5	241.0	261.9	20.9
J272	271.9	241.0	30.9	241.0	248.8	7.8
J283	272.7	241.0	31.7	241.0	256.3	15.3
J354	272.6	241.0	31.6	241.0	260.5	19.5
J344	272.8	241.0	31.8	241.0	255.4	14.4

GSI Jet Grouting
Column Master Sheet

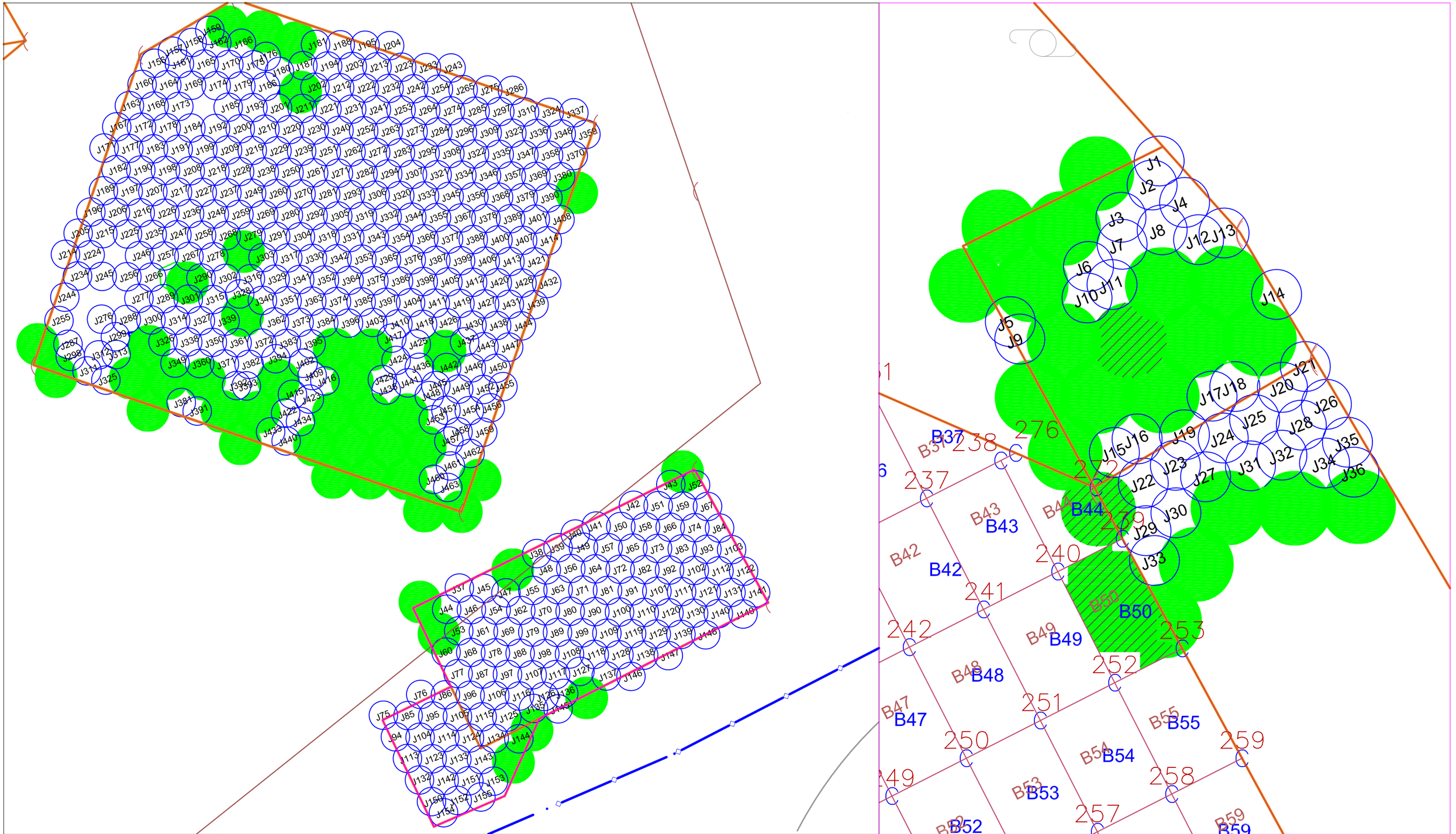
Column ID	Start Depth	Stop Depth	Total Drill Depth	Bot of JG Col	Top of JG Col	Grout Length
	El. FT	El. FT	FBGS	El. FT	EL. FT	LF
J366	272.3	240.8	31.5	240.8	258.1	17.3
J355	272.4	241.0	31.4	241.0	258.0	17.0
J377	272.1	241.0	31.1	241.0	258.5	17.5
J367	272.2	241.0	31.2	241.0	257.8	16.8
J356	272.3	241.0	31.3	241.0	257.3	16.3
J368	272.2	241.0	31.2	241.0	251.3	10.3
J308	272.9	241.0	31.9	241.0	259.1	18.1
J388	272.0	241.0	31.0	241.0	260.4	19.4
J378	272.1	241.0	31.1	241.0	251.8	10.8
J400	272.0	241.0	31.0	241.0	261.1	20.1
J389	272.1	241.0	31.1	241.0	261.0	20.0
J379	271.8	241.0	30.8	241.0	261.0	20.0
J369	272.2	241.0	31.2	241.0	261.8	20.8
J407	272.0	241.0	31.0	241.0	261.0	20.0
J401	272.0	241.0	31.0	241.0	261.0	20.0
J390	271.9	241.0	30.9	241.0	257.2	16.2
J380	272.0	241.0	31.0	241.0	261.8	20.8
J408	271.9	241.0	30.9	241.0	248.3	7.3
J414	271.8	241.0	30.8	241.0	261.0	20.0
J148	273.6	242.7	30.9	242.7	264.4	21.7
J130	273.6	243.0	30.6	243.0	268.1	25.1
J111	273.5	243.0	30.5	243.0	260.7	17.7
J140	273.7	243.0	30.7	243.0	268.2	25.2
J121	273.6	243.0	30.6	243.0	268.2	25.2
J102	273.5	243.0	30.5	243.0	262.9	19.9
J119	273.6	243.0	30.6	243.0	259.7	16.7
J110	273.6	243.0	30.6	243.0	259.8	16.8
J101	273.6	243.0	30.6	243.0	263.0	20.0
J147	273.6	243.0	30.6	243.0	259.4	16.4
J129	273.6	243.0	30.6	243.0	252.9	9.9
J139	273.6	243.0	30.6	243.0	264.4	21.4
J120	273.6	243.0	30.6	243.0	260.7	17.7
J149	273.4	243.0	30.4	243.0	268.1	25.1
J131	273.5	243.0	30.5	243.0	268.1	25.1
J112	273.5	243.0	30.5	243.0	268.1	25.1
J76	272.6	243.0	29.6	243.0	259.0	16.0
J86	272.7	243.0	29.7	243.0	259.1	16.1
J75	273.3	243.0	30.3	243.0	256.9	13.9
J85	272.5	243.0	29.5	243.0	258.6	15.6
J94	273.4	243.0	30.4	243.0	258.4	15.4
J95	272.8	242.8	30.0	242.8	259.0	16.2
J105	273.1	243.0	30.1	243.0	259.0	16.0
J113	273.5	242.7	30.8	242.7	247.9	5.2
J113	269.2	243.0	26.2	243.0	258.2	15.2
J104	273.0	243.0	30.0	243.0	258.2	15.2
J132	273.3	243.0	30.3	243.0	258.3	15.3
J123	272.8	243.0	29.8	243.0	257.9	14.9

GSI Jet Grouting
Column Master Sheet

Column ID	Start Depth	Stop Depth	Total Drill Depth	Bot of JG Col	Top of JG Col	Grout Length
	El. FT	El. FT	FBGS	El. FT	EL. FT	LF
J114	272.8	243.0	29.8	243.0	258.8	15.8
J150	273.4	243.0	30.4	243.0	256.9	13.9
J154	273.1	243.0	30.1	243.0	249.3	6.3
J142	272.9	243.0	29.9	243.0	257.9	14.9
J133	273.0	243.0	30.0	243.0	258.7	15.7
J124	272.9	243.0	29.9	243.0	249.0	6.0
J152	273.0	243.0	30.0	243.0	249.7	6.7
J151	272.8	243.0	29.8	243.0	253.5	10.5
J93	273.8	243.0	30.8	243.0	265.3	22.3
J74	273.9	243.0	30.9	243.0	262.9	19.9
J83	273.7	243.0	30.7	243.0	264.9	21.9
J92	273.7	243.0	30.7	243.0	262.9	19.9
J59	273.8	243.0	30.8	243.0	263.1	20.1
J66	273.6	243.0	30.6	243.0	263.0	20.0
J73	273.5	243.0	30.5	243.0	262.9	19.9
J82	273.5	243.0	30.5	243.0	262.9	19.9
J91	273.6	243.0	30.6	243.0	260.7	17.7
J65	273.5	243.0	30.5	243.0	262.1	19.1
J51	273.8	243.0	30.8	243.0	263.0	20.0
J58	273.5	243.0	30.5	243.0	262.2	19.2
J50	273.2	243.0	30.2	243.0	264.2	21.2
J57	273.4	243.0	30.4	243.0	259.9	16.9
J49	273.9	243.0	30.9	243.0	260.6	17.6
J48	273.0	243.0	30.0	243.0	258.6	15.6
J56	273.3	243.0	30.3	243.0	258.6	15.6
J64	273.6	243.0	30.6	243.0	258.5	15.5
J72	273.6	243.0	30.6	243.0	260.7	17.7
J71	273.5	243.0	30.5	243.0	259.3	16.3
J81	273.6	243.0	30.6	243.0	260.5	17.5
J47	273.1	243.0	30.1	243.0	259.0	16.0
J55	273.2	243.0	30.2	243.0	258.6	15.6
J63	273.4	243.0	30.4	243.0	258.6	15.6
J62	273.3	243.0	30.3	243.0	257.3	14.3
J70	273.2	243.0	30.2	243.0	258.5	15.5
J80	273.2	243.0	30.2	243.0	257.7	14.7
J90	273.8	243.0	30.8	243.0	259.5	16.5
J100	273.6	243.0	30.6	243.0	259.9	16.9
J79	273.3	243.0	30.3	243.0	258.5	15.5
J89	273.3	243.0	30.3	243.0	257.8	14.8
J99	273.8	243.0	30.8	243.0	257.3	14.3
J109	273.9	243.0	30.9	243.0	259.6	16.6
J108	273.3	243.0	30.3	243.0	256.9	13.9
J54	273.0	243.0	30.0	243.0	259.0	16.0
J61	272.9	242.9	30.0	242.9	257.9	15.0
J68	273.0	243.0	30.0	243.0	262.0	19.0
J88	273.1	243.0	30.1	243.0	261.5	18.5
J98	273.3	243.0	30.3	243.0	259.9	16.9

GSI Jet Grouting
Column Master Sheet

Column ID	Start Depth	Stop Depth	Total Drill Depth	Bot of JG Col	Top of JG Col	Grout Length
	El. FT	El. FT	FBGS	El. FT	EL. FT	LF
J107	273.2	243.0	30.2	243.0	259.8	16.8
J145	273.3	243.0	30.3	243.0	265.6	22.6
J126	273.3	243.0	30.3	243.0	265.6	22.6
J136	273.6	243.0	30.6	243.0	265.5	22.5
J117	273.4	242.8	30.6	242.8	265.7	22.9
J127	273.4	243.0	30.4	243.0	256.9	13.9
J45	272.7	242.7	30.0	242.7	263.7	21.0
J46	272.7	242.7	30.0	242.7	263.7	21.0
J44	272.7	242.7	30.0	242.7	263.7	21.0
J53	272.8	242.8	30.0	242.8	263.8	21.0
J37	272.8	242.8	30.0	242.8	263.8	21.0
J60	272.8	242.8	30.0	242.8	257.3	14.5
J77	273.0	243.0	30.0	243.0	259.3	16.3
J78	273.1	242.8	30.3	242.8	263.8	21.0
J118	273.6	243.0	30.6	243.0	257.6	14.6
J137	273.6	243.0	30.6	243.0	249.8	6.8
J128	273.8	243.0	30.8	243.0	259.6	16.6
J146	274.0	243.0	31.0	243.0	259.4	16.4
J96	273.2	243.0	30.2	243.0	258.2	15.2
J115	273.4	243.0	30.4	243.0	259.0	16.0
J134	273.5	243.0	30.5	243.0	257.0	14.0
J138	273.8	243.0	30.8	243.0	259.4	16.4
J38	273.2	243.0	30.2	243.0	258.6	15.6
J39	272.7	243.0	29.7	243.0	260.7	17.7
J40	273.0	243.0	30.0	243.0	260.7	17.7
J41	273.7	242.5	31.2	242.5	260.1	17.6
J42	273.5	243.0	30.5	243.0	264.3	21.3
J43	273.7	243.0	30.7	243.0	263.0	20.0
J52	273.7	243.0	30.7	243.0	261.0	18.0
J67	273.9	243.0	30.9	243.0	261.6	18.6
J84	274.1	243.0	31.1	243.0	260.0	17.0
J141	274.0	243.0	31.0	243.0	256.2	13.2
J153	273.3	243.0	30.3	243.0	258.2	15.2
J155	273.5	243.0	30.5	243.0	258.2	15.2
J143	273.3	243.0	30.3	243.0	253.5	10.5
J144	273.6	243.0	30.6	243.0	256.3	13.3
J125	273.4	243.0	30.4	243.0	266.1	23.1
J106	273.4	243.0	30.4	243.0	266.1	23.1
J135	273.7	243.0	30.7	243.0	266.1	23.1
J116	273.5	243.0	30.5	243.0	266.1	23.1
J122	274.3	243.0	31.3	243.0	257.0	14.0
J103	274.3	243.0	31.3	243.0	259.8	16.8
J69	273.6	243.0	30.6	243.0	256.6	13.6
J97	273.6	242.5	31.1	242.5	265.9	23.4
J87	273.6	243.0	30.6	243.0	261.5	18.5



Geo-Solutions

SHEET 1 OF 1

Drawing Name: JG Final Layout

Former Suffern, NY MGP Site
Jet Grouting

Jet Grouting Final Column Layout

Suffern, NY

GEO-SOLUTIONS PROJECT #15-131

REVISIONS			
REV	DESCRIPTION		
a	Reviewed:	Chkd:	Appr.:
b	Reviewed:	Chkd:	Appr.:
c	Reviewed:	Chkd:	Appr.:

DRAWN BY: TLD 04/11/2018
CHECKED:
APPROVED:

APPENDIX H
SITEWIDE INSPECTION FORM

SUFFERN – ANNUAL INSPECTION CHECKLIST

Inspection Date: _____/_____/_____

Inspector Name: _____

1. Institutional Controls

The following questions will be completed after a driving and/or walking survey of the Suffern site has been completed.

Are there any new residential, commercial or industrial structures at the property?

Yes □ No □

Is the new facility being used for nonconforming purposes (e.g., commercial and industrial uses only)?

Yes □ No □

Is there any evidence of potable or process water wells at the property?

Yes □ No □

Is there any evidence of recent excavations in the areas with subsurface work restrictions? If so, contact the owner to determine if the subsurface work was completed in accordance with the excavation work plan. If the inspection finds evidence that the institutional controls are being violated or are suspected of being violated, the findings will be reported to NYSDEC within 48 hours of the inspection.

Yes □ No □

Notes:_____

_____

_____

_____

2. Facility Wide Piezometers and Sparge Wells

Is there any damage to the protective bollards for the wells?

Yes □ No □

Notes:_____

Are wells made visible by painting and numbering? Yes □ No □

Notes:_____

Do wells have concrete surface aprons adequate to ensure that the well samples are not impacted by surface water?

Yes □ No □

Notes:_____

Is there any damage to the protective casing?

Yes □ No □

Notes:_____

Are wells secured by locking? Yes □ No □

Notes:_____

_____

3. Facility Security

Damage to perimeter fencing and/or gates?

Yes □ No □

Gates properly chained and locked?

Yes □ No □

Excessive vegetation along perimeter fencing? Is brush cutting needed?

Yes □ No □

Are all "No Trespassing" signs present and in adequate condition?

Yes □ No □

Notes:_____

_____

4. Cover Inspection

Evidence of subsidence, settlement, cracks, or animal burrows?

Yes □ No □

Evidence of deterioration or malfunction of cap?

Yes □ No □

Evidence of erosion damage?

Yes □ No □

Vegetative cover in place?

Yes □ No □

Are there woody plants that need to be removed?

Yes □ No □

Is there evidence of water ponding on the surface?

Yes □ No □

Notes:_____

_____

5. Corrective Actions Completed

Notes:_____

_____

APPENDIX I

PUBLIC WATER SUPPLY PROTECTION AND MITIGATION PLAN

Public Water Supply Protection and Mitigation Plan

Suffern Manufactured Gas Plant Site
Suffern, New York

Orange & Rockland Utilities, Inc.

July 26, 2019

OBG
Part of Ramboll

JULY 26, 2019| PROJECT #67893

Public Water Supply Protection and Mitigation Plan

Suffern Manufactured Gas Plant Site
Suffern, New York

Prepared for:

Orange & Rockland Utilities, Inc.
3 Old Chester Road
Goshen, New York 10924

TIMOTHY J. OLEAN
Technical Director

TABLE OF CONTENTS

LIST OF APPENDICES

1 BACKGROUND

The Suffern Manufactured Gas Plant (MGP) Site (Site) is located at 3 Pat Malone Drive in the Village of Suffern, New York, approximately 0.2 miles north of the Suffern rail station. An MGP operated at the Site from 1902 to 1935. The Suffern Gas Company MGP began gas manufacturing operations in approximately 1902 using the Lowe carbureted water gas process. In general, the plant consisted of a former MGP building that included a coal storage room, a boiler room, a generator room, and a storage room as well as a meter room and a pump house that were attached to the MGP building. Additionally, a 50,000-cubic foot (cf) gas holder and 7,000-gallon steel oil storage tank were built prior to operation. By the end of 1925, the MGP plant was rebuilt as a coal gas plant and shortly after (August 1926) the ownership was transferred to the Ramapo Gas Corporation. The coal gas plant operated at the MGP property from 1925 to 1935. In general, the configuration of the MGP plant remained largely unchanged after it was rebuilt as a coal gas plant. In July 1935, manufactured gas production ceased and manufactured gas was replaced with natural gas, which was supplied by the Home Gas Company, the West Shore Gas Company, and Rockland Gas Company. During the 1940s and early 1950s an electroplating facility was in operation at this location. The Site was also used to manufacture buses until 2008. The Site is zoned for manufacturing land use and is currently used as a natural gas regulating and metering station.

The remediation of the former MGP site began in 2016. The site was remediated in accordance with the remedy selected by the NYSDEC in the Record of Decision (ROD) for the Suffern former MGP Site, No. 3-44-045 dated March 2014. The goal of the cleanup action for the site was to achieve cleanup levels that protect public health and the environment. Clean up for the site included excavation and off-site disposal of approximately 20,000 cubic yards of coal tar contaminated soil to approximate depths of up to 15 feet. In areas with deeper contamination, approximately 17,000 cubic yards of coal tar contaminated soil was solidified. Solidification was performed to depths of up to 35 feet. Remedial construction was completed in 2017. A Site Management Plan (SMP) was established which details the requirements for site management including soil management in the event of any future excavations and long-term groundwater monitoring. Due to proximity of the Site to the Village of Suffern public water supply well field, the selected remedy also required the development and implementation of a Public Water Supply Protection and Mitigation Plan (Plan).

2 PURPOSE

This Plan was developed per selected remedy element No. 6 of the ROD. The purpose of this Plan is to:

a) Evaluate the existing long-term groundwater monitoring program and determine whether additional sentinel monitoring points and/or increased sampling frequency are necessary to ensure adequate detection and warning of potential MGP-contamination into the public water supply.

b) As necessary, install wellhead treatment systems or comparable alternative measures, or upgrade existing systems, for public water supply wells that are threatened or impacted by MGP related contamination in the future.

c) Provide immediate notification to the New York State Department of Environmental Conservation (NYSDEC), New York State Department of Health (NYSDOH), Rockland County Health Department (RCHD), and the Village of Suffern if MGP-contaminant concentrations in a sentinel well(s) exceed a specified action level and implement appropriate response actions.

3 GROUNDWATER MONITORING PROGRAM

3.1 GROUNDWATER MONITORING PRIOR TO REMEDIATION

Due to the proximity and downgradient location of the municipal supply wells for the Village of Suffern, quarterly or biannual groundwater monitoring has been performed at the Site since 1999. The quarterly monitoring program that was performed prior to remediation was conducted in accordance with the NYSDEC-approved document entitled "Quarterly Groundwater Monitoring Work Plan, Suffern Former MGP Site" (hereto referred as "Quarterly GWMP"), dated April 8, 2010

Monitoring wells and multi-channel well ports located at the Site monitor two zones of the unconsolidated aquifer (glaciofluvial unit) to vertically profile concentrations of contaminants of concern (COCs) and determine the extent of MGP-related impacts.

Monitoring wells were also installed beyond the MGP-impacted groundwater, about 100 feet from the municipal supply wells, to provide a means of detecting potential migration of MGP constituents in groundwater towards the Village of Suffern water supply wells (Appendix A, Figure 1). The municipal supply wells are screened from approximately 45 feet to 130 feet below ground surface. A monitoring well network designed to sample groundwater at various depths from the water table to the top of bedrock was established to rule out the existence of preferential pathways of contaminant flow towards the supply wells.

Based on groundwater data collected since 1999, groundwater containing COCs at concentrations greater than NYSDEC standards and guidance values is primarily limited to the Site. Detected concentrations off-site in the direction of the Well Field area have been limited and sporadic in nature.

3.2 GROUNDWATER MONITORING DURING REMEDIAL ACTION

Prior to the implementation of the remedial action, a groundwater monitoring plan was developed in concert with NYSDEC, NYSDOH and RCDOH. The plan "Groundwater Monitoring Plan During Remedial Construction" included sampling of all on site wells to establish baseline conditions prior to construction followed by biweekly (i.e., once every two weeks) groundwater monitoring of selected wells for the duration of the in-situ solidification (ISS) portion of the remedy. The increased sampling frequency provided an effective early warning of any potential MGP-related contaminant migration towards the Well Field as a result of intrusive activities. The estimated travel times for contaminant migration between the treatment areas and the Suffern Well Field are on the order of years. Groundwater monitoring of wells close to the ISS monolith were included (e.g., MW2, MW19, MW-29, MW30, MW31, and WP7). This monitoring program was based on the conservatively assumed maximum displacement of 5 feet and the average linear groundwater velocity within the shallow zone (13.25 feet/year) being greater than the expected contaminant transport rates. Pumping activity for the Suffern Well Field was documented during the same period that the site gradients were measured.

The biweekly sampling interval (i.e., once every two weeks) met or exceeded the monitoring goals, of early detection of contaminant migration based on chemical fate and transport properties. The groundwater sampling included the following:

- Five monitoring wells and one CMT directly downgradient of the ISS area were sampled biweekly, during ISS, and analyzed for benzene, toluene, ethylbenzene and xylene (BTEX) compounds and naphthalene via USEPA Method 8260C.
- Sampling provided sufficient vertical coverage (five in shallow zone and seven in deep zone) between the ISS areas and the Village of Suffern water supply wells. The monitoring of the five identified monitoring wells and one CMT continued for one complete cycle after the ISS was completed.
- The subject wells were also monitored for increases in pH and conductivity weekly during active ISS as these parameters, which typically temporarily increase during ISS, and would provide an early indicator of potential groundwater impact.

Results were provided to the NYSDEC, NYSDOH, and RCDOH during remedial construction. During remediation, no changes to groundwater conditions were observed that required initiation of mitigation measures. A final letter report, including the analytical reports, was prepared summarizing the results of each monitoring event and was submitted to the regulatory agencies and the Village of Suffern.

3.3 GROUNDWATER MONITORING PLAN POST-REMEDIATION

At the completion of remediation in 2017, per the ROD, the quarterly monitoring plan was evaluated in relation to post remediation groundwater conditions. A revised quarterly groundwater sampling plan was submitted to NYSDEC and NYSDOH on October 13, 2017(Appendix A). The revised plan was initiated and will continue to be conducted at the Site. Key elements of the quarterly monitoring program are as follows:

- Seventeen monitoring wells are gauged for water levels including: MW1, MW2, MW4, MW5, MW10, MW16, MW19, MW22, MW23, MW25, MW26, MW29, MW30, MW31, MW33, MW34, and MW35. The monitoring wells and multi-channel well ports for post-remedial monitoring are shown in Appendix A, Figure 1 and Table 1.
- These monitoring wells are gauged for the presence or absence of non-aqueous phase liquids (NAPLs).
- Gauging is performed for both light non-aqueous phase liquid (LNAPL), and dense non-aqueous phase liquid (DNAPL).
- Groundwater samples are collected from ten monitoring wells including several multi-channel wells.
- Samples are analyzed for VOCs, SVOCs and cyanide.
- Samples are sent to a certified laboratory which will perform analyses under the NYSDOH Environmental Laboratory Approval Program (ELAP).
- The methods used for the analyses, and the quality control measures performed, are consistent with the specifications provided in the NYSDEC Analytical Services Protocol (ASP).

Results are provided in a report to the NYSDEC, NYSDOH, and RCDOH and the Village of Suffern for each quarterly sampling event.

4 CONTINGENCY MEASURES

4.1 INSTALLATION OF SPARGE WELLS

Prior to implementation of remedial action 31sparge wells were installed at the site. The objective of installing these wells was to have a system in place as a contingency measure that may be quickly started at the site to provide a barrier to, or to treat, dissolved-phase contaminants. The measure would be implemented, if needed, so that groundwater leaving the site meets the NYSDEC Groundwater Standard or Guidance Values.

Air or ozone injection was determined to be an effective treatment for COCs in Site groundwater as demonstrated in the bench top study provided in the Technical Memo dated December 15,2015 Appendix B. As described in detail in the *Sparge Well Installation Work Plan* (CH2M, March 2016), 31 sparge wells were installed, each including four 1-inch sparge points to depths of 100 feet, 75 feet, 50 feet and 25 feet below grade. 6 piezometers were also installed with three, 1-inch monitoring points to depths of 75 feet, 50 feet and 25 feet below grade. Pilot testing was performed on two of the newly installed sparge wells. Pilot test data were used to verify well spacing and understand characteristics of the sparge wells and aquifer as well as aid in design of a full-scale injection system, if necessary. The well details and results of this test and the installation details are provided in Appendix C.

The pilot testing demonstrated that the initial spacing of 25 feet is appropriate for full scale operation. The multiple layered sparge screens were installed to assure coverage throughout the vertical section of the aquifer and this pilot test established that the multiple layers of sparge screens can be operated effectively allowing sparging to reach all depths of the aquifer, including between silt zones or confining layers.

Conditions during remediation did not require use of the sparge well network. The network will remain in place for use as a contingency measure should long term monitoring indicate need for active treatment of the plume.

4.2 INCREASED MONITORING

If new constituents are detected at significant concentrations and/or a significant increase in COC concentrations is observed in the post remediation monitoring discussed in Section 3.3, when compared to previous data, a resampling event may be conducted to confirm or verify the initial analytical results. Significant, for the purposes of this document, is defined as any increase in comparison to baseline analytical results. Any occurrence of constituents not detected in baseline analytical results, or any increase in the COC concentrations over baseline values, will be discussed with NYSDEC, NYSDOH and RCDOH to determine the potential need for resampling or other contingency measures.

If concentrations of constituents in groundwater samples collected from wells are significantly greater than baseline concentrations and or concentrations observed during ongoing quarterly monitoring, a confirmatory sample will be collected unless a decision is made to immediately implement further contingencies in consultation with NYSDEC, NYSDOH and RCDOH. Confirmatory samples will be collected with an expedited turn-around time (TAT) to document results prior to the next sampling event. If the confirmatory sample also indicates an increase in concentration compared to the baseline concentration, additional contingencies will be assessed in consultation with NYSDEC, NYSDOH, and RCDOH for evaluating the reasons for the observed change and the potential for impacts to occur in other areas downgradient of the Site.

If significant changes in groundwater quality due to site-related contamination are identified and confirmed through resampling, then several possible response actions may be considered. These response actions will be determined in consultation with NYSDEC, NYSDOH, and RCDOH and could include modifying sampling frequencies or increasing the number of monitoring wells sampled in that area, to further evaluate the extent and conditions of groundwater impacts. Groundwater contingency measures could be implemented if the results of successive monitoring events indicate that COC concentrations are trending upward or if the leading edge of the plume is advancing toward the Suffern Well Field.

In the event MGP-contaminant concentrations in a sentinel well(s) exceed a specified action level is confirmed the following two contingency measures have been established:

- Air Sparging/Oxidative Sparging (AS/OS
- Alternative Water Supply

The contingency measure implemented will depend on the level of impact as determined during post-remedial monitoring, the location, the current site conditions, and other factors.

4.3 AIR SPARGING/OXIDATIVE SPARGING

Air sparging/oxidative sparging (AS/OS) will be implemented as a contingency measure if monitoring performed in Section 3.3 indicates that COCs are advancing towards the site perimeter and Suffern Well Field as confirmed by the sampling described in Section 4.2.

Based on the results of the ground water monitoring described in Section 3, a target treatment zone would be established using the well network already in place and described in Section 4.1. A skid-mounted injection system would be procured and connected to the target treatment wells at the depths indicated and injection would begin. Additional piezometers may be installed at that time to enhance system performance evaluation and optimization if determined to be necessary. If ozone were used it would be at very low levels (1-3% of total injected flow) it is very likely to be diminished in groundwater before it reaches existing buried pipelines, especially at the deeper injection points. If the target treatment area were shallow and in the area of known gas utility lines at the Site, additional monitoring for vapors in the area would be performed to ensure that ozone does not come in to contact with the pipes. Air only injection would also be considered if contact with ozone remains a concern at system implementation.

To maintain the readiness of the sparge well system, all wells will be visually inspected yearly as part of on-going site inspection activities as required in the SMP.

4.2 PRIVATE WATER SUPPLY WELL

In the event of an imminent threat to the Village of Suffern's water supply due to MGP-related contamination, and in consultation with the NYSDEC/NYSDOH and RCDOH, the Suffern Well Field could be shut down and an alternative water supply provided to users via the existing interconnection with a private water supply, SUEZ Environment (formerly United Water) of NY (SUEZ). There are three existing interconnections between SUEZ and the Village of Suffern. In all cases, SUEZ's hydraulic gradient is higher than Suffern's PWS so no additional pumping systems would be required.

5 NOTIFICATION PROCEDURES

In the event the contaminant concentrations in a sentinel well(s) are significantly greater than baseline concentrations and or concentrations observed during ongoing quarterly monitoring, O&R or their designee will notify the NYSDEC, NYSDOH, Rockland County Health Department, and the Village of Suffern within 24 hours.

A written report will follow verbal notification and will include:

- Name and location of the Site
- Name of person and company submitting the report
- Date, approximate time, and specific location of the exceedance
- Corrective action and countermeasures taken, including a description of equipment repairs and replacements, if required, for spare well and monitoring well system components
- Description of the Site, including maps, flow diagrams, and topographical maps

Agency Contact	Phone Number
New York Department of Environmental Conservation **Mr. John Spellman** Division of Environmental Remediation Bureau of Technical Support 625 Broadway - 11th Floor Albany, NY 12233-7020	518-402-9686
New York Department of Health **Mr. Anthony Perretta** Corning Tower Empire State Plaza, Albany, NY 12237	518-402-7860
Rockland County Health Department **Mr. Dan Miller** Robert L Yeager Health Center 50 Sanatorium Road, Building D Pomona, NY 10970	845-364-2289
Village of Suffern **Charles Sawicki** 61 Washington Avenue Suffern, NY 10901	845-357-2602

Appendix A

Post-Remedial Quarterly Groundwater Monitoring Plan

GEI Consultants

October 13, 2017

Consulting
Engineers and
Scientists

Mr. John Spellman, P.E.
Division of Environmental Remediation
New York State Department of Environmental Conservation
625 Broadway
Albany, NY 12233-7014

Re: Proposed Scope of Work
Post-Remedial Quarterly Groundwater Monitoring
Suffern Former MGP Site
NYSDEC Site # 3-44-045

Dear Mr. Spellman:

This work plan has been prepared by GEI Consultants, Inc., P.C. (GEI) for Orange and Rockland Utilities, Inc. (O&R) to present a proposed scope of work for post-remedial quarterly groundwater monitoring at the former manufactured gas plant (MGP) site in Suffern, New York.

Background

The final tasks for the implementation of the remedy for the Suffern MGP site were completed in late July 2017. The first post-remedial quarterly groundwater monitoring event was performed in early August 2017 (3rd Quarter 2017 Event). A report for the quarterly event (dated August 25, 2017) was submitted to the New York State Department of Environmental Conservation (NYSDEC).

The NYSDEC and the New York State Department of Health (NYSDOH) have required that quarterly monitoring continue at the site following implementation of the remedy. A proposed scope for the event planned for November 2017 (4th Quarter 2017) event is described below. The scope of work described below for some site wells has been modified from the scope included in the 2016 Groundwater Monitoring Work Plan (GMWP) [NRT, 2016]. The proposed modifications are based on a review of the 2016/2017 Bi-Weekly and Quarterly groundwater results, and are anticipated to more completely evaluate groundwater quality at locations between the remedial area and the adjacent, downgradient Village of Suffern municipal water extraction wells.

The post-remedial groundwater scope of work described in this work plan may be further modified, if necessary, during preparation and NYSDEC approval of the Site Management Plan (SMP) for the Suffern MGP site.

Proposed Quarterly Field Monitoring Activities

Monitoring Well Elevation Gauging

Seventeen monitoring wells installed at the site will continue to be gauged to map the direction of groundwater flow. The direction of groundwater flow for the shallow and deeper portions of the aquifer will continue to be mapped for each event.

GEI Consultants, Inc., P.C.
1301 Trumansburg Road, Suite N, Ithaca, New York 14850
607.216.8955 fax: 607.274.7577

NAPL Monitoring

The seventeen wells remaining at the site will continue to be gauged for the presence or absence of non-aqueous phase liquids (NAPLs). Gauging will be performed for both light non-aqueous phase liquid (LNAPL), and dense non-aqueous phase liquid (DNAPL).

Village of Suffern Well Pumping Data

The Village of Suffern Water Department will be contacted for each event. Well pumping data and extraction rates for the Village water extraction wells will continue to be provided in the quarterly reports.

Groundwater Sampling and Analyses

The monitoring wells and multi-channel well ports proposed for post-remedial monitoring are shown in Figure 1. The wells and CMT ports to be sampled are identified in Table 1. Included in the table are the well designations, the analyses to be performed (VOCs, SVOCs, and/or total cyanide). Also included in the table are the sampling rationales for each well or CMT port.

The samples will continue to be sent to a certified laboratory which will perform analyses under the NYSDOH Environmental Laboratory Approval Program (ELAP). The methods used for the analyses, and the quality control measures performed, will continue to be consistent with the specifications provided in the NYSDEC Analytical Services Protocol (ASP).

Schedule

The next sampling event planned for the site (4th Quarter event) is targeted for November 2017. The NYSDEC will be notified of the proposed dates within the notification period specified by the Department.

If the proposed scope of work described above is acceptable, please provide approval for the proposed plan. If you have any questions regarding the proposed scope of work for the sampling, please do not hesitate to contact me at (607) 216-8958. Please direct the Department's official response to Maribeth McCormick of O&R.

Sincerely,

GEI CONSULTANTS, INC., P.C.

James Edwards, P.G.
Geologist/Project Manager

JHE:amm

Attachments: Table 1 – Post-Remedial Quarterly Groundwater Sampling Plan
Figure 1 – Post-Remedial Quarterly Monitoring Plan

c: Maribeth McCormick – Orange and Rockland Utilities, Inc.
Anthony Perretta – NYSDOH
Maureen Schuck – NYSDOH

Table

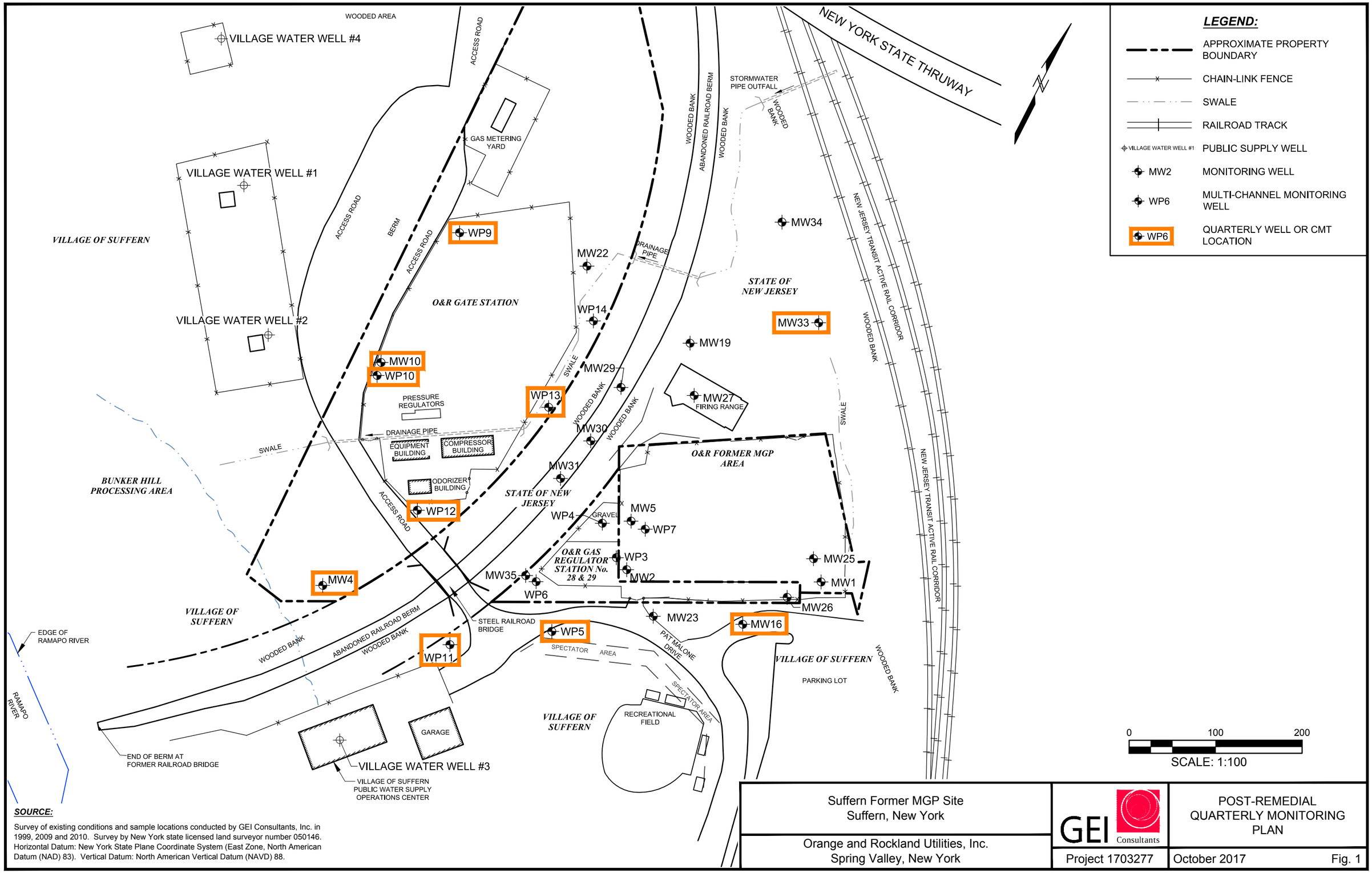
Table 1. Post-Remedial Quarterly Groundwater Sampling Plan
Suffern MGP Site

Well or CMT	VOC	SVOC	Total Cyanide	Rationale
MW4			X	Sentinel Well. Down gradient concentrations of total cyanide.
MW10	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at location between remedial area and Village Well # 2. MW10 will monitor groundwater quality at the water table, and the WP10 ports will monitor deeper groundwater quality at this location.
MW16	X	X	X	Deep Zone up gradient groundwater quality. VOCs, SVOCs, and total cyanide.
MW33	X	X	X	Shallow Zone up gradient groundwater quality. VOCs, SVOCs, and total cyanide.
WP5(19)	X	X	X	Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, SVOCs, and total cyanide. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP5(32)	X	X	X	Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, SVOCs, and total cyanide. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP5(45)	X	X		Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, and SVOCs. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP5(58)	X	X		Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, and SVOCs. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP5(71)	X	X		Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, and SVOCs. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP5(84)	X	X		Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, and SVOCs. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP5(97)	X	X		Down gradient (Shallow Zone) and cross gradient (Deep Zone) concentrations of VOCs, and SVOCs. Location is between remedial area and down gradient sentinel well WP11, and Village Well # 3.
WP9(12)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at a location between remedial area and Village Well # 4.
WP9(29.5)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at a location between remedial area and Village Well # 4.
WP9(47)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 4.
WP9(64.5)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 4.
WP9(82)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 4.
WP9(99.5)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 4.
WP9(117)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 4.
WP10(32)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at a location between remedial area and Village Well # 2. This port and MW10 will monitor the shallow groundwater zone for total cyanide.
WP10(49)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 2.
WP10(66)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 2.
WP10(83)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 2.
WP10(100)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 2.
WP10(117)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 2.

Table 1. Post-Remedial Quarterly Groundwater Sampling Plan
Suffern MGP Site

Well or CMT	VOC	SVOC	Total Cyanide	Rationale
WP10(134)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Well # 2.
WP11(12)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at location between remedial area and Village Well # 3.
WP11(27)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at location between remedial area and Village Well # 3.
WP11(43)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at location between remedial area and Village Well # 3.
WP11(58)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at location between remedial area and Village Well # 3.
WP11(73)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at location between remedial area and Village Well # 3.
WP11(88)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at location between remedial area and Village Well # 3.
WP11(104)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at location between remedial area and Village Well # 3.
WP12(12)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at a location between remedial area and Village Wells # 2 and # 3.
WP12(34)	X	X	X	Sentinel Well. Down gradient concentrations of VOCs, SVOCs, and total cyanide at a location between remedial area and Village Wells # 2 and # 3.
WP12(54)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Wells # 2 and # 3.
WP12(74)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Wells # 2 and # 3.
WP12(94)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Wells # 2 and # 3.
WP12(114)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Wells # 2 and # 3.
WP12(134)	X	X		Sentinel Well. Down gradient concentrations of VOCs, and SVOCs at a location between remedial area and Village Wells # 2 and # 3.
WP13(12)	X	X	X	Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, SVOCs, and total cyanide.
WP13(29)	X	X	X	Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, SVOCs, and total cyanide.
WP13(47)	X	X		Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, and SVOCs.
WP13(64)	X	X		Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, and SVOCs.
WP13(82)	X	X		Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, and SVOCs.
WP13(99)	X	X		Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, and SVOCs.
WP13(117)	X	X		Location down gradient of remedial area between remedial area and sentinel wells MW10 / WP10 and WP9. Down gradient concentrations of VOCs, and SVOCs.
Trip Blank (Date)	X			QA / QC
Trip Blank (Date)	X			QA / QC
Trip Blank (Date)	X			QA / QC

Figure



SOURCE:

Survey of existing conditions and sample locations conducted by GEI Consultants, Inc. in 1999, 2009 and 2010. Survey by New York state licensed land surveyor number 050146. Horizontal Datum: New York State Plane Coordinate System (East Zone, North American Datum (NAD) 83). Vertical Datum: North American Vertical Datum (NAVD) 88.

Suffern Former MGP Site
Suffern, New York

Orange and Rockland Utilities, Inc.
Spring Valley, New York

GEI Consultants

POST-REMEDIAL QUARTERLY MONITORING PLAN

Project 1703277 | October 2017 | Fig. 1

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Appendix B

Down-Gradient Groundwater In Situ Treatment Bench Study and Contingency Evaluation

Orange and Rockland Down-Gradient Groundwater In Situ Tretament Bench Study and Contingency Evaluation *Suffern, New York*

PREPARED FOR: Maribeth McCormick
Technical Manager – Remediation
Orange and Rockland Utilities

COPY TO: Tim Olean/BOS
Spence Smith/BOS

PREPARED BY: Jim Hartley/SAC
Dusty Berggren/CVO
Bruce Pratt/CVO
Katie Rabe/CVO

DATE: December 15, 2015

PROJECT NUMBER: 650199.06.01

Introduction

This technical memorandum describes the results of the bench-scale treatability study performed to evaluate the potential of several oxidants for use in a possible in-situ treatment system at the Orange and Rockland site in Suffern, New York. The results of this study will be used to support the selection of an oxidant for use in a contingency air sparge treatment system, if compounds of concern (either VOCs or SVOCs) are detected downgradient of the source zone following implementation of the remedial action, which includes source material removal and in situ solidification/stabilization. The objectives of this study were to evaluate the effectiveness of different oxidant strengths to meet groundwater treatment standards, and to simultaneously establish oxidant types or dosages that can be used before forming hexavalent chromium (Cr[VI]) in-situ. The ideal oxidant would effectively treat the contaminants of concern (COCs) while staying below the Cr(VI) production threshold.

Oxygen (concentrated and atmospheric), ozone, and hydrogen peroxide were the oxidants evaluated, and delivered in a manner to produce four levels of oxidative power. Testing was conducted in sealed batch reactors consisting of approximately equal volumes of site soil, groundwater spiked with contaminants, and vacant headspace. For the batch tests, the designated oxidant was supplied to the reactor headspace, then tumbled for a half hour to ensure transfer of the oxidant to the liquid phase. This regimen was repeated for five successive cycles before the water was sampled for analysis of COCs and water quality parameters such as oxidation reduction potential (ORP) and dissolved oxygen (DO). Treatment effectiveness was evaluated based the extent of COC degradation, absence of Cr(VI), and comparative ORP and DO.

Treatability testing was performed at CH2M's Applied Sciences Laboratory (ASL) in Corvallis, Oregon. An overview of sample characterization and experimental setup is presented below. The testing results are discussed below and presented in the attached tables.

Methodology

These sections describe the methods used to prepare and to characterize site samples, and to conduct the batch reactor tests.

Sample Homogenization and Characterization

Soil and groundwater samples were collected at the site on July 28, 2015 and sent to ASL via ground transportation for treatability testing. Approximately 40 kilograms (kg) of soil from location WP13 (17 to 117 feet below ground surface) were collected together with 50 gallons of groundwater. Upon arrival to ASL on August 18, 2015, the soil was thoroughly homogenized into a single bulk sample, which was characterized for chemical and physical properties including:

- VOCs (SW8260B)
- Poly Aromatic Hydrocarbons (PAHs) (SW 8270C-SIM)
- Total Iron (Fe), Arsenic (As), Manganese (Mn), and Chromium (Cr) (SW6010)
- Total Organic Carbon (TOC) (SM5310B)
- Moisture content (SM2540B)
- pH (SW9040D)

All analyses were performed in triplicate. The remaining soil was stored in two 5-gallon buckets at 4 degrees Celsius until used in treatability testing. The results of these soil analyses (except moisture and pH) are presented in Table 1.

The 55 gallon drum of groundwater arrived to ASL on August 20, 2015. The contents of the drum were thoroughly mixed using a drum pump, then distributed equally into nine 5 gallon containers to near zero-headspace conditions. The groundwater sample was then characterized through analysis of the following parameters:

- VOCs (SW8260)
- PAHs (SW 8270C-SIM)
- Dissolved Fe, Cr (SW6010)
- pH, dissolved oxygen (DO) and oxidation reduction potential (ORP) (calibrated bench-top meters)

After characterization, groundwater was stored at 4 degrees Celsius until used for treatability testing.

Results for the groundwater baseline characterization are summarized in Table 2.

Findings for soil and groundwater sample baseline analysis both showed low levels of acenaphthene and pyrene. Low level detections of naphthalene, fluorene, phenanthrene, fluoranthene, and pyrene were found in the native soil, while the site groundwater also contained anthracene. VOCs such as benzene, toluene and acetone were below detection limits. Total chromium was present in the soil at 10.9 - 13.0 mg/kg, and in the water at 24.5 μg/L. The dissolved chromium concentration was found to be 1.36 μg/L.

Treatability testing was designed to represent a possible future groundwater concentration that might occur downgradient of the source zone after source stabilization. This was accomplished by spiking the groundwater with low levels of representative VOCs and SVOCs for treatability testing.

Groundwater Spiking

The representative COCs selected were benzene, toluene, naphthalene, and acenaphthene at the following target concentrations:

- 10 microgram per liter (μg/L) acenaphthene
- 60 μg/L naphthalene
- 150 μg/L benzene
- 300 μg/L toluene

A controlled spiking scheme was employed to minimize the potential for volatile losses in the spiked groundwater before use in the treatability testing, and to allow the materials to be quickly and evenly introduced to each batch of groundwater. This began with a pre-processing step on the groundwater delivered in a shipping drum. After receipt, the site groundwater was allowed to settle for one day, and

sediment was seen to form from the slightly turbid water. The overlaying water was then pumped from the drum into 5-gallon cubitainers, avoiding disturbance of the sediment layer. Some sediment was transferred into the cubitainers; however, groundwater was decanted into a clean cubitainer before use in the treatability study. The study involving the batch reactors required two 5 gallon cubitainers. Each cubitainer was then spiked with a VOC solution (approximately 66 milliliters [mL]) and 600 mL of an SVOC solution, bringing the total volume to 18.9 liters (L) of spiked fluid. The concentrated VOC spiking solution included benzene, toluene and naphthalene. It was prepared in a glass volumetric flask, which was sealed and stirred overnight to solubilize the solid form of naphthalene. This solution was sampled for VOC analysis to confirm the spiking concentrations, then dispensed to a number of 22 mL glass volatile organic analyte (VOA) vials with zero headspace for later use in spiking of the groundwater.

A separate stock solution was made for SVOCs as the low solubility limit necessitated that larger spikes would be necessary. Acenaphthene was selected as the target SVOC constituent given its relatively higher solubility limit of 3.8 milligrams per liter (mg/L) in water at 25 degrees Celsius, while the other SVOCs of potential interest had much lower solubility (less than 65 µg/L). To make the stock solution, 350 mg of acenaphthene (99 percent, powder form) was dissolved in benzene (1.2 mL) in a small vial; acenaphthene is highly soluble in benzene, so this step brought the acenaphthene into a liquid form for easier delivery to the water stock solution. Four microliters of this concentrated mix was then spiked into 4 L of groundwater in a glass jar. The jar was then sealed and stirred overnight to mix as it was noted that the solution immediately crystalized upon contact with water during the addition, and was initially observed floating on the top of the liquid in the container. The target concentration of acenapthene for this stock spiking solution was 290 µg/L.

On October 26, 2015, a 5 gallon poly cubitainer was spiked with 600 mL of the SVOC stock solution containing acenaphthene (with benzene solvent), and three of the 22 mL VOA containers of the VOC stock solution. This spiked groundwater was used in the first three batch tests described below. On October 28, 2015 a second container of spiked groundwater was created using the same stock solutions, and this spiked ground water was used to run the last two batch tests. Baseline analysis of these two stock solutions is summarized in Table 2.

Batch Test Setup

The four oxidation levels for this test were:

1. air (23 percent oxygen by weight)
2. purified oxygen (approximately 99 percent by weight)
3. ozone (approximately 1.3 percent by weight, with about 21.9 percent oxygen), and
4. ozone with peroxide (approximately 1.3 percent ozone, 21.9 percent oxygen, and hydrogen peroxide at 1 percent of total batch fluids).

These will be referred to as the Air, Oxygen, Ozone, and Peroxide-Ozone reactors. A fifth run (“Control”) was also conducted as a control using the same COC spiked groundwater and jar setup, but with nitrogen gas for the headspace. This control served to assess the level of treatment, if any, due to the mixing of the samples or the use of any equipment in the process, as opposed to intrinsic oxidation of the COCs.

Ozone generally has a greater oxidation potential compared to oxygen, but in this trial the ozone was added as a low concentration relative to the pure stream of oxygen. The ozone generator employed for the Ozone test resulted in a 1.3 percent ozone, 21.9 percent oxygen, and 76.8 percent nitrogen mixture; in contrast, the Oxygen test used 99 percent oxygen. For this reason the “ozone” treatment had a lower oxidation potential than the purified “Oxygen” treatment.

The test plan originally used a column reactor packed with soil, and configured to inject a flow of oxidant gas sparge into a circulating spiked groundwater flow as a laboratory approximation of the soil, gas and water

interaction in a field sparging application. Preliminary testing of a column setup resulted in unexpectedly high pressures and trapped gas pockets in the soil, which prevented the flow of groundwater through the column. Because of this, the column setup was abandoned as a method to evaluate the oxidative treatment of groundwater, and was replaced by a sealed batch reactor setup.

Three replicate batch reactors were setup in 1 gallon jars. These jars contained:

- 1.8 kg of soil,
- 1.8 L of spiked groundwater, and
- Air, in the remaining vacant headspace (approximately 1.3 L)

Jar lids were equipped with 2 sealable Swagelok ports to serve as a gas-delivery port and a gas-release port to prevent pressure build up. Once the reactors were prepared, the jars' threads were wrapped in Teflon tape and the lids were secured, prior to inverting the jars for mixing.

The contents of the first groundwater cubitainer were sampled on October 26, 2015 for analysis. The results of this analysis are summarized in Table 2 as 'Spiked GW 10/26'. This batch was then used to fill the reactors for the Control, Air and Oxygen oxidant reactions on the afternoon of the October 26th and the morning of October 27th. The second batch of spiked groundwater was prepared on October 28th, in the same manner. This batch was sampled on October 28th and the results are summarized in Table 2 as 'Spiked GW 10/28'. This batch of spiked groundwater was used to fill the Ozone and Peroxide-Ozone batch reactors.
For each of the tests, the selected oxidant gas was delivered to the headspace at a flowrate of 1.0 liter per minute for approximately 2 minutes to allow for two volume headspace exchanges. In the Peroxide-Ozone test, peroxide was also added (from a 35 percent solution) as one spike at the beginning of the test. Immediately after the gas had been delivered, both Swagelok ports were capped and the reactors were inverted and inspected for leaks.
Reactors were double zip-locked bagged and loaded onto a tumbler for 30 minutes, at 30 revolutions per minute. Once removed from the tumbler, 10 mL of batch fluid was drawn with a gas-tight syringe through the gas-release port and transferred to a sealed 22 mL VOA vial for ORP measurements. Jars were then connected to gas lines to re-supply the selected oxidant prior to returning to the tumblers. The test regimen consisted of five consecutive rounds of repeated tumbling, sample collection, and oxidative gas delivery. In addition to measuring the ORP, dissolved oxygen and pH were also measured prior to the first tumble and after the fifth final tumble. Immediately following the final tumble round, batch fluid and soil were collected and analyzed for VOCs, SVOCs, Cr(VI), iron, and general chemistry bench parameters.

For the trials using ozone, batch fluid was sampled for ozone concentrations by a treatability specialist at the time of sample collection using the DR/890 Data Logging Colorimeter HACH test kit. Based on the results of the HACH kit, low levels of ozone remained in the Ozone reactor fluid, while ozone was found to be below detection limits in the Peroxide-Ozone reactors. Ozone concentrations are recorded for the three replicate Ozone and Peroxide-Ozone reactors in Table 5.

Hydrogen peroxide was also sampled using the hydrogen peroxide HACH test kit during the time of sample collection for the Peroxide-Ozone reactors. Based on the results of the HACH kit, a concentration of approximately 8,000 mg/L (± 2,000 mg/L) of hydrogen peroxide remained in the three replicate Peroxide-Ozone reactors. Results for residual hydrogen peroxide concentrations can be found in Table 5.

Results

Indicator Parameters. The results are shown in Table 3 for the ORP measurements prior to the first tumble and at the end of each tumble interval; Table 4A and 4B summarizes the results of the bench parameter measurements including ORP, pH and DO for each oxidant trial before the first tumble and after the fifth tumble. The results are the average for the 3 replicate reactors. The following were observed:

- The pH began slightly acidic in all batches (5.07-6.64), and became more acidic after each test, with the Peroxide-Ozone test having the most pronounced decrease (3.64-5.79). Additionally, the Control batch pH fell nearly a unit (0.88 units), suggesting that the process itself has an acidifying effect.
- The ORP increased in all batches except the Peroxide-Ozone batch, with the greatest apparent increase with Air (+263mV), followed closely by Purified Oxygen (+225mV). ORP is noted to have increased slightly (+41mV) in the Control batch, suggesting either this approximates the precision of this measurement, or that there is something in the soil that enhances ORP under agitation.
- The DO concentration increased most dramatically with the Peroxide-Ozone batch (to >20 mg/L), and substantially with the Purified Oxygen (from 7.3 to 19.2 mg/L). Conventional oxygenation was observed with the Air (to 8.1 mg/L) and with Ozone (to 9.6 mg/L). The Control batch saw a drop in the DO (8.1 to 5.0 mg/L), suggesting the soil has some amount of natural oxidant demand (NOD).

Treatment Parameters. Table 5 shows a complete list of general chemistry parameters and detected concentrations of VOCs, SVOCs, and metals present in the reactor groundwater after the fifth tumble, and are shown together with the results of the spiked groundwater concentrations at the start of the test (taken as the time zero sample obtained before reactor setup). The Control, Air, and Oxygen reactors were prepared using the spiked groundwater from October 26, while the Ozone and Peroxide-Ozone reactors were prepared with the spiked groundwater from October 28. Observations based on the groundwater results of Table 5 are as follows:

- The spiked groundwater concentrations for benzene, toluene, and naphthalene (as VOC) were consistent between the two test batches. The second batch (10/28) was much lower for acenaphthene and naphthalene (as SVOC) than in the first batch (10/26), which tended to compromise the treatment efficiency comparison between oxidants run with the second batch (Ozone and Peroxide-Ozone) to the other oxidants; this is a limitation on this analysis primarily for acenaphthene, and specifically to whether ozone and peroxide-ozone are demonstrably more efficient at treatment. This specific evaluation will be inferred on the basis of the data which were collected in the balance of the tests.
- All target compounds (benzene, toluene, acenaphthene and naphthalene) showed concentration reductions proportional to oxidant strength, as expected.
- Although not injected as a target compound, acetone and 2-butanone was found at increasing concentrations in the Air, Oxygen, Ozone, and Peroxide-Ozone reactors.
- Hexavalent chromium was below detection (less than 0.4 µg/L) for all of the reactors except for the Peroxide-Ozone reactors, in which the average concentration was 145 µg/L.
- Bromate concentrations remained around 100 mg/L in all reactors except Peroxide-Ozone, where the bromate concentration increased to 264 mg/L (average of 3 replicates).

A complete list of VOC and SVOC detections in the soil of the reactors are presented in Table 6.

- Acetone was shown to be below detection limits in the soil of the Control, Air, Oxygen, and Ozone reactors, but was found in high levels in the Peroxide-Ozone reactor.
- Acenaphthene showed slight concentration reductions with increasing oxidation power compared to the control reactor.
- Using the VOC analysis, naphthalene was not detected, but low levels were reported using SVOC analysis. No apparent trends were observed between increasing oxidative power; the concentrations were all very close to the analytical method quantification limit, which likely compromised the resolution between different tests.

Percent reductions and mass reductions are summarized for the target groundwater VOC and SVOC concentrations for the averaged 3 replicate reactors in Table 7. Percent mass reductions are calculated using two methods: a control-based comparison between the oxidant and control trials, and a spiked groundwater-

based comparison that evaluates the mass reductions due to both oxidant performance and processing effects (e.g, tumbler, handling, etc). The control-based comparison essentially excludes volatile losses in the mass reduction calculations, focusing on what was directly attributable to oxidation, while the spike-based comparison includes both volatile and oxidative losses. Calculations for spiked-groundwater based mass reductions compare the oxidant trials to the corresponding spiked groundwater. Observations based on the results of Table 7 are as follows:

- Benzene, toluene, and naphthalene showed increased mass reduction trending with the addition of stronger oxidants:
    - Air showed 50% to 80% treatment;
    - Purified Oxygen showed 70% to 99% treatment;
    - Ozone showed less effectiveness for acenaphthene, but 87% to 96% for the other compounds;
    - Peroxide-Ozone showed 99%-100% for the VOCs (no results available for SVOCs).
- Hexavalent chromium was detected in low concentrations in the Control, Air, Oxygen, and Ozone batches, but was found in a relatively high levels in the Peroxide-Ozone reactors.

Conclusions and Recommendations

COC degradation was evaluated for contaminated groundwater from the Orange and Rockland site in Suffern, New York by applying several different gas oxidation treatments to jar batch reactors. Results showed an increasing trend for the effectiveness of contaminant mass degradation for groundwater and soil with increasing oxidation strength (Air, Ozone, purified Oxygen, and Peroxide-Ozone, respectively). Generation of hexavalent chromium, acetone, and 2-butanone was pronounced in the Peroxide-Ozone reactors. The Control (nitrogen headspace), Air, Oxygen and Ozone trials showed low levels hexavalent chromium (less than 0.4 µg/L), but the oxidant-containing reactors also generated some acetone and 2-butanone. Generation of these ketones increased with increasing oxidant strength.

Given these findings, it is apparent that for a contingency groundwater treatment system the Peroxide-Ozone system is to be avoided (to avoid generating hexavalent chromium). Of the remaining methods, the highest level of treatment can be achieved using Purified Oxygen or Ozone, for all target compounds. Air was shown to be partially effective, but would require greater contact time to achieve the treatment level of purified oxygen or ozone.

For practical considerations, while an air-based system is the simplest and most economical to operate, this type of system would require two or three lines of sparging wells. A purified oxygen system would require a large, capital- and energy-intensive plant to generate the flow of oxygen needed; in addition, wells, piping and fittings would all need to be selected for their compatibility with purified oxygen. An ozone system is similar in terms of material compatibility (stainless steel is typically used), but because the flow requirement for ozone is limited to a small percentage (1% - 3%) of the total flow, the size of the ozone generation system would smaller and less energy intensive than the purified oxygen plant.

It appears, based on this evaluation, that air and ozone systems should be retained for later consideration. Air is intrinsically less aggressive, so to match the treatment effectiveness of an ozone system, a doubling or tripling of the number of wells (and associated piping) would be required. An ozone system, in contrast, would require more expensive materials (i.e., stainless steel instead of HDPE) for fewer wells. It is expected that if the need for such a system is identified in the future, it will be for a particular geometry and target treatment effectiveness; for this future case, either system might be preferred, depending on whether the concentration reduction target is large or small, or the area requiring treatment is extensive or limited in extent.

Table 1

Baseline Soil Characterization (Dectected Analytes Only)

Orange and Rockland, Suffern, NY

Analyte		Homogenized Soil					
		Rep 1		Rep 2		Rep 3	
Total Organic Carbon	mg/Kg	755		666		463	
VOC							
Acetone	ug/Kg	102	U	104	U	102	U
Benzene	ug/Kg	15.3	U	15.5	U	15.3	U
Toluene	ug/Kg	15.3	U	15.5	U	15.3	U
SVOC							
Naphthalene	ug/Kg	4.43		3.94		4.24	
Acenaphthylene	ug/Kg	1.00	J	0.86	J	0.89	J
Acenaphthene	ug/Kg	8.25		8.35		8.07	
Fluorene	ug/Kg	6.55		8.75		12.5	
Phenanthrene	ug/Kg	3.10		3.77		4.75	
Anthracene	ug/Kg	0.90	J	0.70	J	0.30	U
Fluoranthene	ug/Kg	3.34		6.33		3.11	
Pyrene	ug/Kg	1.37		2.90		1.32	
Metals							
Total Arsenic	mg/Kg	5.57		5.02		5.10	
Total Chromium	mg/Kg	13.0		10.9		12.7	
Total Iron	mg/Kg	15700		12200		12900	
Total Manganese	mg/Kg	98.1		88.9		101	

Qualifiers:

J =The analyte was positively identified. The associated numerical value is an estimated quantity.

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

mg/kg = milligram per kilogram

µg/kg = microgram per kilogram

Table 2

Baseline Groundwater Characterization (Dectected Analytes Only)

Orange and Rockland, Suffern, NY

Analyte		As-Rec. GW 20-Aug		Spiked GW 26-Oct		Spiked GW 28-Oct	
VOCs							
Acetone	ug/L	1.00	U	0.05	U	1.37	J
Benzene	ug/L	0.15	U	45.8		64.8	
Naphthalene	ug/L	0.15	U	21.2		56.0	
Toluene	ug/L	0.15	U	66.5		137	
SVOCs							
Naphthalene	ug/L	0.0063	J	9.24		0.023	
Acenaphthylene	ug/L	0.015		0.52		0.022	
Acenaphthene	ug/L	0.0026	J	21.4		0.31	
Fluorene	ug/L	0.0014	U	0.0013	U	0.0013	U
Phenanthrene	ug/L	0.0042	J	0.0014	U	0.0018	U
Anthracene	ug/L	0.012		0.010		0.011	
Fluoranthene	ug/L	0.0090	J	0.0030	U	0.0031	U
Pyrene	ug/L	0.011		0.0036	U	0.0036	U
Metals							
Total Chromium	ug/L	24.5		--		--	
Dissolved Chromium	ug/L	1.36	J	--		--	
Dissolved Iron	ug/L	97.6	J	--		--	

Qualifiers:

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

J =The analyte was positively identified. The associated numerical value is an estimated quantity.

µg/L = microgram per Liter

mg/L = milligram per Liter

Table 3

Oxidation-Reduction Potential Across Tumble Intervals (Average of 3 Reactors)

Orange and Rockland, Suffern, NY

	Average ORP (mV)					
Tumble	**0**	**1**	**2**	**3**	**4**	**5**
Control- Nitrogen	114.3	135.5	114.1	95.0	261.2	155.1
Air	120.8	217.9	194.8	182.9	223.9	384.1
Oxygen	14.2	109.2	166.2	170.9	210.1	238.9
Ozone	132.3	287.3	277.9	179.9	147.8	170.1
Peroxide-Ozone	297.4	272.8	264.3	258.6	266.2	241.6

Notes:

mV = millivolts

Table 4A

General Chemistry Parameters following the Final Tumble Event (Individual Reactors)

Orange and Rockland, Suffern, NY

		Control-Nitrogen	Air	Oxygen	Ozone	Ozone + Peroxide
		Avg.	Avg.	Avg.	Avg.	Avg.
Initial Pre-tumble	pH	6.21	6.15	6.64	5.21	5.07
	ORP, mV	114.3	120.8	14.2	132.3	297.4
	DO, mg/L	8.10	7.50	7.30	8.98	20.00 [1]
5th Tumble	pH	5.33	5.11	5.79	5.09	3.64
	ORP, mV	155.1	384.1	238.9	170.1	241.6
	DO, mg/L	5.00	8.11	19.20	9.57	20.00 [1]

Note: 1. Measurements were all above the range of the instrument (maximum of 20).

Table 4B

General Chemistry Parameters following the Final Tumble Event (Average of 3 Reactors)

Orange and Rockland, Suffern, NY

		Oxidant				
	units	**Control-Nitrogen**	**Air**	**Oxygen**	**Ozone**	**Peroxide-Ozone**
pH	*SU*	5.33	5.11	5.79	5.09	3.64
ORP	*mV*	155.1	384.1	238.9	170.1	241.6
DO	*mg/L*	5.00	8.11	19.20	9.57	20.00

Qualifiers:

SU = Standard Units

mV = millivolts

mg/L = milligram per Liter

Table 5

Groundwater General Chemistry, VOC, SVOC and Metals Detections

Orange and Rockland, Suffern, NY

Analyte		Spiked GW (10/26)	Spiked GW (10/28)	Control				Air				Oxygen			
				Rep1	Rep2	Rep3	Average	Rep1	Rep2	Rep3	Average	Rep1	Rep2	Rep3	Average
General Chemistry															
pH	SU	--	--	5.33	--	--	5.33	4.83	5.03	5.48	5.11	6.42	4.97	5.98	5.79
ORP	mV	--	--	127.5	151.7	186.0	155.1	387.1	388.5	376.8	384.1	247.4	235.6	233.7	238.9
DO	mg/L	--	--	5.00	--	--	5.00	8.30	7.90	8.12	8.11	20.00 E	17.60	20.00 E	19.20
Ozone	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydrogen Peroxide	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromate	mg/L	--	--	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
VOCs															
2-Butanone (MEK)	µg/L	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
Acetone	µg/L	0.50 U	1.37 J	0.50 U	0.50 U	0.50 U	0.50 U	27.0	18.2	4.99	16.7	1.86 J	2.38	1.61 J	1.95
Benzene	µg/L	45.8	64.8	26.3	26.1	25.4	25.9	19.9	19.6	20.7	20.1	12.1	14.8	13.5	13.5
Chloroform	µg/L	0.26 J	0.28 J	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
Chloromethane	µg/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
Methylene chloride	µg/L	0.32 J	0.43 J	1.91	0.45 J	1.06	1.14 J	0.48 J	0.34 J	0.43 J	0.42 J	0.52	0.38 J	0.45 J	0.45 J
Naphthalene	µg/L	21.2	56.0	22.9	22.8	22.4	22.7	9.99	9.45	9.56	9.67	0.15 U	0.15 U	0.15 U	0.15 J
Toluene	µg/L	66.5	137	47.7	45.9	44.6	46.1	30.2	31.8	32.6	31.5	14.7	16.4	15.2	15.4
SVOCs															
1-Methylnaphthalene	µg/L	0.0028 U	0.0028 U	0.045	0.078	0.042	0.055	0.12	0.072	0.027	0.07	0.040	0.074	0.062	0.059
2-Methylnaphthalene	µg/L	0.0023 U	0.0023 U	0.013	0.022	0.013	0.016	0.038	0.021	0.0096	0.023	0.011	0.017	0.018	0.015
Acenaphthene	µg/L	21.4	0.31	3.59	8.31	6.27	6.06	4.29	4.07	4.37	4.24	0.27	0.93	0.51	0.57
Acenaphthylene	µg/L	0.52	0.022	0.10	0.21	0.15	0.15	0.17	0.12	0.13	0.14	0.045	0.11	0.077	0.08
Anthracene	µg/L	0.010	0.011	0.011	0.023	0.015	0.016	0.024	0.018	0.015	0.019	0.012	0.021	0.023	0.019
Benzo(a)anthracene	µg/L	0.0018 U	0.0018 U	0.011	0.024	0.0097	0.015	0.026	0.023	0.0069 J	0.019 J	0.027	0.021	0.025	0.024
Benzo(a)pyrene	µg/L	0.0024 U	0.0024 U	0.012	0.027	0.012	0.017	0.030	0.028	0.0072 J	0.022 J	0.017	0.022	0.027	0.022
Benzo(b)fluoroanthene	µg/L	0.0029 U	0.0029 U	0.017	0.037	0.015	0.023	0.040	0.039	0.011	0.030	0.026	0.029	0.034	0.030
Benzo(g,h,i)perylene	µg/L	0.0022 U	0.0022 U	0.012	0.028	0.011	0.017	0.030	0.025	0.0076 J	0.021 J	0.012	0.019	0.023	0.018
Benzo(k)fluoranthene	µg/L	0.0032 U	0.0033 U	0.0061 J	0.012	0.0053 J	0.008 J	0.012	0.012	0.0033 U	0.009 U	0.011	0.011	0.012	0.011
Chrysene	µg/L	0.0023 U	0.0023 U	0.012	0.027	0.0089 J	0.016 J	0.031	0.027	0.0062 J	0.021 J	0.024	0.018	0.023	0.022
Fluoranthene	µg/L	0.0030 U	0.0031 U	0.11	0.22	0.097	0.14	0.27	0.19	0.063	0.17	0.21	0.20	0.24	0.22
Fluorene	µg/L	0.0013 U	0.0013 U	0.073	0.16	0.088	0.11	0.23	0.16	0.11	0.17	0.061	0.11	0.12	0.10
Indeno(1,2,3-c,d)pyrene	µg/L	0.0018 U	0.0018 U	0.0094	0.021	0.0091 J	0.013 J	0.024	0.020	0.0061 J	0.017 J	0.010	0.015	0.017	0.014
Naphthalene	µg/L	9.24	0.023	3.53	9.57	8.34	7.15	3.13	3.38	4.95	3.82	0.075	0.12	0.11	0.10
Phenanthrene	µg/L	0.0014 U	0.0018 J	0.058	0.11	0.066	0.08	0.20	0.12	0.038	0.12	0.050	0.071	0.078	0.066
Pyrene	µg/L	0.0036 U	0.0036 U	0.043	0.089	0.038	0.057	0.11	0.084	0.025	0.07	0.093	0.081	0.10	0.09
Metals															
Hexavalent Chromium	µg/L	--	--	0.02 U	0.254 N	0.02 U	0.10 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 N	0.02 N	0.02 N	0.02 N
Iron	µg/L	--	--	150	138	41.0 J	110 J	12.9 J	10.0 U	11.1 J	11.3 J	10.0 U	11.6 J	10.0 U	10.5 J

Qualifiers:

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

J =The analyte was positively identified. The associated numerical value is an estimated quantity.

N = Insufficient sample was provided for the analyst to perform the free chlorine test.

E = Estimate value above calibration range

µg/L = microgram per Liter

mg/L = milligram per Liter

mV = millivolts

SU = Standard Units

Table 5 cont.

Groundwater VOC, SVOC and Metals Detections

Orange and Rockland, Suffern, NY

Analyte		Ozone				Peroxide-Ozone			
		Rep1	Rep2	Rep3	Average	Rep1	Rep2	Rep3	Average
General Chemistry									
pH		4.35	5.65	5.26	5.09	3.72	3.61	3.58	3.64
ORP	mV	170.9	160.9	178.4	170.1	234.6	242.0	248.2	241.6
DO	mg/L	9.21	10.20	9.30	9.57	20.00 E	20.00 E	20.00 E	20.00 E
Ozone	mg/L	0.00	0.25	0.08	0.11	0.00 U	0.00 U	0.00 U	0.00 U
Hydrogen Peroxide	mg/L	--	--	--	--	8000	8000	8000	8000
Bromate	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.227 N	0.223 N	0.343 N	0.264 N
VOCs									
2-Butanone (MEK)	ug/L	6.22	7.07	6.63	6.64	47.3	49.1	51.5	49.3
Acetone	ug/L	66.7	78.5	68.5	71.2	1030	800	925	918
Benzene	µg/L	8.35	9.11	8.43	8.63	0.33 U	0.33 U	0.33 U	0.33 U
Chloroform	µg/L	0.15 U	0.15 U	0.15 U	0.15 U	0.33 U	0.33 U	0.33 U	0.33 U
Chloromethane	µg/L	0.15 U	0.15 U	0.15 U	0.15 U	1.49	1.77	1.69	1.65
Methylene chloride	µg/L	0.39 J	0.33 J	0.37 J	0.36 J	0.73 J	0.64 J	0.61 J	0.66 J
Naphthalene	µg/L	2.27	2.73	2.22	2.41	0.33 U	0.33 U	0.33 U	0.33 U
Toluene	µg/L	15.7	17.5	16.2	16.5	0.33 U	0.33 U	0.33 U	0.33 U
SVOCs									
1-Methylnaphthalene	µg/L	0.0028 U	0.0028 U	0.0028 U	0.0028 U	0.12	0.067	0.098	0.10
2-Methylnaphthalene	µg/L	0.0086 J	0.015	0.0089 J	0.011	0.041	0.021	0.031	0.031
Acenaphthene	µg/L	0.21	0.41	0.18	0.27	0.44	0.46	0.34	0.41
Acenaphthylene	µg/L	0.032	0.040	0.025	0.032	0.074	0.038	0.054	0.055
Anthracene	µg/L	0.01	0.012	0.0097	0.01	0.012	0.0045 J	0.0085 J	0.008 J
Benzo(a)anthracene	µg/L	0.023	0.018	0.014	0.018	0.052	0.019	0.044	0.038
Benzo(a)pyrene	µg/L	0.024	0.020	0.015	0.020	0.049	0.018	0.036	0.034
Benzo(b)fluoroanthene	µg/L	0.031	0.026	0.020	0.026	0.092	0.031	0.068	0.064
Benzo(g,h,i)perylene	µg/L	0.020	0.017	0.012	0.016	0.054	0.019	0.036	0.036
Benzo(k)fluoranthene	µg/L	0.013	0.0098	0.0067 J	0.010 J	0.032	0.013	0.023	0.023
Chrysene	µg/L	0.019	0.016	0.012	0.016	0.056	0.020	0.044	0.040
Fluoranthene	µg/L	0.084	0.083	0.056	0.074	0.16	0.059	0.13	0.12
Fluorene	µg/L	0.078	0.097	0.053	0.076	0.094	0.055	0.076	0.075
Indeno(1,2,3-c,d)pyrene	µg/L	0.016	0.014	0.010	0.013	0.045	0.016	0.031	0.031
Naphthalene	µg/L	1.46	2.02	1.44	1.64	0.22	0.12	0.18	0.17
Phenanthrene	µg/L	0.042	0.055	0.031	0.043	0.092	0.041	0.065	0.066
Pyrene	µg/L	0.053	0.046	0.033	0.044	0.12	0.042	0.098	0.09
Metals									
Hexavalent Chromium	µg/L	0.294 N	0.269 N	0.353 N	0.305 N	144	135	157	145
Iron	µg/L	136	143	141	140	24400	21500	25400 J	23767

Qualifiers:

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

J =The analyte was positively identified. The associated numerical value is an estimated quantity.

N = Insufficient sample was provided for the analyst to perform the free chlorine test.

E = Estimate value above calibration range

Table 6

Soil VOC and SVOC Detections

Orange and Rockland, Suffern, NY

Analyte		Control				Air				Oxygen				Ozone				Peroxide-Ozone			
		Rep1	Rep2	Rep 3	Average	Rep1	Rep2	Rep3	Average	Rep1	Rep2	Rep3	Average	Rep1	Rep2	Rep3	Average	Rep1	Rep2	Rep3	Average
VOCs																					
Acetone	ug/kg	51.8 U	47.0 U	47.7 U	48.8 U	49.2 U	54.3 U	54.1 U	52.5 U	50.8 U	49.6 U	50.1 U	50.2 U	52.6 U	52.8 U	54.9 U	53.4 U	227	182	204	204.3
Naphthalene	ug/kg	27.6 J	16.0 J	14.3 U	19.3 J	14.8 U	16.3 U	16.2 U	15.8 U	15.2 U	14.9 U	15.0 U	15.0 U	15.8 U	15.8 U	16.5 U	16.0 U	14.9 U	13.2 U	14.8 U	14.3 U
SVOCs																					
1-Methylnaphthalene	ug/kg	0.35 J	0.47 J	0.68 J	0.50 J	1.21 J	0.61 J	0.67 J	0.83 J	1.54	1.35	1.22 J	1.37 J	1.19 J	1.07 J	2.55	1.60 J	0.73 J	0.76 J	0.69 J	0.73 J
2-Methylnaphthalene	ug/kg	0.21 U	0.25 J	0.32 J	0.26 J	0.44 J	0.24 J	0.29 J	0.32 J	1.0 J	0.73 J	0.51 J	0.75 J	0.70 J	0.64 J	1.94	1.09 J	0.46 J	0.49 J	0.45 J	0.47 J
Acenaphthene	ug/kg	6.04	9.61	8.80	8.15	12.1	4.25	4.68	7.01	3.73	5.98	2.30	4.00	2.83	4.84	7.48	5.05	1.45	1.30	1.33	1.36
Acenaphthylene	ug/kg	0.50 J	0.53 J	0.57 J	0.53 J	0.95 J	0.39 J	0.55 J	0.63 J	1.23 J	0.76 J	1.49	1.16 J	0.62 J	0.62 J	2.10	1.11	0.35 J	0.30 J	0.30 J	0.32 J
Anthracene	ug/kg	0.30 U	0.30 U	0.31 U	0.30 U	0.32 U	0.32 U	0.31 U	0.32 U	0.53 J	0.33 U	0.33 U	0.40 U	0.37 U	0.35 U	0.62 J	0.45 J	0.32 U	0.3 U	0.32 U	0.31 U
Benzo(a)anthracene	ug/kg	0.18 U	0.18 U	0.23 J	0.20 J	0.92 J	0.19 U	0.21 J	0.44 J	2.36	0.24 J	0.19 U	0.93 J	0.45 J	0.46 J	1.15 J	0.69 J	0.19 U	0.19 J	0.24 J	0.21 J
Benzo(a)pyrene	ug/kg	0.27 U	0.27 U	0.28 U	0.27 U	0.87 J	0.29 U	0.28 U	0.48 J	2.15	0.30 U	0.30 U	0.92 U	0.33 U	0.32 U	1.19 J	0.61 J	0.29 U	0.27 U	0.29 U	0.28 U
Benzo(b)fluoroanthene	ug/kg	0.40 U	0.40 U	0.40 U	0.40 U	1.10 J	0.42 U	0.42 U	0.65 J	2.45	0.44 U	0.43 U	1.11 U	0.49 U	0.47 U	1.49	0.82 U	0.43 U	0.40 U	0.43 U	0.42 U
Benzo(g,h,i)perylene	ug/kg	0.43 U	0.43 U	0.44 U	0.43 U	0.77 J	0.45 U	0.45 U	0.56 J	1.45	0.48 U	0.47 U	0.80 U	0.52 U	0.50 U	0.88 J	0.63 J	0.46 U	0.43 U	0.46 U	0.45 U
Benzo(k)fluoranthene	ug/kg	0.55 U	0.55 U	0.56 U	0.55 U	0.58 U	0.58 U	0.57 U	0.58 U	0.92 J	0.61 U	0.60 U	0.71 J	0.67 U	0.65 U	0.67 U	0.66 U	0.59 U	0.55 U	0.59 U	0.58 U
Chrysene	ug/kg	0.35 U	0.35 U	0.35 U	0.35 U	0.73 J	0.37 U	0.36 U	0.49 J	1.80	0.39 U	0.38 U	0.86 U	0.43 U	0.41 U	1.07 J	0.64 J	0.37 U	0.35 U	0.37 U	0.36 U
Fluoranthene	ug/kg	0.78 J	0.85 J	0.88 J	0.84 J	3.02	0.64 J	0.76 J	1.47 J	5.84	1.33	0.87 J	2.68 J	1.20 J	1.46 J	4.49	2.38 J	0.44 J	0.27 J	0.37 J	0.36 J
Fluorene	ug/kg	0.52 J	0.75 J	0.67 J	0.65 J	1.29	0.60 J	0.94 J	0.94 J	1.25 J	1.33	1.0 J	1.19 J	1.10 J	1.13 J	2.28	1.50 J	0.39 J	0.39 J	0.34 J	0.37 J
Indeno(1,2,3-c,d)pyrene	ug/kg	0.43 U	0.43 U	0.44 U	0.43 U	0.60 J	0.45 U	0.45 U	0.50 J	1.17 J	0.48 U	0.47 U	0.71 J	0.52 U	0.50 U	0.66 J	0.56 J	0.46 U	0.43 U	0.46 U	0.45 U
Naphthalene	ug/kg	2.17	3.76	3.60	3.18	5.09	2.08	2.32	3.16	5.1	4.44	4.67	4.74	4.31	4.31	12.1	6.91	2.72	3.01	2.72	2.82
Phenanthrene	ug/kg	0.53 J	0.54 J	0.65 J	0.57 J	1.62	0.49 J	0.59 J	0.90 J	2.26	0.86 J	0.63 J	1.25 J	0.70 J	0.83 J	5.09	2.21 J	0.43 J	0.38 J	0.33 J	0.38 J
Pyrene	ug/kg	0.38 J	0.36 J	0.38 J	0.37 J	2.01	0.29 J	0.31 J	0.87 J	4.56	0.49 J	0.32 J	1.79 J	0.67 J	0.78 J	3.18	1.54 J	0.29 J	0.20 J	0.24 J	0.24 J

Qualifiers:

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

J =The analyte was positively identified. The associated numerical value is an estimated quantity.

µg/kg = microgram per kilogram

Table 7

Groundwater VOC and SVOC Reduction Calculations, Target Compounds

Orange and Rockland, Suffern, NY

Analyte		Spiked GW (10/26)[1]	Spiked GW (10/28)[2]	Percent Reduction[A]								Mass Reduction				
				Air[1]		Oxygen[1]		Ozone[2]		Peroxide-Ozone[2]		Control[1]	Air[1]	Oxygen[1]	Ozone[2]	Peroxide-Ozone[2]
				Control	Spike	Control	Spike	Control	Spike	Control	Spike	ug/L	ug/L	ug/L	ug/L	ug/L
VOCs																
Benzene	ug/L	45.8	64.8	**23**	**56**	**48**	**71**	--[3]	**87**	--[3]	**99**	**19.9**	**25.7**	**32.3**	**56.2**	**64.5**
Naphthalene	ug/L	21.2	56.0	**57**	54	**99**	**99**	--[3]	**96**	--[3]	**99**	- -[3]	**11.5**	**21.1**	**53.6**	**55.7**
Toluene	ug/L	66.5	137	**32**	53	**66**	**77**	--[3]	**88**	--[3]	**100**	**20.4**	**35.0**	**51.1**	**121**	**137**
SVOCs																
Acenaphthene	ug/L	21.4	0.3	**30**	**80**	**91**	**97**	--[3]	**14**	--[3]	- -[3]	**15.3**	**17.2**	**20.8**	**0.04**	- -[3]
Naphthalene	ug/L	9.2	0.02	**47**	**59**	**99**	**99**	--[3]	- -[3]	--[3]	- -[3]	**2.09**	**5.42**	**9.14**	- -[3]	- -[3]

Note:

A. "Control" represents just the oxidative effect; "Spike" represents the oxidative effect and the mechanical effects from tumbling, handling, etc.

[1] = Used spiked groundwater from 10/26

[2] = Used spiked groundwater from 10/28

[3] = apparent increase in value, statistically unreliable

Appendix C

Sparge Well Installation Report

Sparge Well Installation Report

PREPARED FOR:	Orange and Rockland Utilities, Inc.
PREPARED BY:	CH2M
DATE:	March 8, 2017

On behalf of Orange and Rockland Utilities, Inc. (O&R), CH2M HILL (CH2M) has prepared this technical memorandum summarizing field activities and presenting the pilot test data and results for the installation of sparge wells in support of potential groundwater contingency measures at the Suffern Manufactured Gas Plant (MGP) Site in Suffern, Rockland County, New York (site).

As described in detail in the *Sparge Well Installation Work Plan* (CH2M, March 2016), the scope of work for this well installation was to install 34 sparge wells, each to include four 1-inch sparge points to depths of 100 ft, 75 ft, 50 ft and 25 ft below grade and install 6 piezometers with three 1-inch monitoring points to depths of 75 ft, 50 ft and 25 ft below grade. Pilot testing was performed on two of the newly installed sparge wells. Pilot test data were used to verify well spacing and understand characteristics of the sparge wells and aquifer as well as aid in design of a full- scale injection system at a later date, if necessary.

The overall objective of this work is to have sparge wells in place as groundwater contingency measures. The sparge wells could be quickly utilized during or after the planned in situ solidification (ISS) remedial action at the site to provide a treatment barrier for dissolved-phase contaminants if needed.

This technical memorandum provides a description of deviations from the work plan during the well installation and pilot test work, then presents the pilot test data and finally summarizes results and initial recommendations for full scale sparge system design.

Sparge Well Installation Activities

Utility Clearance

Dig Safely New York was notified of the forthcoming intrusive activities associated with sparge well installation on April 6, 2016. The locations of underground natural gas and water supply mains at the site were marked by O&R and the Village of Suffern, respectively. The absence of underground utilities at the proposed boring locations was confirmed from April 11 to 22, 2016 using an air-knife rig operated by Cascade Drilling, L.P. under the direction of CH2M. At each location a hole measuring approximately 10 to 14 inches in diameter was advanced to 5 or 6 feet below grade. Where borings were installed within 5 feet of marked underground utility, the utility was physically exposed to confirm its exact location.

Drilling and Well Installation

Soil borings where completed from April 18 to June 7, 2016 using the rotosonic drilling method with a mini-sonic rig operated by Cascade Drilling, L.P. under the direction of CH2M. Boreholes for sparge wells were advanced by driving 6-inch diameter steel casing to a final depth of approximately 100 feet below grade. The 6-inch diameter borehole was then overridden with 8-inch diameter casing to approximately 80 feet below grade. For the 6 piezometers, a 6-inch diameter steel casing was advanced to the final depth of approximately 75 feet below grade. Continuous soil samples were collected from the boreholes and geologic observations were recorded on boring log forms provided as **Attachment A**. Soil was described in general accordance with ASTM International (formerly American Society of Testing and Materials) D-2488 (2006). The final locations of all wells are shown in **Figure 1**.

All sparge wells and piezometers were constructed with 1-inch diameter Schedule 80 PVC riser pipe and factory-perforated well screens. Each sparge point consisted of a 3 foot section of 0.05-inch slotted screen with a 4-inch long bottom cap. Piezometer well screens consisted of 5 feet sections of 0.02-inch slotted screen. The annular space between the well screen and borehole wall for the sparge points and piezometers was filled with a #3 and #1 U.S. Silica filter sand, respectively. In general, the filter sand extended 1 to 2 feet above and below each well screen. Intermediate seals between well screens were filled with Cetco Puregold medium bentonite chips. In most cases, 1 foot of #000 U.S. Silica transition sand and 2 feet of bentonite chips were emplaced above the uppermost filter sand. A bentonite grout slurry was used for the upper well seal. At locations where a transition sand was not used, the top bentonite chip seal were allowed to hydrate for at least two hours prior to placing liquid bentonite grout. All wells and piezometers were finished at grade with caps, 18-inch diameter heavy-duty steel road boxes, and concrete aprons. Locks were not installed at this time. **Attachment B** provides the well completion logs for further well installation details and **Table 1** below summarizes the well installation depths.

Three of the proposed sparge well locations (SW04, SW07, and SW16) were not installed due to obstructing field conditions:

- SW04 was terminated at 30 feet below grade because non-aqueous phase liquids were observed during drilling. The remediation limits were extended to address the observed impacts in the SW04 location.
- SW07 could not be installed due to the proximity and density of underground natural gas mains surrounding the proposed location.
- SW16 was eliminated because of spacing considerations after adjusting adjacent borings due to conflicts with underground and overhead utilities, and to accommodate adequate working distances from the abandoned railway bridge along Pat Malone Drive.

At 12 locations (SW03, SW08, SW09, SW10, SW11, SW12, SW20, SW21, SW22, SW23, SW24, and SW34) at least one well screen was adjusted from the proposed construction based on field conditions. In particular, a fine-grained sediment, which was considered unsuitable for sparging, was present at the depth of the proposed shallowest well screen (22 to 25 ft below grade) at 5 locations in the western area of the site (SW20, SW21, SW22, SW23, and SW24). At those locations the shallow well screen was installed above the fine-grained unit, with treatment below this unit planned for the next deeper screen interval, if needed. The proposed deep sparge well screens (97 to 100 ft below grade) at SW03, SW08, SW09, SW10, SW11, and SW34 were adjusted upwards because bedrock was encountered at depths of 93 to 100 ft below grade.

Table 1. Summary of Installed Wells and Associated Depths

Well Type	Target Depth	No. Borings	No. Wells
Sparge Wells: 8”Sonic drilled bore hole with 4-1” Schedule 80 PVC sparge points screened at 25’, 50’, 75’ and 100’ below grade	100	31	124
Piezometers: 6” Sonic drilled bore hole with 3-1” Schedule 80 PVC monitoring points at 25’, 50’ and 75’ below grade	75	6	18

Geologic Observations

The subsurface geology encountered during sparge well and piezometer installation generally agreed with conditions described in previous site investigations, and included fill, alluvium, and bedrock. All well screens were installed in alluvial deposits consisting of laterally variable and heterogeneous sand, gravel, and cobble lithologies with little silt and clay content. With the exception of seven locations (SW03, SW08, SW09, SW10, SW11, and SW34), the alluvium extended to the final depth of the borings (75 to 100 ft below grade). Dark gray to black silt- or clay-rich lithologies were encountered at depths of 20 to 40 feet below grade at borings in the western area of the site (PZ01, PZ03, PZ06, SW21 to SW24, SW26, and SW28). Bedrock was encountered at depths of 93 to 100 ft

below grade at SW03, SW08, SW09, SW10, SW11, SW12, and SW34, and consisted of a competent granitic gneiss with little weathering profile.

Investigative Derived Waste Management

Investigative derived waste (IDW) associated with the drilling activities included soil cuttings, personal protective equipment (PPE), groundwater, decontamination rinsate, and rubbish. At the end of each work day, potentially contaminated soil cuttings, plastic soil bags, and PPE (nitrile gloves) produced during sparge well and piezometer installation were transported from the drilling locations to an impacted soil stockpile in the main area of the site managed by the remedial action contractor, Creamer Environmental Inc. (CEI). The potentially contaminated solid wastes were transported by to an offsite location for thermal treatment by CEI. Groundwater and equipment decontamination rinsates were transported to an onsite water treatment system operated by CEI. General, uncontaminated rubbish (e.g. boxes, well material containers, etc.) were containerized in a roll-off bin for transport to a landfill for disposal.

Pilot Test Activities

Sparge pilot testing at two (2) sparge well locations, SW26 and SW27, was completed from June 6 to June 16, 2016. The testing utilized an Ingersoll-Rand P185WJD compressor supplied by Cascade Drilling, L.P. to inject air at a flow rate of approximately 20 scfm into the two sparge wells at the various depths. Pressure, dissolved oxygen (DO) and oxygen reduction potential (ORP) responses were measured during the air injection at the select piezometer locations and depths. Due to the limitation of downhole transducers to measure only pressure and not the desired DO and ORP, the pilot testing including purging of water from the piezometers to measure DO and OPR using an YSI water quality meter (YSI) and water flow through cell.

Well development of the 6 piezometer well locations (PZ01 to PZ06) with 3 monitoring points (A, B and C) each (total 18 one-inch wells) was completed prior to pilot testing. The objective of the piezometer well development was to ensure each piezometer well exhibited good recharge rates and flows. The wells were pumped to remove a minimum of three well volumes then YSI readings collected while pumping was continued until the turbidity decreases to less than 5 nephelometric turbidity units, or turbidity measurements stabilized to within 10 percent of the previous reading, or a maximum volume of water equal to ten wetted casing volumes had been removed. Attached **Table 2** provides the final well development reading for each piezometer. The DO and ORP measurements collected during well development are used for the baseline sparge testing DO and ORP measurements.

Sparge pilot testing set-up included assembly of a manifold to control flow to the wells including valving, flow meter (0-22 scfm), pressure indicator (0-65 psi) and 1-inch pressure rated hose. Each of the sparge wells was completed with a screw cap to allow connection to the hose while sparging and each well was capped with a screw plug while not in use. Each piezometer had a dedicated pressure transducer inserted to the midpoint of the screen to continuously measure pressure changes in the aquifer throughout the pilot testing.

Once pilot testing set-up was completed, compressed air was slowly applied to the first sparge well, SW26A, for approximately 50 minutes. The air compressor was turned on and pressure was increased to initiate flow into the well. Then the pressure was gradually increased 1 psi at a time, pausing at each new psi for 3 minutes, until a total flow of approximately 20 scfm was reached. This slow increase in pressure was to minimize the chance of “loose” soils blocking the screens. After injection of air for the desired time period, the line was depressurized little by little, taking care to let the pressure dissipate slowly over approximately 10 minutes. This was necessary to keep “loose” silt or sand from flowing into the sparge wells. After each air injection, water from select piezometers was purged and YSI measurements completed to assess the DO and ORP of the affected water. This general approach was repeated at each of the monitoring points located at approximately 25, 50, 75 and 100 ft below ground surface at sparge wells SW26 and SW27. **Table 3** below provides the length of sparge time and selected piezometers for DO and ORP monitoring.

Table 3: Sparging Time and Piezometers Monitored for DO and ORP

Sparged Well	Approximate Depth (ft bgs)	Piezometers to Monitor for DO and ORP*	Sparging time (min):
SW26	A – 25	PZ03A; PZ04A; PZ06A	75
	B – 50	PZ03A, B; PZ04A, B; PZ06A, B	75
	C – 75	PZ03B, C; PZ04B, C; PZ06B, C	120
	D - 100	PZ03B, C; PZ04B, C; PZ06B, C	120
SW27	A – 25	PZ02A; PZ04A; PZ05A	75
	B – 50	PZ02A, B; PZ04A, B; PZ05A, B	75
	C – 75	PZ02B, C; PZ04B, C; PZ05B, C	120
	D - 100	PZ02B, C; PZ04B, C; PZ05B, C	120

*Well nomenclature: A wells are located 25 ft bgs, B wells are located 50 ft bgs, and C wells are located 75 ft bgs.

Pilot Test Results

Table 2 provides a summary of the well development data or baseline data, and illustrates that there is a significant difference in ORP within the pilot test area at several shallow piezometer locations; PZ01A, PZ02A, PZ03A and deeper depths at PZ05 had a strongly negative ORP indicating a natural oxidation demand. Natural oxygen demand is likely due to decaying organic matter or oxidizable minerals (such as iron) and apparently naturally occurring. No observations of anthropogenic, man-made sources of natural oxygen demand, such as fuel hydrocarbons, were observed in the borings near the pilot study area.

Table 4 provides a summary of the DO and ORP readings observed in piezometers during the pilot testing including the sparging location, time, pressure and flow rate. The DO during sparging does not show that all the piezometers responded completely during the brief sparge duration. Initially most of the piezometers showed a decreasing trend, which is consistent with the movement of less oxidized water in response to the initial sparge well pressurization. The DO results indicate that the air was migrating and pressure was spreading through the aquifer; it is expected, but unprovable from the data whether a longer sparging period, or multiple sparging cycles, would have increased the DO in all the piezometers.

The sparge tests proved that the sparge well can accept 20 cfm of air flow into each screened interval. The DO shows there is a transient pressure connection from each of the sparge wells to each of the piezometers, as expected; this is also consistent with a coarse-grained setting, which is also positive for lateral spreading of DO over time. However, the duration of the injection during the test (generally less than two hours sparging time) was insufficient to observe DO increase at the piezometers located approximately 25 feet away or more.

Transducer data is summarized in **Table 5** and show the influence that the sparging has on each piezometer location. The spikes in pressure correlate to the sparging intervals and indicate good hydraulic conductivity throughout the aquifer. The transducer data also observed diurnal effects from the nearby water wells which have been removed from the initial signal to isolate the effect due to sparging; this filtered effect of sparging is shown in **Table 5**.

Pilot Test Conclusions

The piezometers locations were located approximately 22.5 to 28 feet from the pilot test sparge well locations and representative of the sparge well network spacing. Given the positive indications of air flow at the piezometers recorded during the pilot testing, including pressure changes in the aquifer, high air flow rates, ORP and DO measurements, the current spacing of the sparge well network of 25 feet between sparge wells is confirmed as adequate for full scale sparging of the aquifer.

Additional boring log reviews and pilot testing results analysis will be required to determine optimal operation of the sparge wells during full scale operations, should that become necessary. In the shallow areas, such as PZ01A, PZ02A, PZ03A and deeper depths at PZ05, with strongly negative ORP indicating a natural oxidation demand, higher sparge flow rates, sparging at multiple wells or at multiple elevations within a well may be required to provide additional oxidative potential required to achieve the level of oxidization required for treatment.

The dark gray to black silt- or clay-rich lithologies encountered at depths of 20 to 40 feet below grade in the western area of the site (including wells PZ01, PZ03, PZ06, SW21 to SW24, SW26, and SW28) may require operation of various depths of sparging points to reach the more heterogeneous sand above and below the silt- or clay-rich layer. During pilot testing the aquifer directly above these lithologies showed that air movement is impeded through these layers, thus the layer acts as a confining layer keeping air from the shallower soils. From this we learned that deeper wells cannot be relied upon to sparge the full depth of the aquifer, but that shallow wells will need to be operated specifically where such lithologies exist. In general, if impacts are observed only above or below this layer then sparging would only occur in the impacted zone. If impacts are observed both above and below the layer then sparging would be required at points in both zones. For example, wells located in the eastern portion of the site, such as SW1 to SW6, without a shallow silt- or clay-rich lithologies, could operate sparge points at only the deeper points to treat impacts over the entire depth of the well, both shallow and deep. While wells located in the western area, SW21 to SW24, would likely be required to operate all sparge points include the 25 ft below grade depth to reach the shallower soils located above the silt- or clay-rich layer at 20 to 40 ft below grade if both shallow and deep impacts are observed. During the start of full scale sparging operations monitoring of DO and contaminate reductions should be completed for approximately 3 months and then sparging operations adjusted to address an areas that are not being adequately sparged.

In conclusion, the pilot testing proved that the initial spacing of 25 ft will prove appropriate for full scale operation. The multiple layered sparge screens were installed to assure coverage throughout the vertical section of the aquifer; this pilot test proved that the multiple layers of sparge screens can be operated effectively allowing sparging to reach all depths of the aquifer, including between silt zones or confining layers.

Tables

Table 2: Final Well Development Data
Sparge Pilot Testing
Suffern Site, O&R Utilities

WELL	DATE	TIME	WATER LEVEL (ft BTOC)	TOTAL VOLUME PURGED (gallons)	TEMP. (°C)	pH (std. units)	CONDUC-TIVITY (mS/cm)	TURBIDITY (NTU)	DO (mg/L)	ORP (mV)	REMARKS (color, odor, sheen, sediment, etc.)
PZ01A	6/8/2016	14:58	6.10	5.2	11.95	6.63	0.803	2.63	8.91	-92.3	
PZ01B	6/8/2016	15:58	6.30	9.8	12.88	6.37	0.890	17.80	6.92	36.4	
PZ01C	6/8/2016	16:01	6.73	9.6	12.90	6.49	0.942	4.74	6.92	25	
PZ02A	6/8/2016	11:39	6.02	5.1	12.35	6.49	0.991	3.25	4.56	-64.7	
PZ02B	6/8/2016	14:03	6.69	6.3	12.90	6.26	0.911	4.05	5.65	57.8	
PZ02C	6/8/2016	14:11	6.69	8.5	13.10	6.35	0.904	3.97	5.61	66.4	
PZ03A	6/7/2016	16:52	6.05	9.0	13.25	6.43	0.674	15.80	4.54	-48.1	
PZ03B	6/8/2016	10:12	7.15	8.7	13.31	6.29	0.777	4.32	3.76	-13.8	
PZ03C	6/8/2016	11:02	7.09	14.0	13.44	6.27	0.936	27.00	3.50	82.7	
PZ04A	6/7/2016	14:00	7.21	7.7	15.22	6.03	0.782	25.70	1.50	2.2	
PZ04B	6/7/2016	15:22	6.19	10.4	13.99	5.90	0.829	2.35	3.13	159.2	
PZ04C	6/7/2016	15:19	6.23	9.9	14.14	6.09	1.320	4.73	2.79	155.4	
PZ05A	6/7/2016	9:02	7.31	7.3	13.45	5.97	0.522	156.00	2.40	4.8	
PZ05B	6/7/2016	10:24	6.93	11.4	14.97	5.98	0.845	110.00	2.83	-211.7	
PZ05C	6/7/2016	12:11	6.94	15.0	15.51	6.25	1.237	11.30	2.82	-167.90	
PZ06A	6/7/2016	16:42	6.70	8.00	13.18	6.35	0.537	23.20	4.89	-45.20	
PZ06B	6/8/2016	8:56	7.01	12.5	13.61	6.26	0.912	3.45	3.63	41.30	
PZ06C	6/8/2016	8:47	7.09	9.8	13.70	6.42	1.345	3.55	4.07	54.70	

Table 4: Sparging and Piezometer Data
Sparge Pilot Testing
Suffern Site, O&R Utilities

SPARGE WELL	PRESSURE (psi)	FLOW (scfm)	BEGIN SPARGE	END SPARGE	TOTAL SPARGE TIME
SW26A	12	20	10:32	11:58	1:26
PIEZOMETER	**TIME**	**WATER LEVEL** (ft BTOC)	**TOTAL VOLUME PURGED** (liters)	**DO** (mg/L)	**ORP** (mV)
PZ06A	12:17	7.85	2.0	13.8	-61.2
	12:43	7.60	7.8	10.5	-58.7
PZ03A	12:19	7.90	1.0	5.8	-123.6
	12:47	6.96	5.5	10.8	-116.2
PZ04A	12:19	7.57	2.1	13.6	-32.7
	12:59	7.45	10.6	14.6	-18.4

SPARGE WELL	PRESSURE (psi)	FLOW (scfm)	BEGIN SPARGE	END SPARGE	TOTAL SPARGE TIME
SW26B	26	22	8:23	9:41	1:18
PIEZOMETER	**TIME**	**WATER LEVEL** (ft BTOC)	**TOTAL VOLUME PURGED** (liters)	**DO** (mg/L)	**ORP** (mV)
PZ06A	9:58	7.15	0.3	2.22	-64.4
	10:22	7.51	10.3	1.02	-95.3
PZ03A	10:42	6.11	1.0	1.08	-115.6
	10:56	6.09	4.6	0.60	-118.0
PZ04A	10:55	7.48	0.5	4.25	43.3
	11:10	7.53	8.0	3.21	40.0
PZ06B	10:25	7.48	0.3	2.52	-79.1
	10:47	7.43	9.3	1.16	-550.6
PZ04B	11:15	7.30	0.5	2.14	-5.4
	11:30	7.27	8.0	1.26	47.3
PZ03B	11:04	4.34	0.5	0.66	-71.6
	11:25	4.24	10.5	0.36	-41.4

Table 4: Sparging and Piezometer Data
Sparge Pilot Testing
Suffern Site, O&R Utilities

SPARGE WELL	PRESSURE (psi)	FLOW (scfm)	BEGIN SPARGE	END SPARGE	TOTAL SPARGE TIME
SW26C	37.8	21	0.5	14:34	1:52
PIEZOMETER	**TIME**	**WATER LEVEL** (ft BTOC)	**TOTAL VOLUME PURGED** (liters)	**DO** (mg/L)	**ORP** (mV)
PZ04B	14:50	6.91	0.5	5.73	124.3
	15:17	7.20	14.0	9.40	198.1
PZ03B	14:58	6.67	3.5	1.31	-51.7
	15:15	6.69	12.0	0.63	-49.7
PZ06B	15:43	7.02	1.0	0.51	-6.0
	15:54	7.12	5.5	0.46	-20.8
PZ04C	15:25	7.46	0.5	4.72	25.2
	15:43	6.43	9.5	2.08	119.4
PZ03C	15:27	6.68	1.5	0.56	-17.4
	15:37	6.66	6.5	0.51	31.9
PZ06C	16:08	6.50	0.5	3.46	-79.7
	16:35	6.41	14.0	1.70	-392.0

SPARGE WELL	PRESSURE (psi)	FLOW (scfm)	BEGIN SPARGE	END SPARGE	TOTAL SPARGE TIME
SW26D	44	22	0.4	11:16	1:48
PIEZOMETER	**TIME**	**WATER LEVEL** (ft BTOC)	**TOTAL VOLUME PURGED** (liters)	**DO** (mg/L)	**ORP** (mV)
PZ03B	11:25	6.68	1.5	0.52	-76.5
	11:40	7.01	9.0	0.71	-76.3
PZ03C	11:46	7.11	2.0	1.06	-32.2
	12:01	7.20	10.5	0.64	14.7
PZ04B	12:14	7.62	2.5	3.11	60.9
	12:30	7.60	10.5	2.74	86.4
PZ06B	11:30	7.55	0.4	1.06	3.7
	11:46	7.80	2.4	0.97	8.4
PZ06C	11:53	7.36	0.4	1.08	-1.5
	12:02	7.36	1.6	0.95	12.0
PZ04C	12:20	7.33	0.4	3.68	56.3
	12:29	7.33	1.6	4.16	69.0

Table 4: Sparging and Piezometer Data
Sparge Pilot Testing
Suffern Site, O&R Utilities

SPARGE WELL	PRESSURE (psi)	FLOW (scfm)	BEGIN SPARGE	END SPARGE	TOTAL SPARGE TIME
SW27A	13	22	0.6	14:30	0:45
PIEZOMETER	**TIME**	**WATER LEVEL** (ft BTOC)	**TOTAL VOLUME PURGED** (liters)	**DO** (mg/L)	**ORP** (mV)
PZ02A	14:50	7.17	2.5	1.67	-78.1
	15:11	7.24	12.0	0.81	-91.4
PZ04A	14:52	7.85	0.3	3.55	-3.6
	15:07	7.82	1.8	1.47	1.0
PZ05A	15:19	7.51	0.4	1.06	-38.0
	15:37	7.54	1.8	0.69	-39.8

SPARGE WELL	PRESSURE (psi)	FLOW (scfm)	BEGIN SPARGE	END SPARGE	TOTAL SPARGE TIME
SW27B	21	22	0.7	16:59	1:17
PIEZOMETER	**TIME**	**WATER LEVEL** (ft BTOC)	**TOTAL VOLUME PURGED** (liters)	**DO** (mg/L)	**ORP** (mV)
PZ02A	17:05	6.21	3.5	0.75	-92.3
	17:16	6.21	9.0	0.55	-101.7
PZ02B	17:22	6.80	2.0	0.60	-59.8
	17:33	6.81	7.5	0.48	-39.5
PZ05A	16:57	6.40	0.0	0.57	-35.0
	17:03	7.04	0.8	0.43	-33.1
PZ05B	17:11	6.70	0.4	1.13	-29.4
	17:23	6.70	2.1	0.65	-28.3
PZ04A	17:33	7.15	0.4	1.97	5.7
	17:45	7.16	2.0	0.73	6.2
PZ04B	17:49	6.58	0.4	1.79	42.4
	18:04	6.58	2.4	2.40	80.2

Table 4: Sparging and Piezometer Data
Sparge Pilot Testing
Suffern Site, O&R Utilities

SPARGE WELL	PRESSURE (psi)	FLOW (scfm)	BEGIN SPARGE	END SPARGE	TOTAL SPARGE TIME
SW27C	36	20	0.4	10:17	1:45
PIEZOMETER	**TIME**	**WATER LEVEL** (ft BTOC)	**TOTAL VOLUME PURGED** (liters)	**DO** (mg/L)	**ORP** (mV)
PZ02B	10:41	7.09	2.5	0.72	-3.0
	11:04	7.31	14.0	0.241	-2.6
PZ02C	11:10	7.43	1.5	5.1	-11.1
	11:40	7.52	16.5	1.371	-12.6
PZ04B	10:22	7.84	0.1	12.11	164.0
	11:15	7.98	4.0	10.52	201.6
PZ04C	11:22	7.50	0.4	7.64	195.2
	11:34	7.50	1.8	5.59	185.2
PZ05B	11:52	7.30	0.4	0.99	-48.0
	12:05	7.30	1.6	0.6	-52.0
PZ05C	12:02	7.45	3.5	1.321	-42.6
	12:18	7.46	11.5	0.92	-44.9

SPARGE WELL	PRESSURE (psi)	FLOW (scfm)	BEGIN SPARGE	END SPARGE	TOTAL SPARGE TIME
SW27D	44	20	0.6	15:40	2:14
PIEZOMETER	**TIME**	**WATER LEVEL** (ft BTOC)	**TOTAL VOLUME PURGED** (liters)	**DO** (mg/L)	**ORP** (mV)
PZ02B	16:17	6.85	1.5	0.66	-20.8
	16:29	6.91	7.5	0.37	-14.4
PZ02C	15:57	6.65	2.5	0.83	-34.3
	16:11	6.78	9.5	0.42	-39.5
PZ05B	15:35	6.05	0.2	2.25	-76.7
	15:51	6.04	1.5	1.02	-66.2
PZ05C	16:02	6.75	0.2	1.01	-51.7
	16:08	6.76	1.0	1.08	-44.0
PZ04B	16:23	7.40	0.2	8.66	89.1
	16:43	7.43	1.8	8.23	127.3
PZ04C	16:47	6.71	0.2	7.77	130.7
	16:58	6.70	1.3	6.61	128.7

Table 5: Transducer Data Analysis
Sparge Pilot Testing
Suffern Site, O&R Utilities

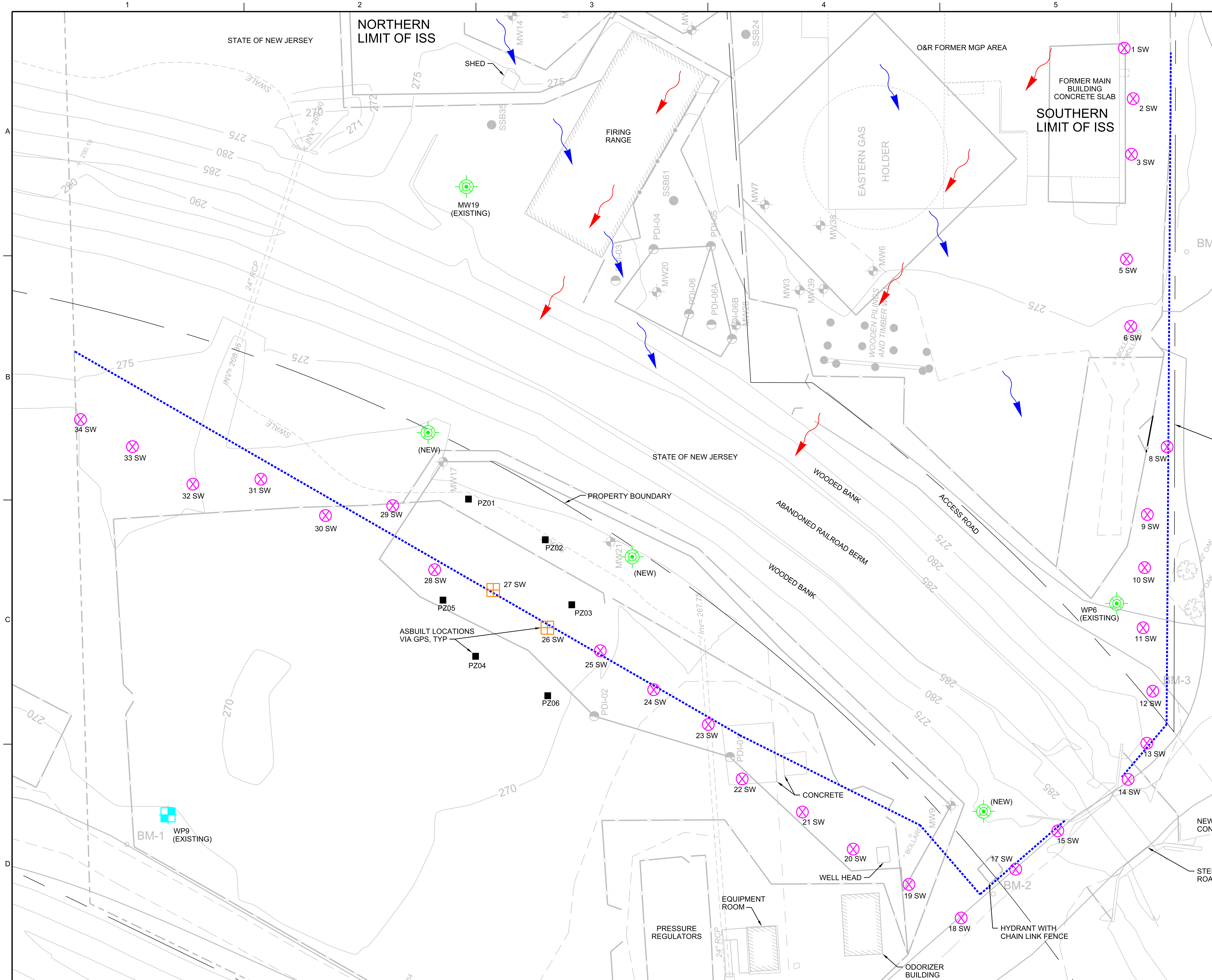
		ELAPSED TIME TO MAXIMUM RESPONSE (minutes)																	
SPARGE INTERVAL	**SPARGE ON/OFF PEROID**	PZ-01A	PZ-01B	PZ-01C	PZ-02A	PZ-02B	PZ-02C	PZ-03A	PZ-03B	PZ-03C	PZ-04A	PZ-04B	PZ-04C	PZ-05A	PZ-05B	PZ-05C	PZ-06A	PZ-06B	PZ-06C
SW26A	6/9/2016 10:32																		
SW26A	6/9/2016 11:23	22	22	22	22	22	22	22	22	22	22	22	24	22	22	24	22	22	22
SW26B	6/10/2016 8:23																		
SW26B	6/10/2016 9:41	11	45	47	11	43	43	9	43	41	19	11	43	43	43	23	19	11	25
SW26C	6/10/2016 12:42																		
SW26C	6/10/2016 14:34	104	112	96	108	110	102	104	108	108	110	44	18	110	112	34	98	48	18
SW26D	6/13/2016 9:28																		
SW26D	6/13/2016 11:16	102	100	98	102	100	100	102	100	100	90	64	100	100	100	100	98	64	100
SW27A	6/13/2016 13:45																		
SW27A	6/13/2016 14:30	17	27	35	17	29	31	17	29	29	33	31	31	25	29	31	33	31	33
SW27B	6/13/2016 15:42																		
SW27B	6/13/2016 16:59	74	36	34	74	72	70	74	72	72	42	72	72	30	36	72	70	70	72
SW27C	6/14/2016 8:32																		
SW27C	6/14/2016 10:17	98	88	82	96	84	80	104	72	62	74	38	22	96	88	16	66	42	26
SW27D	6/14/2016 13:26																		
SW27D	6/14/2016 15:40	130	134	134	134	134	134	134	134	134	134	44	134	132	126	134	134	46	134

		MAXIMUM RESPONSE (psi)																	
SPARGE INTERVAL	**SPARGE ON/OFF PEROID**	PZ-01A	PZ-01B	PZ-01C	PZ-02A	PZ-02B	PZ-02C	PZ-03A	PZ-03B	PZ-03C	PZ-04A	PZ-04B	PZ-04C	PZ-05A	PZ-05B	PZ-05C	PZ-06A	PZ-06B	PZ-06C
SW26A	6/9/2016 10:32																		
SW26A	6/9/2016 11:23	0.68	0.23	0.21	0.94	0.29	0.26	1.26	0.33	0.26	1.11	0.39	0.20	0.61	0.37	0.19	0.69	0.42	0.19
SW26B	6/10/2016 8:23																		
SW26B	6/10/2016 9:41	0.05	0.19	0.18	0.07	0.22	0.20	0.10	0.24	0.20	0.90	0.42	0.17	0.40	0.30	0.16	0.58	0.48	0.18
SW26C	6/10/2016 12:42																		
SW26C	6/10/2016 14:34	0.02	0.27	0.25	0.03	0.31	0.28	0.03	0.36	0.30	1.11	0.71	0.29	0.55	0.41	0.23	0.77	0.77	0.36
SW26D	6/13/2016 9:28																		
SW26D	6/13/2016 11:16	0.05	0.53	0.52	0.06	0.59	0.58	0.06	0.67	0.61	1.47	1.00	0.63	0.85	0.72	0.59	1.18	1.08	0.63
SW27A	6/13/2016 13:45																		
SW27A	6/13/2016 14:30	1.04	0.12	0.11	1.14	0.14	0.14	1.13	0.16	0.13	0.48	0.19	0.10	0.25	0.18	0.09	0.34	0.21	0.10
SW27B	6/13/2016 15:42																		
SW27B	6/13/2016 16:59	0.21	0.40	0.40	0.23	0.44	0.42	0.23	0.47	0.43	0.90	0.56	0.45	0.64	0.52	0.45	0.70	0.56	0.47
SW27C	6/14/2016 8:32																		
SW27C	6/14/2016 10:17	0.03	0.23	0.22	0.03	0.27	0.25	0.04	0.32	0.27	1.00	0.65	0.25	0.50	0.36	0.22	0.73	0.72	0.29
SW27D	6/14/2016 13:26																		
SW27D	6/14/2016 15:40	0.03	0.44	0.41	0.04	0.49	0.46	0.04	0.53	0.48	1.17	0.71	0.49	0.71	0.54	0.47	0.89	0.76	0.49

Table 5: Transducer Data Analysis
Sparge Pilot Testing
Suffern Site, O&R Utilities

		MAXIMUM RESPONSE (feet of water)																	
SPARGE INTERVAL	**SPARGE ON/OFF PEROID**	PZ-01A	PZ-01B	PZ-01C	PZ-02A	PZ-02B	PZ-02C	PZ-03A	PZ-03B	PZ-03C	PZ-04A	PZ-04B	PZ-04C	PZ-05A	PZ-05B	PZ-05C	PZ-06A	PZ-06B	PZ-06C
SW26A	6/9/2016 10:32																		
SW26A	6/9/2016 11:23	1.56	0.54	0.48	2.17	0.66	0.60	2.90	0.75	0.60	2.57	0.90	0.46	1.41	0.86	0.44	1.59	0.96	0.44
SW26B	6/10/2016 8:23																		
SW26B	6/10/2016 9:41	0.12	0.44	0.41	0.17	0.51	0.46	0.23	0.55	0.47	2.07	0.97	0.39	0.93	0.69	0.36	1.33	1.11	0.41
SW26C	6/10/2016 12:42																		
SW26C	6/10/2016 14:34	0.05	0.61	0.58	0.07	0.72	0.64	0.07	0.82	0.69	2.56	1.63	0.67	1.27	0.94	0.53	1.78	1.78	0.84
SW26D	6/13/2016 9:28																		
SW26D	6/13/2016 11:16	0.11	1.22	1.19	0.13	1.37	1.33	0.14	1.54	1.41	3.38	2.30	1.44	1.96	1.65	1.37	2.73	2.48	1.44
SW27A	6/13/2016 13:45																		
SW27A	6/13/2016 14:30	2.39	0.27	0.25	2.64	0.32	0.33	2.62	0.36	0.30	1.10	0.45	0.23	0.58	0.42	0.21	0.78	0.48	0.22
SW27B	6/13/2016 15:42																		
SW27B	6/13/2016 16:59	0.48	0.93	0.93	0.53	1.01	0.97	0.54	1.09	1.00	2.09	1.28	1.04	1.48	1.19	1.03	1.61	1.30	1.09
SW27C	6/14/2016 8:32																		
SW27C	6/14/2016 10:17	0.06	0.54	0.51	0.07	0.63	0.57	0.08	0.74	0.61	2.30	1.50	0.57	1.16	0.83	0.51	1.69	1.67	0.67
SW27D	6/14/2016 13:26																		
SW27D	6/14/2016 15:40	0.07	1.01	0.95	0.09	1.13	1.06	0.10	1.23	1.11	2.69	1.64	1.14	1.63	1.24	1.09	2.05	1.74	1.14

Figures


NORTHERN LIMIT OF ISS
STATE OF NEW JERSEY
SHED
FIRING RANGE
O&R FORMER MGP AREA
FORMER MAIN BUILDING CONCRETE SLAB
SOUTHERN LIMIT OF ISS
EASTERN GAS HOLDER
MW19 (EXISTING)
(NEW)
STATE OF NEW JERSEY
PROPERTY BOUNDARY
WOODED BANK
ABANDONED RAILROAD BERM
WOODED BANK
ACCESS ROAD
PZ01
PZ02
PZ03
PZ04
PZ05
PZ06
ASBUILT LOCATIONS VIA GPS, TYP
1 SW
2 SW
3 SW
5 SW
6 SW
8 SW
9 SW
10 SW
11 SW
12 SW
13 SW
14 SW
15 SW
17 SW
18 SW
19 SW
20 SW
21 SW
22 SW
23 SW
24 SW
25 SW
26 SW
27 SW
28 SW
29 SW
30 SW
31 SW
32 SW
33 SW
34 SW
WP6 (EXISTING)
WP9 (EXISTING)
CONCRETE
WELL HEAD
EQUIPMENT ROOM
PRESSURE REGULATORS
ODORIZER BUILDING
HYDRANT WITH CHAIN LINK FENCE
NEW MULTICHANNEL CONFIRMATION WELL
STEEL RAIL ROAD BRIDGE
PROPERTY BOUNDARY
PROJECT AREA BOUNDARY
VILLAGE OF SUFFERN
PAT MALONE DRIVE
BM-1
BM-2
BM-3
0 20 40 60
SCALE IN FEET

GENERAL SHEET NOTE

1. WELLS 4SW, 7SW AND 16SW WERE NOT INSTALLED.

LEGEND

- SENTINEL WELL
- CONFIRMATION WELL
- OS PIPING - FUTURE
- PILOT STUDY INITIAL WELL
- SPARGE WELL (25' SPACING)
- MULTI-LEVEL PIEZOMETER TO SUPPORT PILOT STUDY (TRIPLE SCREEN) 20-50-75
- SHALLOW GROUNDWATER FLOW DIRECTION
- DEEP GROUNDWATER FLOW DIRECTION

NO.	DATE	REVISION	BY	APVD
2	07-08-2016	AS-BUILT	PAK	KRR
1	03-22-2016	WORK PLAN	PAK	KRR

DSGN: T OLEAN | DR: PA KARABAN | CHK | APVD

SUFFERN FORMER MGP SITE
ORANGE & ROCKLAND UTILITIES, INC.
SUFFERN, NEW YORK

CH2MHILL®

CIVIL
SPARGE WELL INSTALLATION LAYOUT

1"=20'
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	MARCH 2016
PROJ	650199
DWG	FIG1
SHEET	of

FIGURE

FILENAME: FIG01-03-16-16_650199.dgn PLOT DATE: 2016\07\08 PLOT TIME: 9:03:42 AM

Attachment 1
Soil Boring Logs

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID ~~DF~~ PZ-01

Sheet 1 of 3

SOIL BORING LOG

Start Date & Time: 5/11/16 @1410
End Date & Time: 5/12/16 @0805
Water Level, Date & Time:

CH2M Logger: L BADECK
Drilling Contractor: Cascade Drilling LP — M. QUEEN
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
0	NO SAMPLES STARTED COUNTS AT 5'			EXCAVATION BACKFILL	0-6.7 EXCAVATION BACKFILL	1430 BEGIN ADVANCING 6" CASING
					5.0-6.7 LIGHT BROWN GRAVELLY SILT COHESIVE, DAMP/DRY (GM) -FILL-	
5					6.7-9.0 Well Graded Gravel with Sand (GW) grey-brown, wet, loose 60-65% gravel 30-35% Sand	small cobbles
	5-15' 5/11/16 1433	80/120"	0.6			
			1.0	GW	9.0 - 11.6 Saturated, D.O. as above Cobbles small large 60%, gravel C-F 25% Sand 15% (GW)	
10			0.3			
				NR	11.6-15.0 NO RECOVERY	
15				SM	15.0-15.8 Dark olive grey fine sand, little silt (SM) wet	
	15-20 5/11/16 1445	49/60"	0.8	SP	15.8-19.1 Dark grey medium Sand, poorly graded (SP) trace coarse sand, little fine sand, loose	
			0.9	NR	NO RECOVERY 19.1 - 20.0	
20			0.4	SP	20.0-24.1 Dark grey poorly graded medium SAND (SP) trace coarse sand, wet loose	
	20-25' 5/11/16 1455	60/60"	0.2			
25			0.5	SM	24.1-25.0 Dark grey fine Sand, some medium sand, little silt (SM) wet	

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID PH PZ01

Sheet 2 of 3

SOIL BORING LOG

Start Date & Time: 5/11/16 @ 1410
End Date & Time: 5/12/16 @ 0805
Water Level, Date & Time:

CH2M Logger: L. BADRA
Drilling Contractor: Cascade Drilling LP — M. QUEEN
Drilling Method: Rotosonic, 6" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
25	1500 25-30	60/60"	0.3	SP	25.0-25.8 Dark gray poorly graded medium sand, moist, loose (SP)	
				SM	25.8-26.4 Dark gray, fine sand, some silt, cohesive, soft (SM) wet	
			0.3	SP	26.4-27.5 Dark gray loose med sand poorly graded (SP)	
				SM	27.5-29.1 Dark gray fine sand and silt grading to silt (SM) wet, soft	
			0.4		29.1-30.0 D.O. as above except includes 5 angular cobbles	
30	1515 30-35	36/60"		NR	30.0-32.0 NO RECOVERY	
			0.8	SP	32.0-35.0 Poorly graded medium Sand, some CS sand, little fine sand, trace C-F gravel, trace silt (SP) ^ cobbles at 34-34.4	
			0.3			
35	1530 35-40	60/60"	0.2	GW	35.0-40.0 ^ loose Well Graded Gravel and sand, small to large cobbles 25% C-F Gravel 50%, Sand 25% Saturated (Angular - Subrounded Gravel + cobbles)	
			0.4			
40	1545 40-50	48"/120"		NR	40-46.0 NO RECOVERY	NOTE: VERY SOFT/LOOSE DRILLING WITH SAND HEAVE INTO BOREHOLE
			0.8	SP	46.0-50.0 Poorly graded Coarse Sand, little medium sand, trace fine sand & fine gravel, loose, Olive gray	
50			0.9			

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: P+P201

Sheet 3 of 3

SOIL BORING LOG

Start Date & Time: 5/11/16 @ 1410
End Date & Time: 5/12/16 @ 0805
Water Level, Date & Time:

CH2M Logger: C. BARRA
Drilling Contractor: Cascade Drilling LP — M. QUEEN
Drilling Method: Rotosonic, 6 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
50			0.7	GW	50-53.0 well Graded Gravel (GW) yellow brown little Sand Gravel 80% cobbles 5% Sand 15% loose, subangular - subrounded	
			0.5		53.0-60.0 NO RECOVERY	NOTE VERY SOFT/LOOSE DRILLING WITH SAND HEAVE INTO BORING.
55	50-60 1600	36"/120"		NR		
60			0.4		60.0-68.0 Poorly graded medium SAND (SP) moist/wet, loose, trace cs sand, fr fine sand, trace c-f gravel, few small - large cobbles, subangular - subrounded 90% SAND 2.5% cobbles 2.5% gravel	
	60-70 5/12/16 0755	96"/120"	0.1	SP		
68			0.1		NO RECOVERY 68-70	NOTES: VERY SOFT/LOOSE DRILLING WITH HEAVE INTO BORING
				NR		
70			0.5		70.0 - 72.5 POORLY GRADED MEDIUM SAND, (SP) WET, LOOSE, TRACE COARSE SAND, TRACE FINE SAND, TRACE C-F GRAVEL; Subang-Subrounded 95% SAND 5% GRAVEL	
	70-75 0805 5/12/16		0.4	SP		
			0.4		NO RECOVERY 72.5-75.0	NOTE: VERY SOFT/LOOSE DRILLING WITH SAND HEAVE INTO BORING.
75				NR		

BOTTOM OF EXPLORATION: 75.0'

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID PZ02

Sheet 1 of 3

SOIL BORING LOG

Start Date & Time: 5/12/16 1236
End Date & Time: 5/12/16 1445
Water Level, Date & Time:

CH2M Logger: J Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6 ~~5~~" drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-5' Clean Fill material backfilled after excavation, Brown Sand w/ Gravel	
		5'			5- Well Graded Sand w/ Gravel (SW) little DK Brown, moist, V. loose - loose (Fill) f-c	5-15' Rock pushed away sample @ 8'
					7- Turns Grey Brown - DK Grey, more gravel up to 3", subrounded	
5		1237		SW	8-15' No Recovery	
			0.0		15' - Well Graded Sand (SW) wet, V. loose DK Grey - Greyish black, med - C grain	
		3/10'	0.6	--	16 - some dive mottling	
					18' - trace fine gravel	
		X/0'		NO Rec	20 - grey - greyish blue	
10	5-15				24 - Poorly Graded Sand (SP) Grey, moist V loose fine - med grain, 25% fines, micaceous	
		1249				
15				SW		
			0.0			
		10/10'				
20			0.0			
	15-25					
			0.0	--		
		1303		SP		

sonic log, r2, 4/18/16, c. lettich

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID P2 02

Sheet 2 of 5

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			0.1	SP	25-26 Same as above (SP)	
				SW	26 - Same as 15' Well Graded Sand (SW) moist, V. loose grey - greyish black fine - C grain < 5% Fines, some mica	
					29 - increasing C grain	
		10/10			33.5 Poorly Graded Sand (SP) trace silt < 15% Grey - greyish black, moist, loose, fine grain some mica	
30			0.1		34.5 - Same as 26' w/ gravel	
	25-35			--	35 - Same as above, no gravel	
			0.0	SP	37 - increasing C grain, trace gravel	
				--		
				SW	39 - less C, some fines	
35		13/17			41 - Increasing C grain, gravel up 2", rounded	
			0.0		43 - no fines med - C grain, fine - C gravel trace cobbles, subrounded	
		9/10			44-45 N. Recovery	
			0.0		45 - Same as above, ~~no~~ 50% C sand	
40					48' - 49' increased fines	
					49 - Same as 50' w/ gravel (20%) subround	
	35-45		0.0			
				--		
		13/32		No Rec		
45				--		
			0.0	SW		
		7/10				
	45-55		0.0			

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID PZ02

Sheet 3 of 3

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SW GW	51- Well Graded Gravel w/ sand (GW) Fine-C grain, blackish grey, V. loose, mostly granitic, moist, up to 3", subangular-subrounded med-C sand	
	~~50-55~~ 45-55	7/10	0.0	--		
				No Rec	~~55~~ 52-55 No Recovery	
					55- Well Graded Sand w/ Gravel (SW) Brown, wet, V loose, ~~fine~~ med-C grain	
55		1349		--		
			0.0	SW GW SW	55.5- ~~Gravel~~ Well Graded Gravel (GW) with some Sand, fine-C gravel, V loose, subrounded brown, grey, 1"-3" in size	Cobble @ 59'-60' bgs pushed out sample
	55-65				56.3- Same as 55' more gravel (30%) tan-brown, no fines, subround gravel	
		4/10'	0.0	--	59-65 No Rec	
60				No Rec.	65-67' Well Graded Sand w/ Gravel (SW) Tan with Brown, V. loose, moist, fine-C grained 10% fines, micaceous	69' large cobbles in sand pushed out sample
					67- Poorly Graded med Sand w/ Gravel (SP) Tan with brown, V. loose, micaceous, sub round gravels up to 1"	Tagged @ 74' 9", need to blow out rest of sand
					69- cobbles present, subrounded-round, fist sized	
		1413		--		
65				SW	TD 75' @ 1445 5/12/16	
			0.0	--		
		4/10'		SP		
	65-75					
			0.0	--		
70				No Rec		
		1435				

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: PZ03

Sheet 1 of 3

SOIL BORING LOG

Start Date & Time: 5/17/16 0730
End Date & Time: 5/17/16 0915
Water Level, Date & Time:

CH2M Logger: L. BARCA, I Bingeman, J. WEBUS
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-5 Previously excavated, backfilled w/ sand/gravel Brown, loose, moist	
		5'		SW Fill	5-8 - same as above, med dense	
					8-9 - well Graded sand (SW) med-C with <10% fine gravel, white/Gray with some Brown, V loose dry	
5					9-10' No Recovery	
		4'	<0.0	SW Fill	10 - Well Graded Sand (SW) Oily Brown, wet V loose med-C grain, <10% Fines	
				NR		
10						
	10-20' 5/17/16 0820	5/17/16 0820 60/120	<0.2			
15						
20			<0.0		20.0-27.0 Dark Gray poorly graded ~~Sand~~ medium sand, SP, trace coarse sand trace fine gravel, loose, wet	
	20-30' 5/17/16 0820	120/120				
25			<0.1			

ch2m.

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: PZ03

Sheet 2 of 3

SOIL BORING LOG

Start Date & Time: 5/17/16 0730
End Date & Time: 5/17/16 0945
Water Level, Date & Time:

CH2M Logger: L Brorlat
Drilling Contractor: Cascade Drilling LP J. Woods
Drilling Method: Rotosonic, 6 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
25	20-30' 5/17/16 0820	120/120"	<0.3	SP / OL / SP	27.0-28.1 Dark Gray ORGANIC SILT with fine sand, soft wet, ML	
					28.1-30.0 Dark gray Medium Sand poorly graded, trace CS sand, trace to little fine sand SP, wet, loose	
30	30-40' 5/17/16 0830	105/120"	<0.2		30.0-35.0 Dark gray poorly graded SP, medium sand, trace CS sand, trace to little fine sand, wet	
35			<0.4	ML	35.0-37.2 Dark Gray Silt with Sand, trace clay, soft, wet ML	
				GW	37.2-39.0 Dark gray well graded Gravel with Sand GW C-F Gravel 70% Sand 25% Silt 5%	
			<0.2		39.0-40.0 NO RECOVERY	Probable Cobbles
40	40-50' 0840	48/120	<0.2	SP	40.0-42.0 Dark olive gray poorly graded medium sand, trace coarse sand little fine sand, wet soft SP	
			<0.1	SW	42.0-42.9 Dark olive gray Well Graded Sand, some CS-FN gravel subangular to subrounded, SW, wet, loose	
				GW	42.9-44.0 Olive, well Graded Gravel + Sand + Cobbles, broken up, Color looks weathered, wet	
45				NR	44.0-50.0 NO RECOVERY	COBBLES IMPEDING OR BLOCKING CORE BARREL
50						

sonic log, r2, 4/18/16, c. lettich

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: P203

Sheet 3 of 5

SOIL BORING LOG

Start Date & Time: 5/17/16 0730
End Date & Time: 5/17/16 0915
Water Level, Date & Time:

CH2M Logger: L. BARBER
Drilling Contractor: Cascade Drilling LP — J. WELLS
Drilling Method: Rotosonic, 6 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
50					60-60 NO RECOVERY	NOTED VERY NUMEROUS COBBLES CAMMED WITH SOFT COAL SAND.
55	50-60 ft 5/17/16 0850	0/120"		NR		
60			<0.1	SP	60.0-62.0 Light brown / yellow brown poorly graded medium sand, trace CS sand, tr fine sand, SL, loose wet	
	60-70 ft 0900	84/120	<0.2	SW	62.0-64.0 well graded Sand, yellowish brown predominately Coarse sand, trace to little fine gravel, angular, loose, wet, ~~few cobbles~~ occasional cobble, subrounded	
65			<0.1	GW	64.0-67.0 yellowish brown C-f gravel with Coarse sand, cobbles, angular to subangular, few subrounded, dense	
				NR	67.0-70.0 NO RECOVERY	~~Cobbles + loose~~ Cobbles
70			<0.0	SP	70.0-72.0 Yellow brown poorly graded coarse-medium Sand SP, trace to little fine gravel, wet dense	
	70-75 ft 5/17/16 0915	96/120	<0.0	GW	72.0-75.0 Yellow brown well graded Gravel and Sand, cobbles, wet dense	
75						

sonic log, r2, 4/18/16, c. lettich

BOTTOM OF EXPLORATION: 75.0 ft.

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: PZ04

Sheet 1 of 3

SOIL BORING LOG

Start Date & Time: 5/18/16, 1040
End Date & Time: 5/18/16, 1430
Water Level, Date & Time: NM

CH2M Logger: C. Lettich
Drilling Contractor: Cascade Drilling LP, Jon Weeks
Drilling Method: Rotosonic, 6" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-5 Excavation backfill	1040 Begin advancing 6" casing
	0-5 1040	0/60 Excavation Fill		Fill	5-8 Well Graded Gravel w/ Sand (GW), greyish brown, wet, loose, 60% f-c gravel, 35% f-c sand, 5% fines. At 5'-3" of olive brown silt	
					8-8.5 Possibly concrete debris	
5			0.3		8.5-10 Well Graded Sand with Silt and Gravel (SW-SM) greyish brown, moist, 10% fines, 20% fine gravel, 70% f-c sand	
	5-10 1050	60/60	0.1	GW	10-14 Well Graded Gravel w/ Sand (GW) olive brown, moist, loose, 60% f-c gravel to 2.5", 40% f-c sand, trace fines	
			0.0	Conc.	@ 11 becomes wet	
				SW-SM	14-15 Silty Sand with Gravel (SW-SM), greyish brown, wet, 15% fines, 30% fine gravel, 55% f-c sand	
10			0.6	GW	15-17 Clayey Sand w/ Gravel (SC), grey, wet, very loose, 30% fines, 15% fine to crs gravel, 55% f-c sand	
				Tooth	17-20 No Recovery	
	10-20 1102	84/120	0.9	SW-SM	20-28 Well Graded Sand (SW) greyish brown, saturated, very loose, 100% f-c Sand	
15			0.3	SC	28-30 No Recovery	
				No Recovery		
20						
	20-30 1110	96/120	0.1	SW		
			0.3			

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID PZ04

Sheet 2 of 3

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					30-32 same as 20-28 (SW)	
			0.5	SW	32-39 Poorly Graded Sand (SP), yellowish brown, saturated, very loose, 100% f-c sand (dominantly medium)	
	20-30				@37 becomes fine grained	
				No Recovery	39-40 Well Graded Gravel w/ Sand (GW), brown, saturated, very loose, 65% f-c gravel to 1.5", 35% f-c sand	
30					40-42 same as 32-39 (SW)	
			0.5	SW	42-45 Well Graded Gravel w/ Sand (GW), brown, saturated, very loose, 80% f-c gravel to 3", 20% sand	
			0.4		@43 Sand to 30%, gravel to 70%	
					@44 gravel to coarse predominantly and sand to 20%	
35	30-40 1118	120/120	0.3	SP	45-47 Well Graded Sand with Gravel (SW), greyish brown, saturated, 70% f-c sand, 30% f-c gravel	
			0.2		47-49 same as 20-28 (SW),	
					49-50 same as 32-39 (SP)	
				GW		
40						
			0.9	SW		
				GW		
			0.4			
45	40-50 1127	120/120		SW		
			0.6	~~SW~~		
				~~SW~~		
				SW		
			0.4			
				SP		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: P204

Sheet 3 of 3

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
55	50-60 1142	120/120	0.8	SW	50-63 Well Graded Sand (SW), yellowish brown, wet, very loose, 100%. f-c sand coarse fraction is on the smaller end of ~~the~~ coarse	1145 Break lunch
			1.0			1225 Continue drilling
						1250 Reach TD of 75'
					@59 f-c gravel 10%.	
					@60 ~~no gravel~~. fine gravel 10%., 90% f-c sand with abundant sand on coarsest end of spectrum	
			0.9		63-65 Poorly Graded Sand (SP), yellowish brown, ~~wet~~, very loose, 90% f-c sand (med → saturated dominant), 10% fine gravel	
			0.8			
60					65-67 Poorly Graded Sand with Gravel (SP), yellowish brown, wet, very loose, 85% f-m Sand, 10% coarse gravel to 2"	
			1.0		67-70 Same as 63-65	
					70-75 No Recovery, Driller reports very soft material. Probably SP from above	
65	60-70 1233	120/120	0.8	SP		
			1.0	SP		
			0.7	SP		
70	70-75 1250	0/60		No Recovery	TD @ 75' at 1250, 5/18/16	

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: PZ05

Sheet 1 of 3

SOIL BORING LOG

Start Date & Time: 5/13/16 1320
End Date & Time: 5/16/16 1145
Water Level, Date & Time:

CH2M Logger: J Bryeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description (USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy)	Comments (Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm))
					0-5' Previously excavated and backfilled w/ clean sand and gravel, brown, V loose, moist	Raining
					5-6.5' same as above	
					6.5' - Well Graded Sand w/ Gravel (SW) Grey Brown - Brown, med - C grain, moist, V loose gravel up to 2.5", subrounded	·Cobbles pushed out sample
5		1324			8.5' - Well Graded Sand w/ Gravel, (SW) grey, moist-wet, V loose, med-C sand, fine subangular gravel	
			0.1	SW	10-15 No Rec	
		5'/10			15-17.3' Poorly Graded Sand (SP) w/ trace silt, grey, wet, loose, fine grained	
			0.2			
10				No Rec	17.3 - Well Graded Sand (SW) w/ some gravel <18%, Grey - Greyish black, wet V loose, med-C grain, some olive mottling	
	5-15				~19 - increasing subangular - subround gravel	
					~19.5 - olive color	
15		1340		SP		
			0.1			
				SW		
20		6'/10	0.7			
	15-25			No Rec		
		1404				

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID PZ #5

Sheet 2 of 3

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			0.1	SW	25 - same as 19.5, no gravel, some fines	
					32 - increasing med-C grains, <5% fines trace fine gravel, moist, V. loose	
		8/10"			33'-35' No Recovery	- loose material
					35-45 No Recovery	- Driller noted extremely soft material, drill train to vibrate, just pushed through
30			0.0		45-46.1 Poorly Graded Sand (SP) Fine grain, V loose, micaceous, moist	
	25-35				46.1 - same as 32	
						1502 Stop for weekend heavy Rain
			0.0	--	48 - Poorly Graded Sand (SP) Fine-med 2% fines, moist, V. loose Tan-Brown micaceous	
				No Recov		0839 5/16/16 - Resume Drilling
35		1423				
		9/10"				
40	35-45					
45		1438				
				SP		
			0.0	--		
		5/10		gw		
				--		
			0.0	SP		
		1500				

ch2m.

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID P2Ø5 | Sheet 3 of 3

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, ______" drive casing, ______" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					50-55 No Recovery	
					55 - Well Graded Sand (SW) w/ trace gravel Olive Brown - Brown, med-C grain, V. loose moist, large cobble at bottom, granite, rounded	- large cobble @ 54' prevented rest of sample
					59-65' No Recovery	
					65' - 67' - same as 55'	
55				SW	67' - Well Graded Gravel (GW) <15% sand fine - C, subrounded, V. loose, Brown, moist	
			0.0		69' - Poorly Graded Sand w/ Gravel (SP) Olive Brown - Brown, V loose, moist, med grain Fine - C subround gravel, 25%, some cobbles	- cobbles prevented full sample
		4/10'		-- No Rec		
60	Ø 55-65					
65		0903		SW		
				-- GW		
		5/10'		-- SP		
70	65-75			-- No Rec		
		0933				

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: PZ06

Sheet 1 of 3

SOIL BORING LOG

Start Date & Time: 5/27/16, 0730
End Date & Time: 5/27/16, 1040
Water Level, Date & Time: NM

CH2M Logger: C. Lattich
Drilling Contractor: Cascade Drilling LP J. Weeks
Drilling Method: Rotosonic, 6/8" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-6 Fill	Begin advancing 6" @ 0730
	0-5			Excavation Fill	6-9 Well Graded Gravel with Silt & Sand (GW-GM), lt. greyish brown, moist, loose, 60%. f-c gravel to 4", 30% f-c sand, 10%. fines 9-10 No Recovery 10-11 Same as above	
5					11-13 Well Graded Sand w/ Silt & Gravel (SW-SM), saturated, loose, grey, 60%. f-c sand, 30%. fine-coarse gravel, 10%. fines	
	5-10 0730	60/48	0.2	GW-GM	13-20 No Recovery, Driller reports interval 20-30 No Recovery, felt rocky/cobbly	
				NR	30	
10			0.2	SW-SM		
15	10-20 0735	36/120		No Recovery		
20						
	20-30 0740	0/120		No Recovery		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID PZ-06

Sheet 2 of 3

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
30	20-30	0/120		No Recovery	30-33 Poorly Graded Sand (SP), olive brown, saturated, very loose, ~~100~~ 95% f-c sand (f. dom), 5% fine gravel 33-36 Silty Sand (SM), dk. grey, saturated, loose, 60% fine sand, 40% silt, sulfur odor @ 34' 3" layer of black matted organic/plant material	
			0.7	SP	saturated 36-38 Sandy Silt (ML), dk grey, v. soft, 60% fines, 40% fine sand, slight sulfur odor	
				~~SP~~	38-40 No Recovery	
35	30-40 0750	96/120	0.3	SM	40-43 Poorly Graded Sand (SP), olive brown, wet, v. loose, 100% f-c sand (fine dom)	
			0.5	ML	43-44 Well Graded Sand (SW), olive brown, wet, v. loose, 90% f-c sand, 10% coarse gravel	
				No Recovery	44-50 No Recovery. ~~Easy~~/Soft drilling	
40			~~HHHH~~			
			0.8	SP		
			1.0	SW		
45	40-50 0800	48/120		No Recovery		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID PZ06

Sheet 3 of 3

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					50-55 same as 40-43 (SP)	0840 TD@75'
					55-56 same as 43-44 (SW), gravel to 5%.	
			0.8	SP	56-57 Well Graded Sand with Gravel (SW), lt. brownish gray, saturated, loose, 65% f-c sand, 30% fine gravel, 5% fines	
55	SD-60 0807	84/120			57-60 No Recovery	
				SW	60-63 same as 43-44 (SW), fine gravel 5%	
			0.5	SW		
				No Recovery	63-68 same as 56-57. f-coarse gravel to 4" rounded cobbles 30%, no fines	
					68-70 No Recovery	
60					70-74 same as 43-44 (SW), 5% fine gravel	
			0.8	SW	74-75 Well Graded Gravel with sand (GW), yellowish brown, saturated, v. loose, 75% f-c gravel, 25% m-c sand.	
65	60-70 0825	96/120	0.5	SW		
				No Recovery		
70						
	70-75	60/60	0.3	SW		
			0.4	GW	TD@75'	

sonic log, rz, 6/18/16, c. leffler

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW01

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/2/16, 0840
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	Air knifed			Air Knifed	0-5' Previously air knifed for utility clearance	0840 Begin advancing 6" casing
					5-5.5 Well Graded Sand with Silt and Gravel (SW-SM), dk. greyish brown, moist, med. dense, 70% f-c sand, 20% f-c gravel, 10% fines	Estimate water table 14'
						0900 Trouble retrieving 15-20' sample b/c/o material between casing and sample barrel
5					5.5-6 Clayey Sand with Gravel (SC), yellowish brown, moist, med. dense, 60% f-c sand, 20% f-c gravel, 20% fines	
				SW-SM / SC		0930 Begins moderate rain to heavy rain
	5-10 0855	48/60	0.0	FW	6-9 Well Graded Gravel w/ Sand (GW), H. grayish brown, dry, loose, 60% f-c gravel, 35% f-c sand, 5% fines	
			1.6		9-10 No Recovery	
				NR	10-14 same as 5-5.5 (SW-SM), dry, loose	
10					14-17 Same as 6-9 (GW), saturated	
			2.3	SW-SM	17-20 No Recovery	
	10-15 0855	60/60			20-24 Well Graded Sand w/ Gravel (SW), brown, saturated, 65% f-c sand, 30% f. gravel, 5% fines	
			1.4			
15					@21 sand 75%, gravel 20%, fines 5%	
				GW	24-25 Same as 6-9 (GW)	
	15-20 1010	24/60	0.0		25-27 Well Graded Sand (SW), yellowish brown, saturated, v. loose, 95% f-c sand, 5% fine gravel	
				No Recovery	27-29 Silty Sand w/ Gravel (SM), yellowish brown, saturated, v. loose, 60% f-c sand, 25% f. gravel, 15% fines	
20						
	20-25 1020	60/60	0.0	SW	29-30 Silty Gravel w/ Sand (GM), yellowish brown, saturated, v. loose, 60% f-c gravel, 25% f-c sand, 15% fines	
					30-35 No Recovery	
				FW		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW01

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, " drive casing, " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	25-30 1030	60/60	0.0	SW	35-~~39~~39.5 Well Graded Sand (SW), brown, wet, very loose, 90% f-c sand, 10% fine gravel	
			1.5	SM	39.5-40, Silty Sand (SM), light brownish gray, wet, mod. dense, 70% f-m sand, 30% fines	
30	No Recovery			GM	40-44.5 Well Graded Sand (SW), lt brownish grey, saturated, v. loose, ~~40~~ 95% f-c sand, 5% f-c gravel	
				No Recovery	@ 42-42.5 Fines to 10%. Begin getting mod Hydrocarbon odors,	
					@ 43.5 Sheen on free water. dk reddish brown staining and some 0.5-1cm bands of oily dk reddish brown liquid, strong odor	
35	35-40 1045	60/60	0.0	SW	loose 44.5-~~45~~45.5 Silty sand (SM) reddish brown, wet, loose, 80% fine sand, 20% fines. At top of unit about 4cm of staining and sheen	
			0.0		~~45~~ 47 ~~50~~ 47.5-~~52~~ 53 Poorly Graded Sand (SP), ~~#~~ reddish brown, wet, v. loose, some ~~fine~~ sheen on grains and free water. Mod odor. 47-47.5 minor 0.5-1cm stain bands	
40				SM		
			4.8	SW	~~52.5~~ 47.5-53 Well Graded Sand w/ Gravel (SW), greyish brown, saturated very loose, 65% f-c sand, 35% f-c ~~sand~~ gravel, mod odor	
	40-50 1110	120/120	~~4.3~~ 1015		@ 48-48.5 Gravel to 45%.	
45				SM	@ 47.5-50 Slight hydrocarbon odor	
			4.0	SP	@ 51 odor to reddish brown. Fines to 10%	
			2.8	SW		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW01

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			2.3	SW	53-55 Well Graded Gravel w/ Sand (GW), reddish yellow, wet, loose, 50x. f-c gravel, 20x. fine sand	1210-1300 Break lunch 1300 Continue drilling
					55-60 No Recovery	
	50-60 1130	60/120	1.9	GW	60-64 Same as 53-55	
55					64-70 No Recovery	
				No Recovery	70-73 Poorly Graded Sand (SP), yellowish brown, saturated, very loose, 100x. f-m sand (mod dom), rare fine gravel	
					73-75.5 Well Graded Gravel w/ Sand (GW), wet, very loose, 60x. f-c gravel to 3.5" cobble, 40x. f-c sand mild HC odor	
60						
			0.7	GW	75.5-79 Well Graded Gravel w/ Sand (GW), saturated, very loose, 60x. f-c gravel to 3", ~~25~~ 35x. f-c sand, 5x. fine, strong HC odor. Black oily globules 0.5-1mm and sheen on free water. Olive brown. Amount of sheen and oily globs increases to 79'	
65	60-70 1150	48/120		No Recovery		
70						
			5.4 ~~0.3~~	SP		
	70-80 1320	108/120				
			5.7 ~~0.7~~	GW		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW01

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet EGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					No Recovery 79-80	
	70-80 1320	108/120	30 ~~6.0~~	GW	80-88 Well Graded Sand with Gravel (GW), olive brown, 80% f-c sand, 20% f-c gravel to 2.5", Mild HC odor, Saturated, v loose @82 rare 1mm-0.5mm oily black globules on free water, some sheen	1350 Rig down for mechanical 1435 Reach total depth of 100.5
				ND		1530 Complete overdrilling with 8" to 80
80					@84 moderate odor	
			4.5	GW	86- @87.5 strong hydrocarbon odor, sheen on Saturated grains	1600 Begin building 100' well
	80-90 1350	120/120	4.4		88-90 Well Graded Gravel w/ Sand (GW), yellowish brown, Saturated, very loose, ~70% f-c sand, 30% f-c gravel to 2.5" (fine sand), mild HC odor	
85			4.8		90-91 Well Graded Gravel (GW), brownish grey, v loose, Saturated, 90% f-c gravel to 3.5", 10% f-c sand	
			4.2		91-100 No Recovery, Driller reports that ~91-97 felt soft (perhaps fine sand seen nearby), 97-100 felt cobbly	
			1.2	GW		
90			2.6	GW		
	90-100 1430	12/120			No Recovery	
95						
					TD@ 100.5, 1435 5/2/16	

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW-02

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 4/20/16 0830
End Date & Time: 4/21/16 1000
Water Level, Date & Time: —

CH2M Logger: Ian Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6" drive casing, 4" core barrel 9" overcore

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
		1'	NA	Fill GW	Well Graded Gravel (GW) A Dry	Air knife 0-5', pre clear for utility
0835 5			0.0	GW	Well Graded Gravel w/ sand (GW) 5-7' Dark Brown, d/y, 15% cobbles coarse non-plastic, Very loose	Fill material
		5'			7' Turns grayish brown 7-8'	
			0.0		8' Turns brownish gray, more sand 8'-10' less cobbles	
0845 10						
		0			No Recovery	
0900						
~~1055~~ 113 15			0.0	SW	Well Graded Sand w/ Gravel (SW) Brown, loose, 10% cobbles, 15% gravel coarse grained w/ fines, non-plastic, loose	
		5'			17' Same as above but grayish brown, increasing fines	
			0.0		18' (SW-SM) Well graded Sand w/ silt and gravel some cobbles V.Soft, Brownish-Red, moist	Non-Fill
0911 20			0.0	GW	Well graded Gravel (GW) cobble sizes 5% fines granitic rock frags, black, white hard	
		2.5'			21' Well Graded Sand w/ Gravel (SW)	
			0.0	SW	21-23.5' coarse grained moist, dark brown w/ reddish brown 15% gravel, loose	

sonic log, r2, 4/18/16, c. lettich

25

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW02

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time: 4/20/16 0830
End Date & Time: 4/21/16 1000
Water Level, Date & Time: –

CH2M Logger: I. Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
0920 25			0.1	(SW)	Same as above (SW) w/ more cobbles wet	
		5'			27' Well Graded Sand w/ Gravel and clay >15% gravel moist-wet, V. soft, Brown, low plastic	(SW-SC)
			0.0	(SP)	28' Poorly Graded Sand <5% gravel, fine grained V. soft, Brown, micaceous, non-plastic	
0930 30					30-32 - same as above	
		2.5'	0.0		32' Poorly Graded Sand (SP) w/ Very large cobbles. Brown fine grained, moist-wet cobbles are large, white/black/brown, V. strong	Driller noted large cobble pushed sample out
					32.5	0946 Driller stopped for water break
0940 35						0952 Back on Rig
			0.0		35'-37' Same as above w/ more large cobbles	
		4'			(SW-SM) Well Graded Sand w/ Silt and Gravel 37-39' Brown F-C grained, Med dense, low plastic, moist, Very large cobbles present (granitic) 15% cobbles 5% Silt	* large cobbles slightly mixing cores
			0.0			
1000 40						* Driller said boulder or cobble prevented recovery
		0			No Recovery	* 1019 Delivery for Drillers
						* 1110 Return
1111 45						* Coal tar odor strong
			50.7		45-47' Large rock frags + cobbles granite material fines washed out Black/white/Pink/Gray	
		5'			47-50	
				GP	Poorly Graded Gravel with <15% Sand Med-dense, Brown/Black, coarse, sub-angular wet	
			1.3			
1127 50						

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW02

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time: 4/20/16 0830
End Date & Time: 4/21/16 1000
Water Level, Date & Time: —

CH2M Logger: I Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6 " drive casing, 4 " core barrel 9

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
1127 5					Well	
		4'	15.7	(GW)	~~Rocky~~ FD Graded Gravel with <15% sand 10% cobbler, granitic, hard rock frags 1B ~~dense~~ coarse grained, loose, moist, Black, pink Fine, white	50-54 * No odor
			13.6		~~50-54'~~ 1B	
1147 55						11:59 Break 1300 Resume
		0'			No Recovery	* Attaching different sonic head
						* Dropped tag down, came up covered in COAL TAR SHEEN + Odor
1300 60						1315 - Tightening rod arm 1321 - Finish
		0'			No Recovery	13:27 - Rig malfunction 1334 - Resume 1340 - Rod holder sheared bolt 1530 - Drill Rig fixed / Resume
65					1538	
		5'	2.2	SP	65-67' Poorly Graded Sand w/ Gravel (SP) Brown Fine grain, firm-hard moist 15% gravel	
				SP	Poorly Graded very Fine-Fine Sand w/ ~~Trace~~ 1B ~~silt and gravel~~. Brown, 10% gravel, wet trace coarse grains, micaceous, granitic gravel 67-70' subround gravel up to 2", med. dense	Little gravel
			0.0			
1600 70						
			1.4		Same as above (SP) less gravel grayish brown	
		5'			6715 block structure	
			0.0		68' Turns light Brown/Tan very f-f grain med dense - dense, subrounded gravel granitic frags to 2"	
75						

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW02

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time: 4/20/16 0830 | CH2M Logger: I Bingeman
End Date & Time: 4/21/16 1000 | Drilling Contractor: Cascade Drilling LP
Water Level, Date & Time: ⊽ | Drilling Method: Rotosonic, 4" drive casing, 6" core barrel 9

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
						1630 stop drilling for day 4/21/16 0744 Resume Drilling
		5'	2.8	(SP)	Poorly Graded sand w/ Gravel, med-C grain subangular gravel (granitic) up to 2", trace cobbles moist, loose to medium dense, Brown to Yellowish tan, granitic gravel is pink/white/black/grey 75-80'	
			0.8			
0755 80						
		5'	13.4	(SW)	80-85' Well Graded Sand w/ Gravel (SW) Brown/Yellowish Red, moist-wet, Coarse grained subrounded to subangular, cobbles present granite gravel, loose to very loose	
			8.8		84' some cementation, trace fines	
8.17 85						
		0'			No Recovery	* Running 2 core barrels ended up shaking out sample, Noted by driller Very Loose
8839 90						
		5'	26.7	SW	90-93' same as 80-85' (SW) larger gravel pieces 90% gravel wet	
					92-93 larger gravels up to 3" less fines	
			0.8	SP	93-95' Poorly Graded Sand w/ Gravel (SP) Yellowish Brown, wet, f-C grained, loose - DB sub (rounded) gravel (granitic) up to 1 inch	
8909 95						250 gal used H_2O
		3'	7.1	SP	95-98' Same as above med-C grain 4 fist sized cobbles (granitic) rounded loose, white/red/tan/yellow gravel	
						TD = 100' Bgs
0950 100						

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW-03

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 4/25/16 0824
End Date & Time: 4/25/16 1645
Water Level, Date & Time:

CH2M Logger: I Bizeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6" drive casing, 4" core barrel 8' over

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			0		Gravel + cobbles, Fill material from Air knifing and sand	0-5' was cleared via Air Knife
		5'	0			
5						0830
		5'	0	GP	Poorly Graded Gravel w/ Sand (GP) >15% sand, Brown - Reddish Brown, F-C grain gravel up to 2", moist, subrounded - rounded gravel Very loose	
					(GP) 5-12'	
			1.0			
10						0832
		4'	1.1		10-12' same as above	
				SW	Well Graded Sand (SW) little gravel moist, Dk Brown w/ little Tan, Very soft Fine-C sand	Driller noted losing 1' of sample due to soft material "Grabbing extra sample
			0.8	14-15' GP	Same as 5-10' (GP), more cobbles granitic gravel	0836 "Cave in" flush casing and clean out hole
15					15-19' Well Graded Sand w/ Gravel (SW) F-C grain, wet Brown - Dk Brown, Gravel up to 3" Very soft - Soft, sheen in spot 3cm in diameter around 16.5' sand gets finer w/ depth, less little gravel more larger (2") pieces	
		4'	1.9	(SW)		
			0.9			
20						0912
		5'	154		20-23.5 Same as above coarser sand Tan/pink/red grains	
					23.5-25 Poorly Graded Gravel w/ Sand (GW) little sand, coarse grained wet, Light brown to tan, gravel up to cobbles 4" in size angular - subrounded, granitic, very loose	Very High PID (slight odor
			450			0927
25						

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW03

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time: 4/25/16
End Date & Time:
Water Level, Date & Time:

CH2M Logger: I Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			30.4		25-26' same as 23.5-25	0937
		4'			26-27 Poorly Graded Sand (SW) light Brown - Brown, med-C grained, wet / Very soft	
			10.9	(GW)	~~Well~~ 27-29 Well Graded Gravel w/ Sand light Brown - Tan, Very loose wet coarse, gravel up to 2", few fines	(GW)
30						0948
			4.3		30-32 same as 26-27'	
		5'				Strong Odor
					32-35' ~~Poor~~ Well Graded Gravel w/ Sand (GW) same as 27-29' Strong sheen (metallic) angular - sub rounded, wet, Very loose	
			22.7	(GW)	Brown - Grayish (metallic)	
35						1000
		0'			No Recovery	Black coloring / Globules noticed on Rod From 35-40' Strong odor
40						1015
			38.5	(SW)	40-41.5 Poorly graded sand w/ trace Gravel (SW) same as 26-27	Notice Black coloring / Globules about 18' down on rod when pulling up Core barrel
		4'			41.5-44 same as 32-35' (GW) strong odor, metallic sheen, wet, fist sized cobble at end of run	
			70.7	GW		
45						1030
					45-47 (SW) same as 40-41.5	
		5'	40.2			
					47-50 Poorly graded Gravel w/ some Sand (GW) strong odor / sheen, Blackish grey with some brown, fist size cobbles <15% sand, very loose	Continuing to see on core barrels
			48.1			
50						1043

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW03

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time: ~~4/25/1630~~ 4/25/16 | CH2M Logger: I Bingeman
End Date & Time: | Drilling Contractor: Cascade Drilling LP
Water Level, Date & Time: | Drilling Method: Rotosonic, 8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					No Recovery	1114 Rods continue to have sheen when brought up.
55		0				
~~55~~		3'	10.1	SW	55-58 Well Graded sand w/ Gravel (SW) grey with - black, some dk brown, metallic, med-C grain gravel up to 3" in dia, very loose, subangular granitic gravel	1128 Strong odor + sheen
60						~~1150~~
		5'	4.0	SP	60-63 Poorly graded sand (SP) grey with - brown, light brown, med-C grain very soft / very loose, sheen present, odor wet	
			5.9	SP-SM	63-65 Poorly graded sand w/ Trace silt (SP-SM) light brown - tan, moist, Very soft odor, no sheen	
65		5'	2.8		65-70 Same as 63-65' (SP-SM) v.s. slight odor, soft	1150 Lunch - 1155 1302 - back on rig
			0.4			
70			10.8		70-75 (SP-SM) Same as above very soft, Brown - Dk Brown	1310
			0.9			
75						1330

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW03

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time: 4/25/16 0824
End Date & Time: 4/25/16 1645
Water Level, Date & Time:

CH2M Logger: T Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
80	0.5'	0.5'	NA	SP-SM	~~5~~ 75-76 same as 70-75' wet (SP-SM)	1351 - barrel sheared / attempt to retrieve 1359 - reattached - Driller noted vibration of sheared rod ~~the~~ FB vibrated out sample
						1405
					80-81 Same as above	
	3'	3'	9.1	GW	81-83' Well graded Gravel w/ Sand (GW) Coarse grained Dk brown w/ Tan/blacklithic grains (granitic) Very loose, sub angular - subrounded wet,	
			12.8			
85						1430
	0'	0'			No Recovery	Driller noted extremely soft material
						1459
90						
	3'	3'	92.8	GW	90-91' Same as 81-83 wet, Tanish Brown	
			10.4	SW	91-93 Well graded Sand w Gravel (SW) med - coarse grain, moist, Brown with reddish tan grains, Very loose, granite gravel to 1" Slight odor	
95						1535
	5'		139	SW	95-96 same as above greyish brown Well Graded Gravel (GW) wet, grey Coarse gravel with fist size cobbles residuum, loose, sub angular to rounded	
			177			drill chattering 98'
					99' Bedrock	1600 ~~Hole~~ FB Mechical breaks 1607 start running
100						1630 Overdrill for tomorrow attach

Wells @ 25 50 75 98 see seperate diagram

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW04

Sheet 1 of 2

SOIL BORING LOG

Start Date & Time: 4/27/16 1347
End Date & Time: 4/28/16 0900
Water Level, Date & Time:

CH2M Logger: I Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6 1/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
		5'			0-5' Gravels and Fill material	Precleared w/ Air Knife backfilled w/ cutting from vacuum
						Drove 8" casing to 15' after ~~5'~~ coring, flush well to 15' and core again 15-20'
5					5-6' - Asphalt slough - black, sticky, shiny no odor, looks like fresh asphalt	
			0.8		6" - 8' Well Graded Sand w/ Gravel (SW) Reddish Brown - Brown, dry, grave up to 2" rounded grains, med grain size, soft	
		8"	6.3		8' - 9.5' Poorly graded sand w/ little Gravel (SP) very soft, Reddish Brown, small gravel, fine grained	
10			~~1.8~~		9.5 - 10.5 Poorly graded sand w/ silt and some Gravel (SW-SM) Dark Brown - Black; med dense med - C grained	
	5-15				10.5 - 13' Well Graded Sand w/ Gravel (SW) Whitish Grey/ish - Light Brown, loose - med dense chunks of dense bits, gravel pieces to 1" some cobbles of fist size	
			0.7			
15					15' - 16' same as ~~6 - 9.5'~~ above	1410 Casing wet at 16'
			44.4		16 - same as 9.5 - 10.5' Brown, rounded gravel, dense	
	15	5'	62.1		-18 Turns black possibly due to staining gravel increase in size up to 2", rounded	
	20					
			637			1432 Driller notes Hydrocarbon odor Strong Hydrocarbon odor Black
20					20 - Well Graded Sand w/ some Gravel (SW) Black, very loose, ~~medium~~ - coarse grain wet	
			98			
	20-30	10'		22	- increasing gravel size	
					24 - Brownish black coloring w/ pocket of light tan, same material	
25			101			~~1432~~

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW04

Sheet 2 of 2

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description (USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy)	Comments (Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm))
	20-30	10"	154	GW	25- Well Graded Gravel (GW) Reddish-Brown to Black liquid sheen very loose, very strong odor, wet	
			~~154~~	SP	27 - gravel pieces increase in size, no sand → 28 - Poorly Graded Sand (SP) - Grayish Yellow Brown very loose med grain, slight sheen and blackish color when sample broken up	6" pocket of extremely loose gravel strongest sheen/odor, possible bottom of smear zone
30			9.8		• Abandoning Hole at 30' due to Tim Olsen / Randy Smith Conversation about Findings.	1446 Drilling stop to fix hose issue • Need new hose 0930
35						
40						
45						
50						

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW05

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 4/28/16 11:00
End Date & Time: 4/29/16 15:10
Water Level, Date & Time:

CH2M Logger: C. Lothich
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 8/6 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				Air Knife	0-5' Previously air knifed	1100 Begin advancing 6" casing
	Air Knife				5-7' Well Graded Sand w/ Gravel (SW), dk. grey, moist, v. loose, 60% f-c sand, 40% f-c gravel up to 3.5"	1145 15-20' barrel wet
						1200 stop for lunch
					@ 6.5' color to reddish yellow saturated	
					7-15 No Recovery	
5						
			3.6	SW	15-18 Clayey Sand w/ Gravel (SC), brown, moist, med. dense, 55% f-c sand, 20% f-c gravel, 25% fines.	
	5-15' 1122	24/120			@17-18 Abundant orangish brown mottling	
				No Recovery	18-18.5 Well Graded Sand w/ Gravel (SW), dk. grey, loose, 80% f-c sand, 15% gravel, 5% fines, strong hydrocarbon (HC)-like odor and possible staining, wet	
10					18.5-24 Poorly Graded Sand (SP), greyish brown, wet, v. loose, 100% f-m sand (med dominant). Slight HC odor. 4" cobble at base.	
					@20' minor sheen on free water	
					24-25 Well Graded Gravel w/ Sand (GW), dk. brownish grey, saturated, v. loose, 55% f-c gravel to 3", 40% f-c sand, 5% fines. Minor HC odor ↳ (coarse dominant)	
15						
			3.9	SC		
	15-20' 1145	60/60	35.6	SW		
			1.4			
20						
			4.4	SP		
	20-25 1200	60/60	6.5			
			3.5	GW		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW05

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
						1200 Continue drilling
	25-30' 1255	60/60	4.8	SP	25-29 Poorly Graded Sand (SP), olive brown, wet, v. loose, 100% f-m sand (fine dom). Minor HC odor	1400 Mechanical downtime
			4.7		29-30 Poorly Graded Sand with Gravel (SP), olive brown, wet, v. loose, 60% f-m sand (fine dominant), 40% f-c gravel (coarse dominant). Minor HC odor	1420 Resume drilling
			3.7	SP		
30					30-33 Same as 25-29. Minor HC odor	
	30-35 1310	60/60	3.2		33-36 Well Graded Sand (SW), olive brown, wet, v. loose, 100% f-c sand. Minor HC odor	
			4.2			
				SW	36-38.5 same as 25-29 (SP), olive grey minor HC odor	
			5.0			
35					38.5-39 same as 33-36 (SW)	
			4.5		39-39.5 Silty Gravel w/ sand (GM), lt. brownish gray, moist, 50% f-c gravel to 4" cobble, 20% fines, 30% f-c sand, v. loose	
	35-40 1345	60/60	4.1	SP	39.5-40 Well Graded Sand w/ Gravel (SW), lt. brownish olive grey, wet, v. loose, 75% f-c sand, 25% fine gravel	
				SW		
			3.8	GM		
				SW		
40					40-43 Well Graded Sand (SW), greyish brown, saturated, v. loose, 95% f-c sand, 5% fine gravel, slight HC odor	
			1.8	SW		
					43-45 Poorly Graded Sand (SP), olive yellow, wet, v. loose, 100% f-c sand (med dominant)	
			2.1	SP	45-47.5 same as 40-43 (SW)	
					47.5-49 same as 25-29 (SP), olive grey very minor odor	
45	40-50 1430	120/120	1.8	SW	49-50 Silty Sand (SM), olive grey, wet, loose, 70% fine sand, 30% fines	
			2.2	SP		
			3.8	SM		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW05

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
55	50-60 1450	120/120	3.5	SW	50-56 Same as 40-43 (SW), fine gravel to 10%.	1510 Stop to replace jaws
					56-60 Silty Sand (SM), yellowish brown, moist, v. loose, 85% finest sand, 15% fines	1520 Continue drilling
			3.1		60-66 Poorly Graded Sand (SP), yellowish brown, saturated, very loose, 100% fine sand	
			3.0		66-67.5 Same as 56-60 (SM)	
60				SM	67.5-78 same as 60-66 (SP)	
			2.2			
	60-70 1530 ~~1400~~	120/120	2.7	SP		
			2.5			
65						
			1.9	SM		
			2.0	SP		
70						
	70-80 1600	96/120	1.8			
			2.0			

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW05

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
						1625 Heaving sands 80-90 core run
	70-80 1600	96/120	1.8	SP	78-80 No Recovery	
					80-81 Well Graded Gravel with Sand (FW), saturated, v. loose, 60% f-c gravel, 40% f-c sand, light brownish gray	1630 Stop drilling for 4/28/16 @ 90'
			1.0	No Recov.	81-86 Well Graded Sand with Gravel (SW), saturated, v. loose, 85% f-c sand, 15% fine gravel, light brownish gray	4/29/16, 0720 Continue drilling
80				GW		0740 Total depth of 100.5 reached
			0.5		86-88 Poorly Graded Sand (SP), yellowish brown, wet, v. loose, 100% f-m sand (med. dominant)	0800 Begin overdrilling w/ 8" casing to 77'
			0.4	SW	88-90 same as 81-86, color to yellowish brown	
	80-90 1625	120/120			90-91 same as 86-88 (SP)	
85					91-92.5 Poorly Graded Sand with Gravel (SP), yellowish brown, saturated, v. loose, 85% f-m sand (medium dominant), 15% f-c gravel (4.5" cobble)	
			0.8	SP		
					92.5-93 Silty Gravel with Sand (GM), yellowish brown, saturated, v. loose, 50% f-c gravel, 30% f-c sand, 20% fines	
			0.2	SW		
90				SP	93-95 same as 80-81 (GW)	
			0.8	SP	95-100 No Recovery	
				GM		
					Well Completion (see Completion record)	
	90-100 0740, 4/29/16	60/120	0.6	GW	Screened: 97-100', 72-75', 46-49', 22-25'	
95				No Recovery		
					TD @ 100.5' at 0740, 4/29	

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW06

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/18/16 0740
End Date & Time: 5/18/16 1440
Water Level, Date & Time:

CH2M Logger: J Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-5' Previously Air Knifed, backfilled w/ vac'd out material, Sand / gravel / cobbles, grey and black	
		5/5'			5'-7' - Slag; Sandy Gravel, (GW) Black, hard dry	
					7' - Gravel w/ Clay (GW-GC) Well Graded rounded, Brown, loose, dry, clay, 3 semi plastic trace fine sand	
5	0745					
			0.5	GW	8.2' - Well Graded Sand w/ Gravel (SW) loose, dry, Tannish Grey - Grey, some wh.te med-C grain, <10% fines, angular gravel	
		5/5'	0.1	GW-GC	10.5' - Well Graded Sand w/ Gravel (SW) Black, moist, V. loose, med-C grain, angular-subround gravel, fine-C	
				SW		
			0.3		11.5' - Turns Orange-Brown to Tan, moist, some cobbles	
10	0746					
			0.9		12' - micaceous, Brown, <10% fines	
					13.1' - Well Graded Gravel w/ Sand (GW) 25% sand Red-Brown - fine-C gravel, subrounded - sub angular micaceous, med sand	
		10/10'		GW	14' - Brown	
					14.5' - Tan, wet, subround gravel	
15			2.8		15' - Orange-Tan	
	10-20			SP	16.4' - Poorly Graded Sand (SP), med grain V. loose, moist, micaceous, Orange-Brown	
					18' - Olive Brown w/ slight Orange mottling	
			0.2		18.4' - Olive	
20		0800			19' - Orange-Tan	
					22' - Poorly Graded Gravel w/ Sand (GP) - fine gravel, med sand, V. loose, moist, Grey - some C gravel	
		10/10'		GP		
	20-30'		0.2		23.7' - Well Graded Sand w/ some Gravel (SW) <15% gravel, Olive Grey, moist, V. loose med-C grain Sand	- slight hydrocarbon odor
				SW		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW06

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			0.2	SP	~~30.7~~ 25.7' Poorly Graded Sand (SP) Olive Grey, V. loose, moist, med Grain, <10% fine micaceous	
					28.3' - 28.5' - 20% Fines	
					30.7' - some gravel, increasing grain size	
			0.2		31.2' - Well Graded Sand w/ Gravel (SW) Olive-Grey, moist, V. loose, ~~to~~ 15% gravel, subround fine-C sand, some brown mottling	
30		0814				
				SW	33.1' - increasing C grain, less fines, more gravel 20%	
			0.2		34.2' - less gravel, 10%	
		14/10'			37' - decrease in grain size, more med grain than C, trace to no gravel, Olive Brown 15% Fines	
35						
	30-40'		0.3		39' - transitioning to SP	
					40' - Poorly Graded Sand (SP) med grained Olive-Brown - Olive-Grey, V. loose, moist micaceous	
			1.4		43.6' - increasing grain size, trace gravel	
40		0840			46.2' - Well Graded Sand w/ Gravel (SW) Grey - V. loose, moist, med-C grain, fine-C gravel subangular, fist sized cobble	
				SP		
			0.4		47' - less gravel 10%, Olive Brown - Brown	
		9/10'			48' - increasing Fines 15%, Orange-Red mottling	
			0.5		48.3' - Poorly Graded Sand (SP) - Brown, moist fine-med grain, loose, micaceous, 20% Fines some tan mottling	
45						
	40-50			SC	49' - SC No Recovery	
			0.6			
				SP		
				No Rec		
		0913				

ch2m:	Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	Boring ID SWB6	Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			0.3	SP	~~Sam~~ 50 - same as 48.3' (SP)	
					58.4 - increase in fines w 25%, loose	
		10'/10'			60 - ~~few~~ less fines, same as 50'	
					64.5 - slight tannish mottling	
					67.2-68 - same as 58.4, trace grey mottling	
55			0.7		~~70~~ 71.5' - Well Graded Gravel w/ Sand (GW) moist, Brown/White/Grey/Blue/Orange - granitic fine - C gravel, subround - subangular, med - C sand	
	50-60'			SP		
					73.2' - Well Graded Sand w/ some Gravel (SW) V. loose, moist, Brown, med - C grain, subangular gravel, some mica	
			0.2			
60		0945			75.1 - Increases in fines ~20%, Little-No gravel olive Brown, micaceous	
			0.3			
		10'/10'				
				SP		
65			0.1			
	60-70'					
			0.1			
70		1015				
			0.4			
		6'/10'		GW		
	70-80'					
				SW		
			0.2			

ch2m:	Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	Boring ID SW06	Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6" drive casing, ____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SW	76-80' No Recovery	
				No Rec	80 - well Graded Sand w/ Gravel (SW) Brown - Olive Brown, moist, V. loose, ~~subang~~ subangular sand Fine - C grain sand, fine gravel, subangular more C grain sand	
					87.3 - Poorly Graded Sand (SP) Brown moist, loose, f-med grain, micaceous ~25% Fines	
80		10"		SW	93.4' Well Graded Sand w/ Gravel (SW) wet, Brown, med-C grain, 20% fines, gravel up to cobbles, rounded - subrounded	• ~~Cut~~
			-0.6			1200 - lunch
					96 - Dark Brown, more coarse gravel,	1232 - pull 90-100 sample
					96.7 - Brown, increasing C sand	- Cobble in b.t at bottom of sample
85	80-90				TD 100' bgs @ 1310 5/18/16	
			-0.9		Overdrill 8" to 77' bgs 1440 5/18/16	
				SP		
			-0.2			
90		11"				
			-0.3			
		7"		SW		
95	90-100		-0.0			
		13"				

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW08

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/24/16 1100
End Date & Time: 5/25/16 1445
Water Level, Date & Time: N/M

CH2M Logger: I Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, C18 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-5' Previously Air knifed, backfilled w/ sand and gravel, black/Grey, loose dry	
		5'			5' - Well Graded Sand w/ Gravel (SW) Black/Grey, wet, med-C grain, V loose 30% fine gravel - rounded	
					6.6' - dark Reddish Brown, moist, some C gravel	
5		1105				
				SW	8.3' - Olive grey, increasing fine-med sand, trace subround cobbles	
			0.0			
		5'			10' - Tan-Olive grey, well Graded med-C sand trace angular granite cobbles	
					11.7' - Poorly Graded Sand (SP) Olive Grey fine-med (10% fines), V. loose, moist, micaceous	
			0.0			
10		1118				
					13.1' - Olive Brown, increased micas	
			0.0		14.3' - Orange-red mottling	
					17.1' - 17.3' - increased fines 25%	
				SP		
		10/10'			18.2' - 19.5' - Poorly Graded C Sand (SP) Orange-tan, V. loose, wet, <10% med sand	
					18.5' - Well Graded Sand w/ Gravel (SW) Dk Brown-Tan, wet, V. loose, fine-C grain <10% fines, dominated by med sand, trace cobbles subround gravel	
15	10-20		0.0			
					22' - Inherently grain size, majority C sand	
				SP		
					22.5' - 25% round gravel	
			0.0	SP SW	24.6' - Olive grey - Grey, less to no gravel	
20		1130				
	20-30	10/10'				

sonic log, r2, 4/18/16, c. lettich

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW08

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SP-SW-SP	29.3' - Poorly Graded Sand (SP) olive grey V. loose, med grain, moist, micaceous	
					29.7' - Well Graded Sand w/ some gravel (SW) V. loose, grey moist, fine-med.	
			-0.0		26.3' - same as 25.3', some black mottling	
30		14/48			28.5' - larger grains appear, turning orange Brown w/ orange mottling	
			-0.0		30' - same as above, no mottling	
					32' - trace gravel (fine)	
		6.5/16'			33.4' - more fines, loose, olive brown (SP) 25%	
			-0.0		36.2' - trace silt	
35					36.5-40' - No Recovery	
	30-40		-0.0		40' - Well Graded Sand (SW) med-C grain V. loose, moist, Olive Brown, <10% fines	
				No Rec	41.2' - trace fine gravel appears, increasing grain size	
					44.7' - med-C sand, majority C	
40		17/12		GW	46.1' - Well Graded Gravel w/ Sand (GW) DK Brown, fine-C gravel, med-C sand subround-subangular gravel, V. loose, moist	
			-0.0		47.3' - Poorly Graded Sand (SP), fine-med 25% fines, Tan-Brown, loose, some grey mottling moist, trace silt	
		10/10'			47.5' - med grain sand, 10% fines, Orange-Brown micaceous	
45	40-50		-0.0	GW-SP-SP		

sonic log, r2, 4/18/16, c. lettich

ch2m:	Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	Boring ID SW08	Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:
CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			0.0	SP	40- Same as above, (SP), Grey-Brown	
					53- trace fine gravel	
		9/10'			56.2-(SP), increased fines, 25%-30% Tannish Brown	
					59-60' No Recovery	
55	50-60		0.0		60'-66' same as 56.2'	- loose material, washed out of core barrel
					66-70' No Recovery	
				SP	70'-SP, med grain same as 50'	
			-0.0			
				No Rec		
60		1411				
				SP		
		6/10'				
65	60-70					
				~~SP~~ No Rec		
70		1443				
				SP		
		5/10'				
	70-80					

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW08

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				No rec	75-80 No Recovery	
					80 - Well Graded Sand (SW) med-C grain Olive Grey - Olive Brown, V. loose, moist <10% fines	
					82.1 - 82.4' Poorly Graded Sand (SP) Tan Brown, loose, moist, Fine - med, dominated by medium w/ 30% fine, micaceous	
80		15/9		--		
			-0.0	SW	82.4 - Same as 80 w/ 20% fines	
					84.6' - same as 82.1 (SP)	
		19/10		-- SP - SW	86.2' - some angular - sub angular gravel	
					87.8' - ten mottling, round cobble, dry	
					90' - same as above w/ Grey	
85			-0.0		94 - cobbles	
	80-90				96 - Rock - angular fragments, Grey gneissic	- Driller noted rock at ~96', was able to push casing to ~97'
					TD of 97' bgs 1650 9/24/16	
					Overdrill ~~77'~~ 75' bgs (ea)	
90		15/52				
			-0.0			
		4/10			Set well screens at 92-95', 69-72', 47-50', and 22-25'. Bottom two screens shifted up because of bedrock at 96'. See well completion report	
95						
	90-100					
		16/44				

sonic log, r2, 4/18/16, c. lettich

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW09

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/2/16 1423
End Date & Time: 5/3/16 1314
Water Level, Date & Time:

CH2M Logger: I Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-5' Ai - Knifed for utilities, backfilled w/ gravel - cobbles - sand	
		5'			5-5.5 Slag / Fill Sand w/ Gravel (SW) Black, very loose	
					5.5 Well Graded Sand w/ Gravel (SW) med-C grain, dry Reddish Brown, V. loose subrounded gravel	
5		1428			6 - Turns light Brown / Tan, moist	
		5'	0.3	SW	7 - Well Graded Gravel w/ Sand <5% fines (GW) Grey - Olive Grey, wet, very loose, fine - C grain Few cobbles, gravel, & subrounded	
		&		GW		
			0.4		9.5 - Well Graded Sand (SW) w/ few gravel Olive Grey, loose, moist, micaceous med grain	
					10 - fine - med, wet	
10		1440		SW	12.5 Red mottling	
			0.1		13 - Well Graded Sand w/ Gravel (SW) Olive-grey w/ red mottling, moist, med-C grain subround - Subangular Sand, micaceous <5% fines	
		5'			14 - Poorly Graded Sand (SP) <10% fines fine-med grained, Olive grey, moist, micaceous loose	
			0.1			
				SP	15.5	
15		1452			~~14.5~~ Well Graded Sand (SW) moist olive grey w/ slight red mottling, tan/white/red grains med grains, very loose	
			0.3	SW	16.5 - grain size decreases	
		5'			17 - med - coarse grains	
					18.5 - Fine - med Poorly Graded Sand (SP) olive-grey, moist, loose, micaceous <20% fines	
			0.1	SP	20.5 - Well Graded Gravel w/ Sand (GW) Brownish Grey, wet, V loose, subrounded - subangular micaceous	
20		1501			21 - Well Graded Sand w/ Gravel (SW) <5% gravel, med-C sand, wet, olive grey	
			0.5			
		5'			22.5 Turns tan-brown, more gravel	
					24 - Same as 14', <5% silt, micaceous Firm - loose	
			0.2			
25		1509				

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW09

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:

End Date & Time:

Water Level, Date & Time:

CH2M Logger:

Drilling Contractor: Cascade Drilling LP

Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
		5'	0.7	SP	25- Poorly Graded Sand (SP) fine-med loose, ~~med dense~~, moist, light Brownish grey w/ light red brown in spots, micaceous	
					30- Same as above, loose, grey/red mottling	
					35' Same as above, med grain, micaceous moist, reddish Brown - olive brown, loose - V. loose	
		1529	0.2			Switch to 10' runs from 30' bgs down
30					40- ~~ft~~ No Recovery	
			0.6		~~ft~~ - Same as 35'	
		5'		SP		
	30-40'					
35			1.0			
		5'		SP		
			0.9			
40		1544				
		0'				
	40-50					
45						
		4'				
						Stopped for night @ 1615
50		1610				

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW09

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:

End Date & Time:

Water Level, Date & Time:

CH2M Logger:

Drilling Contractor: Cascade Drilling LP

Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SP	Same as above, Poorly Graded Sand (SP) Olive Brown w/ slight tan mottling, loose, moist micaceous fine-medium grain, <20% fines	
		5'	1.0		60-68' same as above	
					70 - ~~Form page~~ Same as above	
55						
	50-60		0.4			
		5'		SP		
			0.3			
		0830				
60						
			0.2			
		5'		SP		
			0.4			
65						
	60-70					
		3'	0.4	SP		
		0857				
70						
			0.1			
	70-80	5'				
			0.2			
75						

ch2m.

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW09

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, ______" drive casing, ______" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description (USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy)	Comments (Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm))
	70-80	4'	0.0	SP	75- SP - same as above, olive Gray - olive - Brown	
					81 - Well Graded Med - C grain Sand (SW) wet, Olive Brown - Yellow Brown Very loose, subround - subangular grains	
					84.5. ~~large~~ gravel appears up to 1", few fines, reddish Brown	
80		0919				
		5'	0.0	SW	85 - Well Graded Gravel w/ Sand (GW) Brown / Black / White / Pink (some granite) very loose, wet, subangular, med - C sand fine - C gravel	
			0.2		86.5 - Same as 75', loose, fine - med (SP) 50% finesand, Olive Brown	
					90-93 - Same as above, hit cobbles or a boulder? switching to coring	
85	80-90	5'	0.2	GW	95 - Bedrock, used wet coring, couldn't get sample from 96-100, left in hole.	
			1.2	SP		
90		1001				
		3'				Hit something hard 93' - chatter - very hard drilling - Sending casing down to prevent breaking bit
		1039 ~~1059~~				
95	90-100	1'				95 switch to wet core - Broken rod fixed in 10 min 1108 Start core 1110 end core 1130
100						

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW10

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: ~~9/4~~ 9/14/16 1410
End Date & Time: 9/15/16 1049
Water Level, Date & Time:

CH2M Logger: I Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6 1/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-5' Air knifed for Utilities, backfilled w/ Sand, Gravel, Cobbles and slag, Black-Grey	
					5-5.5 Slag/Fill, black, hard/dense	
		5'			5.5 - Poorly Graded Sand, (SP) grey-black, loose dry	
					6 - Well Graded Gravel w/ Sand (GW) Grey-Black, v loose, moist, subrounded 20% sand (med-c)	
5		1414			some cobbles,	
			0.3	SP		TB [redacted]
		5'		GW	7.5 - wet	- small piece of steel @ 6.5'bgs
					8 - increasing sand, large cobbles	
			0.2		10 - Well Graded Sand w/ Gravel (SW) Brown, v loose, wet, 20% gravel	
10		1421			10.5 - Turns Grey-black	
			0.3	SW	12 - Poorly Graded Sand w/ Gravel (SP) Grey loose, moist, Found gravel up to 3" Fine-med	
		5'		SP	14 - Well Graded Sand (SW) little gravel Brown, V loose, coarse grain, wet, some mica	
			0.2	SW	15.5' - Turns olive Brown	
15		1431			16' - increased Fine sand	
			0.2		19' - Poorly Graded Sand (SP) Olive Brown - light Brownish Grey, V loose, fine-med grain moist, micaceous	
		5'			21' - 2" gravels appear, ~~&~~ rounded	
			0.2	SP	22' - Well Graded Sand w/ Gravel (SW) - Orangish-Red Brown, very loose, moist, med-C Sand, <10% fines, fine-C gravel subrounded	
20		1438				
			0.4			
		5'		SW		
			0.2			
25		1455				

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW10

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
		5'	0.5	SW	25 - Same as above	
					28' - Well Graded Sand (SW) little gravel Olive Grey - Olive brown, med - C grain, moist very loose, <5% fines, some mica present	
				SW	29.5' - fines increased, 20%	
			0.1		30' Same as above, micaceous	Switch to 10' runs @ 30' bgs
30		1410				
		5'	0.4		32' - less fines, gravel increases, up to 1"	
					34.5 - less gravel, more fines, Granitic gravel subround - subangular	
					35 - Poorly Graded Sand (SP) Light Brown - Yellow Brown, loose, moist, Fine-med, ~~weak cementation~~, micaceous	
					40 - Same as above (SP)	
35			0.5	SP	45 - Same as above (SP)	
	30-40	5'				
			0.1			
40		1540				
			0.3			
		5'		SP		
			0.2			
45	40-50					
		5'	0.3	SP		
						Stop for night 1412
50		1600				

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW10

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			0.2	SP	50 - same as above (SP)	Start drilling 0749
		5'			55' - same as above (SP)	
					60' - same as above (SP) wet	
					~~66~~ 65' same as above (SP), moist	
					70 - same as above (SP), med grained, 20% fines moist, micaceous	
55	50-60		0.5		74 - fines increase 40-50%	
		5'		SP		
			0.2			
60		0907				
			0.1			
		4'				
				SP		
65	60-70		0.1			
		5'				
			0.2			
70		0843				
			0.2			
	70-80	5'		SP		
			0.1			

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW10

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SP	75' Same as above (SP), fine-med, Olive-Brown-Brown, V. loose, micaceous, moist	
	70-80		0.1		80 - Same as above	
80		0910			85 - Well Graded Sand (SW), Olive-Brown-Brown med-C grain, V. loose, moist	
					86.5 - Same as 80'	
		4'	0.3		87.5 - Well Graded Sand w/ Gravel (SW) Brown-Dk Brown, moist, V loose, Subangular-angular gravel, med-C sand, fine-C gravel 30% gravel <5% fines	
			0.2		89 - Poorly Graded Sand (SP) w/ trace silt Dk Brown, moist, loose, fine grained (50%) sand	
85	80-90				90-93' Same as above	
					93 - Bedrock assumed from SW09 coring - gneissic/granitic angular rock, white/Black Pink/Grey	
		5'	0.3			
					TD of ~~100~~ 92.5'	
90		0947	0.1		@ 1050 5/5/16	
		~~4'~~ 3'	0.1			
95		1030				• Rock stuck in bit all SP fell out around

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW11

SOIL BORING LOG

Start Date & Time: 5/6/16 1000
End Date & Time: 5/9/16 1130
Water Level, Date & Time:

CH2M Logger: I Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
		5'			0-5 Previously Air Knifed, backfilled w/ sand/gravel/cobbles, black, dry	Heavy Rain
					5-7 GW, Fill/Gravel, angular, grey, V. loose	
					7-8.5 - Gravel w/ Sand (GW) Well Graded Brown, wet, V loose, med-C sand Fin-C gravel, subrounded	
5			0.0	GW	10 - Well Graded Sand w/ Gravel (SW) Olive Brown, wet V. loose med-C sand gravel (subrounded) up to 2"	
		3.5'	0.0		11.5 - Well Graded Gravel w/ Sand (GW) grey, Coarse gravel to cobbles, angular - subangular, some coarse sand, wet	
10		1026			12 - Well Graded Sand (SW) trace cobbles grey - grey blue, med - C sand, V. loose large cobble	
					16 - Turns Olive Brown - light Brown, no cobbles	
		4'	0.1	SW	18 - Poorly Graded Sand (SP), greyish. blue moist, loose, fine grain, trace silt	
					18.7 - Same as 16' w/ Reddish brown mottling, moist	
15			0.1		23 - Turns reddish Brown, no grey coarser sand w/ gravels present	
	10-20	5'	-0.1	SP / SW		
20		1038	0.1			
	20-30	5'				
			0.1			

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW11

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SW	25-27.5 same as above, (SW) increasing grain size and gravels	
	20-30'	5'			27.5 - Well Graded Sand w/ little gravel (SW), same as above, less gravel, med - C grain sand, olive grey - olive Brown, V loose moist	
			0.1			
30		1055			30 - Same as above	
					34 - increasing grain size, coarse sand	
			0.2		36.5 - Poorly Graded Sand (SP) Olive Brown fine-med grain, micaceous, moist, loose trace coarse cobbles (rounded)	
		5'				
					40 - Same as above, no cobbles, grey-Brown - Olive Brown	
					45 - Yellow Brown to Brown, V. loose	
35			0.2			
	30-40			SP		
		4'				
			0.1			
40		1117				
			0.8			
		5'				
45			0.4			
	40-50					
		4'				
			0.2			
		1237				

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW11

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, ______" drive casing, ______" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	50-60	5'	0.3	SP	50- Same as above (SP)	
					55- Same as above, Olive Brown increased fines	1305 Stopped due to driller leaving
					60- Poorly Graded Sand (SP) - Same as above	5/9/16 0850 Resume
55			0.2		66- Dk Brown - Brown 67- Reddish Brown - Brown, V. loose 69- Few 2-3" ~~cob~~ gravel appear, subrounded - rounded, granitic, Black/white/Grey, more med grain sand, 20% fines	
				SP	70- Well Graded Sand (SW) Brown - Dk Brown Fine - C grained <5% fines, moist, V. loose subround - subangular grains	
		1259	0.1		73- wet, subangular - angular cobbles and gravel present, olive brown	
60	60-70	5'	0.3	SP	74- moist, increasing gravel, SW w/ gravel no cobbles	
65		5'	0.4			
		0908	0.4			
70	70-80	5'	0.4	SW		
			0.6			

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW11

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SW	77.5 - same as 60' (SP) 50% fine sand moist, loose	
	70-80	5'		- -	80 - ~~Well Graded Sand (SW)~~ (SP) med grain olive brown, moist	
			0.5	SP	84.5 - Sub rounded + subangular gravel appears, more fines (25%)	
					85 - Well Graded Sand (SW) w/ some Gravel	
80		0942			Pk Tan - Olive Brown, V. loose, moist, fine-C grain <5% fines, Subangular sand grains	
			0.6		87 - increasing grain size and gravel (20%)	
		5'			89.5 - wet, gravel (30%) (Subangular - rounded) granite	
					90 - Silty Sand (SM) w/ some Gravel	
85			0.4	- -	Grey, some purple mottling, loose - med dense	
				SW	moist, fine - med grain, micaceous	
					-92.5 increasing gravel	
	80-90	5'			-94.5 - Bedrock Granite gneiss, Black, Pink, White	
					TD of 95' @ 1130 5/9/16	
			0.5			
90		1015		- -		
			0.4	SM		
		5'				
			2.4			
95	90-100	1111				

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW12

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/4/16 0800
End Date & Time:
Water Level, Date & Time:

CH2M Logger: C.
Drilling Contractor: Cascade Drilling LP Max Queen
Drilling Method: Rotosonic, 6 5/8" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	0-5' 0805	60/60		SM	0-8' Previously air knifed (~~SM~~). Silty, Sand (SM), dk grayish brown, moist, dense (from air knifing), 70% f-c sand, 20% f-c gravel, 20% fines	0800 Begin advancing 6" casing. Raining.
					8-11 Well Graded Gravel with Sand (GW), lt. grayish brown, wet, loose, 60% f-c gravel, 35% f-c sand, 5% fines	
5					11-20 Poorly Graded Sand (SP), gray, saturated, v. loose, 100% f-m sand	
	5-10 0810	60/60	0.4	GW	@15-16 coarse sand increases to ~10%, rare fine gravel	
					@16 f-m sand w/ fine dominant	
			0.4		20-27 Well Graded Sand (SW), gray, wet, v. loose, 100% f-c sand (f-m dominant)	
10					@23 color change to yellowish brown	
	10-15 0813	60/60	0.2	SP	@24 fine gravel to 10%	
			0.2			
15						
	15-20 0820	60/60	0.5			
			0.3			
20						
	20-25 0845		0.5	SW		
			0.4			

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW12

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			0.5	SW	27-29 Well Graded Gravel w/ Sand (GW), wet, v. loose, 70% f-c gravel to 2", 30% f-c sand, reddish brown	0930 Rig down for mechanical issue
				GW		1040 Continue advancing 6" casing
			0.7	GW	29-35 Well Graded Sand (SW), yellowish brown, wet, v loose, 90% f-c Sand, 10% f-c gravel	1125 Break lunch
						1205 Continue drilling
30	25-35 0915	120/120		SW	@29-30 coarse grain sand dominant	
			0.7		35-43 Poorly Graded Sand (SP) brown, saturated, v loose, 100% f-m sand (med dom)	
			0.3		@41" one 5" cobble and color change to lt. grayish brown, fine sand dominant	
35					43-45' No Recovery	
				SP	45-49 Same as 35-43 (SP)	
			1.4		49-50 ~~WET~~ Same as 29-35 (SW)	
					50-51 Well Graded Sand with Gravel (SW), yellowish brown, wet, very loose, 80% f-c sand, 20% fine gravel	
			0.6			
40	35-45 1055	96/120			51-55 No Recovery	
			0.5			
				No Recovery		
45						
			1.5	SP		
	45-55 1120	1/120				
			1.3	SW		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW12

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	45-55 1120	72/120		SW	~~51-5~~ 55-57 Poorly Graded Sand (SP), yellowish brown, wet, v. loose, 90% f-m sand, 10% fine gravel	1255 Down for mechanical issue
				No Recovery	57-60 Poorly Graded Sand with Gravel (SP), yellowish brown, wet, v. loose, 80% f-m sand, 20% f-c gravel to 2"	
55				SP	60-62 ~~Same as~~ Well Graded Sand (SW) yellowish brown, moist, v loose, 95% f-c sand, 5% f gravel	
			1.1			
				SP	62-63 Same as 55-57	
			1.7	SP	63-65 No Recovery	
	55-65 1240	96/120			65-66 ~~Same as 55-57, saturated~~ Poorly Graded Sand (SP), yellowish brown, saturated, v loose,	
60					66-75 No Recovery 100% f-sand	
			0.9	SW	Driller reports very soft material / easy pushing through interval	
				SP		
				No Recovery		
65				SP		
70	65-75 1330	12/120		No Recovery		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW12

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:

End Date & Time:

Water Level, Date & Time:

CH2M Logger:

Drilling Contractor: Cascade Drilling LP

Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
80	75-85 1440	120/120	1.0 6.1 1.3	SP	75-84.5 Poorly Graded Sand (SP), yellowish brown, wet, very loose, 100% f-m sand (fine dominant)	1450 Down for mechanical issue
					@ 78-79 Saturated	5/5/16 1000 Begin drilling
					84.5-85 Silty Sand (SM), yellowish brown, wet, loose, 85% fine sand, 15% fines	1035 TD @ 100'. Driller reports bedrock at final depth
					85-88 Well Graded Sand (SW), yellowish brown, wet, v loose, 100% fine sand	1100 In process of overdrilling w/ 8" casing
			1.0		88-90 Poorly Graded Sand with Silt (SP-SM), saturated, brown, v. loose, 100% f-c sand	
85				SM	@90 4" rounded cobble in shoe	
					90-95 No Recovery	
			1.1	SW	95-98.5 Well Graded Sand with Gravel (SW), ~~yellowish~~ olive brown, saturated, very loose, 85% f-c sand, 15% fine gravel	
			1.2	SP	98.5-99 Silty Sand with Gravel (SM), yellowish brown, moist, med dense, 80% fine sand, 20% coarse angular gravel, 20% fines	
90	85-95 ~~85-95~~ 1445	60/120	0.8	No Recovery	99-100 Silty Gravel with Sand (GM), lt grey, moist, dense, 70% angular f-c gravel (gneissic granitic clasts), 15% fines, 15% fine sand. Interpreted as weathered bedrock → to 4"	
					@100 hard drilling encountered — probable bedrock contact	
95	95-100 1035, 5/5/16	60/60	1.0	SW		
			1.0	GM		
				GM		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW13

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/10/16 1300
End Date & Time: 5/11/16 1115
Water Level, Date & Time: —

CH2M Logger: I Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-5' Previously Air knifed, Sand / Gravel / Cobbles Black / Brown, Organics, V. loose	
		5/5'			5- Well Graded sandy Gravel (GW) loose, Black/Brown, med-C grain moist Organic odor	
					6.5 - Wet, more rounded gravel with trace cobbles (rounded) fist sized; grey color	
5				GW	7' - Poorly Graded sand with trace gravel (SP) Grey/Brown - Olive-grey, moist, med grained some olive-tan mottling, some mica, V loose	
		4/5'	0.4		9-10 No Recovery	
					10- same as above w/ some gravel, grey	
				SP	10.5- Well Graded Sand w/ some gravel (& SW) Olive-grey, ~~moist~~, V. loose, wet, micaceous, ~~sand~~ angular gravel, fine-C sand	
		NO	0.4			
10		3/4				— 10' runs
				SW	12.5 - Grey/Black w slight tan mottling, increasing gravel up to 3", subround-subangular, med-C sand	Driller noted rock pushed sample out after 5' at 10' bgs
			0.1		13 - Olive color	
					14 - less large gravel, grey/black	
					15-20 No Recovery	
		5/10'			20- Poorly Graded Sand (SP) Olive-Grey to Grey med grained <10% fines, V. loose, micaceous moist	
15			0.2			
	10-20					
		13.27				
20				SP		
			0.2			
	20-30	10/10				
			0.2			

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW13

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SP	25- same as above	
					30- Same as above	
			0.3		31- Well Graded Sand (SW) Fine-C grained <10% fines Olive-Grey w/ tan, V loose, moist, Subangular-subrounded grains	
					34- Same as 30'	
30		13/16				
			0.3	SW	35- Well Graded Sand (SW) med-C grain moist, V. loose, Some gravel, Tannish Brown - yellow brown	
					37- shreading rounded gravel	
		10'/10'			39- Olive Brown, less gravel, V loose, 20% fines	
			0.1	SP	40-46' No Recovery	1420- fix fitting per hose
35						1425- operational
			0.2	SW	46'- Poorly graded Sand (SP) Fine-med <15% fines Olive-Grey, moist, V. loose, micaceous	washed out
	30-40				47.5-48'- Well Graded Coarse Sand (SW) ~~47-4~~ Brown/Orange/Tan/Grey, Subangular, V Loose	
					48' Same as 46'	
			0.3			
40		1402				
45		4'/10'				
	40-50		0.2	SP		
				SW/SP		
			0.2			
		1434				

ch2m	Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	Boring ID SW13	Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					50-60' No Recovery, Tagged Bott @ 59.5'	Driller noted gravels and cobbles when drilling.
					60-61 Well Graded Sand w/ Gravel (trace) (SW) Brown - Olive Brown, moist, V loose, ~~wash~~	60-65 drill chatter
					61.5 - subangular gravel up to 2", increases, greater	
55		0/10'			62 - Poorly Graded Sand (SP) Olive Brown - Brown moist, V loose, trace fine gravel (angular), fine-med grains	
	50-60				63-63.6 - increase in fines, 30-40%,	
					63.6 - same as 62' Dk Brown - Brown, trace gravel	
					65-70 No Recovery	
		1484				
60					70 - Well Graded sand fine - C (SW) <10% fines Brown w/ tn/olive orange, V. loose, moist some mica	
			-0.2	SW	72 - increasing fines	
				--	73.5 - ~~Well~~ increasing C, less fine grains	
				SP		
		5/10'				
65	60-70		-0.2			
		1516				
70				~~SP~~ SW		
			-0.0			
	70-80	7/10'				
			-0.3			

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW13

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SW	75 - Same as above, first size cobble at end of sample, possible cause for missing 3' of recovery, cobble was gneissic granite, black/white, rounded	
	70-80		0.3		77-80' No Recovery	
					80 - Well Graded med-C Sand w/ Gravel (SW) Brown, V. loose, moist, subangular-subround gravel up to 3", moist gravel granite	80-85' - slow drilling w/ 6" casing
80		1'10"		SW		
			0.1		84 - increasing gravel, bedrock cobbles (known from previous holes subround cobbles)	
					87-90 - No recovery	stop for night 1830
		7/10'			90-95 - No Recovery	Switch out rigs due to scheduling. New longstroke rig onsite 0830, start drilling @ 0944
85	80-90'		0.1		95 - Well Graded Sand w/ Gravel (SW) moist, V. loose, Brown w/ white/orange/Black grains, med-C sand, fine-C gravel, subangular-subrounded, some mica	
					98 - Olive brown, <10% Fines	
					99 - angular coarse gravel-cobbles, V loose	
90		1630			TD @ 1111 5/11/16 100' bgs	
		5/10				
95	90-100'		0.0	SW		
		1058				

sonic log, r2, 4/18/16, c. lattich

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW-3/14

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/19/16 1231
End Date & Time: 5/20/16 0915
Water Level, Date & Time:

CH2M Logger: 1 B. Ingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6⅛ " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-5' Previously Air knifed, backfilled w/ sand and gravel, brown, V. loose, dry some organics	
		3" / 5'			5' - Organics, Roots, Silty Sand, (SW) Brown fine-med, dry-moist, some sand gravel, V. loose	
					6.5' - Well Graded Sand w/ Gravel (SW) DK Brown, moist, V. loose, gravel - cobbles, subround gravel 40%, sand - fine-med	
5				SW		
			-0.0		7' - less gravel, Olive Brown, med-C sand brown mottling	
		5" / 5'			8.4' - wet, subangular gravel, 25%	
					10' - Grey with Brown-tan mottling	
			-0.0		12.5' Well Graded Gravel w/ Sand (GW) Greyish Brown, wet, V. loose, fin-C gravel subangular gravel	- large cobble in bottom of sample bag, pushed out sample
10		12"				
					13-20' No Recovery	
			-0.2	-- GW No Rec	20-25' - Grey sand, extremely loose, poured out of core barrel	
		7" / 10'				
15	10-20					
						- Sample is ~~dry~~ wet and V. loose, poured out of core barrel 20-25'
20		13"				
	20-30	5" / 10'				

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW13/14

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			0.1	SP	~~25~~ ~~28~~ - Poorly Graded Sand (SP) Grey fine-med, trace C grains, predominately med grn. V. loose, moist, micaceous	
					~~29.7~~ ~~31.7~~ - increasing C grains, trace gravel	
			0.0		30 - Same as 25'	
30		13/17			33' - same as 29.7	
				SP	35 - Well Graded Sand (SW) Grey w/ olive mottling, med-C grain, moist, V. loose Subangular C sand, trace gravel	
		8/10'	0.0			
					37 - some subangular gravel	
					38-40' No Recovery	
35			0.0	SW	40-45' No Recovery Grey, Wet, V loose sand	- Poured out core barrel
	30-40		0.1		45' - Same as 25' (SP)	
					47' - some slight yellow tan mottling	Very slight odor
		13/32			49.5' - Well Graded sand w/ Gravel (SW) olive-Grey, V. loose, moist, med-C sand fine-C subround gravel	
40						
		5/10'				
45				SP		
	40-50		0.0			
			0.0			
		14/06		SW		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW14

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			0.0	SP	~~Sandy~~ No recovery, Grey, wet, Very loose sand	Poured out core barrel
					~~SP~~ 50- Poorly Graded Sand, (SP), Grey/Brown V. loose, wet, med-fine grain, micaceous	- Driller tagged bottom at 56' w/ rocks, going to blow out and continue drilling, switched bits
		3/10'	0.0		54-60 No Recovery, rocks in hole on bottom	
					60 - Same as 50', Olive Brown, loose Grey mottling	
55	50-60			No Rec	63' - Large subround cobble, possibly cored through	
					63.2' - Well Graded Sand (SW) Brown V. loose, moist, med-c grain, subangular	
					65.4' - large gravel (subangular) to cobbles in sample, majority granitic, some gneissic texture	- Pushed away the rest of the sample
60		14/24			70- Poorly Graded medium Sand (SP) - Brown moist, V. loose, micaceous	
				SP	75' - large subangular granitic cobble	
		6/10			~~74~~	
				SW		
65						
	60-70			No Rec.		
70		15/15				
				SP		
		10/10	0.0			
	70-80					
			0.0			

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW 14

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SW	75 - Well Graded Sand w/ Gravel (SW) Brown, V. loose, med-C grain, <10% fines moist	
			0.0		76.1 - cobbles	
				SP	76.4 - grain size decreases, more med sand, some fines	
				SW		
80		15/20			77' - Same as 70' w/ trace gravel, light Brown	
					78.9 - Same as 75	
			0.0		82' - Olive Brown w/ increased gravel	
		10/10'			82.7 - Tannish Brown, less gravel	
				SW	85.3' - Same as 77', orangish Brown	
85			0.0		86.4' - Same as 75' majority C sand and fine gravel, Dk Brown	
	80-90'				87.1' - Same as ~~75~~ 75', subround gravel	
					90 - Well Graded Sand w/ Gravel (SW) same as above, large cobbles, V. loose wet	1636 - Run sample barrel and casing to 100, pulling sample tomorrow
			0.0			
90		16/18		SW	92-100 No Recovery	0810 - back pulling sample
				SW	TD @ 0825' 5/20/16 100' bgs	92' - large cobble pushed sample out
		2'/10	0.0		Overdrill to 77' bgs @ 0915	
					No Recov.	
95						
	90-100'					
		0822				

sonic log, r2, 4/18/16, c. lettich

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW15

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/23/16, 0755
End Date & Time: 5/23/16, 1400
Water Level, Date & Time: NM

CH2M Logger: C. Leffich
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6/8" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				Air Knifed	0-5 Airknifed previously	0755 Begin advancing 6" casing
	0-5 0755	0/60			5-5.5 Clayey Sand with Gravel (SC), dk brown, moist, med. dense, 15% fine gravel, 25% fines, 60% f-c sand	
					5.5-11 Silty Sand with Gravel (SM), lt. greyish brown, moist to dry, 20% fines 20% f-c gravel, 60% f-c sand.	
5				SC	11-12 Well Graded Sand with Gravel (SW), med. gray, loose, saturated, 5% fines, 15% gravel f-c, 80% f-c sand	
	5-10 0800	60/60	0.1	SM		
			0.2		12-20 No Recovery	
					20-22 Poorly Graded Sand (SP), grey, saturated, very loose, 100% fine sand	
10					22-25.5 same as above, f-c sand, fine dominant	
			0.1	SW	25.5-29 Well Graded Sand with Gravel (SW), brownish grey, v. loose, saturated, 85% f-c sand (m-c dom), 15% fine gravel	
					29-30 No Recovery	
15	10-20 0805	24/120		No Recovery		
20						
	20-30 0815	108/120	0.5	SP		
			0.6	SW		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW15

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
30	20-30 0815	102/120	0.7	SW	30-34 Well Graded Sand (SW), olive gray, v. loose, saturated, 90%. f-c sand, 5%. f. gravel, 5%. fines	
			0.8		34-39 same as 25.5-29 (SW), color to olive brown. Basal gravel 30%. (coarse)	
				NR	39-40 Silty Sand (SM), lt. brownish gray, wet, med dense, 70%. f-c sand, 30%. fines	
			0.6	SW	40-45 Poorly Graded Sand (SP), yellowish brown, wet, 100%. f-m sand (fine dom)	
			0.8		45-48 same as 30-34 (SW), yellowish brown	
35	30-40 0825	120/120	0.8		48-50 Well Graded Sand with Gravel (SW), yellowish brown, saturated, loose, 60%. f-c sand, 30%. f-c gravel to 3.5" cobble in bit, 10%. fines	
			0.9	SM		
40			0.88	SP		
			1.0			
45	40-50 0840	120/120	0.7	SW		
			0.5			

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW15

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
55	50-60 0855	120/120	1.0	SP	50-61 Same as 40-45 (SP), brown	
					@58 rare fine gravel, somewhat coarser sand, brown	
			1.1		61-68 Well Graded Sand (SW), ~~yellowish~~ brown, wet, v. loose, 100% f-c sand (trace fines) (mic. dom)	
			0.9		68-70 Same as 40-45 (SP), lt. orangish brown	
			0.8			
60						
			1.0	SW		
65	60-70 0915	120/120	1.1			
			1.0			
			1.2	SP		
70						
	70-80 0930	120	1.0	SW		
			1.2			

sonic log, r2, 4/18/16, c. lettich

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW15

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	70-80	120/120	1.1	SW	70-77 same as 61-68, olive brown	1000 TD @ 100'
					77-79 Well Graded Sand w/ Gravel (SW), brown, saturated, very loose, 40% f-c gravel to 3"; 60% f-c sand	
			1.0		79-89 same as 61-68 (SW), ~~100~~ 90% f-c sand, 10% fine gravel	
80					89-90 same as 77-79 (SW)	
			0.9			
	80-90	120/120	0.8			
85			0.8			
			1.0			
				SW		
90						
	90-100	0/120		No Recovery		
95	1000					

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW17

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/19/16, 1530
End Date & Time: 5/20/16, 1400
Water Level, Date & Time: NM

CH2M Logger: C. Lettich
Drilling Contractor: Cascade Drilling LP J. Weeks
Drilling Method: Rotosonic, 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	0-5 Air Knifed	0/60		No Recovery	0-5' Previously air knifed 5-7 Well Graded Gravel with Sand & Silt (GW-GM), moist, loose to mod. dense, 60% f-c gravel to 2.5", 15% fines, 25% f-c sand, brown @6 color to yellowish brown 7-10 No Recovery. Cobbles obstructing bit.	1530 Begin advancing 6" casing
5						
	5-10 1535	24/60	0.3	GW-GM	10-13 Silty Sand with Gravel (GSM), yellowish brown, wet, loose, 15% fines, 30% fine gravel, 55% f-c sand. At 13' bit contains 3 x 4" cobbles.	
				No Recovery	13-20 No Recovery. @12.5 color to lt. blueish grey	
10					20-21 Well Graded Sand with Gravel (SW), dk grey, saturated, 75% f-c sand, 25% fine gravel	
			0.6	SM	21-23 Well Graded Sand (SW), olive grey, saturated, 100% f-c sand (dominantly f-m)	
	10-20 1540	36/120	0.9	No Recovery	23-32 Poorly Graded Sand (SP), lt. brownish grey, saturated, 100% f-c Sand (dominantly fine) @ 23-25 5% fines, 95% fine sand	
15						
20						
	20-30 1550	120/120	0.2	SW		
				SW		
				SP		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW#17

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	20-30 1550	120/120	1.2	SP	32-34 Well Graded Sand (SW), gray, saturated, very loose, 100% f-c sand	1620 Stop drilling for 5/19/16
					34-35 Poorly Graded Sand (SP), gray, saturated, very loose, 100% coarse sand with sand	
30					35-36 Poorly Graded Gravel (GP), grey saturated, very loose, ~~90~~ 85% fine gravel, 15% coarse sand	
			1.1		36-37 Well Graded Gravel (GW), gray saturated, very loose, 95% f-c gravel, 5% f-c sand	
			1.0	SW	37-40 Well Graded Sand with Gravel (SW), lt. brownish grey, saturated, very loose, ~~80~~ 80% f-c sand, 20% f-c gravel (fine dominant)	
				SP		
35	30-40 1600	120/120		GP	40-42 Same as 34-35 (SP), f-m sand w/ fine dominant	
			1.1	GW	42-44 Same as 37-40. ~~Trout to 45%, sand to 55%~~ @	
			0.9	SW	44-45 ~~same as 36-37~~ Well Graded Gravel w/ sand (GW), gray, saturated, very loose, 80% fine gravel, 20% coarse sand.	
40				SP	45-48 Same as 32-34 (SW)	
					48-50 No Recovery	
			1.0	SW	50-56 Same as 34-35 (SP), 100% fine sand	
				GW	56-58 Poorly Graded Sand with Gravel (SW), yellowish brown, saturated, loose, 75% f-c sand (fine dom), 25% f-c gravel	
45	40-50 1610	96/120		SW	58-60 Same as ~~44-45~~ 37-40 (SW)	
			1.0			
				No Recovery		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW-17

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					60 - 63.5 Poorly Graded Sand (SP), olive brown, saturated, v. loose, 100%. fine sand	5/20/16, 0740 - Continue drilling
			0.5	SP	63.5 - 65 Well Graded Sand with Gravel (SW), yellowish brown, saturated, loose, 60%. f-c sand, 40%. f-c gravel to 4" cobble. At 65 a 4" cobble in bit.	
55	55-60 1620	120/120			65-70 No Recovery	
			0.8	SW	70-75 Poorly Graded Sand (SP), yellowish brown, wet, v. loose, 100%. f-m sand (~~med.~~ fine dom)	
				No Recovery	75-76 Poorly Graded Sand with Gravel (SP), yellowish brown, wet, v. loose, 80%. f-m sand (fine dom.), 20%. coarse sub round gravel to 3.5" cobbles	
60					77-76 Same as 70-75	
			0.2	SP	78-79 Same as 75-76 with f-c gravel	
					79-80 No Recovery	
	60-65 0810, 5/20/16	60/120	0.1	SW		
65				No Recovery		
70	70-75 0820	120/180	0.2	SP		
			0.5			

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW17

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	70-80 0820	108/120	0.2	SP	80-86.5 Same as 70-75 (SP)	900 TD @ 100'
				SP	@83-84 5%. fine gravel	
			0.1	SP	86.5-88.5 Well Graded Sand (SW), yellowish brown, wet, v. loose, 100%. f-c sand (f-m dom)	
				NR	88.5-89.5 Well Graded Sand w/ Gravel (SW), olive brown, saturated, v. loose, 60%. f-c sand (m-c dom), 40%. f-c gravel to 1"	
80			0.6		89.5-90.5 Well Graded Gravel w/ Sand (GW), olive brown, saturated, v. loose, 70%. f-c gravel to 3", 30%. f-c sand (c-m dom)	
			0.6	SP	90.5-96 Same as 70-75 (SP)	
					96-98 Same as 86.5-88.5 (SW)	
85	80-90 0840	120/120			98-100 same as 89.5-89.5 (well graded sand w/ gravel)	
			0.6	SW		
			0.5	SW		
90				GW		
			0.8	SP		
			0.9			
95	90-100 0855	120/120				
			0.8	SW		
			0.9	SW		

sonic log, r2, 4/18/16, c. lettich

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW18

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 6/7/16, 0845
End Date & Time: 6/7/16, 1600
Water Level, Date & Time: NM

CH2M Logger: C. Lettich
Drilling Contractor: Cascade Drilling LP — M. Queen
Drilling Method: Rotosonic, 6⅝" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
0	0-5 Air knifed	0/60		No Recovery	0-5 Air knifed	0845 Begin advancing 6" casing
					5-7 Well Graded Gravel with Sand (GW), dk brown, moist (saturated at very bottom), loose, 50% f-c gravel, 45% f-c sand, 5% fines	
					7-10 No Recovery	
5	5-10 0850	24/60	0.2	GW	10-11 Silty Sand (SM), yellowish brown, saturated, loose, 85% f-c sand, 15% fines	
				No Recovery	11-12 Same as 5-7 (GW), saturated, yellowish brown	
					12-14 Well Graded sand with Gravel (GW), yellowish brown, saturated, very loose, 80% f-c sand, 20% fines	
10				SM	14-20 No Recovery	
	10-20 0900	48/120	0.5	GW	20-24 Well Graded Sand (SW), grey, saturated, very loose, 95% f-c sand, 10% f-c gravel to 3".	
				SW		
			0.2	SW	24-25 Poorly Graded Sand (SP), grey, saturated, v. loose, 100% f-m sand (fine majority)	
15				No Recovery	25-30 No Recovery	
20	20-30 0915	60/120	0.5	SW		
			0.4	SP		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW18

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	20-30 0915	60/120		No Recovery	30-35 Same as 20-24 (SW), cond 33' @ 31' 4" seam SP @ 33-35 coarsens	
30					35-40 No Recovery	
			0.4	SW	40-45 Well Graded Sand (SW), gray, saturated, very loose, 100% f-c sand, trace fine gravel @ 47'-3" seam of silty sand	
	30-40 0925	60/120	0.4			
35				No Recovery		
40			0.3	SW		
	40-50 0950	60/120	0.5			
45				No Recovery		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW18

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
55	50-60 1020	120/120	0.5	SP	50-60 Poorly Graded Sand (SP), lt. brownish grey, wet, very loose, 100% f-m sand (fine ~~sand~~ majority).	
					@ 51-52 10% fine gravel	
					60-70 No Recovery	Driller reports very soft formation
					70-80 No Recovery	
			0.5		70-80 Fill a bit coarser sand	
60						
65	60-70 1035	0/120		No Recovery		
70						
	70-80 1050	0/120		No Recovery		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW18

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
80	70-80 1050	0/120		No Recovery	80-90 No Recovery. Very soft	1130 Attempted to retrieve 90-100 3x and using flapper bit.
					90-92 Poorly Graded Sand (SP), yellowish brown, Saturated, very loose 100% fine sand	1145 TD@100'
85	80-90 1110	0/120		No Recovery		
90			0.0	SP		
95	90-100 1145	24/120		No Recovery		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW19

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/19/16, 0750
End Date & Time: 5/19/16, 1400
Water Level, Date & Time: NM

CH2M Logger: C. Lettich
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6/8" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-5 Previously Air Knifed	0750 Begin advancing 6" casing
	Air Knifed			No Recovery	5-8 Well Graded Gravel with Sand (GW), brown, moist, loose, 60% f-c gravel, 40% f-c sand	
					@ 7-7.5 Color change to brownish black @ 7.5-8 color to orangish brown	
5					8-11 Well Graded Sand w/ Gravel (SW), lt. greyish brown, dry, loose to med dense, 60% f-c sand, 40% f-c gravel to 5" cobble	
	5-10 0755	60/60	0.3	GW	@ 10 color to dk greyish brown	
			0.7	SW	11-15 Well Graded Gravel with Silt and Sand (GW-GM), orangish brown, wet, loose, 10% fines, 60% f-c gravel to 3.5" cobbles, 30% f-c sand	
10					@ 11.5 color to olive grey	
			1.5	GW-GM	@ 12 color to dk grey w/ slight organic odor	
					15-20 No Recovery. Driller reports soft material after gravel to 15'. See below.	
			0.8		20-22 Well Graded Sand (SW), dk. grey, saturated, very loose, 90% f-c sand, 10% f. gravel	
15	10-20 0805	60/120				
				No Recovery	22-25 Well Graded Gravel with Sand (GW), dk. grey, very loose, 80% f-c gravel to 3.5" cobble, 20% f-c sand	
					25-30 No Recovery.	
20						
			0.6	SW		
	20-30 0815	60/120				
			0.7	GW		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW19

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
30	20-30 0515	60/120		No Recovery	30-35 Well Graded Sand (SW), dk grey, saturated, very loose, 100% f-c sand (mid & coarse dominant)	
					35-40 No Recovery. Driller reports soft material	
			0.5	SW		
			0.7			
35	30-40 0822	60/120		No Recovery		
40			0.5	SW		
	40-50 0830	96/120	0.8			
45			0.5			
				GW		
				No Recovery		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW19

Sheet 3 of 7

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			0.6	SP	40-47 Same as 30-35 (SW) 47-48 same as 22-25 (GW)	
			0.7	SW	48-50 No Recovery 50-53 Poorly Graded Sand (SP), olive grey, saturated, very loose, 100% f-c sand (fine dominant)	
55	50-60 0840	60/120		No Recovery	53-55 Same as 30-35 (SW). 5% fine gravel. Color to yellowish brown 55-60 No Recovery	
60					60-64 Well Graded Sand (SW), yellowish brown, saturated, very loose, 100% f-c sand (f-m dominant) 64-70 No Recovery	
			0.7	SW	70-73 Same as 60-64 (SW)	
			0.6		73-75 same as 50-53 (SP)	
65	60-70 0850	48/120		No Recovery		
70						
	70-80 0905	1/120	1.0	SW		
			0.9	SP		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW19

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	70-80 0905	108/120	1.0	SW	75-78 ~~same as~~ Well Graded Sand (SW), olive brown, saturated, very loose, 95% f-c sand (m-c dominant), 5% f. gravel	0940 Reach final depth of 100'
			1.1	GW	@ 77-78 interval coarsens downward	0950 Begin overdrilling with 8" casing to 80'
				NR	78-79 Well Graded Gravel (GW), brown, saturated, very loose, 90% f-c gravel to 4" cobble, 10% coarse sand	
80					79-80 No Recovery	
	80-90 0920	0/120		No Recovery	80-90 No Recovery. Very soft material lost.	
					90-96 Same as 75-78. No gravel.	
85					96-98 same as 50-53 (SP)	
					98-100 No Recovery	
90			1.1	SW		
	90-100 0940	96/120	1.0			
95			1.0	SP	TD @ 100' at 0940, 5/19/16	
				No Recovery		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW20

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/23/16, 1530
End Date & Time: 5/24/16, 1330
Water Level, Date & Time: NM

CH2M Logger: C. Lettich
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-5 Clean backfill from excavation	1530 Begin advancing 6" casing.
	Excavated	0/60			5-12 Silty Gravel with Sand (GM), brown, moist, medium dense, 650x. f-c gravel, 15x. fines, 35x. f-c sand, up to 5" cobble	
					@ 11 becomes olive & saturated	
					@ 11.5 becomes black. Sulfur odor, mild	
5					12-15 Poorly Graded (SP), dk. gray, saturated, very loose, 100x. fine sand	
	5-10 1535	60/60	0.2	GM	15-20 No Recovery	
			0.1		20-21 Same as 12-15' (SP)	
					21-23 Clayey Sand (SC), dk grey, wet, loose, 60x. fine sand, 40x. fines, organic/ sulfur odor	
10			0.4		@ 23 6" of black organic material up to 30x.	
			0.9		27-30 Sandy Clay (CL), dk grey, very soft, 70x. fines, 30x. fine sand	
	10-20 1540	60/120	0.5	SP	30-35 Sandy Gravel with Sand (GW), gray, saturated, very loose, 65x. f-c Gravel, 35x. f-c sand (well Graded)	
15					35-40 No Recovery. Driller reports interval feels cobbly.	
				No Recovery		
20						
				SP		
	20-30 1545	120/120	0.4			
			0.7	SC		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW20

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	20-30 1548	120/120	0.6		40-50 No Recovery. Driller reports interval felt cobbly.	1620 Quit drilling for 5/23
			0.7	CL		
30						
			0.5			
				GW		
			0.4			
35	30-40 1600	60/120				
				No Recovery		
40						
	40-50 1610	0/120		No Recovery		
45						

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW2Ø

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			0.1	SW	50-52 Well Graded Sand (SW), grey, wet, v. loose, 95% f-c sand, 5% f. gravel	0735, 5/24 – Pusume drilling. Raining hard
					52-55 Well Graded Sand w/ Gravel (SW), grey, wet to saturated v. loose, 70% f-c sand, 30% f-c gravel to 4"	
			0.1	SW	~~56~~ 55-58 same as above. Sand to 20%. Color to yellowish brown	
55	50-60 0740, 5/24/16	96/120			58-60 No recovery	
			0.0	SW	60-66 same as 52-55 (SW), m-c sand 80%, f-c gravel 20%, brown	
					@65-66 color to yellowish brown, sand f-m	
				NR	66-69 Poorly Graded Sand (SP), yellowish brown, wet, v. loose, 100% f-m sand (f dom)	
60					69-70 Poorly Graded Sand with Gravel (SP) yellowish brown, wet, v. loose, 80% f. sand, 20% c. gravel	
				SW	70-72 same as 66-69 (SP)	
					72-73.5 Well Graded Sand w/ Gravel (SW), strong brown, wet, v. loose, 70% f-c ~~gravel~~ sand (coarse dom.), 30% f. gravel	
65	60-70 0755	120/120			73.5-75 Well Graded Gravel w/ Sand (GW), 85% f-c gravel, to 3", 15% f-c sand	
				SP		
				SP		
70						
	70-80 0810	60/120		SP		
				GW		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW20

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	70-80 0810	60/120		No Recovery	75-80 No Recovery 80-81 same as 72-73.5 (SW) 81-82 same as 66-69 (SP) 82-83 same as 73.5-75 (GW), gravel to 60%, sand to 40%	0845 TD @ 100'. Begin advancing 8" casing 1140 Break lunch. In process setting 50' well 1330 Complete Grouting
80			0.3	SW	83-90 No Recovery	
				SP	90-93 same as 66-69 (SP)	
	80-90 0825	36/120	0.3	GW	93-94.5 Well Graded Sand (SW), yellowish brown, wet, v. loose, 95% f-c sand (f-m dom) 5% fine gravel	
85				No Recovery	94.5-95 Well graded Gravel w/ Silt & Sand (GW-GM), yellowish brown, loose, saturated, 10% fines, 30% f-c sand (f. dom), 60% f-c gravel to 4.5" cobbles 95-100 No Recovery. Driller reports interval silt cobbly	
90						
			0.4	SP		
	90-100 0843	60/120	0.5	SW	Set Well Screens: 17-20', 47-50', 72-75', 97'-100'. See well completion reports.	
95				GW-GM		
				No Recovery	TD 100' @ 0845	

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW21

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/31/16 0900
End Date & Time: 5/31/16 1630
Water Level, Date & Time: NM

CH2M Logger: C. LeHich
Drilling Contractor: Cascade Drilling LP M. Queen
Drilling Method: Rotosonic, 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-6 Excavation Backfill	0900 Begin advancing 6" casing
					8-10 No Recovery	
	0-5' 0855	0/60		Fill	10-11 Well Graded Gravel with Silt and Sand (GW-GM), yellowish brown, saturated, loose, 50% f-c gravel to 4+ in cobbles (~~tit~~ cored cobble larger than 6"), 40% f-c sand, 10% fines	
5					11-20 No Recovery. Drill reports interval felt rocky to begin with and softer below ~~at~~ 12-13'. Larger cobble ~~from~~ 11' at blocking core barrel	
	5-10 0900	36/60			20-22 Clayey Sand (SC), dk. gray, saturated, loose, 80% fine sand, 20% fines. 2" seam of poorly graded sand.	
				No Recovery		
10					22-30 No Recovery. Driller reports interval felt very soft.	
			0.2	GW-GM		
15	10-20 0910	12/120		No Recovery		
20						
			0.0	SC		
	20-30 0920	24/120				
				No Recovery		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW21

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	20-30 0920	24/120		No Recovery	~~30-34~~ Silty Sand (SM), dk gray, saturated, ~~loose~~, 60%. fine sand, 40%. fines. 0.5" to 1" layer of organic/plant material every 12-16"	
					~~34-36.5~~ 37 Clay Sandy ~~Silt~~ (CL), dk gray, wet, ~~very loose~~, 60%. fines, 40% fine sand. soft	
30					~~36.5-37~~ 36.5-37 Fines to 70%	
			0.1	SM	37-40 Well Graded Gravel with Sand (GW), dk. gray, saturated, v. loose, 80%. f-c gravel, 20%. f-c sand	
	30-40 0930	120/120	0.1		40-41 Well Graded Sand (SW), dk. gray, saturated, very loose, ~~100%. f-c~~ 95%. f-c sand, 5%. fines	
35			0.0	CL	~~42-43~~ 41-42 Well Graded Sand with Gravel (SW), ~~dk~~ olive gray, saturated, very loose, 80%. f-c sand, 20%. f-c gravel to 2.5"	
			0.0	GW	42-43 Same as 37-40 (GW)	
					43-50 No Recovery	
40				SW		
			0.0	SW		
				GW		
45	40-50 0945	36/120		No Recovery		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW21

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					50-60 No Recovery. Driller reports interval was very soft.	1340 Complete overdrilling with 8" casing to 80'
					60-62 Poorly Graded Sand (SP), olive brown, saturated, very loose, 100% f-c sand (fine dom), abundant micas	
					62-64 Well Graded Sand (SW), olive brown, saturated, very loose, 100% f-c sand	
55	50-60 1000	0/120		No Recovery	64-65 Same as 60-62 (SP), color change to yellow brown.	
					65-70 No Recovery	
					70-75 same as 60-62 (SP), color to yellowish brown, sand f-m (f. dom.)	
60					75-76 Poorly Graded Sand with Gravel (SP), yellowish brown, saturated, very loose, 70% f-m sand, 30% f-c gravel to 3.5" cobbles	
				SP		
			0.0	SW	76-80 Well Graded Gravel with Sand (GW), brown, saturated, very loose, 65% f-c gravel to 4" cobbles, 35% f-c sand (m-c dom)	
65	60-70 1020	60/120		SP		
				No Recovery		
70						
	70-80 1045	~~60/120~~ 120/120	0.0	SP		
				~~No Recovery~~		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW21

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:

End Date & Time:

Water Level, Date & Time:

CH2M Logger:

Drilling Contractor: Cascade Drilling LP

Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	70-80 1045	120/120	0.0	SP	80-81 Poorly Graded Sand (SP), yellowish brown, wet, v. loose, 100% f-m sand (f. dominant)	1135 TD @ 100'
				GW	81-82 Well Graded Sand (SW), yellowish brown, saturated, v. loose, 90% f-c sand, 10% fine gravel. Gravel to 40% lower 3".	1140 Break lunch
80					82-84 same as 80-81 (SP). 3" SW in middle.	
				SP	84-87 Well Graded Gravel with Sand (GW), yellowish brown, saturated, v. loose, 75% f-c gravel to 3", 25% f-c sand	
				SW		
	80-90 1105	84/120	1.8	SP	87-90 No Recovery	
					90-93.4' same as 80-81 (SP)	
85			1.0	GW	@93-94 fine gravel to 10%	
					94-95 same as 84-87 (GW), coarse gravel to 3" dominant	
				No Recovery	95-100 No Recovery. Driller reports mainly easy drilling except for occasional 1' rocky interval — interpret as mainly sand with gravel layers.	
90				SP		
	90-100 1135	60/120		GW		
95				No Recovery		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW22

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 6/2/16, 0930
End Date & Time: 6/2/16, 1620
Water Level, Date & Time: NM

CH2M Logger: C. Lettich
Drilling Contractor: Cascade Drilling LP M. Queen
Drilling Method: Rotosonic 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-7' Excavation fill	0930 Begin advancing 6" casing
	0-5	0/60		Fill	7-8' Well Graded Sand with Silt & Gravel (SW-SM), reddish brown, moist, loose, 10% fines, 30% f-c gravel to 5" cobble, 60% f-c sand	
					8-10' No Recovery	
5					10-13 Well Graded Gravel with Sand (GW), yellowish brown, saturated, v. loose, 70% f-c gravel to 3", 30% f-c sand	
	5-10 0945	36/60	0.7	SW-SM	13-16 Poorly Graded Sand (SP), gray, saturated, loose to very loose, 95% fine sand, 5% fines	
				No Recovery	16-17 Well Graded Gravel with Silt & Sand (GW-GM), yellowish brown, v. loose, 60% f-c gravel, 10% fines, 30% f-c sand	
10						
			0.5	GW	17-18 same as 10-13 (GW).	
					18-20 No Recovery	
			0.4	SP	20-22' Sandy Silt (ML), dk. gray, wet, v. soft, 60% fines, 40% fine sand, some black plant material present	
15	10-20 0955	96/120			22-25 Silty Sand (SM), dk. gray, wet, loose, 60% fine sand, 40% fines. @ 2-3 mm seams of black matted plant material every 6-8"	
				GW-GM	~~25~~	
			0.4	GW		
				No Recovery		
20						
			0.7	ML		
	20-30 1005	120/120				
			1.0	SM		

ch2m	Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	Boring ID SW22	Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	20-30 1005	120/120	SW		25-26 Well Graded Sand (SW), dk. gray, saturated, very loose, 100% f-c sand	
			SM	0.7	26-26.5 same as 22-25 (SM),	
			SW		26.5-28.5 same as 25-26 (SW)	
			SM	0.6	28.5-31 same as 22-25 (SM)	
30					31-32 same as ~~22-25 (SM~~ 25-26 (SW)	
					32-33 same as 22-25 (SM)	
			SW	0.3	33-34 Sandy Clay (CL), dk gray to black, wet, very soft, 70% fines, 30% fine sand	
			SM			
			CL	0.5	34-35.5 same as 25-26 (SW)	
			SW			
35	30-40 1015	72/120	GW		35.5-37 Well Graded Gravel with Sand (GW), dk gray, saturated, v. loose, 70% f-c gravel, 25% f-c sand, 5% fines	
			No Recovery		37-40 No Recovery	
					40-41 Same as 25-26 (SW)	
					41-45 Well Graded Sand with Gravel (SW), gray, saturated, v. loose, 80% f-c sand, 20% f-c gravel to 3.5" cobble	
40				SW		
			0.5		45-48 Well Graded Gravel w/ Sand (GW), dk. gray, saturated, v. loose, 80% fine gravel, 20% f-c sand (coarse dom.)	
				~~GW~~		
					48-49 same as ~~25-26~~ 41-45 (SW)	
	40-50 1030	120/120	0.5	SW	49-50 Well Graded Gravel w/ Sand (GW), yellowish brown, saturated, v. loose 80% f-c gravel (coarse dom), 20% coarse sand	
45			0.4	GW		
			0.5	SW		
				GW		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW22

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SW	~~Well~~ 50-53 Well Graded Sand (SW), olive gray, saturated, v. loose, 90% f-c sand, 10% fine gravel	
			0.3			
				SP	53-54.5 Poorly Graded Sand (SP), olive brown, wet, v. loose, 95% f-c sand (fine dom.), 5% fine gravel	
				SP	54.5-55.5 Poorly Graded Sand with Gravel (SP), wet, v. loose, olive brown, 80% fine sand, 20% f-c gravel	
55	50-60 1045	120/120		GW	55.5-57 Well Graded Gravel w/ Sand (GW), dk. yellowish brown, saturated, v. loose, 70% f-c gravel, 30% f-c sand	
			1.6			
				SW	57-67 Well Graded Sand w/ Gravel (SW), dk. reddish brown, saturated, v. loose, 75% f-c sand, 25% f-c gravel @61 color to reddish brown @64-66 Gravel to 35% and coarse @66-67 color to very dark reddish brown	
60			1.7			
					67-68 same as 55.5-57 (GW), sand to 45%, gravel 55%	
	60-70 1105	120/120			68-70 same as 54.5-55.5 (SP)	
65			1.6		70-80 No recovery	
				GW		
				SP		
70						
	70-80 1138	0/120		No Recovery		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW22

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:

End Date & Time:

Water Level, Date & Time:

CH2M Logger:

Drilling Contractor: Cascade Drilling LP

Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
80	70-80 1138	0/120		No Recovery	80-84 Poorly Graded Sand (SP), olive gray, wet, v. loose, 100% f-c sand (med. dom)	1300 TD @ 100'
					84-85 Poorly Graded Sand with Gravel (SP), yellowish brown, wet to saturated, v. loose, 70% fine sand, 30% coarse gravel	1620 Complete grouting
					85-100 Poorly Graded Sand (SP), yellowish brown, saturated to wet, v. loose, 100% fine sand, rare fine gravel	
					@ 85-89 medium grained sand	
			1.7	SP		
85	80-90 1235	120/120		SP		
			2.1	SP		
90						
			1.6			
95	90-100 1300	120				
			1.9			
					TD @ 100'	

sonic log, rz, 6/18/16, c. lettich

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW23

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 6/3/16, 0530
End Date & Time: 6/6/16, 1130
Water Level, Date & Time:

CH2M Logger: C. Lothrich
Drilling Contractor: Cascade Drilling LP M. Queen / B. Grim
Drilling Method: Rotosonic 6 1/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-7 Excavation Fill	0830 Begin advancing 6" casing. Raining
	0-5 0830	0/60		Fill	7-8 Well Graded ~~Gravel~~ Sand with Silt & Sand (GW-GM), yellowish brown, moist, loose to med dense, 60% f-c gravel, 30% f-c sand, 10% fines	
					8-10 No Recovery	
5					10-14 same as 7-8'	
					@12 color change to brownish gray	
	5-10 0840	36/60	0.2	GW-GM	14-15 Poorly Graded Sand with Silt (SP-SM), lt. gray, wet, loose, 90% f-m sand (fine sand), 10% fines	
				No Recovery	15-20 No Recovery	
10					20-22 Well Graded Sand (SW), gray, wet, v loose, 100% f-c sand	
			0.3	GW-GM	22-24 Silty Sand (SM), dk gray, wet to saturated, v loose, 80-90% fine sand, 10-20% fines, 2-3 mm seams of black organic material @ 23 & 22.5'. 2" seam of sandy organic soil at 24	fine
	10-20 0850	60/120	0.3			
15					24-25 Poorly Graded Sand with Silt (SP-SM), dk gray, saturated, 90% fine sand, 10% fines	
				No Recovery	25-26 same as 20-22 (SW)	
					26-27 same as 22-24 (SM) with 4" seam of SW as 25-26	
20						
	20-30 0900	84/120	0.4	SW		
			0.4	SM		
				SP-SM		

smw log_r2_5/11/16 c.lothrich

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW23

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SW	27-30 No Recovery	
	20-30	84/120	0.6	SM	30-32 Same as 22-24 (SM), fines 30%, sand 70%	
				No Recovery	32-33 Well Graded Sand with Silt (SW-SM) dk grey, saturated, very loose, 90% f-c sand, 10% fines	
30						
			0.4	SM	33-34 Sandy Clay (CL), dk gray, wet, v. soft, 70% fines, 30% fine sand, 2mm seams of plant material	
				SW SM	34-36 Sandy Silt (ML), dk gray very soft, ≤ wet, 60% fines, 40% fine sand, seams of plant material	
			0.4	CL		
	30-40	108/120		ML	36-38.5 Silty Sand (~~ML~~ SM), dk gray, wet ~~to~~ med dense to loose, 60% fine sand, 40% fines, ~~seams~~ of plant material	
35	0920			ML		
			0.1	SM	@ 37 3" seam of well graded Sand w/ gravel	
			0.1	SW	38.5-39 Well Graded Gravel w/ Sand (GW), gray, saturated, v loose, ~~50~~ 50% fine gravel, 45% f-c sand, 5% fines	
				NR		
40					39-40 No Recovery	
			0.6	SW	40-41.5 Well Graded Sand (SW), dk gray, saturated, very loose, 100% f-c sand	
				SM		
				GW		
	40-50	36/120		~~NR~~	41.5-42 same as 36-38.5 (SM), saturated	
45	0940			No Recovery	42-43 Well Graded Gravel (GW), brownish grey, saturated, v loose, 90% f-c gravel (coarse dom), 10% f-c sand	
					43-50 No Recovery, Driller reports interval was soft	

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW23

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					50-60 No Recovery	
					60-62 Well Graded Sand (SW), yellowish brown, saturated, 100% f-c sand, v loose	
					62-63 Poorly Graded Sand (SP), yellowish brown, saturated, v loose, 100% f-~~m~~ sand (fine dominant)	
55	50-60 0950	0/120		No Recovery	63-64 Poorly Graded Sand (SP), yellowish brown, saturated, v loose, 100% m-c sand (coarse dominant)	
					64-64.5 Well Graded Sand with Gravel (SW), yellowish brown, saturated, 75% f-c sand, 25% fine gravel, trace fines	
60					64.5-70 No Recovery	
				SW	70-~~77.0~~ 97.5 Same as 62-63 (SP)	
					@77-78 trace fine gravel	
				SP	@79 4" cobble	
				SP	@96 trace fine gravel	
65	60-70 1010	66/120		SW		
					No Recovery	
70						
	70-80 1035	120/120	0.3 0.4	SP		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW23

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					See page 3 for soil descriptions to ~~98.0~~ 97.5	1140 TD @ 100'
	70-80 1035	120/120	0.5	SP	97.5-99, Well Graded Gravel with Sand (GW), yellowish brown, saturated, very loose, 80% f-c gravel to 4", 20% f-c sand	
			0.3			
80					99-100 No Recovery	
			0.3			
	80-90 1105	120/120	0.4			
85						
			0.5			
			0.5	SP		
90						
			0.6			
	90-100 1135	108/120	0.5			
95						
			0.4			
			0.4	FW		
				NR		

sonic log, r2, 4/18/16, c. lettich

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 6S0199.11.01

Boring ID SW24

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 6/1/16, 0830
End Date & Time: 6/2/16, 0900
Water Level, Date & Time: NM

CH2M Logger: C. Lettrich
Drilling Contractor: Cascade Drilling LP B. Grim
Drilling Method: Rotosonic, 6/4" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				Fill	0-7 Excavation backfill	0830 Begin advancing 6" casing
	0-5	0/60			7-9 Well Graded Gravel with Sand (GW), Brownish gray, saturated, loose, 65% f-c gravel (to 3", 5% fines, 30% f-c sand	
					9-10 No Recovery	
5					10-11 Silty Sand (SM), olive brown, saturated, loose, 20% fines, 10% fine gravel, 70% fine-coarse sand	
	5-10 0836	48/60			11-13 Well Graded Sand with Gravel (SW), dk. brownish gray, saturated, v loose, 30% coarse gravel, 70% f-c sand	
			0.3	GW	13-15 Poorly Graded Sand (SP), dk. brownish gray, saturated, v. loose, 10% fine gravel, 5% fines, 80% f-c sand (fine dominant)	
				NR		
10					15-20 No Recovery	
				SM		
			0.7	SW	20-21 Silty Sand (SM), dk. gray, wet, loose to med dense, 70% fine sand, 30% fines, 5mm seam of black mottled plant material	
				SP	21-22 Well Graded Sand (SW) dk gray, saturated, v. loose, 95% f-c sand, 5% fines	
	10-20 0847	60/120	0.5			
15				No Recovery	22-25 Silty Sand (SM), as 20-21. 40% fines, 60% fine sand, seams of plant material every 6-12"	
					~~25~~	
20				SM		
	20/30 0900	120/120	0.8	SW		
			1.0	SM		

sonic log, r2, 4/18/16, c. lettrich

ch2m:	Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	Boring ID SW24	Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SW	25-26 same as 21-22 (SW)	
			0.9	SM	26-27 same as 20-21 (SM), fine sand 80%, fines 20%	
	20-30 0900	120/120		SP		
			0.9	SW	27-28 Poorly Graded Sand (SP), dk gray, saturated, loose, f-m sand (fine dom), 10% fines	
30				SM	28-29.5 same as 21-22 (SW)	
				SP		
			0.5	ML	29.5-30 Same as 26-27 (SM)	
					30-31 same as 27-28 (SP)	
				SM	31-32.5 Sandy Silt (ML), dk brownish gray, wet, v. soft, 70% fines, 30% fine sand @ 2-4mm thick seam of plant matted plant material, approx 8-12"	
	30-40 0920	60/120	0.4	GW	32.5-34 Silty Sand (SM), dk. brownish gray, wet, very loose, 60% fine sand, 40% fines	
35				No Recovery	34-35 Well Graded Gravel (GW), dk gray, saturated, very loose, 90% f-c gravel, 10% f-c sand	
					35-40 No Recovery. Driller reports interval was soft	
40				SW	40-42 Well Graded Sand (SW), gray, saturated, v. loose, 100% f-c sand, coarsens downward	
			0.5	SM	42-43.5 Silty Sand (SM), dk. gray, saturated, loose, 60% fine sand, 40% fines	
				SW	43.5-44.5 Well Graded Sand with Gravel, yellowish brown (SW), saturated, v. loose, 80% f-c sand (m-c dom.), 20% fine gravel	
	40-50 0940	72/120	0.0	SP	44.5-46 Poorly Graded Sand with Gravel (SP), yellowish brown, wet, v. loose, 85% f-c sand (medium dominant), 15% coarse gravel to a 3.5" cobble stuck in drill bit	
45				No Recovery	46-50 No Recovery	

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW24

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
55	50-60 1005	120/120	1.0	SP	50-55 Poorly Graded Sand (SP), yellowish brown, wet, very loose, 100% f-m sand (fine dom)	
			1.5	SP	55-57 Well Graded Sand (SW), yellowish brown, wet, v. loose, 95% f-c sand 5% fine gravel. Two 3" cobbles at bottom of unit.	
					57-65 Same as 50-55 (SP), medium dominant	
			0.6	SW	@ 63 fine grained sand dominates	
				SP	65-67 Well Graded Sand with Gravel (SW), yellowish brown, saturated, v. loose, 70% f-c sand, 30% f-c gravel to 3" common	
			0.4		67-70 same as 57-65 (SP)	
60					70-74 same as 55-57 (SW), trace fine gravel	
			0.8	SP	74-77 same as 50-55 (SP)	
			0.6			
65	60-70 1030	120/120	0.5	SW		
			0.4	SP		
				NR		
70			0.6	SW		
	70-80 1105	120/120	0.3			
				SP		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW24

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
						1230 TD @ 100'
			0.0	SP	77-79 Poorly Graded Sand with Gravel (SP), yellowish brown, wet to saturated, v. loose, ~~10% fine sand, rare fine gravel~~ 85% fine sand, 15% fine gravel	1330 Begin advancing 8" casing 0-80
	70-80 1105	120/120	0.2	SP	79-81 same as 50-55 (SP), trace fine gravel	1640 Stop for 6/1, installed 100, 75, 30' wells
80				SP	81-83 same as 55-57 (SW)	6/2/16, 0830 Grouting 0900 Complete grouting
			0.2		83-86 same as 50-55 (SP), trace fine gravel	
				SW	86-89 Well Graded Sand with Gravel (SW), yellowish brown, saturated, very loose, 60% f-c sand (majority m-f), 40% f-c gravel (majority fine)	
			0.7	SP	89-96 same as 50-55 (SP), trace fine gravel	
85	80-90 1140	120/120				
			0.5		96-100 Well Graded Gravel with Sand (GW), yellowish brown, saturated, loose, ~~30~~ 30% f-c sand, ~~30~~ 70% f-c gravel (majority fine gravel).	
				SW		
			0.5			
				SP		
90						
			0.0			
			0.0			
			0.0			
			0.0			
95	90-100 1230	(20/120	0.0			
			0.0			
			0.0			
			0.0	GW		
			0.0			

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW25

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/26/16, 0930
End Date & Time: 5/26/16, 1600
Water Level, Date & Time: NM

CH2M Logger: C. Lethich
Drilling Contractor: Cascade Drilling LP J. Weeks
Drilling Method: Rotosonic, 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
0	0-5	0/60		Fill	0-7 Excavation backfill	0930 Begin advancing 6" casing
					7-11 Well Graded Gravel with Silt & Sand (GW-GM) lt. grayish brown, dry to moist, 10% silt, 25% f-c sand, 65% f-c gravel	
					11-12 Well Graded Sand w/ Gravel (SW), dk. gray, saturated, v. loose, 5% fines, 20% gravel, 75% f-c sand	
5	5-10 @ 0945	60/60			12-16 Poorly Graded Sand (SP), dk. gray, saturated, v. loose, ~~5% fines, 20% gravel, 75% f-c~~ (c) 95% f-m sand (fine dom), 5% fine gravel	
			0.3	GW	@ 13' gravel to ∅%	
				GM	16-20 No Recovery	
10					20-27.5 same as 12-16 (SP), f-c sand. (fine dom.)	
			0.5	SW	27.5-28 Silty Sand (SM), dk. gray, saturated, loose, 20% fines (including dk. grayish brown matted organic/plant material), 80% f. sand, slight sulfur odor	
	10-20 @ 0950	72/120	0.8	SP	28-29 Sandy Silt (ML), dk. gray, saturated, ~~v. loose~~ soft, 60% fines, 40% fine sand. Slight sulfurous odor	
15					29-30 No Recovery	
				No Recovery		
20						
	20-30 @ 1000	108/120	1.0	SP		
			0.5			

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW25

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	20-30 1000	108/120	1.2	SP	30-32 Sandy Clay (CL), dk. gray, saturated, v. soft, 60% fines, 40% fine sand	
				SM	32-38 Clayey Sand (SC), dk. gray, saturated, loose, 60% f. sand, 40% fines	
			1.2	ML	38-39 same as 30-32 (CL)	
				NR	39-40 same as 32-38 (SC)	
30				CL	40-50 No Recovery	
			1.1			
			1.3	SC		
35	30-40 1005	120/120	1.0			
			1.0	CL		
				SC		
40						
					No Recovery	
45	40-50 1015	0/120				

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW25

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
55	50-60 1025	120/120	0.6	SW	50-56 Well Graded Sand (SW), yellowish brown, wet, very loose, 100% f-c sand	
			1.2		56-56.5 Well Graded Sand with Gravel (SW), yellowish brown, saturated, ~~v~~ loose, 80% f-c sand, 20% fine gravel	
			1.4	SW	56.5-58 Poorly Graded Sand with Gravel (SP), yellowish brown, wet, v. loose, 85% f-m sand (fine dom), 15% coarse gravel to 3.5"	
			1.2	SP	58-60 Poorly Graded Sand (SP), yellowish brown, wet, v. loose, 100% f-m sand (fine dom).	
60				SP	60-61 same as 50-56 (SW), olive brown	
					61-67 same as 58-60 (SP), f-c sand, fine dom, olive brown	
				SW	67-68.5 same as 50-56 (SW), olive brown	
			1.8		68.5-75 Well Graded Sand with Gravel (SW), olive brown, saturated, loose 5% fines, 45% f-c gravel to 4" cobbles, 50% f-c sand. 2" silt layer @ 69'	
65	60-70 1040	120/120	1.6	SP	@ 70-75 rare fine gravel	
			1.4		@ 70 color to yellowish brown	
				SW		
			1.3			
70				SW		
	70-80 1055	120/120	0.2			
			1.1			

sonic log, r2, 4/14/16, c. lethich

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW25

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			1.8	SP	75-78 ~~Poorly~~ Graded Sand (SP), yellowish brown, wet, v. loose, 100% f-m sand (fine dom)	
	70-80 1055	120/120	1.3	SW	78-83 Well Graded Sand with Gravel (SW), yellowish brown, wet, v. loose, 15% fine gravel, 85% f-c sand (f-m dom.)	1130 TD @ 100'. Break lunch 1230 Begin overdrilling with 8" casing to 77'
80					83-84.5 same as above, 5% fines, saturated	
			1.9		84.5-89 Well Graded Gravel with Sand (GW), yellowish brown, saturated, v. loose, 70% f-c gravel (fine gravel dom.), 30% f-c sand (coarse sand dom)	
	80-90 1115	120/120	1.5		89-90 same as 83-84.5 (SW w/ 5% fines)	
85				GW	90-100 No Recovery. Driller reports the interval felt soft similar to sands above.	
			0.5			
			0.3			
				SW		
90						
	90-100 1130	0/120		No Recovery		
95						
					Reach TD of 100' at 1130, 5/26	

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW26

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/17/16 1145
End Date & Time: 5/17/16 1530
Water Level, Date & Time:

CH2M Logger: L. BAUER
Drilling Contractor: Cascade Drilling LP J. WEEKS
Drilling Method: Rotosonic, 6 1/8" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
0				GW FILL		START @ GRADE AT 5 FT IN EXCAVATION BACKFILL.
5	5-10' 1150	60/60"	0.1	GW FILL EXCAVATION BACKFILL	5.0-8.6 Brown well-graded gravel with Silt, little c-f sand FILL/GW dry/damp, dense	
				GW	8.6-10.0 Gray brown well graded gravel with Sand, dry/damp, subangular, dense	
10			0.1	SP	10.0-11.0 Olive gray poorly graded med Sand, trc cs Sand, trace fine sand SP; wet, soft/loose	
			0.0	GW	11.0-12.0 Olive well graded Gravel with Sand, little silt, wet,	Gravel 70% Sand 20% Silt 10%
	10-20'	102/120 1210	0.2	SP	12.0-18.5 - Dark gray poorly graded fine Sand, little med Sand trace silt loose, wet, SP	
15			0.1			
			0.3	NR	18.5-20.0 no recovery	LOOSE SOFT FINE SAND PROBABLY FELL OUT OF SAMPLER
20						
	20-30	120/120 1340	0.3	SP	20.2-25.1 Very dark gray poorly (SP) graded medium Sand (trace cs Sand, trace fine Sand, loose, wet	
25						

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW26

SOIL BORING LOG

Start Date & Time: 5/17/16 1145
End Date & Time: 5/17/16 1530
Water Level, Date & Time:

CH2M Logger: L. BARKER
Drilling Contractor: Cascade Drilling LP J. WEEKS
Drilling Method: Rotosonic, 6 5/8" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
25					25.1 - 30.0 very dark gray SILT, some fine sand, little organic silt, soft wet	
			0.0	SM/OL		
30			0.2		30.0 - 32.7 dark Olive gray fine sand, silt interbedded with organic silt, coarsens with depth, soft, wet OL/SM	
	30-40	48/120		OL/SM		
			0.5	OL/SM	32.7 - 34.0 Olive gray coarse sand interbedded with M-F sand, and Organic silt, SOFT wet	
35					34-40 NO RECOVERY	
				NR		
40	40-50 1410	60/120	0.2	SW	40-45.0 Olive c-F well Graded Sand, trace Fine Sand, little silt, wet, loose	
45					45-50 NO RECOVERY	
				NR		
50						

ch2m:	Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	Boring ID SW26	Sheet 3 of 4

SOIL BORING LOG

Start Date & Time: 5/17/16 1145
End Date & Time: 5/17/16 1530
Water Level, Date & Time:
CH2M Logger: LOU BERGER
Drilling Contractor: Cascade Drilling LP JOHN WEEKS
Drilling Method: Rotosonic, 6 5/8" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
50	SB-60 1415	48/120"		SP	50-54.0 Olive Brown poorly graded sand SP ~~non-plastic~~ Coarse to medium, little fine gravel, damp, wet	
55				NR	54.0-60.0 No recovery	
60	60-70 1420	120/120"	0.3 0.5	SP	60.0-70.0 Red Brown poorly graded medium sand, trace to little CS sand, trace C-F gravel angular to subrounded, occasional small cobble (SP)	
70	70-80 1432	120/120"	0.3 0.4	SP	70.0-78.5 Olive gray poorly graded medium sand, trace CS sand, trace fine sand, trace C-F gravel, SP, wet	
75						

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW26

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time: 5/17/16 1145
End Date & Time: 5/17/16 1530
Water Level, Date & Time:

CH2M Logger: LOU BARBER
Drilling Contractor: Cascade Drilling LP JOHN WEEKS
Drilling Method: Rotosonic, 10 1/8" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
75			0.6		Color changes from Olive Gray to red-brown	
	70-80' 1430	120/120		SP	78.5-80.0 Red-Brown fine sand, trace silt poorly graded SP, wet, med dense	
80			0.3			
				SP	80.0-88.0 Red Brown med Sand little cs sand, little c-f gravel, wet dense poorly graded	
85	80-90' 1500	120/120"				
				GW	88.0-90.0 Red Brown well Graded Gravel with Sand & Silt, wet, dense few cobbles	
90					NO RECOVERY 90-100	ROUGH DRILLING NUMEROUS COBBLES
	90-100' 1530	0/120				
95						
100						

sonic log, r2, 4/18/16, c. lattich

BOTTOM OF EXPLORATION: 100 FT

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW27

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/13/16 0915
End Date & Time: 5/16/16 @ 1120
Water Level, Date & Time:

CH2M Logger: J Bingaman / L Barber
Drilling Contractor: Cascade Drilling LP Gonzalez / Weeks
Drilling Method: Rotosonic, 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
		5'		Excavation BACKFILL	0-5 Previously excavated and backfilled w/ clean fill, sand, gravel, Tan-Brown, V. loose fine- C grain	0920 · Core barrel swingarm won't retract, attempting to fix ~~0928~~
5	5-10 5/16/16	0916 36/60			5-6.3 BACKFILL Red Gray Gravelly SILT with SAND (ML) damp/moist	
				SW	6.3 Yellow-Brown well graded SAND ~~GRAVELLY SAND~~ with GRAVEL, damp loose	
					8.0-10.0 NO RECOVERY	
10	10-20	48/120	0.0	GW	10.0 -13.0 Yellow Brown well Graded GRAVEL WITH SAND, loose, wet/saturated 13.0 14.0 Dark Gray ORGANIC SILT little fine sand, Cobble at 13.0 large	
			0.0	OL	13.0-14.0 14.0-20.0 NO RECOVERY	POOR RECOVERY DUE LOOSE SOFT, SATURATED WATER SOILS + OCCASIONAL LARGE COBBLE
15						
20	20-30	96/120	0.0	SP	20.0-27.4 Dark Gray poorly graded medium Sand, trace cs sand, little fine sand, trace fine gravel (SP), wet loose	
26						

soil log ch2m

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW27

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time: 5/13/16 @0900
End Date & Time: 5/16/16 @1120
Water Level, Date & Time:

CH2M Logger: L. BARCA
Drilling Contractor: Cascade Drilling LP J. WEEKS
Drilling Method: Rotosonic, 6 1/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	20-30 5/16/16 0850	96/120	0.0	GW	27.4-28.0 Dark gray well Graded Gravel with Sand, wet Subrounded	
				NR	28.0-30.0 No Recovery	Core Bluey
30						
	30-40 5/16/16 0850	96/120	0.0	SP	30.0-37.0 Dark gray poorly graded medium sand, trace silt, trace C-F gravel, wet SP	
			0.0			
35			0.0			
					37.0-37.0 Gray well Graded Gravel with Sand, few Cobbles	Cobbles prevent recovery
					35.0-40.0 No Recovery	
40						
	40-50 5/16/16 0930	0/120		NR	40.0-50.0 No Recovery	Cobbles prevented sample recovery
45						
50						

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID 7SW27

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time: 5/13/16 @ 0900
End Date & Time: 5/16/16 @ 1120
Water Level, Date & Time:

CH2M Logger: L BARTLETT
Drilling Contractor: Cascade Drilling LP JOHN WEBERS
Drilling Method: Rotosonic, 6/8" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
50	50-60 5/16/16	78/120"	50.0	SP	50.0-57.5 Brown Graded Sand Coarse to medium, little c-F gravel loose, wet subang-subrounded few small cobbles SP	
55			50.0			
				NR	57.5-60.0 NO RECOVERY.	
60	60-70 5/16/16	72/120"	50.0	SP	60.0-64.9 Red Gry Coarse Sand poorly graded, some medium sand, trace subang fine gravel SP wet, loose	
65			50.0	GW	64.9-66.0 well Graded Gravel with Sand subang-sub rounded small cobbles, wet	
				NR		
70	70-80 5/16/16 1030	112"/120	50.0	SP	70.0-79.0 poorly Graded Red Brown medium Sand, little CS sand, trace C-F subang-subrounded Gravel, loose, wet few small cobbles 76-79	

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW27

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time: 5/13/16 @ 0900
End Date & Time: 5/16/16 @ 1120
Water Level, Date & Time:

CH2M Logger: ~~[illegible]~~ L. BARNETT
Drilling Contractor: Cascade Drilling LP JOHN WEEKS
Drilling Method: Rotosonic, 6 5/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					See 70.0 - 79.0 Previous Page	
	70-80	112/120	0.0	SP		
			0.0	ML	79.0 - 79.7 Gray brown fine SANDY SILT, damp, crumbly ~~soft~~ soft	
80					80.0 - 85.0 Olive brown fine Sand, some silt, trace c-m sand, poorly graded, SP, wet	
	80-90 5/16/16	80/120		SP		
85					85.0 - 87.7 Well Graded Gravel with Silt and Sand, submerged & sub-rounded, few small cobbles medium dense, wet	
				GW		
				NR		
90						
	90 - 100 5/16/16	0/120"		NR		
95						
100						

Bottom of Exploration: 100 FT

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW28

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/12/16 @ 1235
End Date & Time: 5/12/16 @ 1600
Water Level, Date & Time:

CH2M Logger: L. BARLOW
Drilling Contractor: Cascade Drilling LP — MAX QUOON
Drilling Method: Rotosonic, 6 8" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (Inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					0-6.5 EXCAVATION BACKFILL	BEGIN ADVANCING CASING 1235
					FILL	
5	STARTED CASING AT 5 FT		0.7	FILL	5.0-6.5 LIGHT BROWN GRAVELLY SILT, COHESIVE, DAMP (6M) -FILL-	
	5-15' 5/12/16 1425	96"/120"	0.3	GW	6.5-9.0 Well Graded GRAVEL, Subangular Grey-brown, saturated (wet) Little C-F Sand trace silt Cobbles 40% Gravel 40% Sand 8% Silt 2%	
10			0.8	SP	9.0 (2.0) 13.0 Medium Sand, poorly graded (SP) Dark grey, trace fine sand, trace CS Sand, trace fine Subang-Subr gravel, wet	
			0.7	NR	13.0-15.0 NO RECOVERY	NOTES VERY WET SAND CASING VIBRATION SAND AWAY FROM BARREL
15	15-20' 48/60" 1440	48/60"		SP	15.0-19.0 Dark grey & black FINE SAND, poorly graded trace silt, very loose wet	Runny Sands while cleans casing
				NR	19.0-20.0 NO RECOVERY	
20	20-25' 45/60" 1420	45/60"	0.1	SP	20.0-21.0 D.O. AS 15-19	
				OL	21.0-25.0 Olive grey to dark grey ORGANIC SILT blended with silt, fine sand lenses of peat (OL) very soft/loose	lenses or seams of peat every 1-2"
25			0.3			

sonic log, rz, 4/18/16, c. lettich

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW28

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time: 5/12/16 @ 1235
End Date & Time: 5/12/16 @ 1600
Water Level, Date & Time:

CH2M Logger: L. BARRA
Drilling Contractor: Cascade Drilling LP — MAX QUIGG
Drilling Method: Rotosonic, ____" drive casing, ____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
25	25-30 1300	60/60"	0.7	GW	25.0-30.0 Dark Gray well Graded Gravel and Sand (GW), wet, loose Subangular - Subrounded Cobbles 10% Gravel 60% Sand 30%	
			0.8			
30					34.5	
			0.0	SP	30.0 - Poorly graded medium Sand, little Cs sand, trace fine sand (SP) trace fine subang-subrounded gravel, wet, loose	
	30-40 1340	108/120"	0.2	SP	34.5 -39.0 Dark gray poorly graded medium sand, tr cs sand, tr fine sand trace silt (SP) loose, wet	
35					38.0 Little gravel appears to 39 ft	
			0.3			Large round cobble at tip of Sampler 39' blocked out soil from 39-40.
				NR	39.0 -40.0 NO RECOVERY	
40			0.3		40.0-44.5 Dark gray poorly graded medium Sand, little coarse sand, trace fine gravel SP, wet, loose	
			0.7	SP		
	40-50 1415	90/120"			44.5-45.5 Dark gray Sandy SILT with GRAVEL ML, wet, cohesive/crumbly Subangular - Subrounded	
45			0.4		45.5-47.5 ~~Dark~~ Olive gray medium Sand SP, poorly graded, little C-F gravel little Cs Sand, wet loose	
					47.5 -50.0 NO RECOVERY	HEAVING SANDS, VERY LOOSE DRILLING
50				NR		

ch2m:	Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	Boring ID SW28	Sheet 3 of 4
	SOIL BORING LOG		Driller M. QUEEN
Start Date & Time: 5/12/16 @ 1235	CH2M Logger: L. BARCA		
End Date & Time: 5/12/16 @ 1600	Drilling Contractor: Cascade Drilling LP		
Water Level, Date & Time:	Drilling Method: Rotosonic, 6" drive casing, 4" core barrel		

Feet BGS	Interval (ft)	Recovery (Inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
50	50-60 ft 1425	30/120"		NR	50.0-57.5 NO RECOVERY	POOR RECOVERY. DRILLER BELIEVES CORE BARREL IS PUSHING ASIDE SOFT RUNNING SAND.
55						
			0.6	GW	57.5-59.5 Well Graded Gravel + Sand GW Red-Gray, loose, wet subangular to subrounded small cobbles 5% Gravel 55% Sand 40%	
60	60-70 ft 1445	32/120		SP	59.5-60.0 Brown fine SAND, poorly graded well sorted, clean, loose to slightly dense (SP)	
			0.3		60.0-62.7 Gray brown fine SAND, poorly graded (SP) some medium sand, trace coarse sand, loose, wet	
65				NR	62.7-70.0 NO RECOVERY	NOTES: VERY SOFT LOOSE SOILS, SAND HEAVE INTO CASING.
70	70-80 1520	96/120"	0.0	SP	70.0-77.6 Red-Gray poorly graded medium Sand (SP) trace coarse Sand, trace C-F Gravel; few small cobbles subrounded gravel is subangular to subrounded, moist some cohesiveness	
			0.1			
75						

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW28

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time: 5/12/16 @1235
End Date & Time: 5/12/16 @1600
Water Level, Date & Time:

CH2M Logger: L. BARCA
Drilling Contractor: Cascade Drilling LP — MAX QUIGLEY
Drilling Method: Rotosonic, 6 1/8" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
75				SP		
	70-80 1520	96/120"	0.5	GW	77.6-78.0: Red Grey well Graded Gravel (GW) and Sand trace silt subang-subrounded, small cobbles	NOTES: CASING PUSHING ON COBBLES FROM 78.0
				NR	78.0-80.0 NO RECOVERY	
80			0.0	SP	80.0-85.0 RED-GRAY POORLY GRADED Medium Sand (SP) little Cs Sand, little c-F subang-subr gravel, Few small cobbles, wet, medium Strength	
	80-90 1540 5/12/16	59"/120	0.0		LARGE COBBLE AT 85 FT.	
85				NR	85.0-90.0 NO RECOVERY	NOTES - LARGE COBBLE AT BOTTOM OF SAMPLE BLOCKED 85-90 FROM ENTERING CORE BARREL.
90			0.4	SP	90.0-97.0 Red Grey poorly graded (SP) medium Sand, little coarse Sand, varying amounts of gravel, trace to little C-F gravel subangular to subrounded, wet	Medium dense to dense according to drilling action.
	90-100 1600 5/12/16	120/120"	0.2			
95			0.4	GW	97.0-100.0 Brown well graded Gravel (GW) with Sand Few small Cobbles Subangular to subrounded Cobbles 5% Gravel 80% Sand 15%, dense wet	Dense as by drilling action.
100			0.1			

sonic log, r2, 6/18/16, c. lettich

BOTTOM OF EXPLORATION: 100.0 FT

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW29

Sheet 1 of ___

SOIL BORING LOG

Start Date & Time: 5/6/16 1040
End Date & Time:
Water Level, Date & Time:

CH2M Logger: C Leftich
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic 6 5/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
0-5 1040	Previously Air Knifed Excavated	Air Knifed Excavated		FILL	0-5 Previously ~~air knifed~~ excavated	1040 Begin advancing 6" casing. Heavy rain
					5-9 Well Graded Gravel w/ Sand (GW), brown, wet, loose, 70% f-c gravel to 4" rounded cobbles, 30% f-c sand	
					@8' becomes saturated and very loose	
					9-10 No Recovery	
5						
	5-10 1045	48/60	0.1	GW	10-11 Well Graded Sand with Gravel (SW), brown, saturated, very loose, 80% f-c sand, 20% f-gravel	
			0.0		11-13 Same as 5-9 (GW), silt to 5%	
				NR	13-16 Silty sand with Gravel (SM), ~~g~~brownish gray, saturated, very loose, 60% f-c sand, 20% f gravel, 20% fines	
10			0.0	SW		
			0.2	GW	16-18 Silty Sand (SM), red gray, saturated, very loose, 80% fine sand, 20% fines	
					18-20 No Recovery	
	10-20 1050	96/120	0.0	SM	20-24 Well Graded Sand (SW), brownish gray, ~~sat~~ wet, v loose, 90% f-c sand, 10% f gravel	
15					24-25 Same as 5-9 (GW)	
			0.0		25-26.5 same as 13-16 (SM)	
				NR	26.5-28 Well Graded Sand with Gravel (SW), gray, saturated, very loose, 70% f-c sand, 30% f-c gravel to 4" semi-rounded cobbles	
20						
	20-30 1427 1440	96/120	0.6	SW	28-30 No Recovery. Large cobbles from 28' obstructing bit	
			0.4	GW		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW29

Sheet 2 of ___

SOIL BORING LOG

Start Date & Time:

End Date & Time:

Water Level, Date & Time:

CH2M Logger:

Drilling Contractor: Cascade Drilling LP

Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	20-30 1140	96/120	0.2	SM	30-34 Well Graded Sand (SW), brownish gray, saturated, very loose, 100% f-c sand	1215 Break lunch
			0.1	SW	34-37 Well Graded Gravel with Sand (GW), saturated, very loose, 55% f-c gravel to 4" cobbles, 45% f-c sand	
				NR		
30					37-40 No Recovery	
			0.1	SW	40-42 Poorly Graded Sand (SP), brownish gray, saturated, 100% f-m sand (fine dominant)	
			0.0		42-50 No Recovery. Driller reports very soft material	
35	30-40 1155	84/120	0.0	GW		
			0.1			
				No Recovery		
40						
			0.0	SP		
				No Recovery		
45	40-50 1215	24/120				

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW29

Sheet 3 of ___

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
50	50-60 1355	60/120	0.1	SW	50-55 Well Graded Sand (SW), brown, saturated, very loose, 100% f-c sand	1315 Continue drilling 1335 Unable to retrieve sample 50-60 — Attempt again. Got 5' of run.
					@54' have a 4" rounded cobble	
			0.1		55-60 No Recovery. Driller reports very soft material	
55					60-73 Poorly Graded Sand (SP), brown, saturated, very loose, 100% f-m sand	
					73-77 Same as 50-55 (SW), 10% f-c gravel	
				No Recovery	77-79 same as 60-73 (SP)	
					79-~~80~~ 80 Well Graded Sand w/ Gravel (SW), yellowish brown, wet, v. loose, 80% f-c sand, 20% f-c gravel	
60						
	60-70 1420	120/120	0.2	SP	80-82 Well Graded Sand (SW), greyish brown, wet, very loose, 95% f-c sand, 5% fine gravel	
			0.1		82-83 same as 60-73 (SP)	
					83-85 Same as 79-80	
65					85-90 No Recovery. Cobbles stuck in bit. Driller reports soft material in this interval	
			0.0			
70						
	70-80 1500	120/120	0.2			
			0.1	SW		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW29

Sheet 4 of ___

SOIL BORING LOG

Start Date & Time:

End Date & Time:

Water Level, Date & Time:

CH2M Logger:

Drilling Contractor: Cascade Drilling LP

Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	70-80 1500	120/120	0.1	SW	90-92 Same as 50-55 (SW), saturated	1400, Hit total depth of 100'
			0.0	SP	92-95 Well Graded Gravel with Sand (GW), yellowish brown, wet very loose, 70% f-c gravel to 3.5" cobbles, 30% f-c sand	
80				SW	95-100 No Recovery. Driller reports interval felt to be gravel	
			0.3			
				SP		
	80-90	60/120	0.2	SW		
85				No Recovery		
90			0.1	SW		
	90-100 1600	60/120	0.0	GW		
95				No Recovery	TD @ 100' at 1600, 5/6/16	

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW30

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 5/10/16, 0830
End Date & Time:
Water Level, Date & Time:

CH2M Logger: C. Lettich
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
0	0-5'	Air Knifed		Air Knifed	0-5' Previously air knifed	0830 Begin advancing 6" casing.
					5-9 Well Graded Gravel with Sand (GW), dk. greyish brown, moist, loose, 60% f-c gravel to 4" rounded cobbles, 40% f-c sand	0835 Stop to reconfigure work area
					C8 becomes saturated. Estimated water table	
					9-10 No Recovery	
5					10-11 Well Graded Sand (SW), brown, saturated, v. loose, 90% f-c sand, 10% fine gravel	
	5-10 0850	48/60	5.9	GW	11-~~15~~ Same as 5-9 (GW), fines to 5%, color to yellowish brown, saturated	
			0.8		~~15~~-18 Silty Sand (SM), medium gray, saturated, loose, 70% fine sand, 30% fines	
				NR		
10				SW	18-19 Same as above (SM), fine sand to 55%, fines to 45%. 4" rounded cobble in bit at 19'	
			0.4		19-20 No Recovery	
				GW	20-22 Same as 10-11 (SW), color brownish grey	
			0.2		22-27 Well Graded Sand with Gravel (SW) yellowish brown, wet to saturated, v. loose, 80% f-c sand, 20% f-c gravel to 3.5"	
15	10-20 0910	108/120	0.2	SM	27-28 Well Graded Gravel w/ Sand (GW), yellowish brown saturated, v. loose, 65% f-c gravel, 30% f-c sand, 5% fines	
			0.1		28-30 same as 22-27 (SW), color change to yellowish brown	
				NR		
20			0.4	SW		
	20-30 ~~933~~ 940	120/120		SW		
			0.3			

sonic log, r2, 4/18/16, c. lettich

ch2m:	Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	Boring ID SW30	Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	20-30 933	120/120	0.2	SW	30-32 Well Graded Sand (SW), yellowish brown, wet, v. loose, 90% f-c sand, 10% f-c gravel	
				GW	32-32.5 Poorly Graded Sand (SP), yellowish brown, saturated, v. loose, 100% f-m sand (fine dom.)	
			0.1	SW	32.5-34 Same as 30-32 (SW)	
30					34-36 Same as 32-32.5 (SP), color lt. grey	
			0.3		36-45 Well Graded Sand with Gravel (SW), greyish brown, wet, v. loose, 75% f-c sand, 25% f-c gravel (fine dom.)	
				SP		
			0.3	SW	@41 color change to brownish grey @44 color change to yellowish brown	
35	30-40 1005	120/120		SP	45-46 Same as 30-32 (SW)	
			0.3		46-50 same as 36-45 (SW), gravel only fine, @46-47 color reddish brown @47- color to strong brown @47-48 gravel to 30%	
			0.3	SW		
40						
			0.2			
			0.2			
45	40-50 1040	120/120				
			0.2			
			0.2			

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW30

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description (USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy)	Comments (Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm))
			0.3	SP	50-53 Poorly Graded Sand (SP), lt. brownish grey, wet, v. loose, 100% f-c sand (med. dom.)	1130 Break lunch 1210 Continue drilling
			0.4	SW	53-55 Well Graded Sand (SW), lt. brownish grey, saturated, v. loose, 90% f-c sand, 10% fine gravel	
55	50-60 1100	120/120		SW	55-60 Well Graded Sand with Gravel (SW), dk. brown, saturated, v. loose, 60% f-c sand, 40% fine gravel	
			0.2	SW	60-61 same as 50-53 (SP), saturated	
			0.1		61-62 Well Graded Gravel with Sand (GW), yellowish brown, wet, very loose, 70% fine gravel, 30% f-c sand	
60					62-63 same as 55-60 (SW), sand 75%, gravel 25%	
				SP	63-64 Poorly Graded Sand with Gravel (SP) yellowish brown, wet, v. loose, 60% fine sand, 40% coarse gravel	
			0.2	SW	64-68 same as 50-53 (SP), f-m sand with medium dominant	
			0.1		68-70 No Recovery	
65	60-70 1120	96/120		SP	70-83 Poorly Graded Sand (SP), olive yellow, saturated, very loose, 100% f-m sand with mica	
			0.1			
			0.2	No Recovery		
70						
	70-80 1235	120/120	0.1	SP		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW30

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					83-90 No Recovery. Driller reports lost interval was very soft. Probable SP/SW from above	1340, Reach total depth of 100'
	70-80 1235	120/120	0.1	SP	90-92 Well Graded Sand (SW), olive brown, saturated, very loose, 95% f-c sand, 5% fine gravel	1350 Begin advancing 8" casing to 80'
80					@92-93 Grades to Poorly Graded Coarse sand	
			0.4		93-94 Poorly Graded Gravel (GP) olive brown, saturated, very loose, 80% fine gravel, 20% f-c sand	
					94-97 Well Graded Sand with Gravel (SW) olive brown, saturated, very loose, 60% f-c sand, 30% f-c gravel to 5" oblate cobble	
85	80-90 1300	36/120		No Recovery	@95 color change to yellowish brown	
					97-99 Poorly Graded Sand with Gravel (SP), yellowish brown, wet, very loose, 80% f-m sand, 20% coarse gravel to 3"	
					99-100 Silty Gravel with Sand (GM), yellowish brown, saturated, ~~loose~~, 15% fines, 60% f-c gravel to 3", 25% f-c sand	
90			0.2	SW		
				SP	Well Completions (See Completion Report) Screens at 97-100, 47-50, 22→25	
			0.6	GP		
95	90-100 1335	120/120	0.4	SW		
			0.3	SP	TD @ 100' at 1340, 5/10/16	
				GP		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW31

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 4/28/16 15:17
End Date & Time:
Water Level, Date & Time:

CH2M Logger: I Bingeman
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6⅛" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
					Previously cleared w/ Air knife, backfilled w/ cobbles, boulders, and sand	"Overdrilling" 12'38 to 77' Rod rack not directly behind so slower loading
		5'			5'-8' Well Graded Sand w/ Gravel (SW) >15% Gravel, greyish Brown, med-C grain granitic gravel subangular-subrounded, moist very loose	
5		1518			8'-9' same as above w/ less gravel (<5%) Wet, Brown - DK Brown, muddy appearance	" " 1239
			0.0		10-15' No Recovery, all liquid	
		4'		SW	15 - Poorly Graded Sand (SP) <15% gravel Olive Grey - Grey Brown f-m grains, wet very loose	
			0.0		16 - grain size becomes just medium	
					17 - coarse sand, <5% fines	
					18 - Fine gravel pieces mixed w/ coarse sand	
10		1525			18.5 - Coarse gravel to 2" pieces, granitic, subangular to subrounded, 10% fines	Switch to 10' runs @ 10' bgs ~~1242~~ " " 1242
		0'			19'-20 Well Graded Sand w/ Gravel (>15%) (SW) med-C, Olive-Grey-Brown, very loose subangular-subrounded	
					20-30 No Recovery - loose material - likely coarse sand - gravel based upon above lithology	~~1243~~ " " 1243
15			0.0	SP		
		5'	0.0			
		1546	0.0	SW		@ 20' bgs changed bit to add catch basket on end for better recovery
20						- basket broke when drilling no recovery possible, put in another basket
		0'				
25						

ch2m	Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	Boring ID SW31	Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6.8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
29					30-35' - No Recovery, soft drilling, loose material	
		0'			35-39' Recovered	
					35 - Well Graded Sand (SW) Dark Olive-Brown fine grained, very soft, wet	
38		16 11			36 - grain size increase to med, subangular grains	@ 30 switch bits to flapper bit
					38 - Granitic gravel appears up to 1" in size	1643 Stop for night
		0			40 Poorly Graded Sand (SP) Olive Brown very loose, wet, f-m grains, subangular	0720 Resume in morning (4/29)
					42 - med - c grain size, sub angular - angular	
35					44 - Well Graded Gravel w/ Sand (GW) >15% sand grey-ish brown - granitic gravel, very loose, med-c sub angular	
			0.0	SW		
		4'	0.0		45.5 - Turns Dk brown - black, gravel size decreases	
			0.0		46 - Dk Brown Poorly Graded Sand (SP) same as 40'	
40		16 12			48 - Turns light Brown - Tan, Fine - med grains ~~more~~ 10 ~~fines~~ 20% fine sand	
		0720				
			0.0	SP	49 - Spots of Dk Brown mottling	
		5'	0.2			
				GW		
45			0.5			
		5'		SP		- Easy drilling
			0.5			
50		0741				

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW31

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6 1/8" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
		0741			50 - Same as above, Fine grain, micaceous, wet	
		4'	0.9	SW	52-54 Well Graded Sand (SW) Olive-Brown med grain, moist, very loose, trace granitic gravel micaceous,	
					55 - same as above, gravel appears up to 1" in size	
55					57 - Coarse grained, increasing gravel, subangular-sub rounded, moist, loose	
		5'	1.1		58 - Well Graded Gravel w/ Sand (GW) Brown coarse sand, fine-coarse gravel, sub ang.-subround some granitic gravel, moist, very loose	
			1.3	GW		
60	0807	0807				Stop 5 min to fix bit basket"
					60-65 No Recovery, all liquid leaving core barrel	
		0'			65-66' Same as 52-54' F-m grain wet, no gravel, micaceous	
					66'-67' ~~Same as 58~~ Well Graded Sand w/ Gravel (SW) f-med-c grains, sub ang-subrounded wet, micaceous, very loose, Brown w/ pink, white black, tan grains	
65			0.7	SW	67-69' same as 58' (GW)	
		4'			70-73' Well Graded Sand w/ Gravel (30%) (SW) Olive-brown w/ grey, wet, very loose, large cobble present, subang-subround med-C grain sand, micaceous, some granitic gravel	
			1.3	GW		
70	0848					Stop 5 min" "
				SW		
		3'	1.0			
75						

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW 31

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6 7/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				SW	75-78' same as 70-73' (SW) no cobbles, just gravel (mostly granitic)	
		3'	1.3		80- same as above, wet	
					83- larger gravel appears (granitic), some cobbles (fist sized)	
80		0933			84- Well Graded Gravel w/ Sand (>15%) (GW) Olive-Brown to Olive-Grey (wet), fine-C gravel subround-subangular, mostly granitic, med-C sand very loose	
			0.8		85-87.5 Poorly Graded Sand (SP) fine-med Yellowish Brown-Brown, wet, loose-med dense	
		5'			87.5- Well Graded Sand w/ Gravel (SW) -med-C grain sand, very loose, wet, olive Brown to Brown, fine-C gravel, subangular-subrounded majority gravel granitic and 0.5"	
			1.7	GW		
85						
				SP	95- same as 85'	
		5'			97- same as 87.5 larger gravels and cobbles toward bottom hard drilling, angular cobble at 99' bgs gneissic banding, K-spar, med grain sizes	
			1.3	SW		
90		1014				
					See ~~#~~ IO well diagram for corresponding wells for SW 31, move up 1 foot due to cobbles at 100 to 99' base on conversation w/ C. Lettich	
		0'			TD of 100' bgs	
					11:09 4/29/16	
95				SP	Overdrilling of 77' @ 1308	
		5'	0.9			Driller notes boulders, tough drilling around 99'
				SW		
			0.8			Bradco Rod trying to retrieve 1050
		1109				Get 8" ready 1122

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW32

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 4/19/16, 1400
End Date & Time: 4/21/16, 1240
Water Level, Date & Time: NM

CH2M Logger: C. Lattich
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic 6/8" drive casing, 4" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
5'	0-5' Air Knifed	0"/60			0-5' cleared by air knife – abundant gravel and cobbles. Noted boulder in hole sidewall	1400 Begin advancing 6" Hole cleared by air knife to 5'. Plan to overdrill w/ 8" to 75'.
					5-7.5 Well Graded Gravel with Sand (GW), brown, saturated, very loose, 75% f-c gravel and cobbles, 25% f-c sand	
5					7.5-13 Well Graded Sand with Gravel (SW), brown, saturated, very loose, 75% f-c sand, 25% f-c gravel	
	5-10' 1415	60/60	0.0	GW	@9' color to gray. Gravel to 3".	
				SW	@11' Color to grayish brown. Gravel to 40% up to 4"	
10			0.2		13-15 As 5-7.5. Gravel to 3.5" and 55%, sand 45%	
	10-15' 1425	60/60	0.1		15-16.5 Well Graded Sand (SW), yellowish brown, saturated, very loose, 90% f-c sand, 10% fine gravel	
				GW	16.5-20 Same as 13-15. Color to yellowish brown	
			0.2	GW	20-25 No Recovery. Cobble jammed core barrel	
15				SW		
	15-20' 1453	60/60	0.0	GW		
			0.0			
20						
	20-25 1458	0/60"	No Recovery	No Recovery		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW32

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, " drive casing, " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	25-30 1510	60/60	0.0 0.0	SW	25-26 Well Graded Sand (SW), yellowish brown, saturated, very loose, 95% f-c sand, 5% fines 26-~~30~~ Well Graded Sand with Gravel (SW) yellowish brown, saturated, very loose, 75% f-c sand, 25% fine gravel	1555 Added sand catcher to bit
30	30-35 1535	60/60	0.0 0.0	SW	30-35 Same as 25-26 (SW), color to yellowish gray. fine portion dominant @ 34' fines to 10%, color to brown 35-40 No recovery 40-42.5 Well Graded Sand (SW), yellowish brown, wet, very loose, 90% f-c sand, 10% cobble to 5". ~~At 42.5~~ @ 42.5-43 6" seam of well graded gravel	
35	35-40 1555	0/60		~~SW~~ No Recovery	43-45 Same as 26-30, gravel to 3" and 30% 45-49 Poorly Graded Sand (SP), yellowish brown, wet, very loose, 100% medium sand 49-50 Well Graded Sand (SW) yellowish brown, wet very loose, 100% f-c sand, rare fine gravel.	
40	~~40~~45 1605	60/60	0.0 0.0	SW		
45	45-50 1630	60/60	0.0 0.0	SP SW		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW32

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	50-55 810	0/60		No Recovery	50-55 No Recovery 55-60 Same as 49-50 (SW) 60-65 Well Graded Sand with Gravel (SW), yellowish brown, wet, very loose, 85% f-c sand, 15% f. gravel	1640 hydraulic line came loose while retrieving 50-55' sample = 4/20/16, 0800 Continue with drilling. Recover core 50-55' 810 Lost 50-55' run b/c sand catcher broke. Replaced sand catcher. Attempt 10' run 55-65'
55			0.0		@ 62-63 Gravel to 30% and 2" max @ 63 fine gravel to 25%	= 4/21/16 0820 Continue building well, Bentonite to 82'
	55-65 842	120/120	0.4	SW	65-70.5 Same as 49-50 (SW)	
60				#####	70.5-73 Well Graded Gravel with Sand (GW), yellowish brown, saturated, very loose, 65% f-c gravel to 4" cobbles, 35% f-c sand	
			0.1		~~73 Well Graded Gravel (GW), yell~~ 73-75 Well Graded Gravel (GW), yellowish brown, saturated, very loose, 90% fine-coarse gravel with cobbles to 5"	
			0.0			
65				SW		
			0.2			
	65-75 925	120/120	0.4			
70						
			0.2	GW		
			0.2			

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW32

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
80	75-85' 1010	60/120	0.1	GW	75-79.5 Poorly Graded Sand (SP), yellowish brown, saturated, very loose, 100% medium sand	Drilling becomes difficult at 95'
			0.2	GW	79.5-78 Transitional between SP and GW	1130 Reach total depth of 100'. Begin overdrilling with 8" casing
				GW	78-80 Well Graded Gravel (GW), grey, saturated, very loose, 90% f-c gravel to 3", 10% coarse sand	1200 8" to 30'. Break for lunch
				No Recovery	80-85 No recovery probably due to gravel obstructing sampler	1430 Begin building 100' ("D") well
				SP	85-86.5 Poorly Graded Sand (SP), yellowish brown, saturated, very loose, 100% f-m sand	1505 Begin building 75' ("C") well
85	85-90' 1050	60/60		GW	86.5-90 Well Graded Gravel (GW), yellowish brown, saturated, very loose, 60% f-c gravel to 2.5", 40% f-c sand	4/21/16 0820 - Continue building well. Working on "B" well / 50' completion. Bentonite to 32'
			0.1	SP	90-93 No recovery. Push fine sand out of way	940 Completed placing uppermost 18-20' bentonite layer. Wait at least 2 hrs
			0.1	GW	93-95 Same as 85-86.5 (SP)	1215 Begin grouting from 18' up
90	90-100' 1130	84/120		GW	95-97.5 Well Graded Sand with Gravel (SW), yellowish brown, saturated, very loose, 85% f-c sand, 15% fine gravel, trace fines	1240 Complete grouting
				No Recovery	97.5-100 Well Graded Gravel with silt and sand (GW-GM), saturated, very loose, 60% f-c gravel to 5" cobbles, 30% f-c sand, 10% fines	
			0.1	SP	Well Completion (see completion record)	
95				SW	"A" screen 22 → 25' "B" screen 47 → 50' "C" screen 72 → 75' "D" screen 97-100'	
			0.0			
			0.0		TD @ 100' with 6" casing	

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW33

Sheet 1 of 4

SOIL BORING LOG

Start Date & Time: 4/22/16, 1135
End Date & Time: 4/26/16, 0815
Water Level, Date & Time:

CH2M Logger: C. Lettich
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	0-5' 1137	0/60	Air knifed	Air knifed	0-5' Previously air knifed	1135 Begin advancing 6" casing. 0-5' previously cleared by air knife.
					5-7.5' Well Graded Sand with Silt and Gravel (SW-SM), moist, loose, 50% f-c sand, 40% f-c gravel to 3" cobble, 10% fines	1225 Break lunch
5					7.5'-10 Well Graded Gravel with Silt and ~~Gra~~ Sand (GW-GM), greyishish brown, moist, loose, 50% f-c gravel to 4" cobble, 40% f-c sand, 10% fines	
	5-10' 1142	60/60	0.2	SW-SM	10-12.5 Silty Sand with Gravel (SM), ~~yellow~~ greyish brown, saturated, loose, 60% f-c sand, 20% f. gravel, 20% fines	
			0.8	GW-GM	12.5-21 Well Graded Sand with Gravel (SW), greyish brown, wet, v. loose, 60% f-c sand, 40% f-c gravel to 4" cobbles (rare), trace fines	
10					@ 18-19 Color change to yellowish brown, fines to 5%, gravel to 35%	
			0.0	SM	@ 20-21 Gravel 20%, Sand 80%	
					@ 21-24 Well Graded Gravel with Sand (GW), greyish brown, wet, v. loose, 60% f-c gravel to 3", 40% f-c sand	
	10-20' 1200	120/120	0.0	SW	24-25.5 Same as 12.5-21.5" cobble at very bottom	
15			0.0		25.5-26.0 ~~Poorly Graded Sand with Silt (SW)~~ Silty Sand, yellowish brown wet, loose, 70% fine sand, 30% fines	
			0.0		26-27.5 Well Graded Sand (SW), light grey, wet, v. loose, 100% f-c sand	
20					27.5-35 Poorly Graded Sand (SP), grey, wet, v. loose, 100% m. sand, rare f. gravel	
	20-30 1210	120/120		GW	@ 35 color to reddish brown	
				SW		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW33

Sheet 2 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description (USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy)	Comments (Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm))
				SW		
				~~SW~~		
				SW	35-36 Well Graded Sand with Gravel (SW), orangish brown, saturated, very loose, 85% f-c sand (skewed to coarse), 20% f. gravel	1305 Resume drilling from 30'
				SP	36-37.5 same as 27.5-35 (SP), orangish brown	
	20-30 1210	120/120			37.5-~~39~~ 40 same as 35-36', color to brownish grey, f-c sand (no dominant size)	
30					@39-40 gravel to 30%, fines to 5%	
			0.0		40-44 same as ~~27.5~~ 27.5-35 (SP), yellowish brown, f-m sand 100% (predominantly medium)	
			0.0			
					44-45 Well Graded Sand (SW), yellowish brown, wet, v. loose, 100% f-c sand	
35	30-40 1330	120/120		SW	45-46 Well Graded Gravel with Sand (~~GW~~ SW), yellowish brown, saturated, very loose, ~~80~~ 75% f-c gravel to 3", 20% f-c sand, 5% fines	
			0.0	SP		
			0.0	SW	46-47 same as 44-45 (SW)	
					47-48 same as ~~40~~ 40-44 (SP)	
40					48-50 No Recovery	
			0.0	SP		
			0.0			
	40-50 1345	96/120		SW		
45				GW		
			0.0	~~SW~~		
				SP		
				No Recovery		

ch2m:

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW33

Sheet 3 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
			0.0	SP	50-53 Poorly Graded Sand (SP), yellowish brown, saturated, v. loose, 100% f-m sand (med. predominant)	1515 Shutdown operations for 4/22/16. Secure hole for the weekend.
				SW	53-55.5 Well Graded Sand (SW), yellowish brown, wet, v. loose, 100% f-c sand (f-m dom.)	4/25/15, 0810, Resume drilling from 70'
55	50-60 1425	96/120	0.0	GP	55.5-57 Poorly Graded Gravel with Sand (GP), yellowish brown, saturated, 65% fine gravel, 35% f-c sand	
			0.0			
			0.0	GW	57-58 Well Graded Gravel with Sand (GW), 55% f-c gravel to 3", 45% f-c sand, saturated	
			0.0	No Recovery	58-60 No Recovery	
60				SW	60-68 Same as 53-55.5 (SW), f-c sand	
					68-70 No Recovery	
					@ 66-67 10% fine gravel	
65	60-70 1505	96/120			70-71 Well Graded Gravel w/ Silt and Sand (GW-GM), yellowish brown, saturated, loose, 50% f-c gravel to 2.5", 40% f-c sand, 10% fines	
					71-74 Well Graded Sand with Gravel (SW), yellowish brown, saturated, 70% f-c sand, 30% coarse gravel to 3"	
					~~74-75 As above, gravel to fine~~	
				No Recovery	74-75 Well Graded Sand with Gravel and Silt (GW-GM) yellowish brown, saturated, 70% f-c sand, 20% fine gravel, 10% fines	
70				GW-GM	@ 74.5-75 Coarse gravel and cobbles to 4.5"	
	70-80 4/25/14, 0840	60/120	0.0	SW		
			0.0			
				GW-GM		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW33

Sheet 4 of 4

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
				No Recovery	75-80 No Recovery	0950 Reach total depth 100'
	70-80 0840	60/120			80-85 Well Graded Sand with Gravel (SW), yellowish brown, saturated, v. loose, 80% f-c sand, 15% f-c gravel (find dem.), 5% fines	1020 Begin overdrilling w/ 8" casing to 77'
					85-90 No Recovery	1050 Complete overdrilling
					90-95.2 Well Graded Sand (SW), yellowish brown, wet, v. loose, 100% f-c sand, rare fine gravel	1125 In process of setting 100' well screen
80						1200 100' screen pulled up to ~99.3' while removing casing.
			0.3	SW	95.2-95.5 Silt (ML), yellowish brown, moist, firm, 90% fines, 10% fine gravel at base	
	80-90 0917	60/120			95.5 - 97 Well Graded Gravel with Sand (GW) yellowish brown, saturated, v. loose, 60% f-c gravel up to 4" cobble, 35% f-c sand, 5% fines	1350 Near completion adding sand to 75' screen
			0.2			1425 Begin adding sand for 50' screen.
85					97-100 No Recovery	1508 Begin adding chips from 45-27.
				No Recovery		4/26/16 0800 - grouting in progress
						0815 - grouting complete
90						
			0.4	SW	Well Completion (see Completion Report): Screens at 97-100', 72-75', 47-50', and 22-25'	
	90-100 0950	84/120	0.2			
95				ML		
			0.3	GW		
				No Recovery	TD @ 100', 0950, 4/25/16	

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW34

Sheet 1 of 45

SOIL BORING LOG

Start Date & Time: 4/26/16, 1045
End Date & Time:
Water Level, Date & Time:

CH2M Logger: C. Leffich
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	0-5 Air Knifed				0-5' Previously air knifed. Soil contained cobbles and boulders to 14"	1045 Begin advancing 6" casing. Raining
					5-12.5 Well Graded Gravel with Sand (GW) and silt (GW-GM), greyish brown, fm wet, v. loose, 60% f-c gravel to 2.5", 35% f-c sand, 5% fines	
5					@8.5-10 Same as above. Cobbles dominate to 5", sand 15%, fines 25%	
	5-10 1100	60/60	2.1	GW-GM	@10-12.5 saturated, f-c gravel to 2"	
			1.2		12.5-16.0 Poorly Graded Sand (SP), grey, wet, v. loose, 100% f-m sand (dominantly medium)	
10					16-21 Well Graded Gravel with Sand (GW), med. grey, wet, v. loose, 55% f-c gravel to 2", 40% f-c sand, 5% fines	
			0.0		@18 color to yellowish brown	
					21-24 Well Graded Sand with Gravel (SW), 60% f-c sand, 40% f-c gravel, to 4" cobble, saturated, very loose yellowish brown	
	10-20 1115	120/120	0.2	SP		
15					24-26 Poorly Graded Sand (SP), yellowish brown, wet, v. loose, 90% f-c sand (predominantly medium), 10% fine gravel	
			0.8		26-30 No Recovery	
			0.2	GW		
20						
	20-30 1130	72/120	0.0	SW		
			0.0			
				SP		

ch2m.

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW34

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, 6/8 " drive casing, 4 " core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	20-30 1130	72/120	0.0	SP	30-32 Same as 24-26	
				No Recovery	32-34 Well Graded Sand (SW), yellowish brown, saturated, very loose, 70% f-c sand, 30% f. gravel, micaceous	
					34-35 Well Graded Gravel w/ Sand (GW) yellowish brown, saturated, v. loose, 80% f-c ~~sa~~ gravel to 4" cobble, 20% coarse sand	
30	30-40 1150	60/120	0.0	SP	35-40 No Recovery	
					40-41 Silty Sand (SM), brown, saturated, v. loose, 85% f. sand w/ muscovite, 15% fines	
			0.0	SW	41-50 No Recovery	
35				GW		
				No Recovery		
40	40-50 ~~12/120~~ 1320	12/120	0.0	SM		
45				No Recovery		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW34

Sheet 3 of ~~4~~ 5

SOIL BORING LOG

Start Date & Time:

End Date & Time:

Water Level, Date & Time:

CH2M Logger:

Drilling Contractor: Cascade Drilling LP

Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
55	50-60 1355	72/120	0.0	SP	50-51 Poorly Graded Sand (SP), yellowish brown, saturated, v. loose, 95% f. grained micaceous sand, 5% fines	1435 Rain begins
						1450 Lightning – stop work
			0.0	SW	51-55 Well Graded Sand (SW), yellowish brown, saturated, v. loose, 100% f-c sand	1530 Stop work for 4/26 because of rain & lightning
			0.0		55-56 Well Graded Sand with Gravel (SW), yellowish brown, saturated, v. loose, 75% f-c sand, 25% f-c gravel to 2"	4/27/16, 0730 – continuing drilling beyond 70'
					56-60 No Recovery	
60				No Recovery	60-63 same as 51-55 (SW)	
					63-66.5 same as 55-56, gravel 30%	
					66.5-68 Well Graded Gravel with Sand (GW), yellowish brown, wet, very loose, 75% f-c gravel to 4", 25% f-c sand	
					68-70 No Recovery	
	60-70 1430, 4/26	96/120	0.0	SW	70-74 Well Graded Sand (SW), yellowish brown, wet, v. loose, 95% f-c sand, 5% f. gravel	
65			0.0		74-76 Same as 66.5-68 (GW)	
			0.0	GW		
				No Recovery		
70	70-80 0745, 4/27	108/120	0.0	SW		
			0.0			
				GW		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID: SW34

Sheet 4 of 5

SOIL BORING LOG

Start Date & Time:
End Date & Time:
Water Level, Date & Time:

CH2M Logger:
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description: USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments: Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	80-82 0745	108/120	0.0	GW	76-79 Well Graded Sand w/ Gravel (SW), yellowish brown, saturated, v. loose, 75% f-c sand, 25% f. gravel ~~to 3"~~. 3" cobbles at 79	0825 on 80-90' core run not able to go beyond 89'. Changed bit.
			0.0	SW	79-80 No Recovery	
					80-81 Poorly Graded Sand (SP), yellowish brown, saturated, loose, 100% f-m sand (medium dom.)	0903 Dry cored through hard material at 89-90 and 96-97.
80				No Rec.		
				SP	81-82.5 same as 70-74 (SW)	1015 Very slow drilling 97-100'. More boulders and possibly bedrock. Stop to change out jaws
	82-89 0825 (see notes)	108/108 (see notes)	0.0	SW	82.5-87 same as 76-79 (GW) @82.5-84 f. gravel to 30% @84-87 f-c gravel to 5" cobble 40-45%	1130 Communicate w/ office and want to attempt going to 105 to confirm if bedrock.
			0.0		87-89 No Recovery	
85				GW	89-90 Granitic Gneiss boulder	
			0.2		90-95 Clayey Sand with Gravel (SC), brown, wet, loose, 40% f-c sand, 35% f-c gravel to 3", 25% fines	
				No Recovery	@92-95 sand to 40%, gravel to 25%, fines to 35%	
	89-97 0900	96/96		Granitic	95-96 Clayey Gravel with Sand (GC), brown, wet, med dense, 50% f-c gravel to 3", 30% f-c sand, 20% fines	
90			0.0	SC	96-105 Bedrock — Granitic rock with weak gneissic texture	
			0.0			
95			0.0	GC		
	97-105 1001	36/36		Granitic		

ch2m

Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

Boring ID SW34

Sheet 5 of 5

SOIL BORING LOG

Start Date & Time:

End Date & Time:

Water Level, Date & Time:

CH2M Logger:

Drilling Contractor: Cascade Drilling LP

Drilling Method: Rotosonic, _____" drive casing, _____" core barrel

Feet BGS	Interval (ft)	Recovery (inches)	Soil PID (ppm)	USCS Code	Soil Description USCS soil name, USCS group symbol, color, moisture content, relative density, or consistency, soil structure, mineralogy	Comments Remarks, depth of casing, drilling & fluid loss, tests, breathing zone PID (ppm)
	100-105 1230	60/60		Granitic		1230, Reach final depth @ 105' 1330 Begin overdrilling with 8" casing to 71'
105					Well Completion (see completion report): Screened: 22-25, 47-50, 66-69, 85-88 TD @ 105' at 1230, 4/27/16	

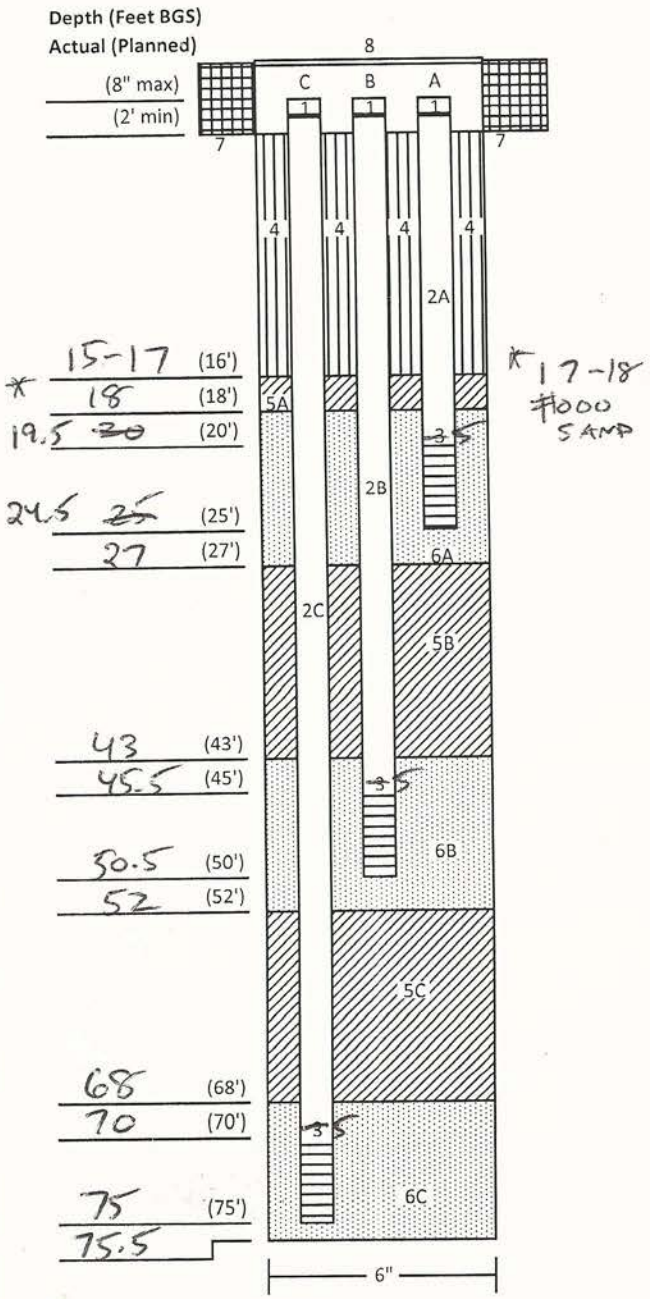
Attachment 2
Well Completion Reports

ch2m	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER ~~PZ01~~

WELL COMPLETION REPORT

Start Date & Time: 5/12/14 @ 0805	CH2M Logger: L. BARCA
End Date & Time:	Drilling Contractor: Cascade Drilling LP
Water Level, Date & Time: NM	Drilling Method: Rotosonic

Well Diagram



* 17-18 #000 SAND

Well Materials Used

1) 1-inch Diameter Well Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	19.5	feet
2B)	45.5	feet
2C)	70	feet

3) 5 feet of 1-inch Diameter Schedule 80 PVC, 0.02" Slot Screen

4) High Sodium Bentonite Grout

Type:

Bag Size: 50 LBS

Quantity: 1/2 bags (0.5 Bag / 15 Gal Water)

5) Bentonite Chips

Type: 3/8" CHIPS

Bag Size: 50 LBS

5A)	~~1~~	bags
5B)	4	bags
5C)	4	bags

6) Filter Sand

Type: #1 U.S. Silica Sand

Bag Size: 20 LBS (1/2 BAG #000)

6A)	3	bags
6B)	3	bags
6C)	2.5	bags

7) Concrete

Type: Sakrete High Strength Premix

Bag Size: 80 lb

Quantity: ~4 bags

8) Road Box

Type: Emco Wheaton Heavy-Duty Traffic-rated

Size: 18"

NOTES: 5/12/14
SURFACE ROAD BOX / CONCRETE TO BE INSTALLED AT LATER DATE

Abbreviations

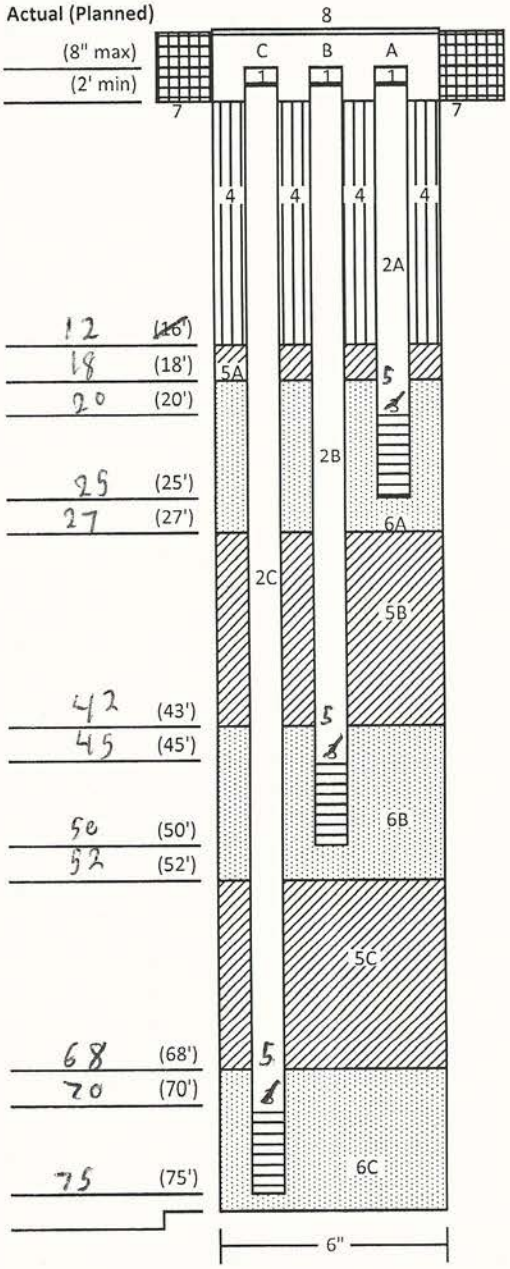
'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m.	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER PZ02

WELL COMPLETION REPORT

Start Date & Time:	5/12/16 1457	CH2M Logger:	I Bingeman
End Date & Time:	5/13/16 0800	Drilling Contractor:	Cascade Drilling LP
Water Level, Date & Time:	—	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) 1-inch Diameter Well Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	20	feet
2B)	45	feet
2C)	70	feet

3) 5 feet of 1-inch Diameter Schedule 80 PVC, 0.02" Slot Screen

4) High Sodium Bentonite Grout

Type: Cetco

Bag Size: 50#

Quantity: 1 bags 40 gal

5) Bentonite Chips

Type:

Bag Size:

5A)	1	bags
5B)	3.5 tot.	bags
5C)	2.5	bags

3.5 stop for day needs more chips

6) Filter Sand

Type: #1 U.S. Silica Sand

Bag Size: 50#

6A)	2	bags
6B)	3	bags
6C)	2.75	bags

1/2 bag OOC sand

7) Concrete

Type: Sakrete

Bag Size: 80lbs

Quantity: 3.5 bags

8) Road Box

Type: Emco Wheaton Heavy-Duty Traffic-Rated

Size: 18"

Abbreviations

'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:

Orange & Rockland Utilities
Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

WELL NUMBER PZ03

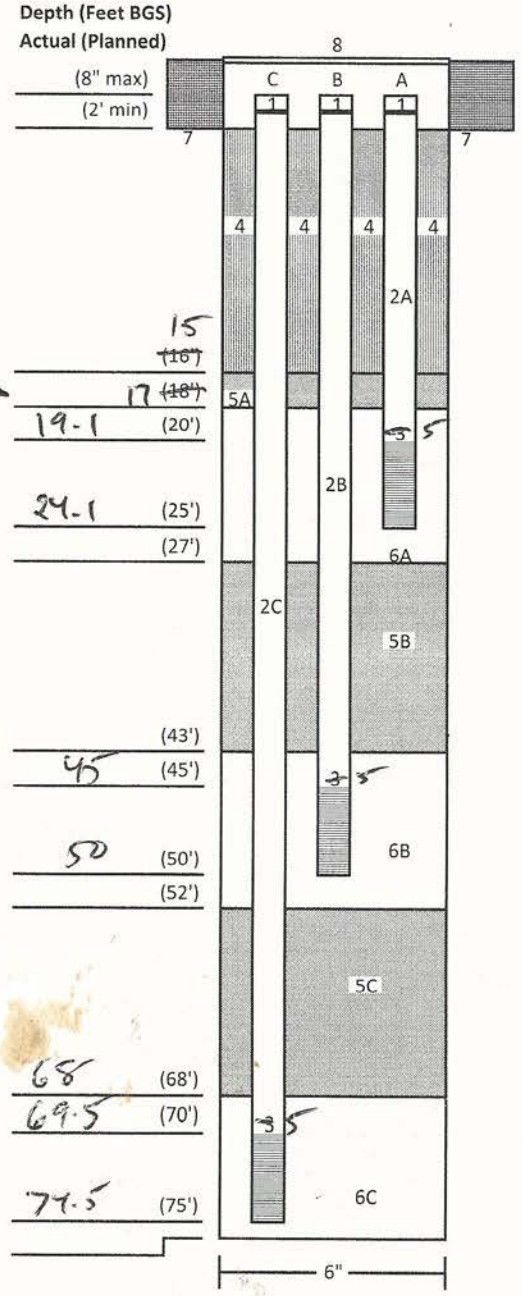
WELL COMPLETION REPORT

Start Date & Time: 5/17/16 /0915 CH2M Logger: L. Barnett

End Date & Time: ~~4/04~~ 5/17/16 @1100 Drilling Contractor: Cascade Drilling LP J. Weeks

Water Level, Date & Time: Drilling Method: Rotosonic

Well Diagram



15 Bent. Chips
17 #0005and
18

15 ~~(16')~~
17 ~~(18')~~ (20')
19.1
24.1 (25')
(27')
45
50
68
69.5
74.5

Well Materials Used

1) 1-inch Diameter Well Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	19.1	feet
2B)	45	feet
2C)	69.5	feet

3) 5 feet of 1-inch Diameter Schedule 80 PVC, 0.02" Slot Screen

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 lbs

Quantity: ~~2~~ 1 bags/gallons

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 lbs

5A)	0.5	bags
5B)	3.5	bags
5C)	3.5	bags

6) Filter Sand

#0005and 0.5 Bags

Type: #1 U.S. Silica Sand

Bag Size: 50 lbs

6A)	2	bags
6B)	2	bags
6C)	2	bags

7) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80#

Quantity: 4 bags

8) Road Box

Type: EMCO Wheaton ~~High Strength Premix~~ Heavy-Duty Traffic Rated

Size: 18"

Abbreviations

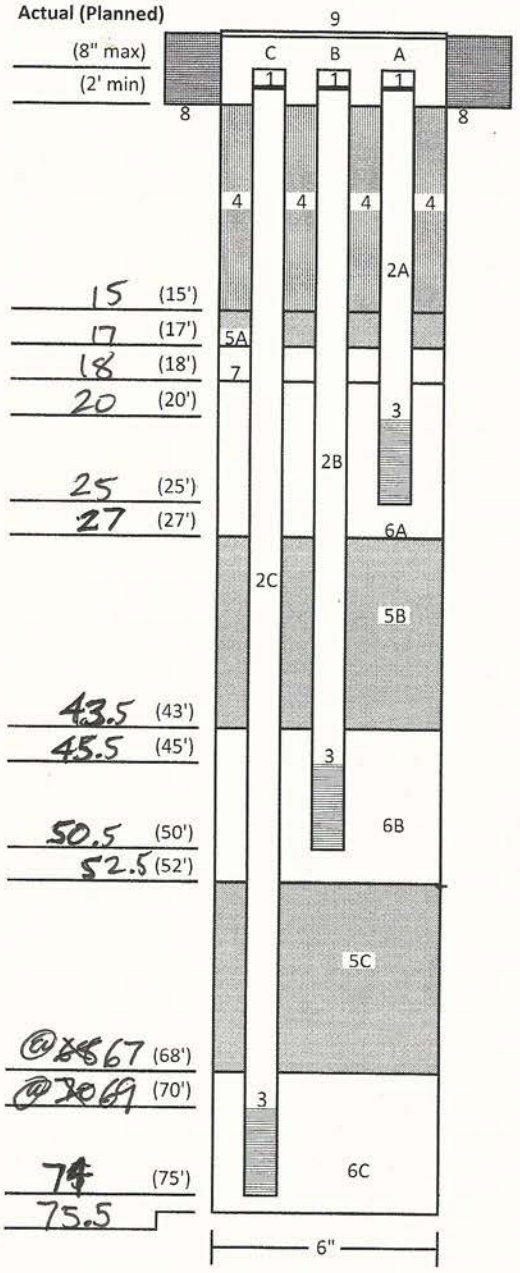
'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER PZ04

WELL COMPLETION REPORT

Start Date & Time:	5/18/16, 1040	CH2M Logger:	C. Leftich
End Date & Time:	5/18/16, 1430	Drilling Contractor:	Cascade Drilling LP Jon Weeks
Water Level, Date & Time:	NM	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) 1-inch Diameter Well Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	20	feet
2B)	45.5	feet
2C)	69	feet

3) 5 feet of 1-inch Diameter Schedule 80 PVC, 0.02" Slot Screen

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 lb

Quantity: 1.5 ~~/25 to 40~~ bags/gallons

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 lb

5A)	1	bags
5B)	3.5	bags
5C)	3.5	bags

6) Filter Sand

Type: #1 U.S. Silica Sand

Bag Size: 50 lb

6A)	4.0	bags
6B)	~~3~~ 2.5	bags
6C)	2.5	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

Bag Size: 50 lbs.

0.5 bags

8) Concrete

Type: Sakrete High-Strength Premixed Concrete

Bag Size: 80 lbs

Quantity: ~~3~~ 4 bags

9) Road Box

Type: EMCO Wheaton 18" traffic rated vault

Size: 18"

ch2m:

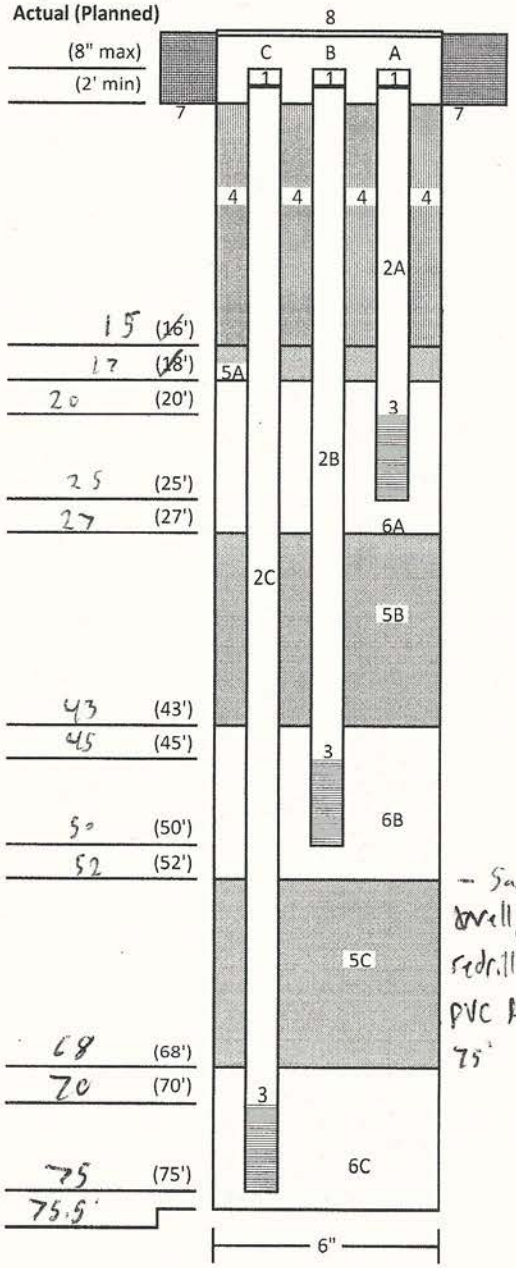
Orange & Rockland Utilities
Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

WELL NUMBER
PZ05

WELL COMPLETION REPORT

Start Date & Time:	5/16/16 1240	CH2M Logger:	I Bingeman
End Date & Time:	5/17/16 1445	Drilling Contractor:	Cascade Drilling LP
Water Level, Date & Time:		Drilling Method:	Rotosonic

Well Diagram



000 sand 19

- Sand in well, need to redrill / pull out PVC liser from 75'

Well Materials Used

1) 1-inch Diameter Well Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	20	feet
2B)	45	feet
2C)	70	feet

3) 5 feet of 1-inch Diameter Schedule 80 PVC, 0.02" Slot Screen

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 lb

Quantity: 1.5/~40 bags/gallons

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 lb

5A)	~~3.75~~ 1.75	bags
5B)	4	bags
5C)	4 ~~3.25~~	bags

6) Filter Sand

Type: #1 U.S. Silica Sand

Bag Size: 50 lb

6A)	3.25	bags
6B)	2.5	bags
6C)	~~2.5~~ 2.5	bags

3/8 coe sand bag

7) Concrete

Type: Sakrete

Bag Size: 80 lb

Quantity: 4 bags

8) Road Box

Type: Emco Wheaton Heavy-Duty traffic-rated vault

Size: 18"

Abbreviations

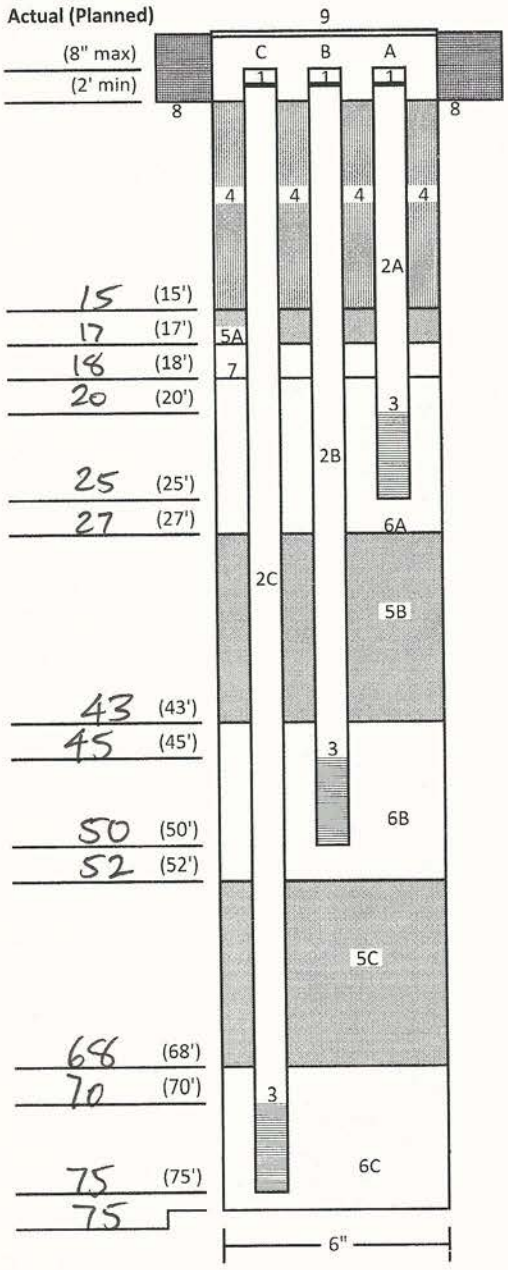
'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER PZ06

WELL COMPLETION REPORT

Start Date & Time:	5/27/16, 0730	CH2M Logger:	C. Lettich
End Date & Time:	5/27/16, 1040	Drilling Contractor:	Cascade Drilling LP J. Weeks
Water Level, Date & Time:	NM	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) 1-inch Diameter Well Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	20	feet
2B)	45	feet
2C)	70	feet

3) 5 feet of 1-inch Diameter Schedule 80 PVC, 0.02" Slot Screen

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50#

Quantity: 1/25 bags/gallons

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size:

5A)	1	bags
5B)	4	bags
5C)	3.5	bags

6) Filter Sand

Type: #1 U.S. Silica Sand

Bag Size: 50#

6A)	3.5	bags
6B)	2.5	bags
6C)	2	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

Bag Size: 50#

0.25 bags

8) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80#

Quantity: 4 bags

9) Road Box

Type: Emco Wheaton Heavy-Duty Traffic-Rated

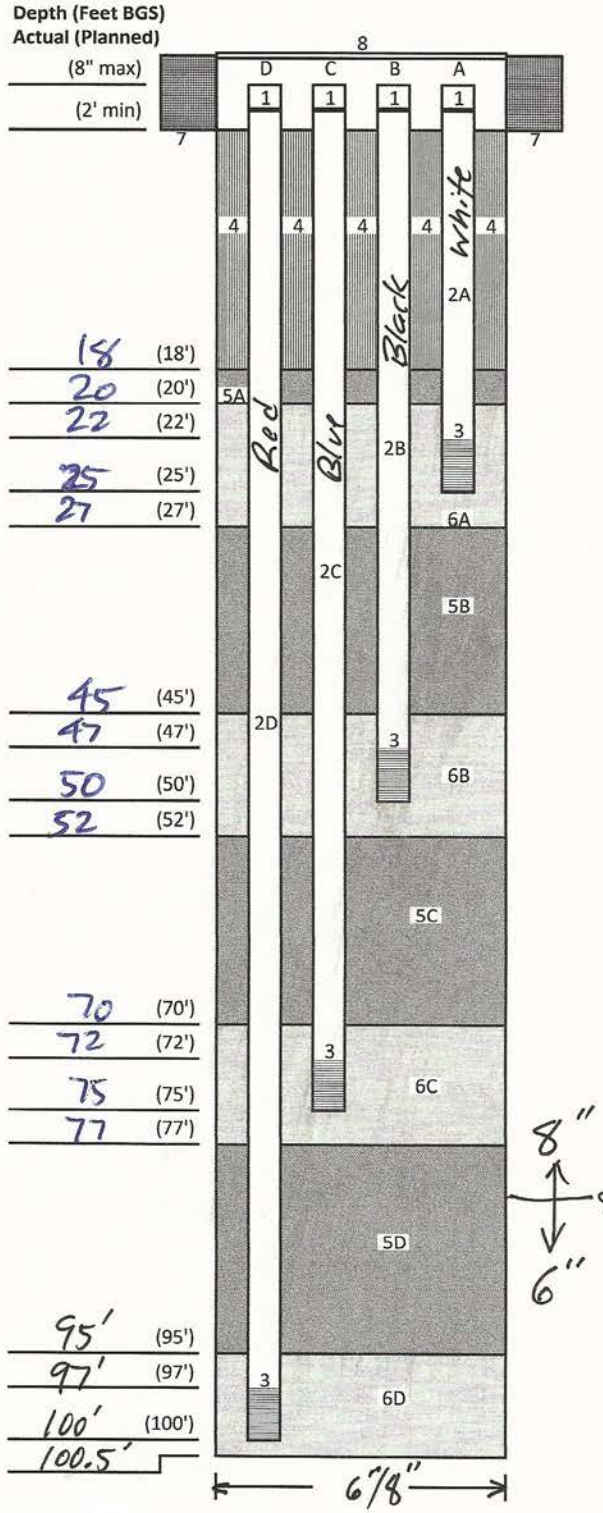
Size: 18"

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	**WELL NUMBER** SW01

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time: 5/2/16, 0840	CH2M Logger: C. Lettich
End Date & Time: 5/3/16, 1400	Drilling Contractor: Cascade Drilling LP
Water Level, Date & Time:	Drilling Method: Rotosonic

Well Diagram



Well Materials Used

1) ~~Threaded Schedule 80 PVC Cap~~ 1" J-Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 3 bags ~60-70 gal

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	8	bags
5C)	8	bags
5D)	2	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	4.5	bags
6B)	4	bags
6C)	3	bags
6D)	2	bags

7) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80 lb

Quantity: 4 bags

8) Road Box

Type: Emco Wheaton Heavy-Duty Traffic-Rated

Size: 18"

Abbreviations

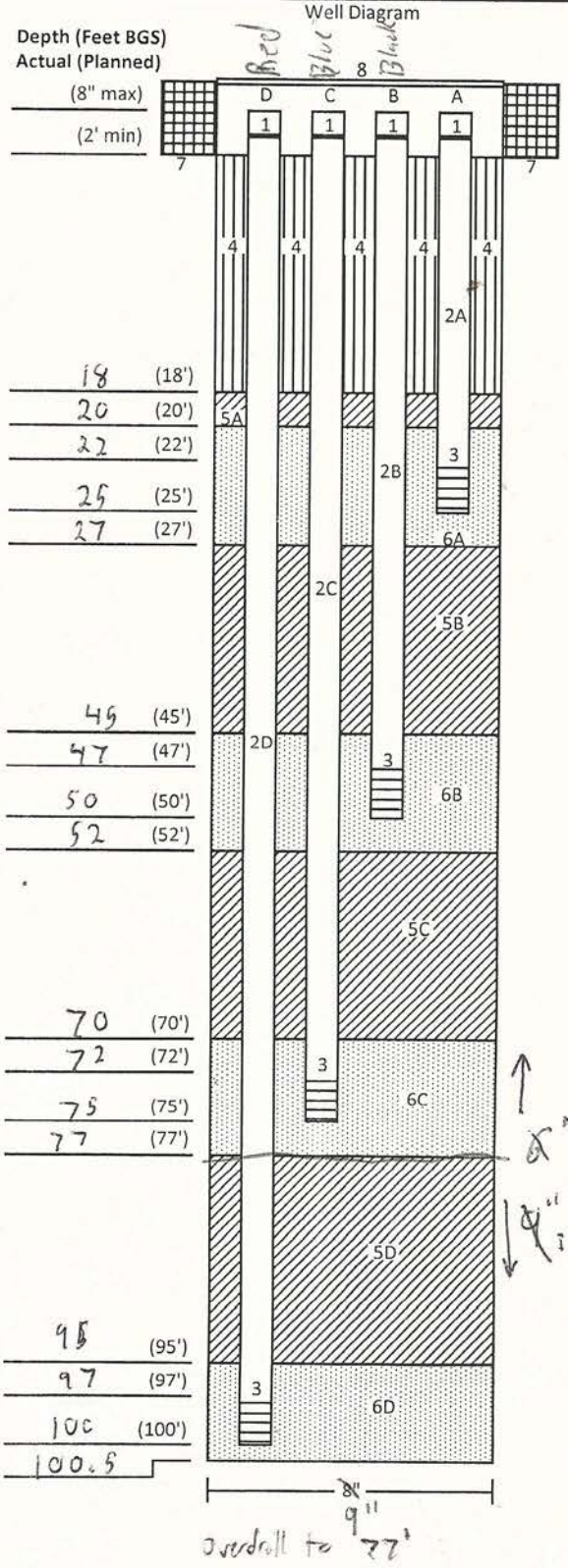
'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW02

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	4/21/16 1700	CH2M Logger:	J Bingeman
End Date & Time:	4/22/16 1354	Drilling Contractor:	Cascade Drilling LP
Water Level, Date & Time:	—	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3 feet of 1-inch Diameter Schedule 80 PVC, 0.05" Slot Screen

4) High Sodium Bentonite Grout

Type: CETCO Grout
Bag Size: 50
Quantity: ~~3~~ 3 bags

5) Bentonite Chips

Type: Pure Gold Medium chips
Bag Size: 50 lbs

5A)	1.5	bags
5B)	11	bags
5C)	10	bags
5D)	6	bags

6) Filter Sand

Type: #3 U.S. Silica Sand
Bag Size: 50 lb

6A)	7	bags
6B)	6	bags
6C)	5	bags
6D)	2	bags

7) Concrete

Type: Sakrete High-Strength Premix
Bag Size: 80 lb
Quantity: 4 bags

8) Road Box

Type: Emco Wheaton Heavy-Duty Traffic-Rated
Size: 18"

Abbreviations

'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW03

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	4/26/16 0946	CH2M Logger:	J. Bingeman
End Date & Time:	4/27/16 1110	Drilling Contractor:	Cascade Drilling LP
Water Level, Date & Time:		Drilling Method:	Rotosonic

Well Diagram

Depth (Feet BGS)
Actual (Planned)

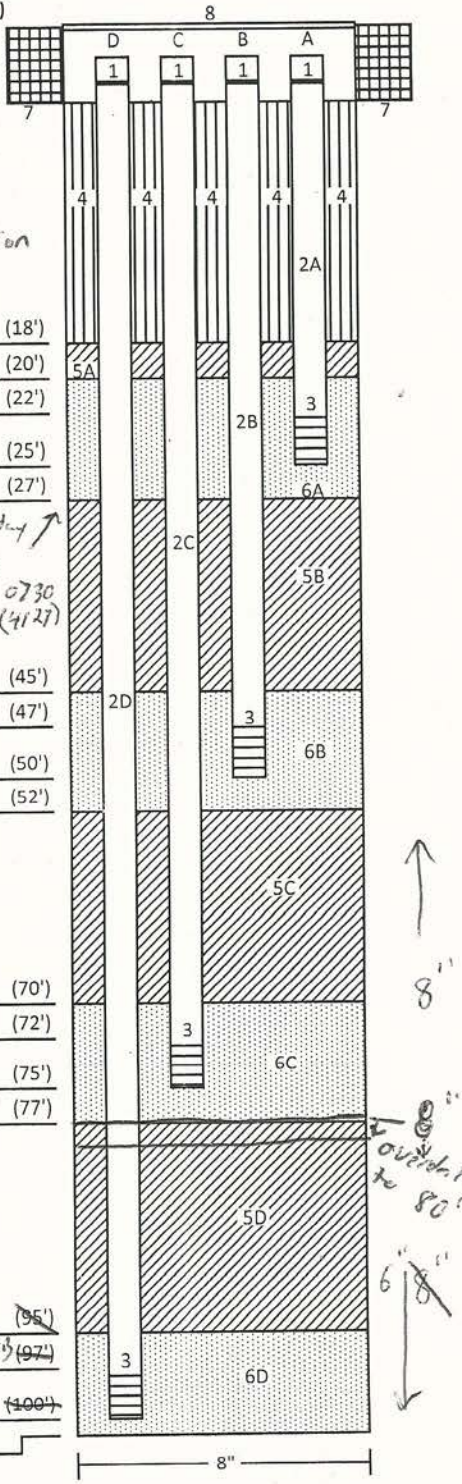
(8" max)
(2' min)

Boring 2W hydration 0800

18 (18')
20 (20')
22 (22')
25 (25')
27 (27')

stopped for day due to lightning 1500, Resume 0730 (4/27)

45 (45')
47 (47')
50 (50')
52 (52')
70 (70')
72 (72')
75 (75')
77 (77')
92 (95') ~~(95')~~
95 ~~94~~ 93 ~~(97')~~
98 ~~(100')~~
100



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	94	feet

3) 3 feet of 1-inch Diameter Schedule 80 PVC, 0.05" Slot Screen

4) High Sodium Bentonite Grout

Type: CETCO
Bag Size: 50 lb
Quantity: 3 bags ~ 90 gal

5) Bentonite Chips

Type: Cetco Pure gold medium chips
Bag Size: 50 #

5A)	1.5	bags
5B)	9.5	bags
5C)	9.75	bags
5D)	4.5	bags

6) Filter Sand

Type: #3 U.S. Silica Sand
Bag Size: 50 #

6A)	4	bags
6B)	2	bags
6C)	4.75	bags
6D)	~~2.44~~ 2.25	bags

Bottom well screen @ 98' 2' sand on bottom

7) Concrete

Type: Sakrete High-Strength Premix
Bag Size: 80lb
Quantity: 4 bags

8) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated
Size: 18"

Abbreviations

'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW05

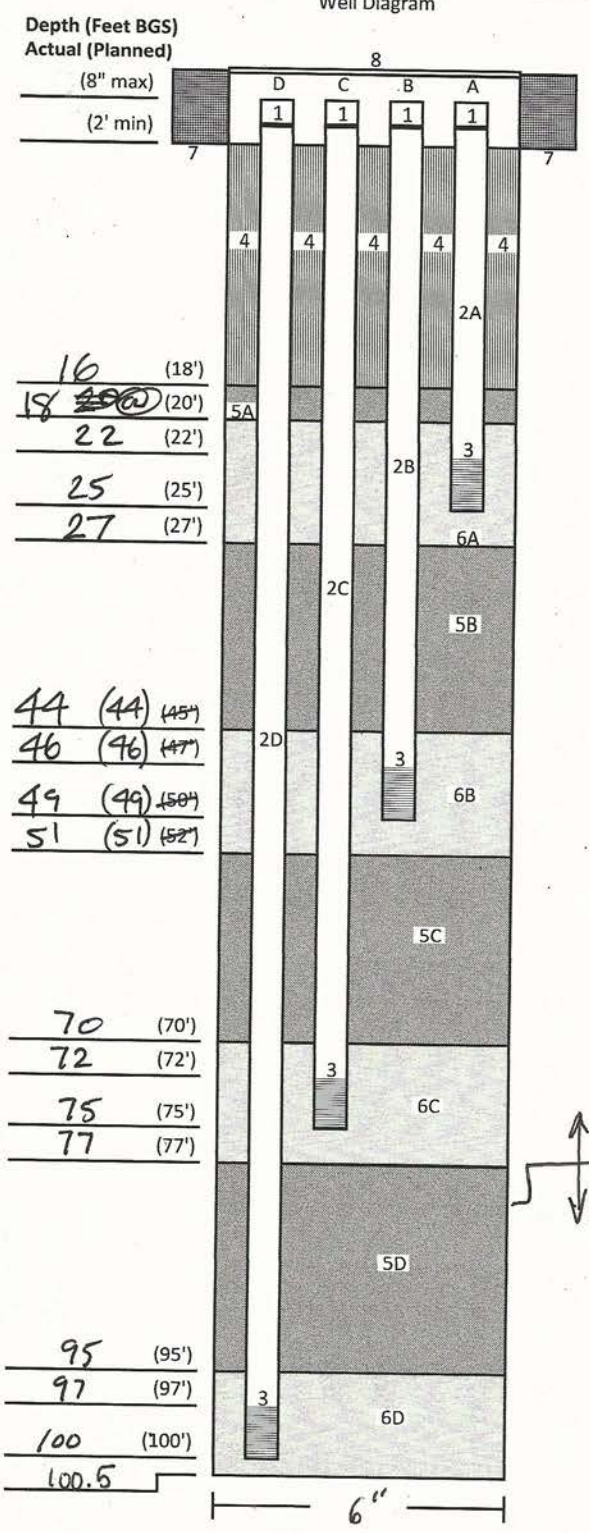
NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time: 4/28/16, 1100 — CH2M Logger: C. Leftich

End Date & Time: 4/29/16, 1510 — Drilling Contractor: Cascade Drilling LP

Water Level, Date & Time: NM — Drilling Method: Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	46	feet
2C)	~~72~~	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 3 bags ~~75~~ gals

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	8	bags
5C)	9	bags
5D)	5	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	6	bags
6B)	9	bags
6C)	4	bags
6D)	2	bags

8" / 80" / 6"

7) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80lb

Quantity: 4 bags

8) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated

Size: 18"

Abbreviations

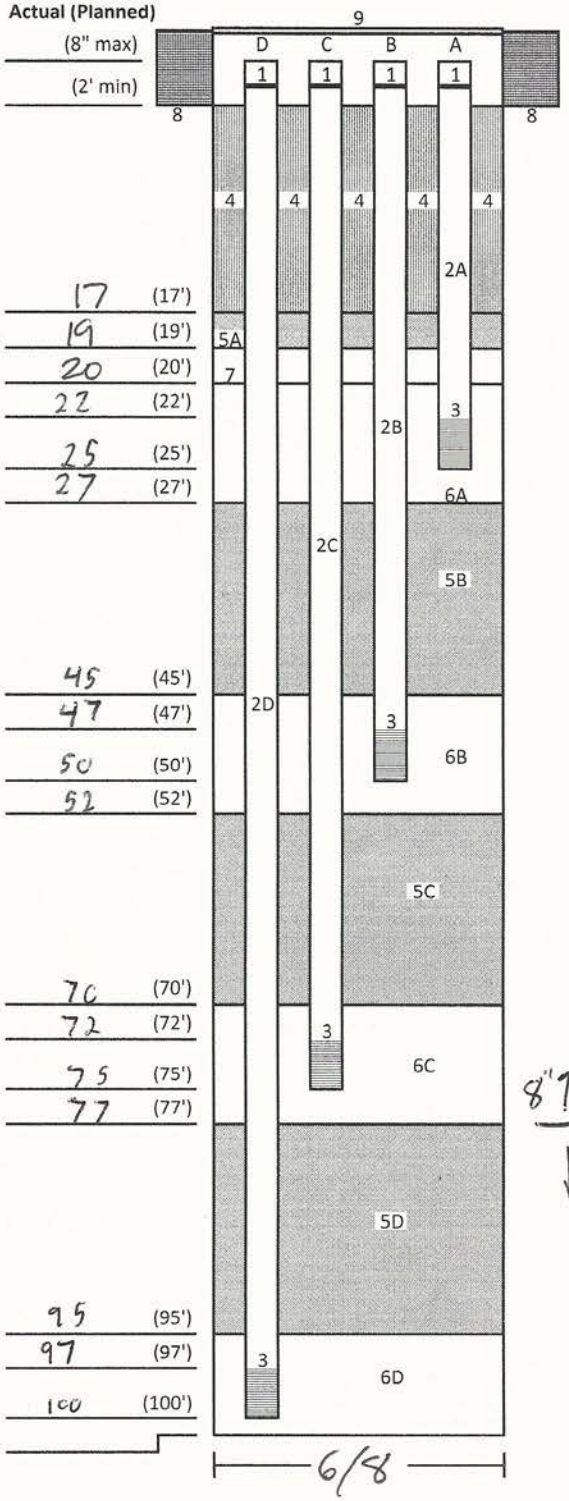
' feet
" inch
BGS below ground surface
PVC polyvinyl chloride

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	**WELL NUMBER** SW06

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	5/18/16 1445	CH2M Logger:	I Bingeman
End Date & Time:	5/19/16 0925	Drilling Contractor:	Cascade Drilling LP
Water Level, Date & Time:	–	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 1.25 bags 50 gal

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1.5	bags
5B)	7.25	bags
5C)	8	bags
5D)	6.5	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	2.75	bags
6B)	3.5	bags
6C)	2.5	bags
6D)	2	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

Bag Size: 50#

1/2 bags

8) Concrete

Type: Sakrete

Bag Size: 80#

Quantity: 4 bags

9) Road Box

Type: EMCO Wheaton Road Grade

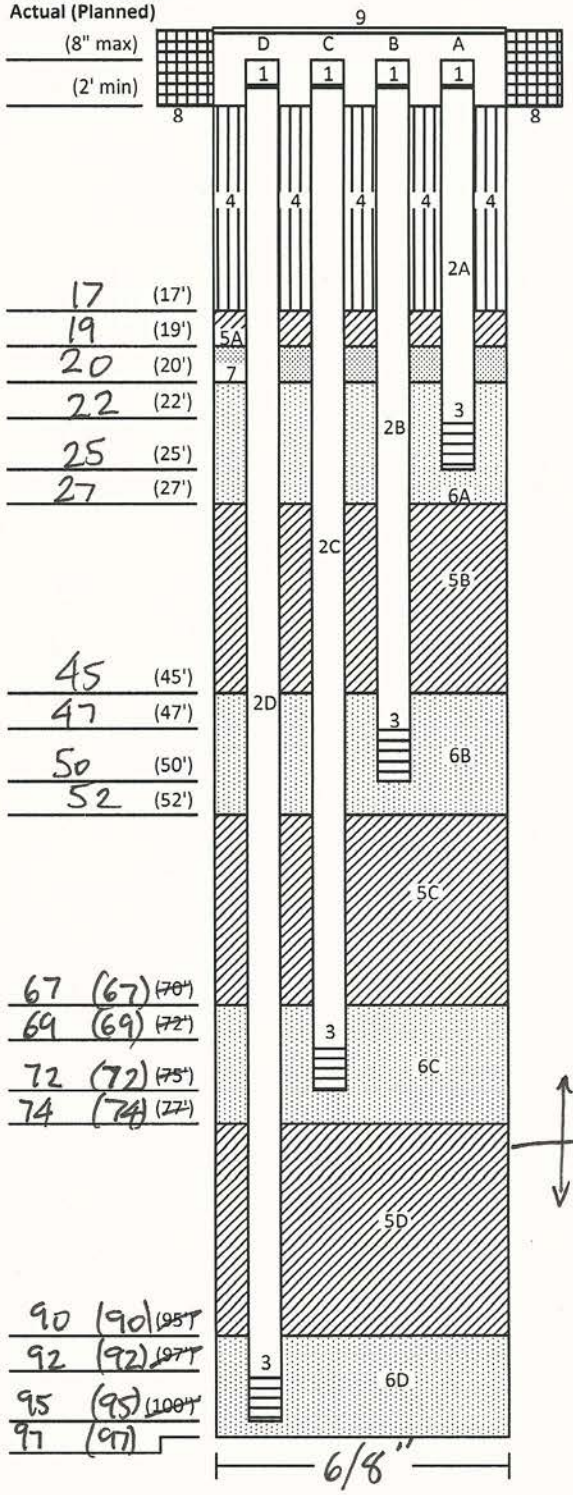
Size: 18"

ch2m.	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW08

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	5/24/16, 1100	CH2M Logger:	C. Lettich / I. Bingeman
End Date & Time:	5/25/16, 1445	Drilling Contractor:	Cascade Drilling LP, J. Gralia
Water Level, Date & Time:	NM	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) ~~Threaded Schedule 80 PVC Cap~~ 1" J-Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet	230'
2B)	47	feet	
2C)	69	feet	
2D)	92	feet	

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 2/50 bags/grout

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	~~2~~ 1	bags
5B)	6.5	bags
5C)	7	bags
5D)	6	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	3.5	bags
6B)	3	bags
6C)	4	bags
6D)	3	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

Bag Size: ~~50 #~~ 0.75 bags

8) Concrete

Type: Sakrete High-Strength Readymix

Bag Size: 80#

Quantity: 4 bags

9) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated

Size: 18"

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	**WELL NUMBER** SW09

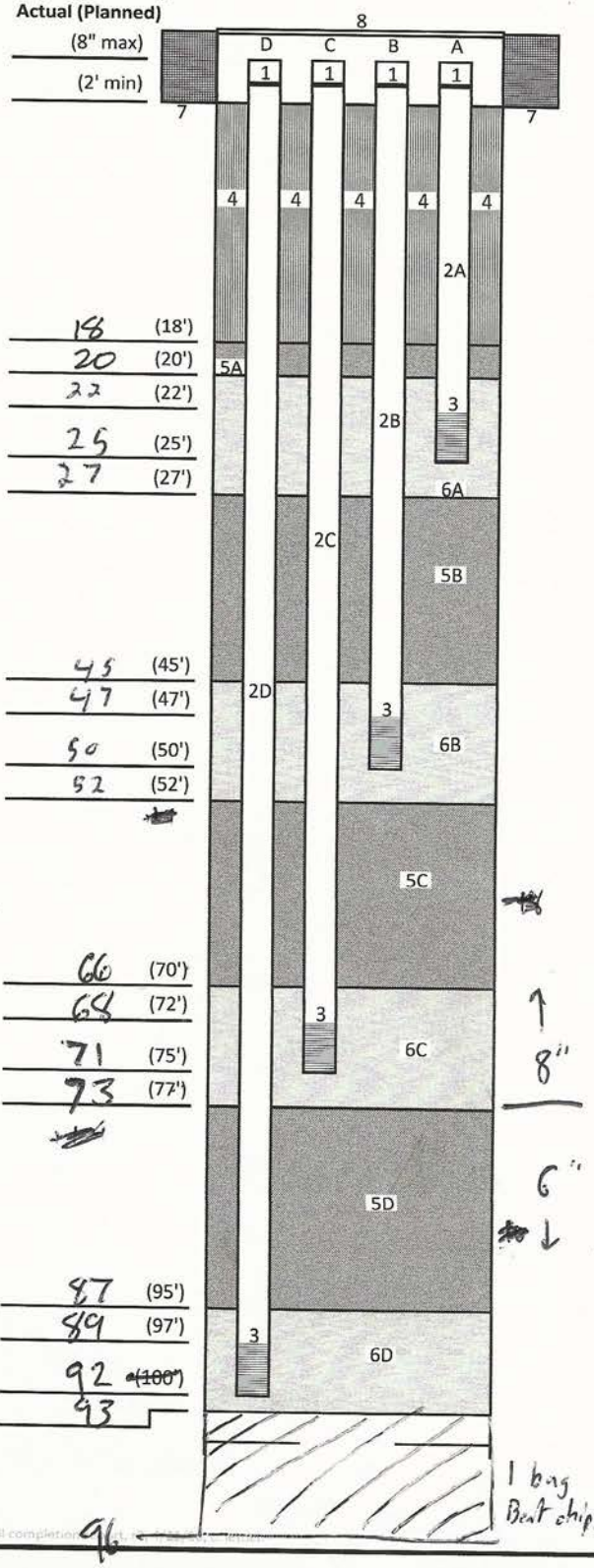
NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time: 5/3/16 1320 | CH2M Logger: I Bingeman

End Date & Time: 5/4/16 1301 | Drilling Contractor: Cascade Drilling LP

Water Level, Date & Time: — | Drilling Method: Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	68	feet
2D)	89	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 2 bags

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	6	bags
5C)	5.5	bags
5D)	3	bags

5E) 1 bag (93-96')

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	5	bags
6B)	4.5	bags
6C)	4	bags
6D)	3	bags

7) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80lb

Quantity: 4 bags

8) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated

Size: 18"

Abbreviations

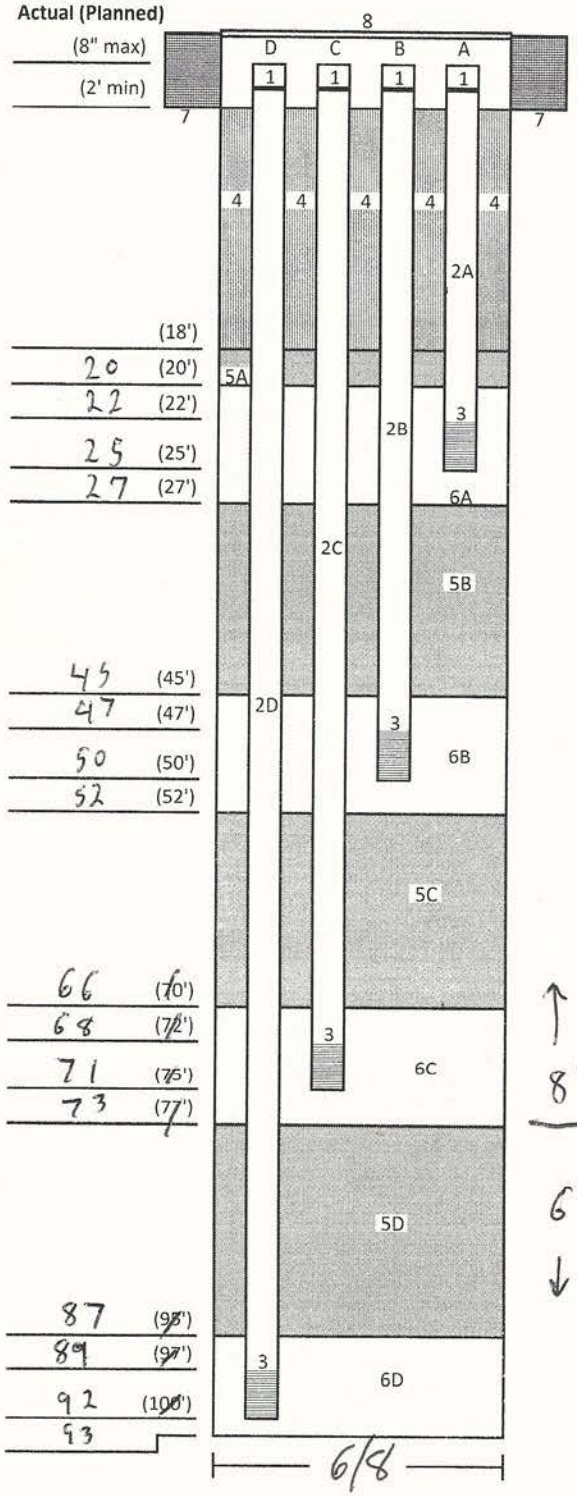
'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	**WELL NUMBER** SW10

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	5/5/16 1050	CH2M Logger:	I Bingeman
End Date & Time:	5/6/16 0803	Drilling Contractor:	Cascade Drilling LP
Water Level, Date & Time:	—	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	68	feet
2D)	89	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 2 bags

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	6.5	bags
5C)	5.5	bags
5D)	3.5	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	4.5	bags
6B)	5.5	bags
6C)	2.5	bags
6D)	2.5	bags

7) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80lb

Quantity: 3.5 bags

8) Road Box

Type: Emco Wheaton Heavy-Duty Traffic-Rated

Size: 18"

Abbreviations

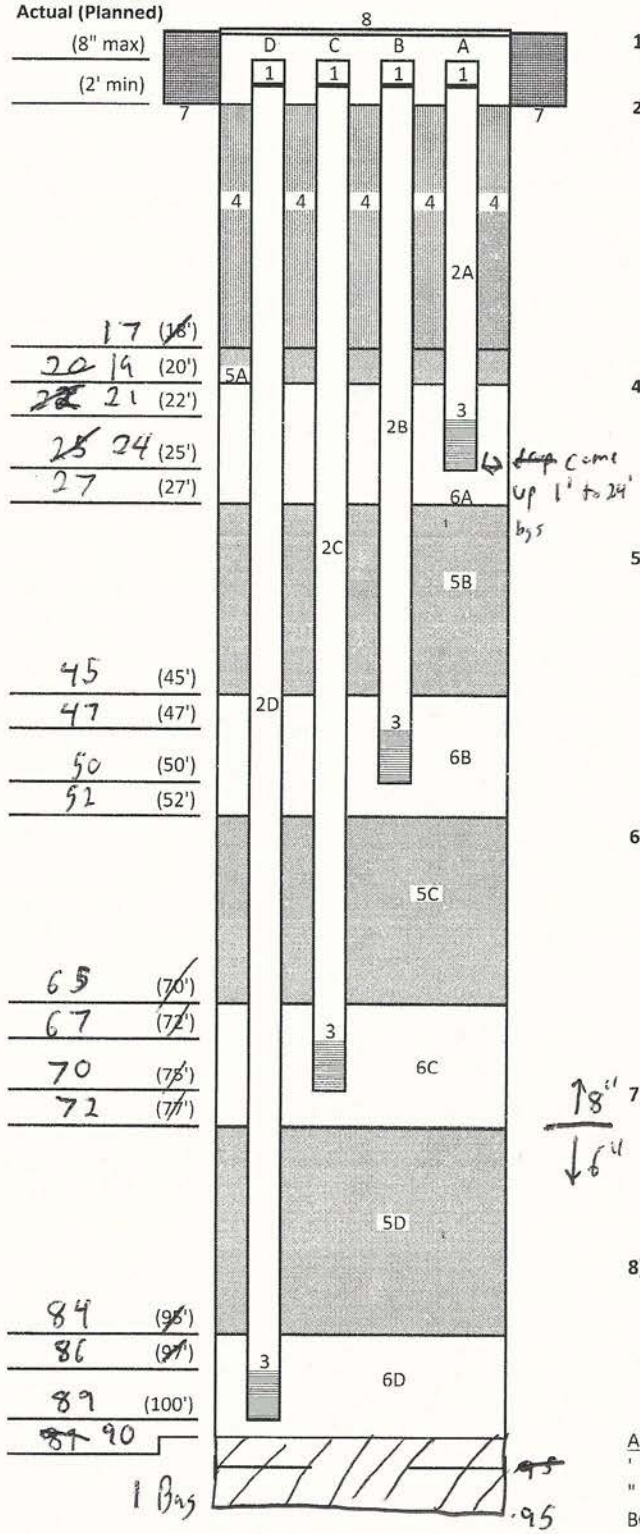
'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW11

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	1225 5/9/16	CH2M Logger:	J Bingeman
End Date & Time:	1203 5/10/16	Drilling Contractor:	Cascade Drilling LP
Water Level, Date & Time:	—	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	~~22~~ 21	feet
2B)	47	feet
2C)	67	feet
2D)	86	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 2 bags ~ 67 gal.

~~top~~ came up 1' to 24' bgs

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	0.5	bags	Hydrate 0933
5B)	6	bags	
5C)	5.5	bags	
5D)	3.5	bags	

5E) 1 bag (chips from 90-95)

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	~~3.5~~ 4.5	bags
6B)	3.75	bags
6C)	4.5	bags
6D)	2.5	bags

↑8" ↓6"

7) Concrete

Type: Sakrete

Bag Size: 80lbs

Quantity: 4 bags

8) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated

Size: 18"

Abbreviations

'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:

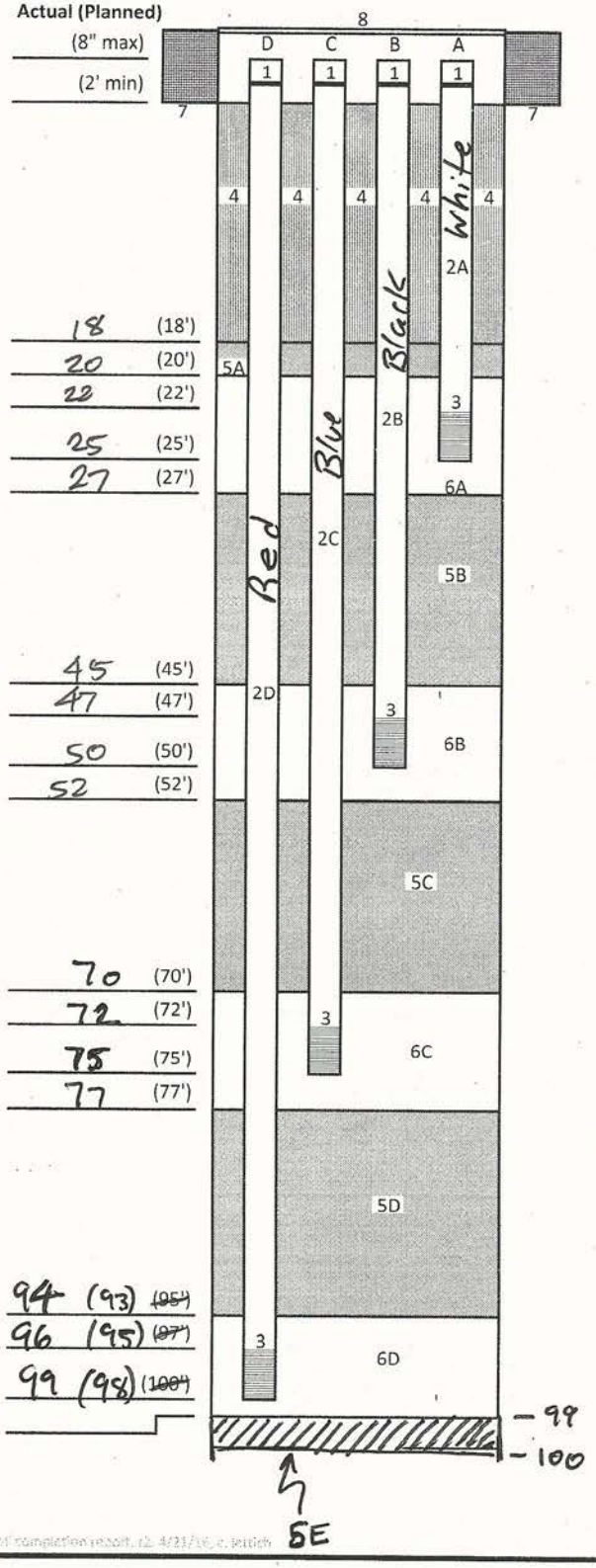
Orange & Rockland Utilities
Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

WELL NUMBER SW12

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time: 5/4/16, 0800
End Date & Time: 5/6/16, 1000
Water Level, Date & Time: NM
CH2M Logger: C. Lattich
Drilling Contractor: Cascade Drilling LP
Drilling Method: Rotosonic

Well Diagram



Well Materials Used

1) ~~Threaded Schedule 80 PVC Cap~~ 1" J-Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	96	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout
Bag Size: 50 pounds
Quantity: 2.5 bags

5) Bentonite Chips

Type: Cetco Puregold Medium Chips
Bag Size: 50 pounds

5A)	1	bags
5B)	7.5	bags
5C)	7.5	bags
5D)	~~3~~ 4	bags

5E) 0.25 bags (chips from 99-100)

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand
Bag Size: 50 pounds

6A)	4	bags
6B)	4	bags
6C)	4	bags
6D)	2	bags

7) Concrete

Type: Sakrete High-Strength Premix
Bag Size: 80 lb
Quantity: 3.5 bags

8) Road Box

Type: Emco Wheaton Heavy-Duty Traffic-Rated
Size: 18"

Abbreviations

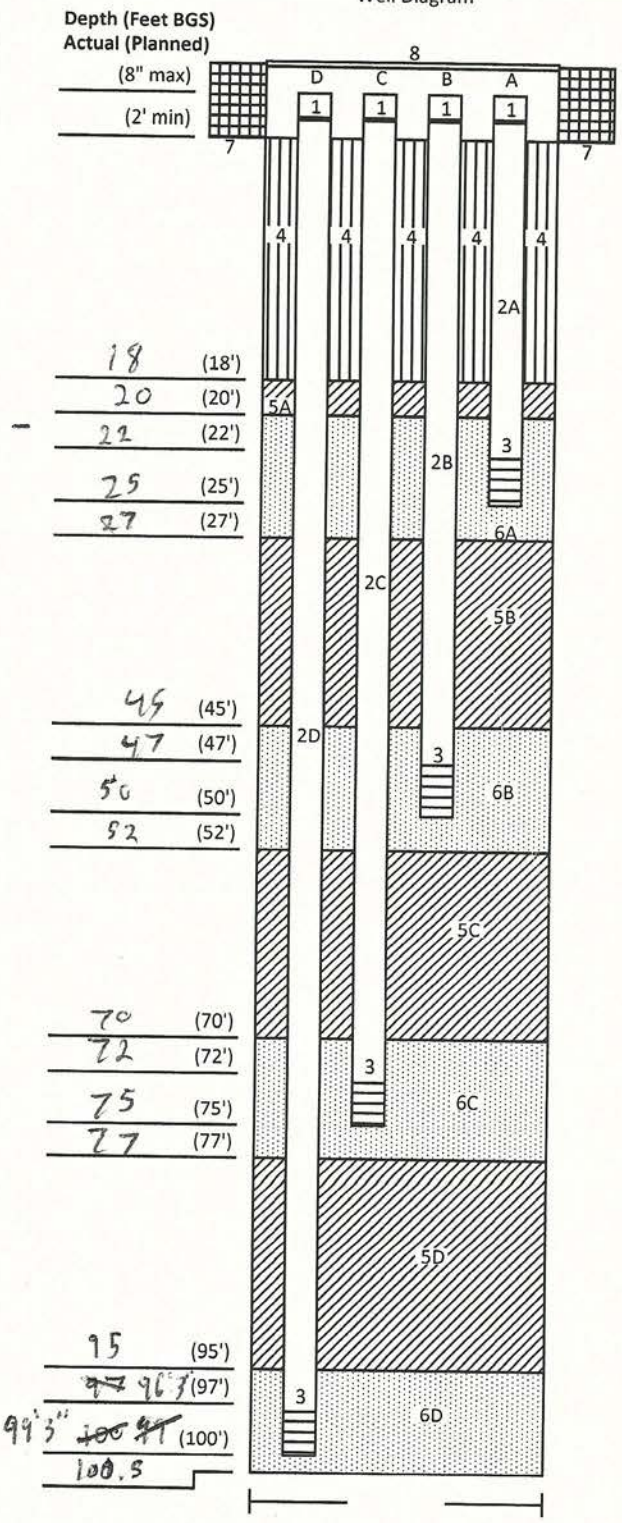
'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW13

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	5/11/16 1140	CH2M Logger:	I Bergeman
End Date & Time:	5/12/16 0956	Drilling Contractor:	Cascade Drilling LP
Water Level, Date & Time:	—	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22'	feet
2B)	47'	feet
2C)	72'	feet
2D)	96'3"	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 2/~~20~~ bags/gals

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	6	bags
5C)	8	bags
5D)	2.25	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

000 sand 1/2 bags

6A)	~~12~~ 3	bags
6B)	~~3~~ 4.5	bags
6C)	3	bags
6D)	2	bags

7) Concrete

Type: Sakrete

Bag Size: 80 lbs

Quantity: 3.5 bags

8) Road Box

Type: Emco Wheaton Heavy-Duty Traffic-Rated

Size: 18"

Abbreviations

'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:

Orange & Rockland Utilities
Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

WELL NUMBER SW14

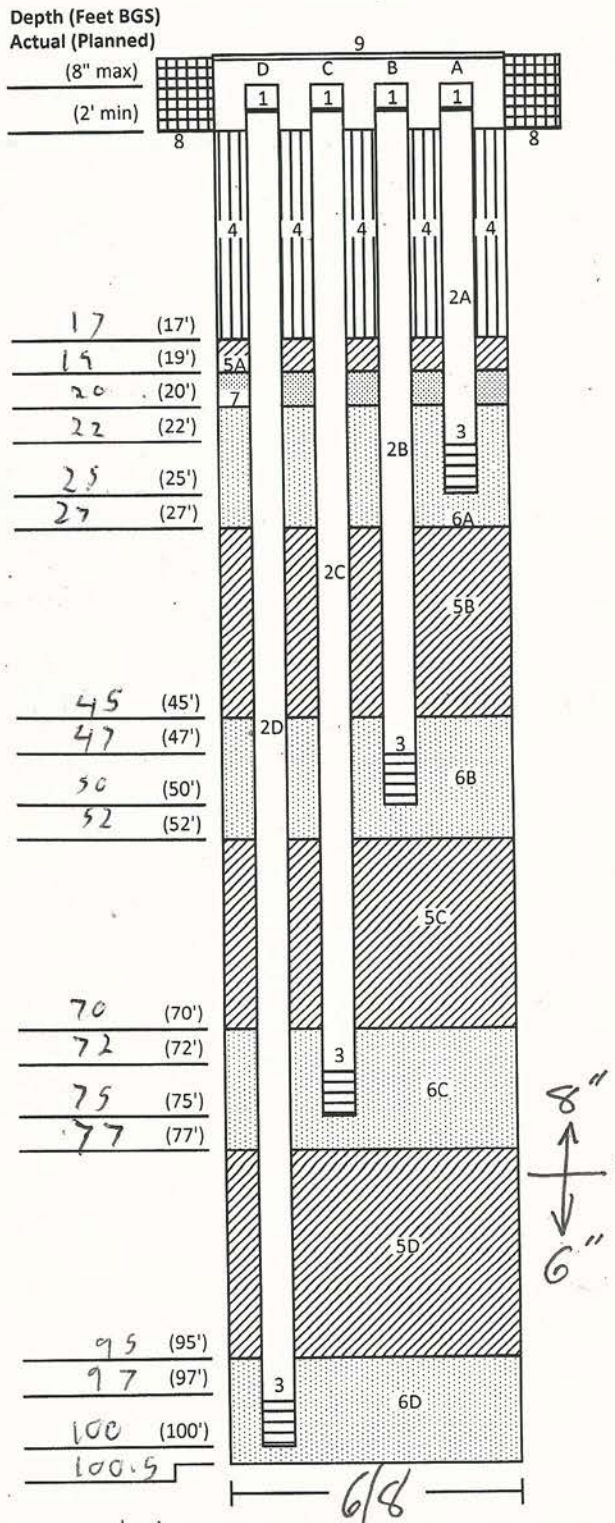
NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time: 5/20/16 0915 CH2M Logger: I Bingham

End Date & Time: 5/24/16 0841 Drilling Contractor: Cascade Drilling LP

Water Level, Date & Time: NM Drilling Method: Rotosonic

Well Diagram



Had to redrill to 100' due to broken well. Start setting 5/23/16 1135.

nested well completion report, rs: 5/13/16, c. lottich

Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 2.25 bags

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	4	bags
5C)	7	bags
5D)	4.5	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	3	bags
6B)	7	bags
6C)	4.5	bags
6D)	2.5	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

Bag Size: 30 Ft

1/2 bags

8) Concrete

Type: Sakrete

Bag Size: 80#

Quantity: 4 bags

9) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic Rated

Size: 16"

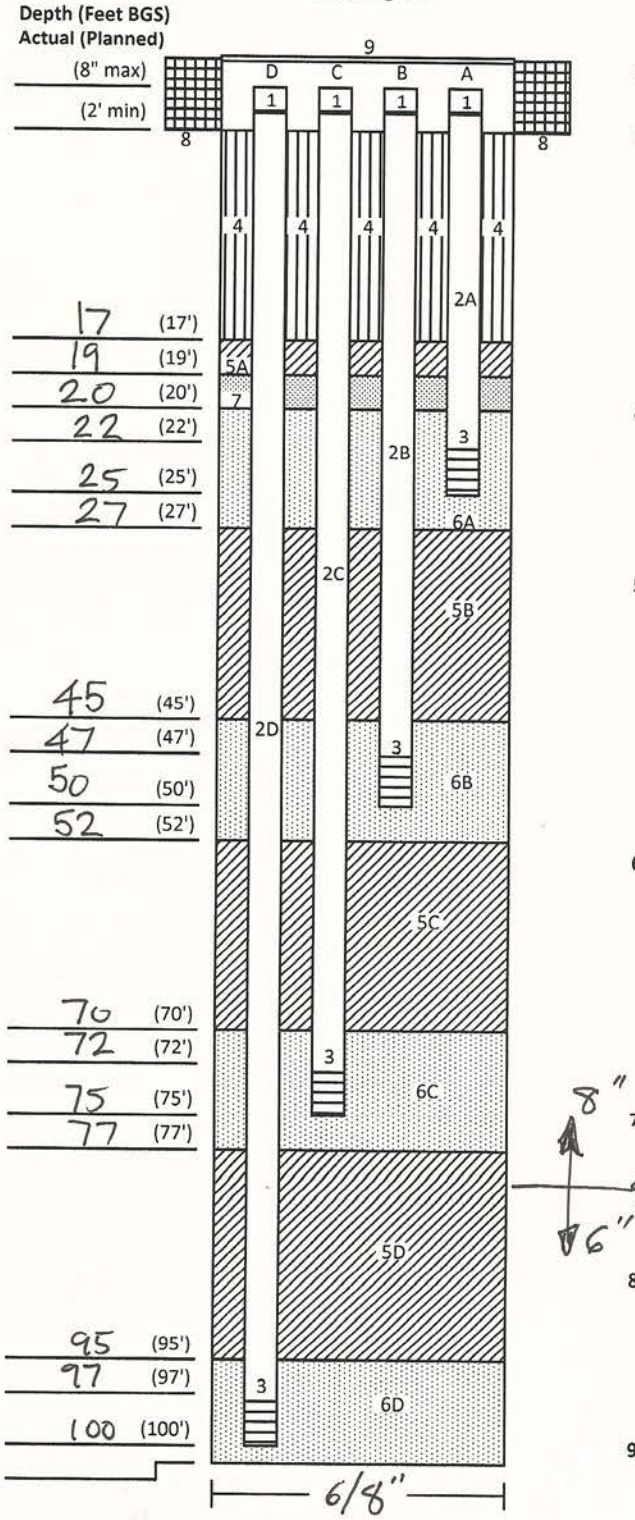
ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW15

NESTED SPARGE WELL COMPLETION REPORT

MD, 6" 100 rod

Start Date & Time:	5/23/16 0755	CH2M Logger:	C. Lettich
End Date & Time:	5/23/16, 1400	Drilling Contractor:	Cascade Drilling LP J. Weeks
Water Level, Date & Time:	NM	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 2/50 bags/gallons

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	9	bags
5C)	10	bags
5D)	5	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	4.5	bags
6B)	4.5	bags
6C)	4.5	bags
6D)	2	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

Bag Size: ~~0.5~~ 50lb

0.5 bags

8) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80lb

Quantity: 4 bags

9) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated

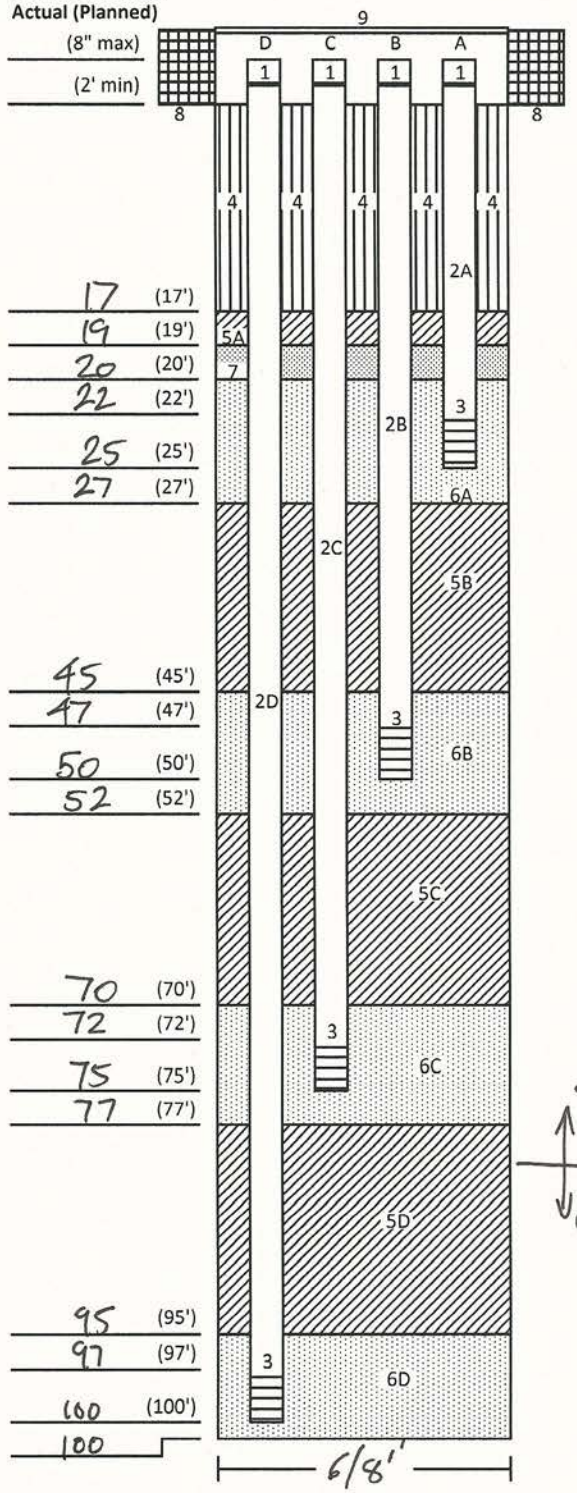
Size: 18"

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW17

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	5/19/16, 1530	CH2M Logger:	C. Lettich
End Date & Time:	5/20/16, 1400	Drilling Contractor:	Cascade Drilling LP J. Weeks
Water Level, Date & Time:	NM	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) ~~Threaded Schedule 80 PVC Cap~~ 1" J-Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 2 bags

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	6.5	bags
5C)	6	bags
5D)	4.5	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	5	bags
6B)	4	bags
6C)	5	bags
6D)	2	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

Bag Size: 50 lbs.

0.5 bags

8) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80 lb

Quantity: 4 bags

9) Road Box

Type: EMCO Wheaton, Heavy-Duty Traffic-Rated Vault

Size: 18"

ch2m

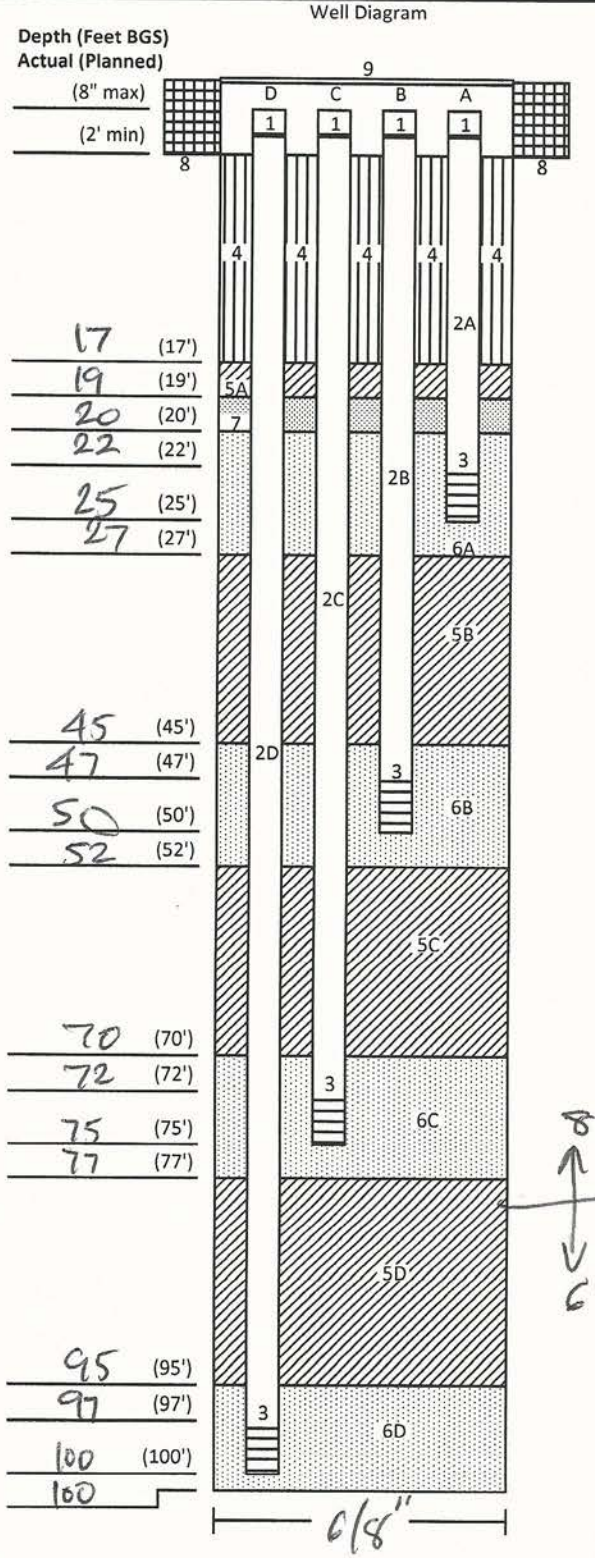
Orange & Rockland Utilities
Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

WELL NUMBER SW18

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	6/6/16, 0845	CH2M Logger:	C. Lettich
End Date & Time:	6/7/16, 1600	Drilling Contractor:	Cascade Drilling LP M. Queen
Water Level, Date & Time:	NM	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout
Bag Size: 50 pounds
Quantity: _____ bags

5) Bentonite Chips

Type: Cetco Puregold Medium Chips
Bag Size: 50 pounds

5A)	1	bags
5B)	8	bags
5C)	8	bags
5D)	4	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand
Bag Size: 50 pounds

6A)	4	bags
6B)	4	bags
6C)	4	bags
6D)	2	bags

7) Transition Sand

Type: #000 U.S. Silica Sand
Bag Size: ~~80# 50#~~
0.5 bags

8) Concrete

Type: Sakrete High-Strength ~~Red~~ Premix
Bag Size: 80#
Quantity: 5 bags

9) Road Box

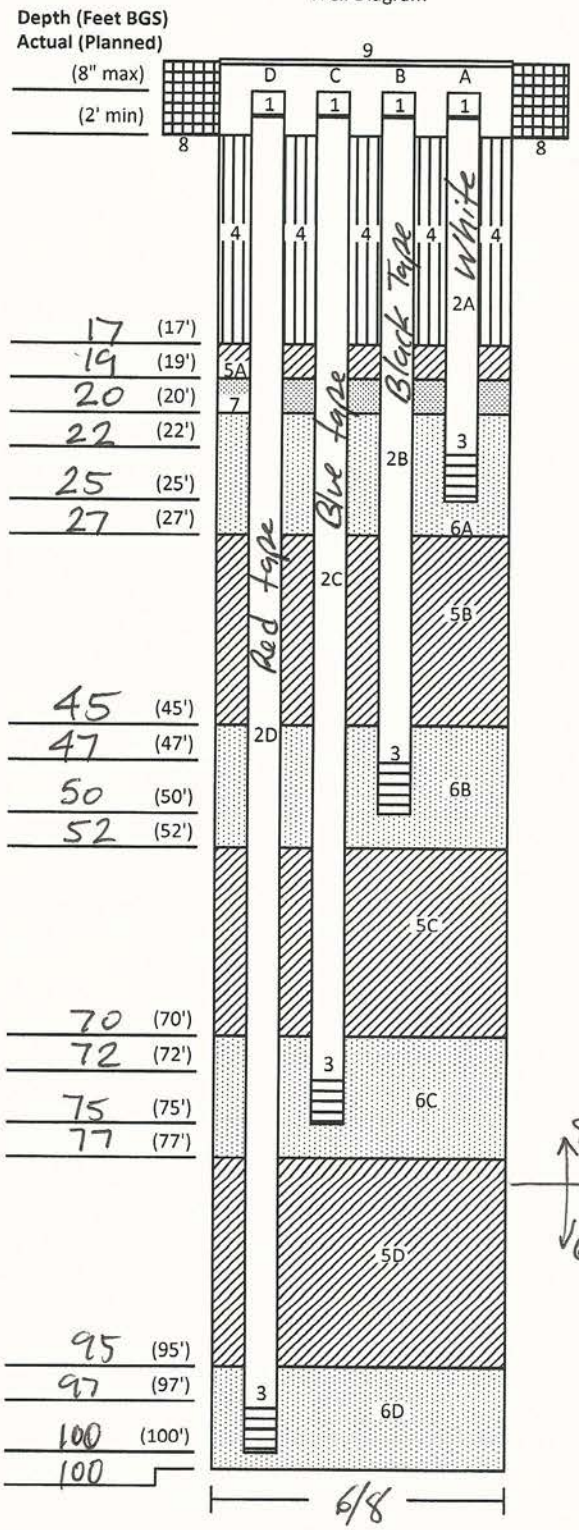
Type: Emco Wheaton High-Strength Traffic-Rated
Size: 18

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW19

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	5/19/16, 0750	CH2M Logger:	C. Lettich
End Date & Time:	5/19/16 1400	Drilling Contractor:	Cascade Drilling LP Jon Weeks
Water Level, Date & Time:	NM	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) ~~Threaded Schedule 80 PVC Cap~~ 1-inch J-Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

] 238' total riser

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 2/50 bags/gallons

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	6.5	bags
5C)	6	bags
5D)	4.5	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	4	bags
6B)	3.5	bags
6C)	4	bags
6D)	2.5	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

Bag Size: 50 lb

0.5 bags

8) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80 lb

Quantity: ~~3.5~~ 4.0 bags

9) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated

Size: 18"

ch2m:

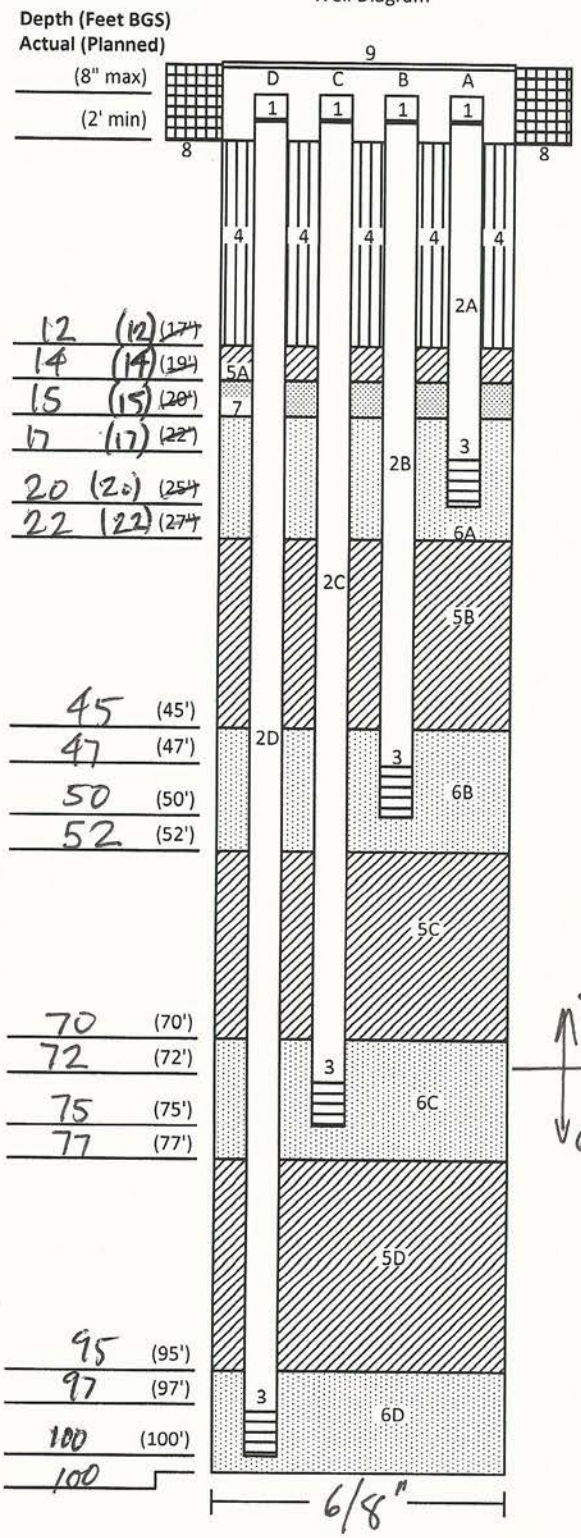
Orange & Rockland Utilities
Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

WELL NUMBER SW2Ø

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time: 5/23/16, 1530 — CH2M Logger: C. Lettich
End Date & Time: 5/24/16 1330 — Drilling Contractor: Cascade Drilling LP J. Weeks
Water Level, Date & Time: NM — Drilling Method: Rotosonic

Well Diagram



Well Materials Used

1) ~~Threaded Schedule 80 PVC Cap~~ 1" J-Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	17	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout
Bag Size: 50 pounds
Quantity: 1/30 bags/gallons

5) Bentonite Chips

Type: Cetco Puregold Medium Chips
Bag Size: 50 pounds

5A)	1	bags
5B)	6	bags
5C)	8	bags
5D)	5	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand
Bag Size: 50 pounds

6A)	4	bags
6B)	4	bags
6C)	4	bags
6D)	2	bags

7) Transition Sand

Type: #000 U.S. Silica Sand
Bag Size: ~~50#~~
0.5 bags

8) Concrete

Type: Sakrete High-Strength Premix
Bag Size: 4
Quantity: 80# bags

9) Road Box

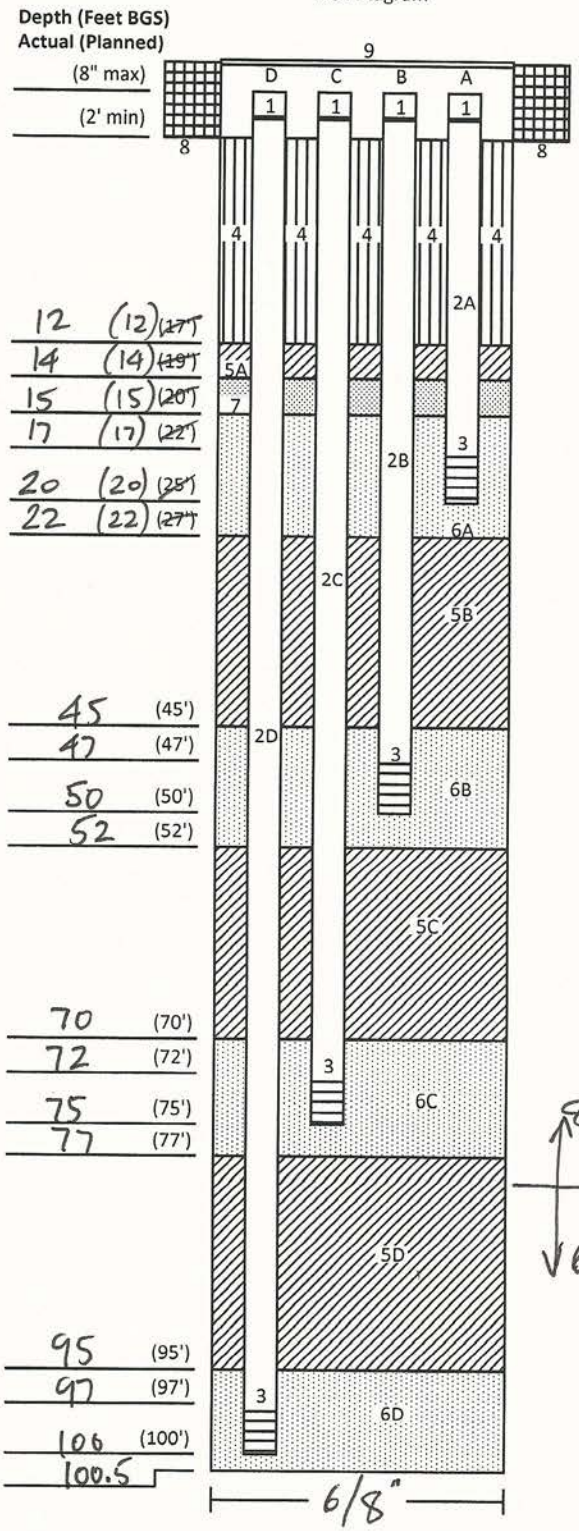
Type: Emco Wheaton Heavy-Duty Traffic-Rated
Size: 18"

ch2m	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW21

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	5/31/16, 0900	CH2M Logger:	C. Lettich
End Date & Time:	5/31/16, 1630	Drilling Contractor: Cascade Drilling LP	M. Queen
Water Level, Date & Time:	NM	Drilling Method: Rotosonic	

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	17	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 31/30 bags/gallons

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	10	bags
5C)	8	bags
5D)	4	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	4	bags
6B)	4	bags
6C)	4	bags
6D)	2	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

Bag Size:

0.5 bags

8) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80lb

Quantity: 4 bags

9) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated

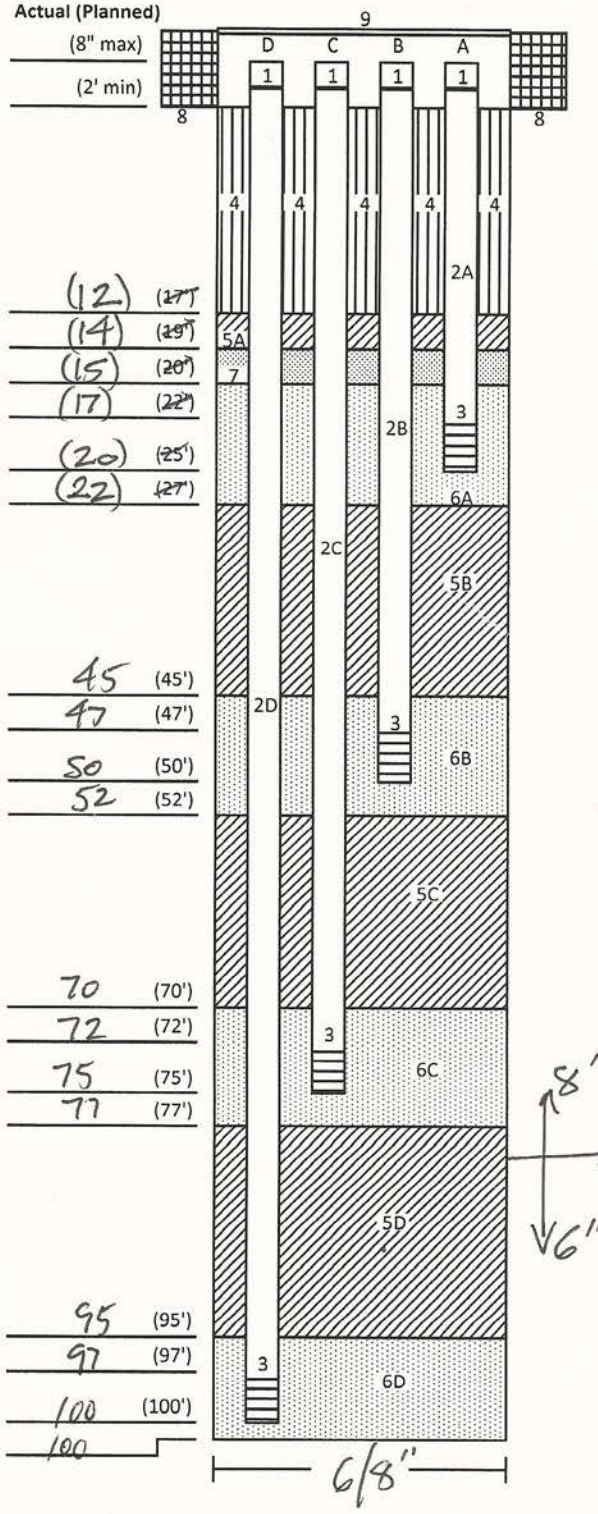
Size: 18"

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW22

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	6/2/16, 0930	CH2M Logger:	C. Lettich
End Date & Time:	6/2/16, 1620	Drilling Contractor:	Cascade Drilling LP M. Queen
Water Level, Date & Time:	NM	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	17	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 1/30 bags/gallons

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	4	bags
5B)	10	bags
5C)	10	bags
5D)	8	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)		bags
6B)	4	bags
6C)	4	bags
6D)	2.5	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

Bag Size: @ 50#

0.5 bags

8) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80#

Quantity: 4 bags

9) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic Rated

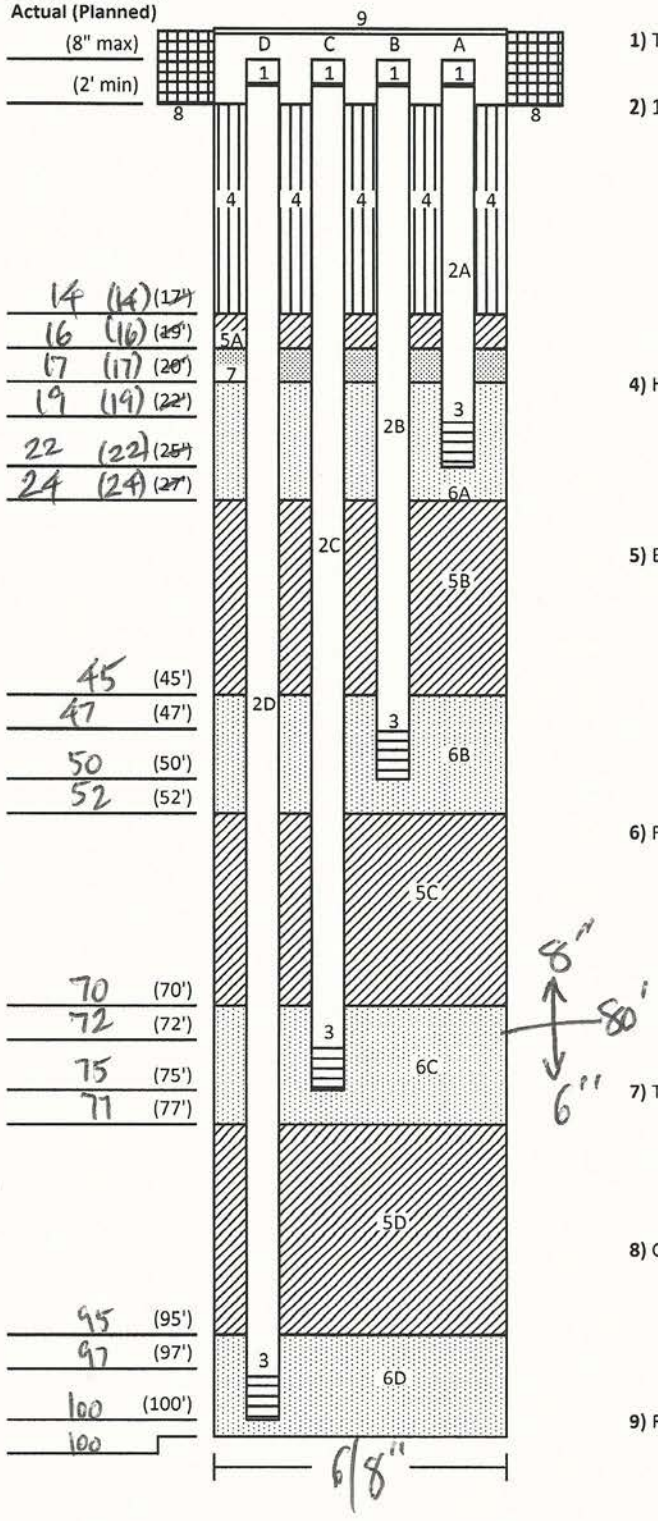
Size: 18"

ch2m	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW23

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	6/3/16, 0830	CH2M Logger:	C. Lettich
End Date & Time:	6/6/16, 1130	Drilling Contractor:	Cascade Drilling LP M. Queen/B. Frim
Water Level, Date & Time:	NM	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	19	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: ~~6~~ bags

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	9	bags
5C)	8	bags
5D)	4	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	4	bags
6B)	4.5	bags
6C)	4.5	bags
6D)	2	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

Bag Size: ~~50#~~ 50#

0.5 bags

8) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80#

Quantity: bags

9) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated

Size: 18"

ch2m

Orange & Rockland Utilities
Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

WELL NUMBER SW24

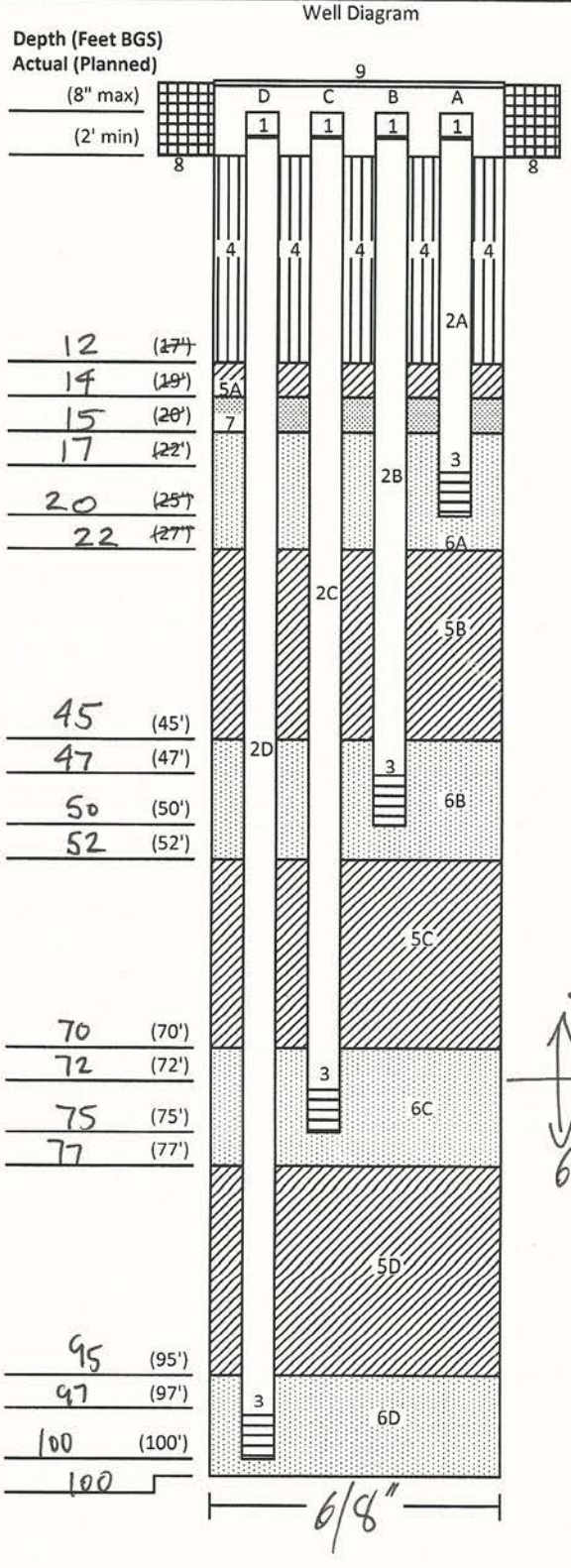
NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time: 6/1/16, 0830 | CH2M Logger: C. LeHich

End Date & Time: 6/2/16, 0900 | Drilling Contractor: Cascade Drilling LP B. Grim

Water Level, Date & Time: NM | Drilling Method: Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	17	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: ~~61.5~~/40 bags/gallons

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	9.5	bags
5C)	8	bags
5D)	4	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	4	bags
6B)	4	bags
6C)	4.5	bags
6D)	2	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

Bag Size: 50 #

0.5 bags

8) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80#

Quantity: 4 bags

9) Road Box

Type: Emco Wheaton Heavy-Duty Traffic-Rated

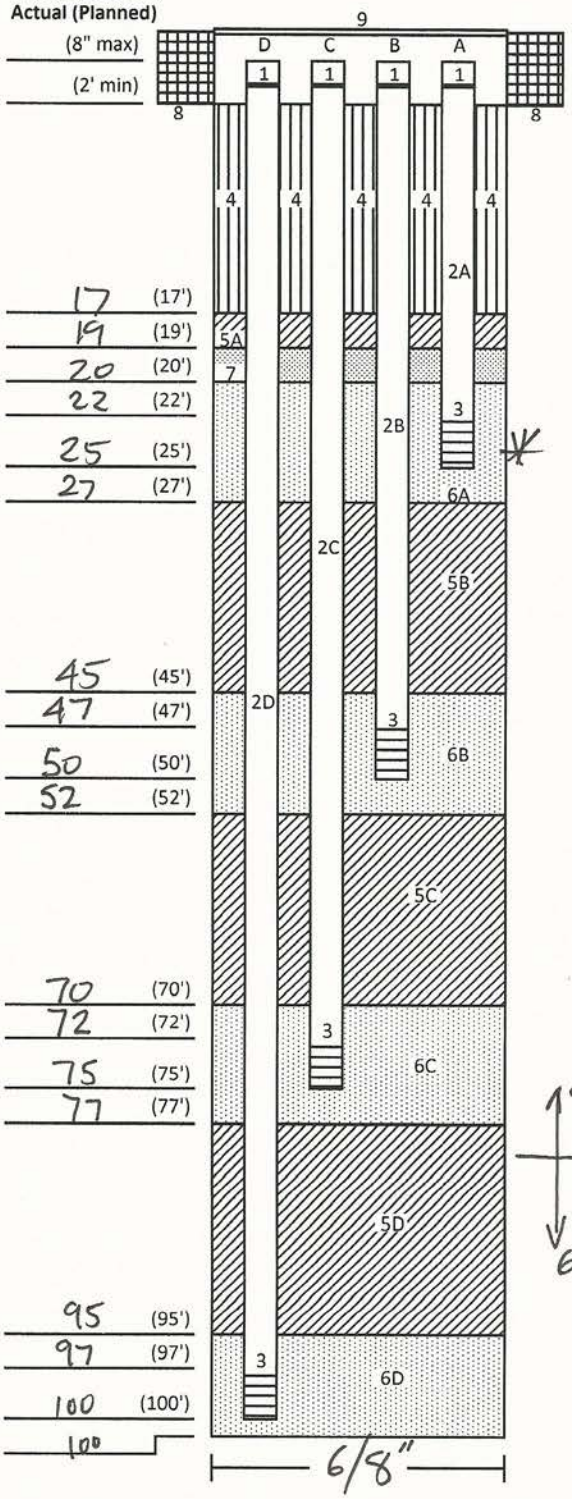
Size: 18"

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW25

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	5/26/16, 0930	CH2M Logger:	C. Lettich
End Date & Time:	5/26/16, 1600	Drilling Contractor:	Cascade Drilling LP J. Weeks
Water Level, Date & Time:	NM	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) ~~Threaded Schedule 80 PVC Cap~~ 1-inch J-Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 2/50 bags / gallons

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	8	bags
5C)	7	bags
5D)	4.5	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	4	bags
6B)	4	bags
6C)	4	bags
6D)	2	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

~~80~~ Bag Size: 50#

0.5 bags

8) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80lb

Quantity: 4 bags

9) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated

Size: 18"

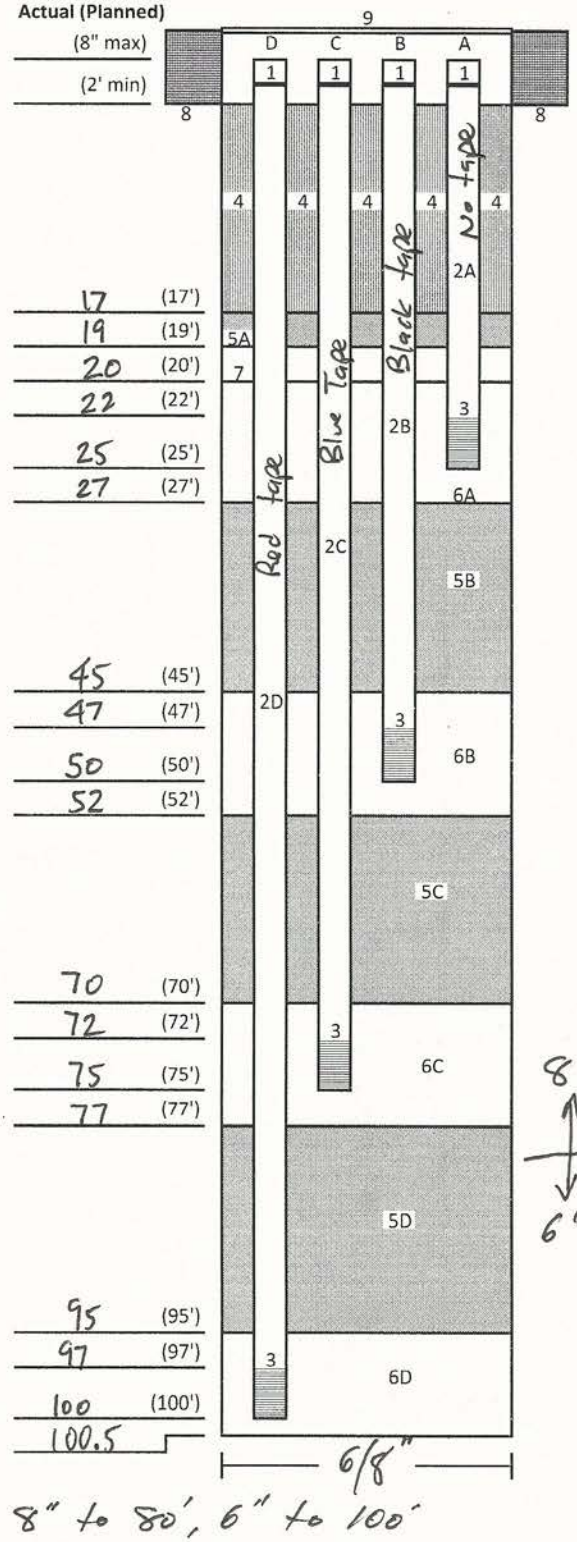
* while setting well tape on top of casing was not completely secured & 6" on sand fell into casing

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW26

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	5/17/16, 1530	CH2M Logger:	L. Baerger / C. Hettich
End Date & Time:	5/18/16, 0930	Drilling Contractor:	Cascade Drilling LP Jon Weeks
Water Level, Date & Time:	NM	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) ~~Threaded Schedule 80 PVC Cap~~ 1" J-Plugs

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 1.5/~~30~~ 45 bags/gallons

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	8	bags
5C)	8	bags
5D)	3	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	5	bags
6B)	5	bags
6C)	5	bags
6D)	2	bags

7) Transition Sand

Type: #000 U.S. Silica Sand

Bag Size: 50 lbs

0.5 bags

8) Concrete

Type: Sakrete High-Strength Premixed Concrete

Bag Size: 80 lb

Quantity: 4 bags

9) Road Box

Type: EMCO Wheaton 18" heavy-duty traffic-rated vault

Size: 18"

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW27

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time: 5/16/16
End Date & Time: 5/16/16 1600
Water Level, Date & Time: NM

CH2M Logger: L. BARCLAY
Drilling Contractor: Cascade Drilling LP J. WEBBS
Drilling Method: Rotosonic

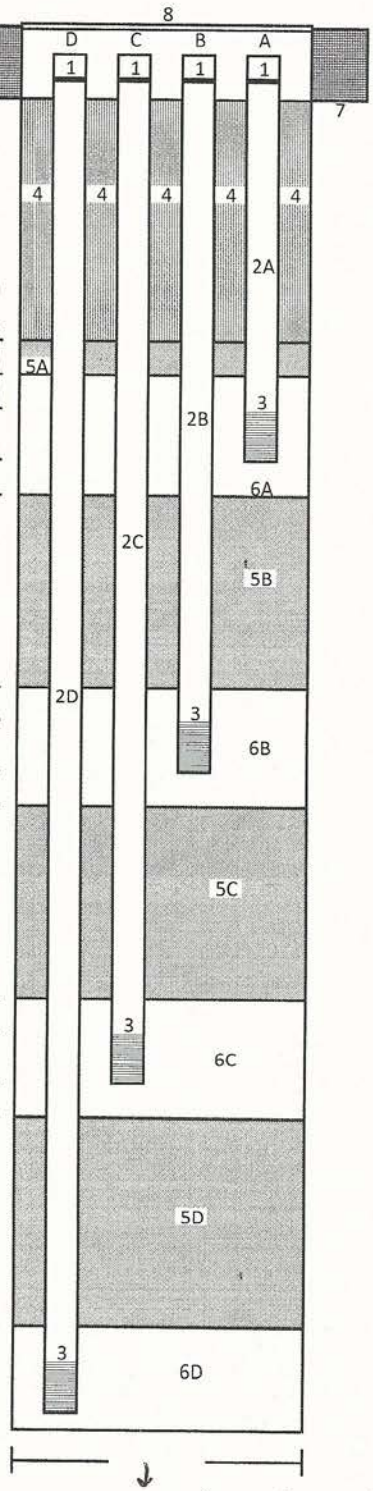
Well Diagram

Depth (Feet BGS)
Actual (Planned)

(8" max)
(2' min)

17 Bent. Chips
19 #1000
20

17' (18')
20 (20')
22 (22')
25 (25')
27 (27')
45 (45')
47 (47')
50 (50')
52 (52')
70 (70')
72 (72')
75 (75')
77 (77')
95 (95')
97 (97')
100 (100')
100.5



6" CASING TO 100.5 FT (including Silt)
5" CASING TO 80.5 FT (including Silt)

Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout
Bag Size: 50 pounds
Quantity: 2 1/2 bags

5) Bentonite Chips

Type: Cetco Puregold Medium Chips
Bag Size: 50 pounds

5A)	1	bags
5B)	7.5	bags
5C)	7.5	bags
5D)	4	bags

6) Filter Sand 0.5 #1000 SAND

Type: #3 U.S. Silica Filpro Sand
Bag Size: 50 pounds

6A)	14	bags
6B)	4	bags
6C)	4	bags
6D)	2	bags

7) Concrete

Type: Sakrete High Strength Premix
Bag Size: 80lb
Quantity: 4 bags

8) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated
Size: 18"

Abbreviations

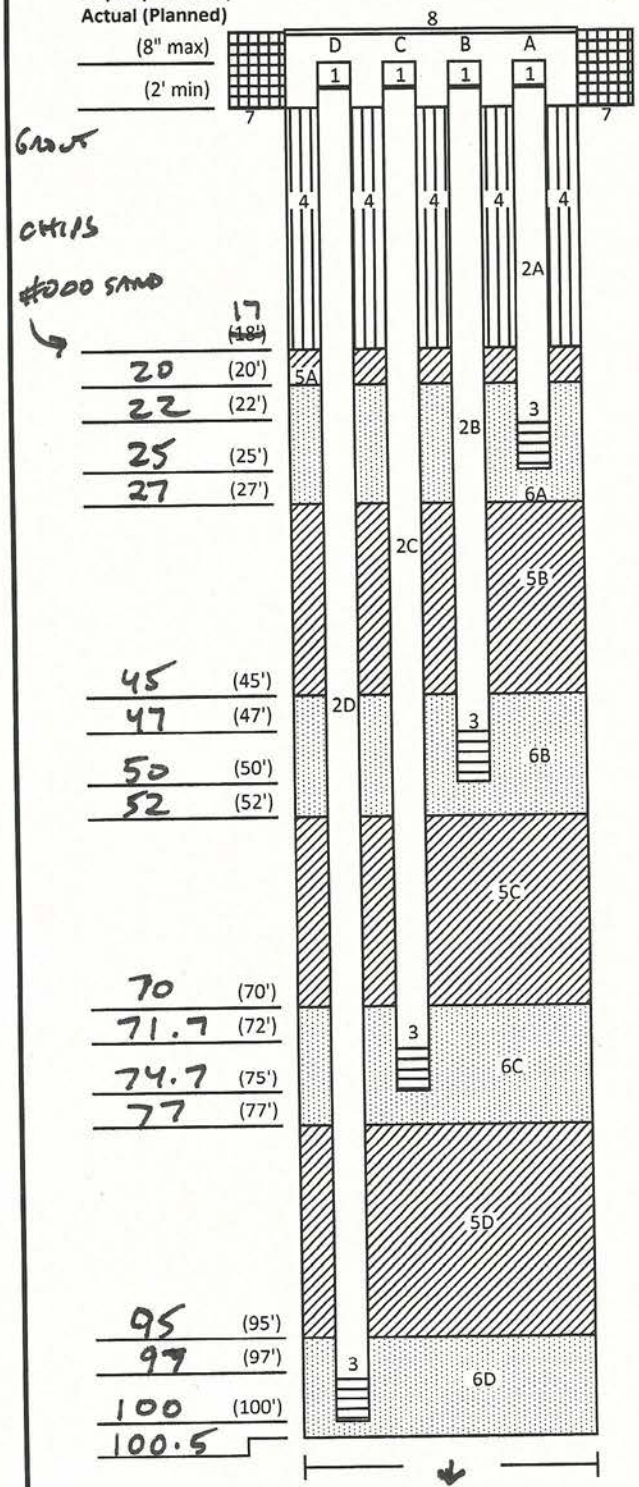
'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW28

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	5/12/16 @ 1600	CH2M Logger:	L. BAERGA
End Date & Time:	5/13/16 @ 1110	Drilling Contractor:	Cascade Drilling LP — M. QUEEN
Water Level, Date & Time:	NM	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet	
2B)	47 ~~50~~	feet	
2C)	~~74.7~~	feet	71.7
2D)	97	feet	

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 2.5 bags/gals

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	8	bags
5C)	8	bags
5D)	4	bags

6) Filter Sand — 1 BAG OF #000 SAND

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	4	bags
6B)	4	bags
6C)	4	bags
6D)	2	bags

7) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80lb

Quantity: 4 bags

8) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated

Size: 18"

Abbreviations

'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m

Orange & Rockland Utilities
Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

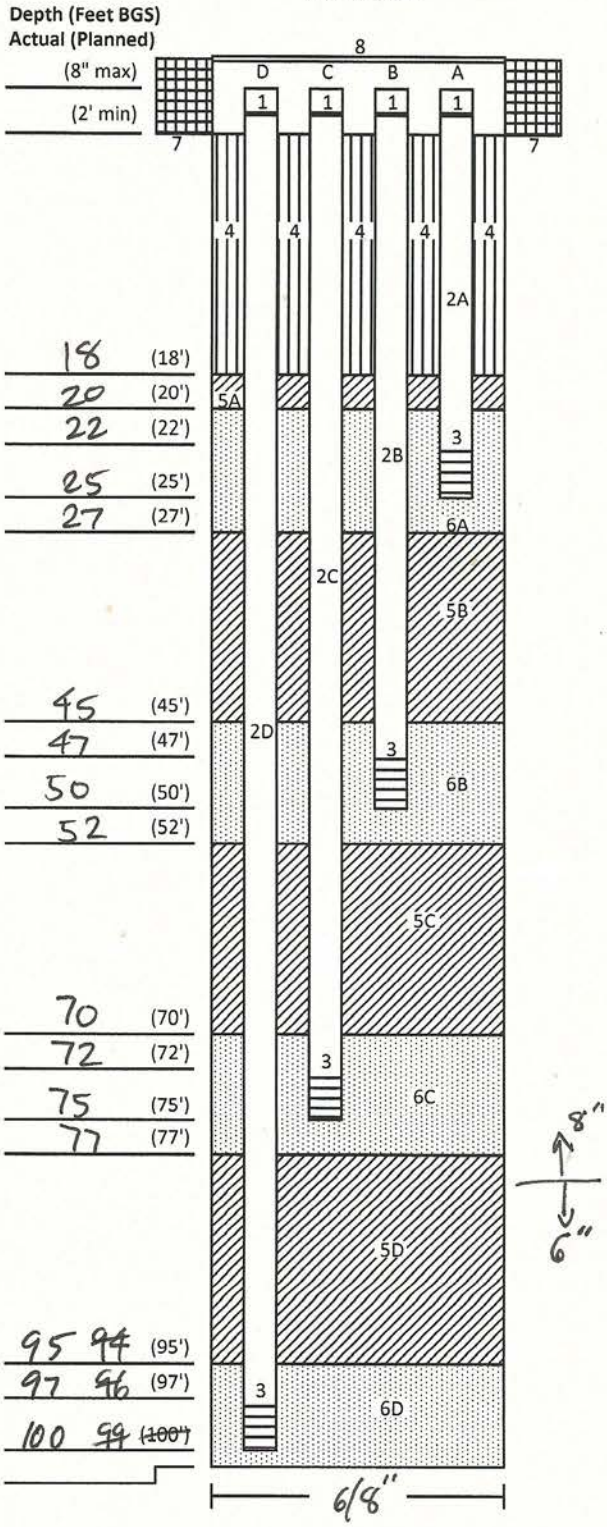
WELL NUMBER
SW29

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time: 5/6/16, 1040
End Date & Time: 5/9/16, 1615
Water Level, Date & Time: NM

CH2M Logger: C. Lettich
Drilling Contractor: Cascade Drilling LP, Max Queen
Drilling Method: Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout
Bag Size: 50 pounds
Quantity: 2.5/~60 bags/gals

5) Bentonite Chips

Type: Cetco Puregold Medium Chips
Bag Size: 50 pounds

5A)	1	bags
5B)	8	bags
5C)	8	bags
5D)	4	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand
Bag Size: 50 pounds

6A)	3.5	bags
6B)	4	bags
6C)	3.5	bags
6D)	3	bags

7) Concrete

Type: Sakrete High-Strength Premix
Bag Size: 80 lb
Quantity: 4 bags

8) Road Box

Type: Emco Wheaton Heavy-Duty Traffic-Rated
Size: 18"

Abbreviations

'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:

Orange & Rockland Utilities
Suffern Former Manufactured Gas Plant Site
Suffern, NY, Project 650199.11.01

WELL NUMBER SW3Ø

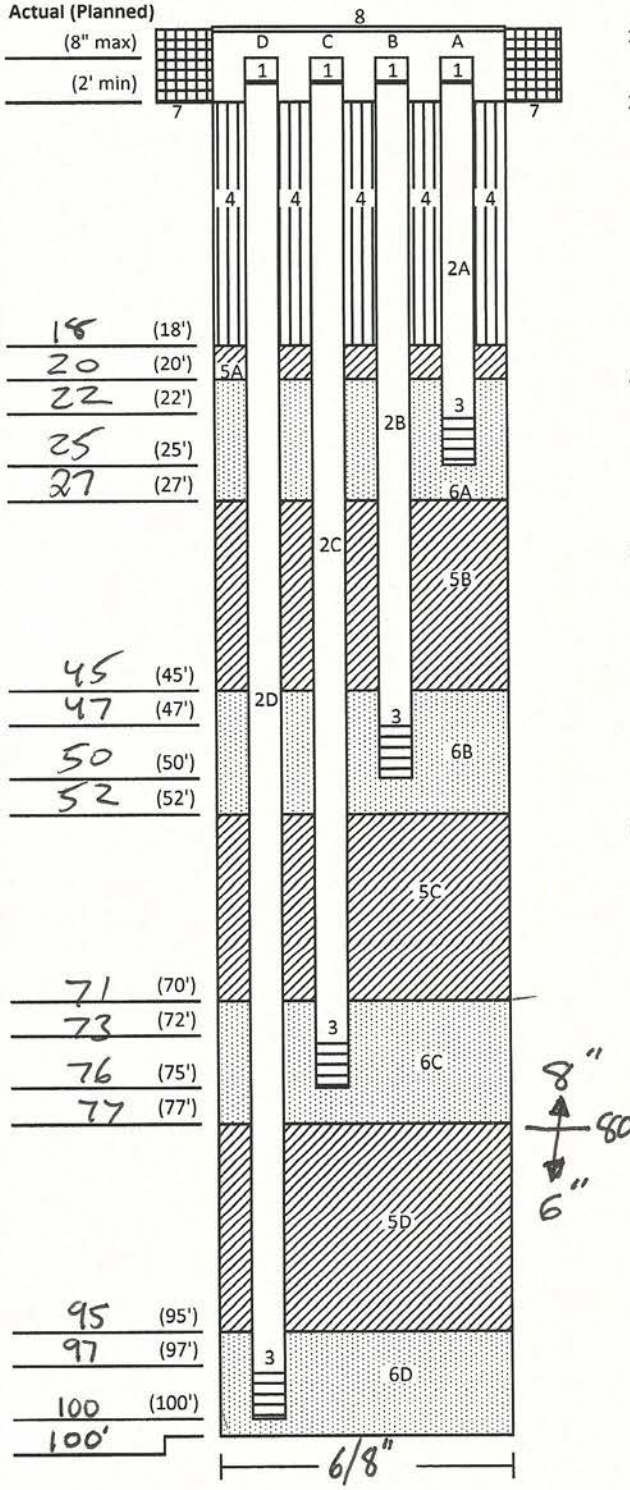
NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time: 5/10/16, 0840 | CH2M Logger: C. Lettich

End Date & Time: 5/11/16, 1235 | Drilling Contractor: Cascade Drilling LP, Max Queen

Water Level, Date & Time: NM | Drilling Method: Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	73	feet
2D)	97	feet

3) 3' of 1" Diameter Schedule 80 PVC, 0.05" Slot with 3" end cap.

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout

Bag Size: 50 pounds

Quantity: 3/75 bags/gals

5) Bentonite Chips

Type: Cetco Puregold Medium Chips

Bag Size: 50 pounds

5A)	1	bags
5B)	9	bags
5C)	8	bags
5D)	4	bags

6) Filter Sand

Type: #3 U.S. Silica Filpro Sand

Bag Size: 50 pounds

6A)	5	bags
6B)	5	bags
6C)	4	bags
6D)	2	bags

7) Concrete

Type: Sakrete High-Strength Premix

Bag Size: 80lb

Quantity: 4 bags

8) Road Box

Type: Emro Wheaton Traffic-Rated Heavy-Duty

Size: 18"

Abbreviations

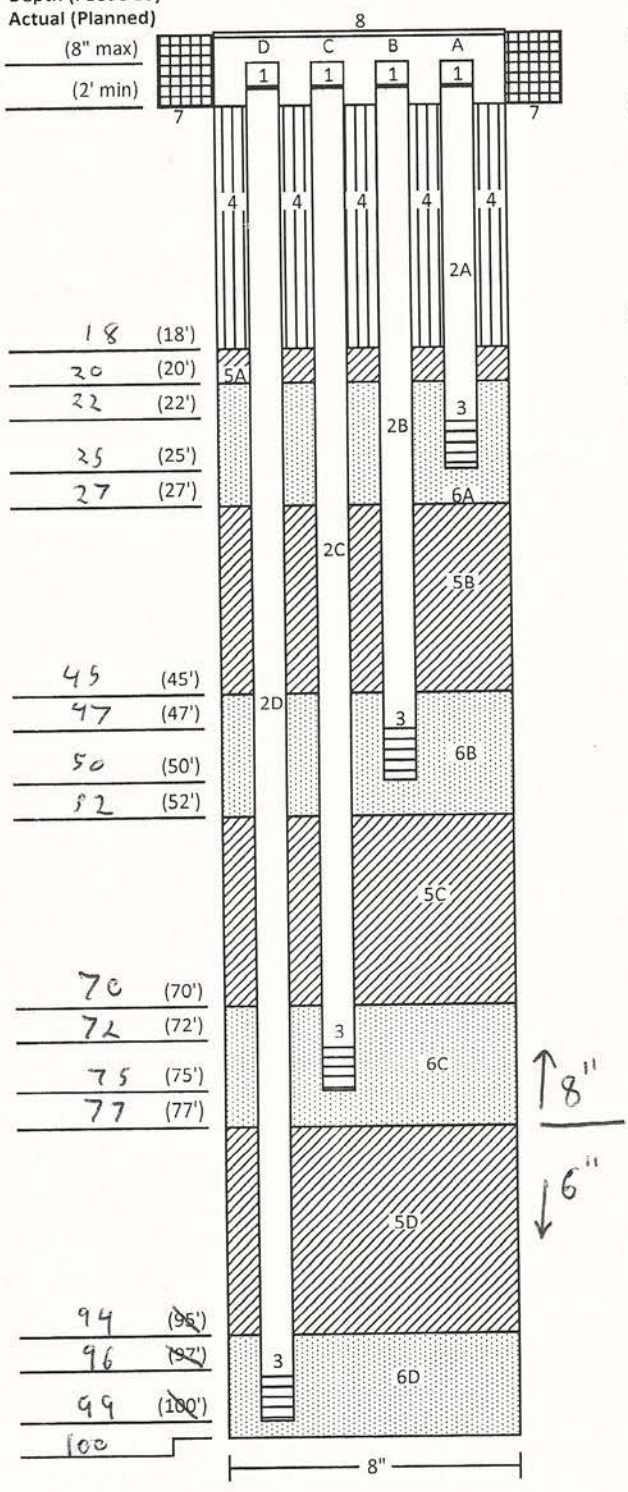
'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW31

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	4/29/16 1308	CH2M Logger:	I Bingeman
over weekend End Date & Time:	5/2/16 1215	Drilling Contractor:	Cascade Drilling LP
Water Level, Date & Time:	—	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	96	feet

3) 3 feet of 1-inch Diameter Schedule 80 PVC, 0.05" Slot Screen

4) High Sodium Bentonite Grout

Type: Ceto High Solids Powdered Grout
Bag Size: 50#
Quantity: 3 bags 75 gals

5) Bentonite Chips

Type: Puregold Medium chips
Bag Size: 50 #

5A)	1.5	bags
5B)	5	bags
5C)	4.5	bags
5D)	3	bags

6) Filter Sand

Type: #3 U.S. Silica Sand
Bag Size: 50#

6A)	5	bags
6B)	3.5	bags
6C)	3.5	bags
6D)	2.5	bags

7) Concrete

Type: Sakrete High-Strength Premix
Bag Size: 80#
Quantity: 4 bags

8) Road Box

Type: Emco Wheaton Heavy-Duty Traffic-rated
Size: 18"

Abbreviations

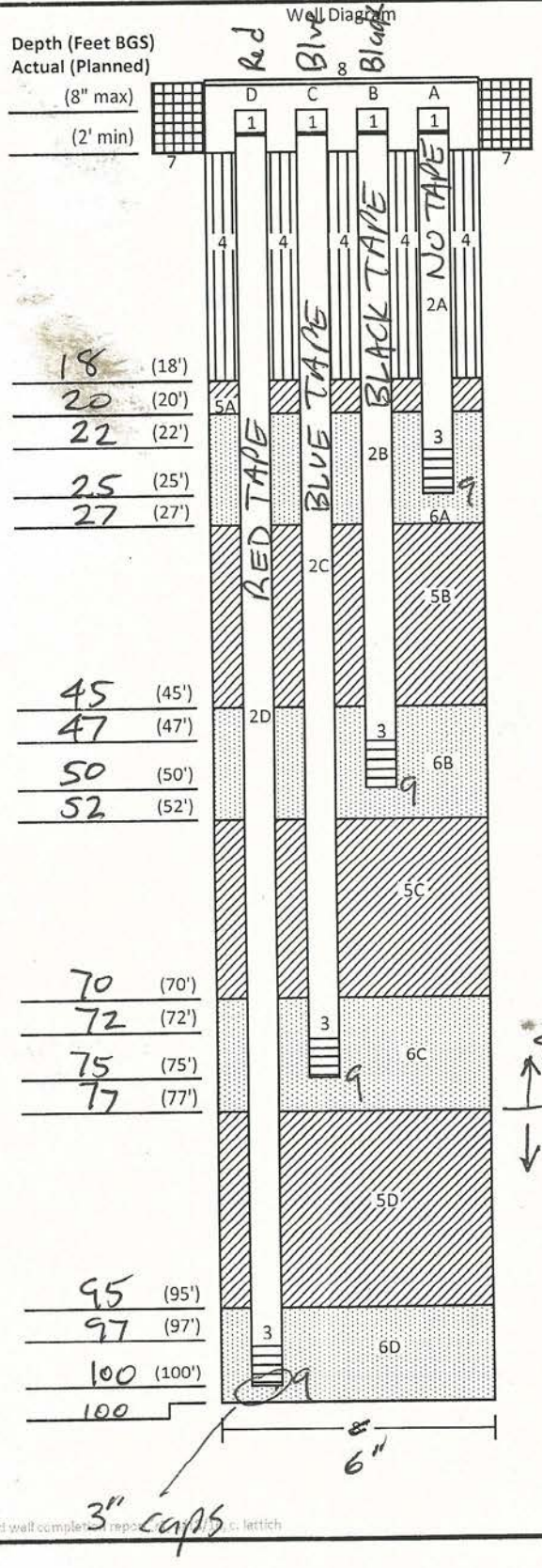
'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW32

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time: 4/19/16, 1400	CH2M Logger: C. Hlitch
End Date & Time: 4/21/16, 1240	Drilling Contractor: Cascade Drilling LP
Water Level, Date & Time: NM	Drilling Method: Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	97	feet
2B)	72	feet
2C)	47	feet
2D)	22	feet

3) 3 feet of 1-inch Diameter Schedule 80 PVC, 0.05" Slot Screen

4) High Sodium Bentonite Grout

Type: Cetco High Solids Powdered Grout
Bag Size: 50 #
Quantity: 1 bags ~45 gal

5) Bentonite Chips

Type: Cetco Pureqold Medium Chips
Bag Size: 50 lb

5A)	0.5	bags
5B)	5.0	bags
5C)	4.5	bags
5D)	3	bags

6) Filter Sand

Type: #3 U.S. Silica Sand (Filpro)
Bag Size: 50 #

6A)	~~5~~ 5.5	bags
6B)	4.0	bags
6C)	4.5	bags
6D)	1.75	bags

4.1.15

7) Concrete

Type: Sakrete High-Strength Premix
Bag Size: 80 lb
Quantity: 4 bags

8) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated
Size: 18"

9) 3" long 1" diameter cap

Abbreviations

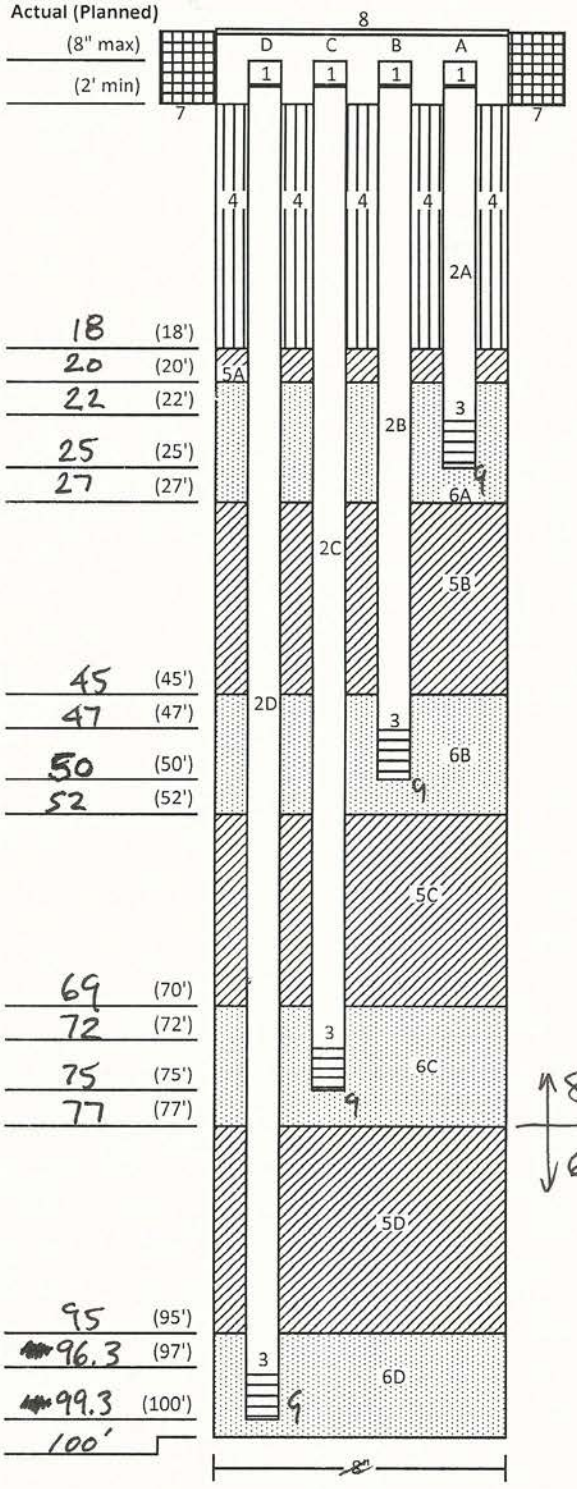
'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW33

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time: 4/22/1135	CH2M Logger: C. Lettich
End Date & Time: 4/26/16 0815	Drilling Contractor: Cascade Drilling LP
Water Level, Date & Time:	Drilling Method: Rotosonic

Well Diagram



Well Materials Used

1) ~~Threaded Schedule 80 PVC Cap~~ 1" J-Plug

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	72	feet
2D)	96.3	feet

3) 3 feet of 1-inch Diameter Schedule 80 PVC, 0.05" Slot Screen

4) High Sodium Bentonite Grout

Type: Cetco High Solids Bentonite Grout
Bag Size: 50#
Quantity: 2 bags ~40 gals

5) Bentonite Chips

Type: Cetco Puregold Medium Chips
Bag Size: 50#

5A)	1.0	bags
5B)	~~4.25~~ 5.5	bags
5C)	4.5	bags
5D)	3	bags

6) Filter Sand Filpro

Type: #3 U.S. Silica Sand
Bag Size: 50#

6A)	~~4.5~~ 5.0	bags
6B)	4.5	bags
6C)	3	bags
6D)	2.75	bags

7) Concrete

Type: Sakrete High-Strength Premix
Bag Size: ~~80#~~
Quantity: 4 bags

8) Road Box

Type: EMCO Wheaton High-Strength Traffic-Rated
Size: 18"

9) 3" long end cap

Abbreviations

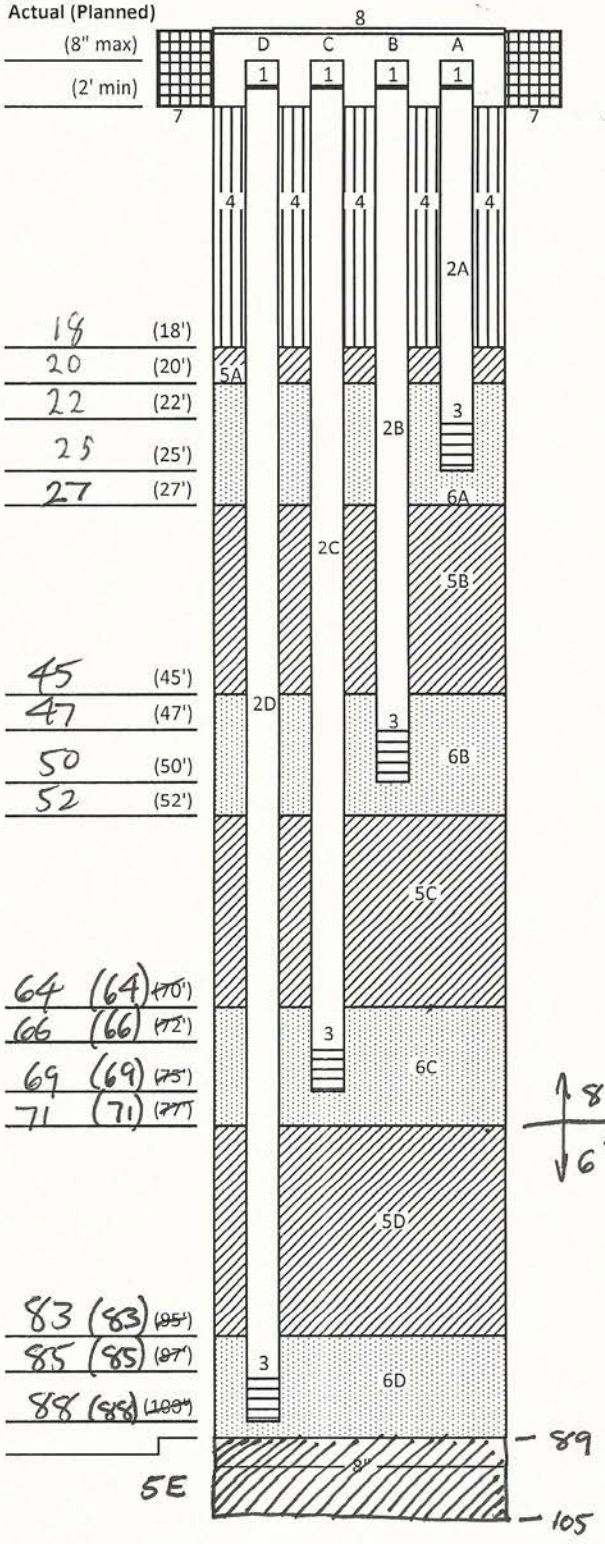
'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

ch2m:	Orange & Rockland Utilities Suffern Former Manufactured Gas Plant Site Suffern, NY, Project 650199.11.01	WELL NUMBER SW34

NESTED SPARGE WELL COMPLETION REPORT

Start Date & Time:	4/27/16 1330	CH2M Logger:	C. Lettich / L. Bingeman
End Date & Time:	4/28/16 1238	Drilling Contractor:	Cascade Drilling LP
Water Level, Date & Time:	NM	Drilling Method:	Rotosonic

Well Diagram



Well Materials Used

1) Threaded Schedule 80 PVC Cap

2) 1-inch Diameter Schedule 80 PVC Riser

2A)	22	feet
2B)	47	feet
2C)	66	feet
2D)	85	feet

3) 3 feet of 1-inch Diameter Schedule 80 PVC, 0.05" Slot Screen

4) High Sodium Bentonite Grout

Type: Cetco High-Solids Powdered Grout
Bag Size: 50#
Quantity: 1.5 bags 40 gal

5) Bentonite Chips

Type: Cetco Puregold Medium Chips
Bag Size: 50 lb

5A)	1.25	bags
5B)	5.5	bags
5C)	4	bags
5D)	2	bags

5E) 2 bags (chips from 89-105')

6) Filter Sand

Type: #3 U.S. Silica Sand
Bag Size:

6A)	4.5	bags
6B)	5	bags
6C)	4	bags
6D)	3	bags

7) Concrete

Type: Sakrete High-Strength Premix
Bag Size: 80#
Quantity: 4 bags

8) Road Box

Type: EMCO Wheaton Heavy-Duty Traffic-Rated
Size: 18"

Abbreviations

'	feet
"	inch
BGS	below ground surface
PVC	polyvinyl chloride

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